The Quit Propensity of Indebted Workers *

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Job Market Paper

Abstract

This paper studies the effect of holding a mortgage on quit rates for a subsample of young workers between ages 25 and 37 extracted from the NLSY79, a well known US survey. I show that workers who have to meet mortgage payments have, ceteris paribus, lower quit rates. Results show that mortgage paying workers have lower quit propensities than the rest of workers after controlling for covariates and unobserved heterogeneity. Some suggestive results pointing to a possible causal link are also provided. However, no definite causal relationship can be established and interpretation of results must be cautious.

Keywords: Housing markets, housing tenure, credit constraints.
JEL codes: R30, G21

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1 Introduction

A large research agenda had studied the interactions between labor and housing markets. Since at least Oswald (1999), several studies have explored the links between homeownership and job related migration (see Head and Lloyd-Ellis (2012) and Green and Hendershott (2001)). Other studies have documented that during a housing bust agents with negative housing equity may be effectively 'lock-in' to their homes (see Ferreira, Gyourko and Tracy (2010), Engelhardt (2003) and the references therein). In both cases, agents will act as if facing higher moving costs. Insofar as internal migration may even out unemployment disparities over different locations, this may translate into higher unemployment rates.

In this paper I propose an alternative channel relating labor and housing markets. Using data from the National Longitudinal Survey of Youth (NLSY79), a US panel, I show that mortgage paying households are less likely to quit their jobs than other home-owners. Across specifications, households paying a mortgage are between 3% and 5% less likely to quit their jobs. My findings are obtained after controlling for observed and unobserved worker heterogeneity and are documented both for all quits and quits out of the labor force.

The link between quit rates and housing debt has implications for worker turnover and labor market allocations beyond the internal migration channel which has been frequently emphasized in the literature. If mortgage debt reduces workers' propensity to take up an alternative job, this will affect the allocation of workers to firms. Moreover, it may sustain relative low quality employer-employee matches, with its concomitant influence in productivity and wages.

The effect of liquidity and debt repayment constraints on quitting decisions had been suggested in Shaw (1987). However the study of the relationships between households' financial decisions and their propensities to quit has barely been addressed directly in the literature.[1] In the case of the female participation literature, both Fortin (1995) and Del Boca and Lusardi (2003) provide evidence indicating that mortgage commitments lead to increase female labour supply. While the decision to remain active or inactive in the labor market may be related to quit rates, in this paper I also consider voluntary employer to employer transitions of workers remaining active.

[1] An exception are the studies on the effect of pension schemes on quitting (see for example Allen, Clark and McDermed (1993) and Ippolito (2002)).

The objective of this paper is to test the effect of mortgage obligations on quit rates by using data on market transitions and mortgage debt from for workers between 25 and 37 years of age. On the first place, the detailed information coming from the NLSY79 is used to obtain a predictive effect of holding a mortgage on quit rates after controlling for covariates. On a second stage, I exploit the longitudinal dimension of the data by estimating a non-linear correlated random effects approach to deal with unobserved individual heterogeneity. The estimated effects are in line with the hypothesis in both cases with the effect of holding a mortgage on quit rates being stronger in the case of males.

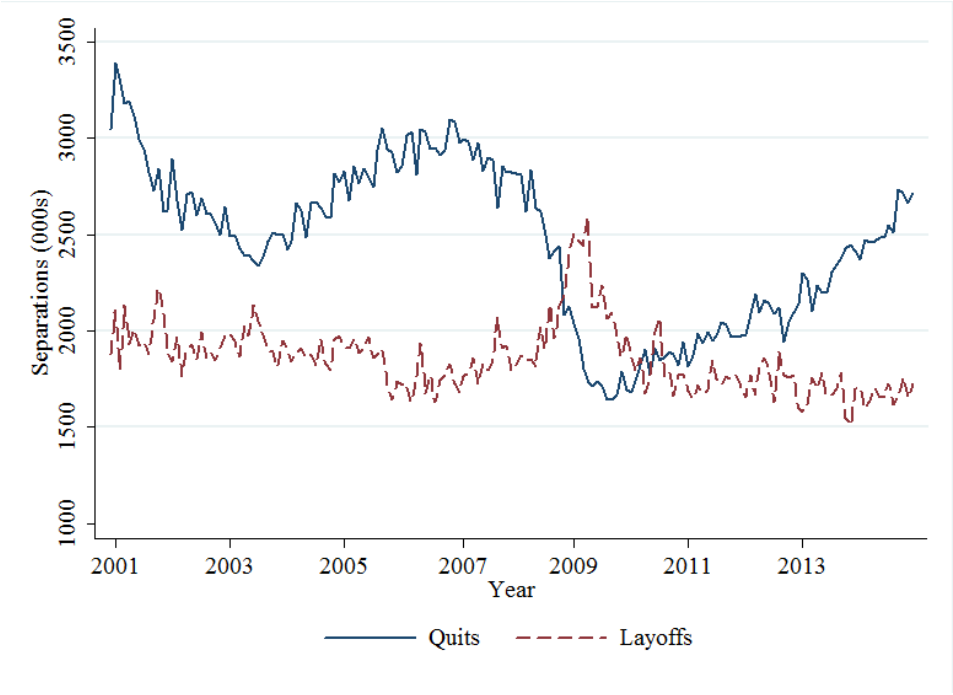
Results are interpreted in terms of the risks involved in quitting. Indebted workers quitting out of the employment status will face an immediate and certain reduction in income. Unless savings are large, this will lead indebted households to sharply reduce consumption to keep up mortgage payments. Hence, the negative effect of mortgage commitments on quits out of the labor force is intuitive. The case of job-to-job transitions is more subtle. Workers changing jobs face uncertainty regarding job characteristics and higher probabilities of layoff during the first months in the new job. As a consequence the risks of reduced consumption and/or debt default may also increase with an employer to employer (EE) transition even if the wage in the new job is higher than in the previous one. As will be shown below, the effect of mortgage commitments on a household's willingness to take a risky bet is ambiguous. The empirical results presented suggest that, in the context explored here, mortgage paying households are less likely to take new risks.

A major obstacle in this study is the possible endogeneity of the mortgage variable in any quit equation, discussed in the context of the female participation literature and explained below for quits. While no obvious instrumentation strategy is available, it is reassuring that all estimates reported in this paper convey the same message. Finding an alternative empirical specification which may yield identification under weaker assumptions is an interesting matter for further research.

This paper is structured as follows. Section 2 discusses the importance of quit rates in labor markets and provides a simple framework from which to interpret the effect of mortgage commitments on quit rates. Section **??** enumerates the sources of data and provides some descriptive statistics for the estimation sample. Section 4 presents the empirical strategy and estimation results. Section **??** discusses some of the limitations of the empirical approach followed in this paper and concludes.

FIGURE I

SEPARATIONS IN THE UNITED STATES



Source: Bureau of Labor Statistics. Job Openings and Turnover Survey.

2 The Decision to Quit

Quitting is, together with layoffs, the main force driving job changes and constitutes a key determinant of labor market turnover. Figure I shows the number of monthly layoffs for the US in the years between 2001 and 2014. In the US quits account for the majority of separations, with annual quit rates being on average larger than those for layoffs during expansions, a finding also documented by Bagan Jr (1981) for the period between 1965 and 1980. This relationship shifts during recessions (as happened between 2009 and 2010), but quits continue being an important even in these periods.

In the analysis below I consider both voluntary employer to employer (EE) transitions and quits outside of the labor force. It is well established that the hazard rate of a layoff decreases with time after the first few months on a new job. Fabrer (1994) uses NLSY79 data to show that the hazard rate of layoffs starts declining three months after the initial job transition. This fact makes EE transitions inherently risky.

From a theoretical point of view we can think that when an agent under-

goes an EE transition, some details of the new match are unknown. In the first few months at a job information on match quality is revealed and a layoff may occur. If this does not happen, the layoff probability decreases with time. This intuition is formalized in Jovanovic (1979). In Shaw (1987) quits are modelled as inherently risky both when quitting into unemployment or when quitting to take up another job. In fact, the modelling device used there is based on portfolio theory, with workers allocating their human capital wealth across several options with stochastic returns. In this paper I study empirically how mortgage obligations affect the probability of undergoing an EE transition.

The cases of quitting into inactivity has been studied in the female participation and generates a reduction in disposable income, an increase in leisure time (or home production) and may increase future income uncertainty. Bottazzi (2004) presents a life-cycle model and uses panel data on UK households to document a positive effect of having mortgage commitments on female participation. Fortin (1995) uses Canadian data to present evidence in the same direction. My paper contributes to this literature by focusing on the the effect of mortgages on the quit decision by both female and male agents.

Owner occupied housing is the main asset in a households' asset portfolio in the US. As the Survey of Consumer Finances 2009 indicates, the primary residence corresponds to above 44% of the value of total asset holdings for households in the first nine income deciles. This is not a mere consequence of the housing boom. The 1995 wave of the survey shows that the residence corresponded to the main non-financial asset held by US families (with the average share of non-financial assets being larger than the average share of financial assets). These patterns are also common in other countries.[2].

Acquisition of a house often requires assuming mortgage debt given the difference in relative sizes between household incomes and home values. This underlines the importance of housing-secured debt in the obligations side of the families' balance sheets. This paper studies how this type of debt affects agents' labor market paths through their effects on quit behaviour.

[2]The Encuesta Financiera de las Familias, a Spanish survey, indicates that the main residence also constitutes the most important asset in the families' portfolio in Spain. A similar picture emerges from United Kingdom's Wealth and Assets Survey. Jansson (2013) documents similar evidence for Sweden.

2.1 Framework

This section introduces a simple consumption-leisure framework to illustrate the quit/stay decision faced by an individual worker. Within this framework I include mortgage obligations as reducing disposable income.[3]

Mortgage debt can affect the decision to quit in a different manner depending on whether the agent is quitting into inactivity or experiencing a job-to-job transition. In the first case, mortgage payments affect the consumption leisure trade-off via a reduction in disposable income and thus increase the marginal utility of consumption. If consumption and leisure are complements, this will result in a reduction in the marginal utility of leisure too. As a result the reservation wage required for becoming active is lower.

The case of employment transitions is less clear cut. We can think an employer-to-employer transition as a risky bet. If the worker stays on the new job, she will enjoy larger income. However, with some probability the match is unsuccessful and the worker becomes unemployed, and only receives a fraction of the wage in the first job. The effect of mortgage payments on the reservation wage leading the worker to change employers can be shown to be ambiguous as its effect on the willingness to page is also ambiguous.

Suppose a worker has utility function $u(c, l)$ depending on consumption c and leisure l. The function is assumed to be twice differentiable along both arguments satisfying the following:

$$\begin{array}{lll} u_c(c,l) > 0 & u_{cc}(c,l) < 0 & \lim_{c\to 0^+} u_c(c,l) = \infty \\ u_l(c,l) > 0 & u_{ll}(c,l) < 0 & \lim_{l\to 0^+} u_l(c,l) = \infty \end{array}$$

The agent has two sources of income: labor income which is obtained by reducing leisure and an exogenous source of income w_s which can be seen as the wage of the spouse. Working for employer A, the agent obtains wage w. On the other hand, the agent has to meet mortgage payment M with $M < 1$. Agents cannot default on their obligations and I impose that $w_s > M$.[4]

Regarding leisure, inactive agents will have all available time T devoted to leisure while active agents will only have time $\overline{L}$ with $T > \overline{L}$. The agent stays active if her wage is above a reservation value $\underline{w}$. Assuming the household is

[3]The flow of housing services is not included in the exposition. We can think of housing services as a fixed parameter in the utility function and compare mortgage paying homeowners with other homeowners.

[4]If $w_s < M$ the no default condition implies that workers will never quit into inactivity. Insofar as we are looking at trade-offs involved in the decision to quit this is not the case of interest.

composed of a couple sharing consumption equally, $\underline{w}$ is defined implicitly by

$$u(\frac{\underline{w} + w_s - M}{2}, \overline{L}) = u(\frac{w_s - M}{2}, T) \tag{1}$$

We are interested in knowing how M affects $\underline{w}$. Applying the implicit function theorem to expression 1 it is straightforward to show that the derivative of $\underline{w}$ with respect to M is negative (see Appendix 1). Note that this implies that agents with a mortgage will be less likely to quit into inactivity.

To explore the case of EE transitions, consider now active workers who are deciding whether to stay with employer A or change to employer B. Work hours are the same with both employers ($T - \underline{L}$) and the jobs differ in the wage offer with ($w_B > w$). It is clear that if there is no uncertainty and all the aforementioned conditions are satisfied the agent will change to employer B. Suppose now that if the agent changes jobs there is a probability $(1 - p)$ that the new match is unsuccessful, resulting in a layoff. In this event the agent collects no income and devotes his idle hours to leisure.

Under this setup and normalizing the w to 1, the worker will accept a new job offer if it is above $\overline{w_B}$, defined implicitly by:

$$pu(\frac{\overline{w_B} - w_s - M}{2}, \overline{L}) + (1 - p)u(\frac{w_s - M}{2}, \overline{L}) = u(\frac{1 + w_s - M}{2}, \overline{L}) \tag{2}$$

It is straightforward to show that the effect of M on $\overline{w_B}$ is now ambiguous and depends both on p and on the values of marginal utility of consumption in each state of nature.[5] If the posted wages of alternative employers are random from the point of view of the agent this will imply that the effect of having a mortgage on quit rates is also ambiguous. In Section 4 I show that the data point to a negative effect of mortgages on quits.

3 Data and Descriptives

The data used to test the aforementioned hypothesis is a subsample of the National Longitudinal Survey of Youth 79, a longitudinal survey elaborated by the US Bureau of Labor Statistics which has been extensively used in the literature.

The choice of this dataset over other data sources is well grounded. Addressing this issue empirically requires information on both labor histories

[5]See proof and a numerical example to illustrate this point in Appendix 1

and housing debt for individual workers. Note that this is seldom the case when using firm level or social security data which constitutes the standard in the quit literature. Moreover, the availability of information which allows to differentiate between quits and other separations is key. Looking at the timing of transitions between states and general firm conditions has been used in the past for this purpose (see for example Galizzi and Lang (1998)) yet this is problematic in the sense that it may lead to miscoding of different separations.

The NLSY79 allows addressing both concerns. On the first place, it includes extensive information on household debt included mortgage debt outstanding in the waves after 1985. Regarding the second problem, the NLSY79 questionnaire includes specific questions associated to transitions which allow to pinpoint quits and differentiate them from other separations such as layoffs or ends of contract.

This said, one must note that the dataset is not without problems if its own. The subsamples corresponding to immigrants have being thoroughly criticized for not being representative. As a consequence, supplements are excluded from the subsample used here, which focuses only on the core sample. In addition, lack of sufficiently disaggregated geographical identifiers implies that it is impossible to identify workers moving from one city to another. The public-use version of the database only includes four regional identifiers for the whole US, corresponding to the census regions: Northeast, North-central, South and West. As discussed below this will be a major setback in order to identify a possible causal effect of holding a mortgage on the quit propensity.

In order to express all money variables in 1985 US dollars, Consumer Price Indices at the region level are obtained from the Bureau of Labor Statistics for all years between 1985 and 1994. Furthermore, indices on housing prices at the state level and state specific weights were obtained from the US Federal Housing Finance Agency. These were used to construct regional level housing price indices for the years above.

3.1 Quit Variable Definition

The data analysis and estimations presented below deal with three definitions of the quit variable. They are the following:

$$Q_{it}^{All} = \begin{cases} 1 \text{ if worker } i \text{ quit her main job in year } t \\ 0 \text{ if worker } i \text{ stayed in her main job in year } t \end{cases}$$

$$Q_{it}^{J} = \begin{cases} 1 \text{ if worker } i \text{ quit her main job in year } t \text{ with a new job lined up} \\ 0 \text{ if worker } i \text{ stayed in her main job in year } t \end{cases}$$

$$Q_{it}^{Nj} = \begin{cases} 1 \text{ if worker } i \text{ quit her main job in year } t \text{ with no job lined up} \\ 0 \text{ if worker } i \text{ stayed in her main job in year } t \end{cases}$$

The first corresponds to all quits, and usually constitutes the key variable in most of the quit literature. It is a straightforward aggregation of all the quit motives presented in the "Reason Respondent Left Job" question of the NLSY survey. The second is constructed by combining the previous question with another one asking whether or not the respondent had a new job lined up at the time of the quit. Finally, the third is built with the same information with $Q_{it}^{N} = Q_{it}^{All} - Q_{it}^{J}$ Naturally, the first definition includes and expands the second and third in the sense that for all observations for which $Q_{it}^{J} = 1$ or $Q_{it}^{Nj} = 1$ it is also true that $Q_{it}^{All} = 1$.[6]

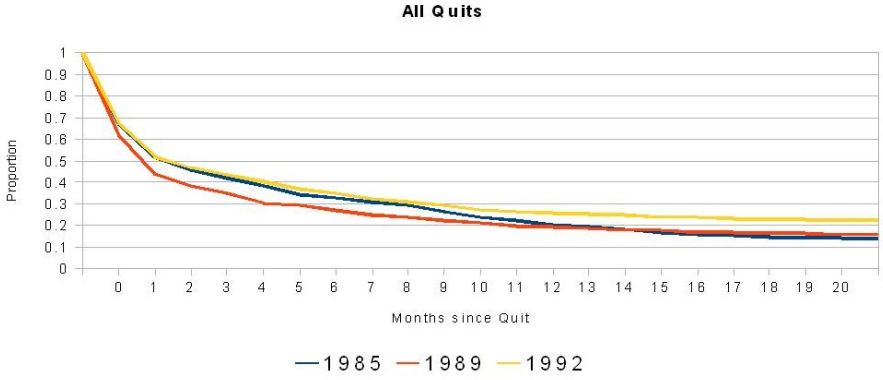
Regarding the definition of the main job, it is the only reported job in the relevant year if only one job is reported. If more than one job is reported for a given year and no quit is observed the main job is defined as the job which reports the largest income. That is, if a worker is working in two jobs over the whole year the main job is that which reports him or her the highest wage. If, moreover, the individual works in a job up to march and quits to take up another job in September the main job is the first one given that it was the main job at the time of quitting. In general, the principal job is the highest wage job at any specific month with the quit variable taking value one if the worker quits that job. Note that this definition may be problematic if there is wild misreporting of wage incomes for different jobs.

Figure II presents the evolution of average times to employment for three years in the sample. Results show that both the mean and the standard deviation of the time to employment are large, although around half of the workers return to employment after two months. This points in two directions. On the first place it may suggest that workers take time to look for another job after a quit. On the second it may be indicative of the uncertainty in the time to employment for each worker.

[6] An important note is to be made here. The definition of employer-to-employer transitions which is implicit in the difference between both quit definitions does not coincide with the definition used, for example, in Fallick and Fleischman (2004) in which the identification of EE transitions is based on the timing of employer changes.

FIGURE II

FRACTION WITHOUT JOB AFTER QUITTING



Source: NLSY79.

3.2 Estimation Sample and Controls

The initial sample includes 53,105 observations in total corresponding to 5,645 different workers. However, this differs from the final sample in several respects. In an attempt to isolate the effect of mobility, observations corresponding to workers reporting a change of region between successive interviews are excluded. Furthermore, the estimation sample is based on workers between 25 and 37 years of age. The reason to exclude younger workers is that their labor market patterns may be different from those of workers above 25. Observations for which no job is reported are also omitted from the analysis. Government workers are also excluded from the final sample. Finally and given that lags of savings and household net worth are used all observations for 1985 are also excluded. Thus, the final estimation sample corresponds to an unbalanced panel of 34,844 observations corresponding to 5,574 workers.

Throughout the whole master thesis subindex i denotes the worker and subindex t denotes the time period. The key regressor in all specifications below will be a dummy variable md_{it} taking value 1 if the worker comes from a mortgage indebted household and value 0 otherwise.

The vector of worker specific controls x_{it} is divided into time varying controls x_{it}^V and time invariant x_i controls such that $x_{it} = (x_{it}^V, x_{it})$. The rationale for this separation is associated to the use of the Correlated Random Effects Model estimated in section 3.2. Vector x_{it}^V includes a marital status dummy, number of children dummies, wage of the spouse, lagged money savings (in the form of bank accounts or other money savings), lagged net worth (exclud-

ing housing assets, mortgage and money savings) tenure at the job, income at the job, a part-time job dummy, and income from other sources in the household (business or farm income for both the respondent and his or her spouse). The inclusion of number of children dummies for one child, two children, three children, four children and five or more children attempts to capture non linearities possibly missed if considering number of children as a single control. On the other hand, time invariant controls x_i include gender, racial dummies for black and hispanic racial groups and years of education, which is time invariant for most workers in the sample.

3.3 Descriptives

Table I presents descriptive statistics for three waves in the estimation sample. We can see that quit rates are on average higher for younger cohorts although the pattern is not so clear in the case of quits with no job lined up. This may be associated to higher turnover between employers during youth while the variance in quits with no job lined up may be associated to quits out of the labor force (e.g.: participation decisions). The increase in the proportion of households holding a mortgage is not surprising given the increasing age of the sample and the fact that it is composed mostly of young agents. The same applies for the evolution of wage incomes or the fraction of workers married which show a steady increase.

Figure III displays the quit rate for workers with and without a mortgage. Workers from households holding mortgage obligations have lower quit rates on average than those coming from indebted households. However, this may be associated to heterogeneity in worker characteristics. As an illustration, married workers have lower quit rates on average. Given that marriage and holding a mortgage are expected to be highly correlated this simple means comparison can hardly be taken as evidence of the truth of the hypothesis and may be capturing differences in workers' characteristics rendering the ceteris paribus claim impossible.

A crucial aspect of quits is their correlation in time. A simple correlation of quits with its lags may be misleading in the sense that it may hide unobservable heterogeneity at the worker level. In order to deal with these problem three fixed effects regressions are run: quit on its first lag, its second lag and

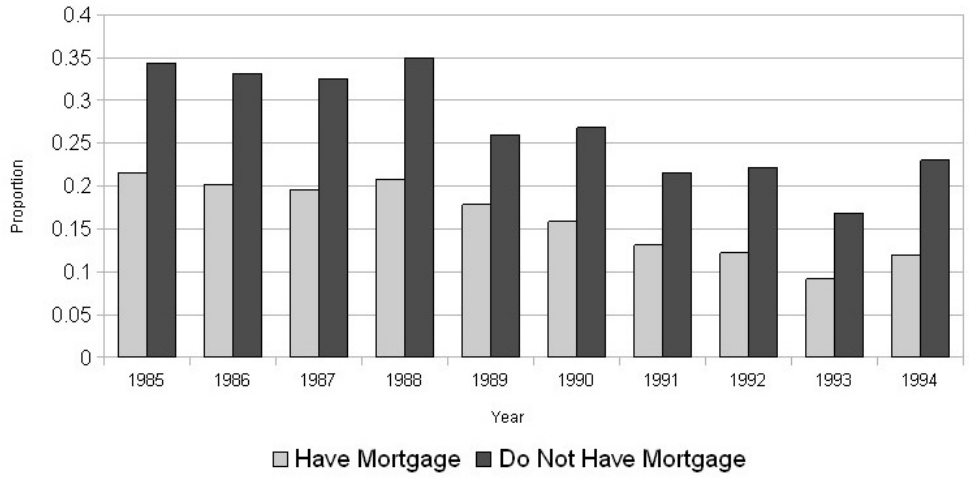
TABLE I

DESCRIPTIVE STATISTICS

		1986	1990	1994
All Quit	Mean	22.30%	20.72%	17.05%
Mortgage Dummy	Mean	29.68%	39.23%	52.36%
Married Dummy	Mean	51.62%	56.36%	62.37%
Quits No Job Lined Up	Mean	13.15%	19.00%	14.58%
Yearly Wage Income	Median	12,785	14,251	15,543
	Standard Deviation	10,014	11,177	14,634
Spouse Yearly Wage Income	Mean	6,967	8,562	10,745
	Standard Deviation	10,965	12,987	15,171
Mortgage Debt (if Mortgage)	Mean	39,219	45,666	50,469
	Standard Deviation	27,160	35,375	37,651
Years of Tenure	Median	2.19	2.59	3.90
Years of Education	Mean	13.18	13.18	13.31
Number of Children	Mean	0.78	1.01	1.38
Black Dummy	Mean	11.6%	11.5%	10.6%
Hispanic Dummy	Mean	6.6%	6.6%	6.8%
Decsriptive statistics computed for the estimation sample. Source NLSY 79.				

FIGURE III

QUIT RATES AND MORTGAGES



Source: NLSY79.

its third lag. Results, presented in Table 2 point to a negative inter-temporal correlation in quits.

4 Estimation and Results

As mentioned above, the objective is to test whether having a mortgage has negative effect on the quit propensity of workers. I consider three definition of quits, based on variables Q^{All}, Q^{J} and Q^{Nj} corresponding to all quits, quits with a job lined up (EE transitions) and quits with no job lined up (interpreted as quits into inactivity). To estimate the effect of mortgages on these variables I follow three estimation strategies:

The baseline specification is estimated using a pooled probit model of the quit variable on a mortgage dummy, controls, occupation and region-time dummies. This allows to calculate the quit probabilities predicted for the mortgage indebted and non-mortgage indebted households separately after controlling for covariates.

In order to control for unobserved heterogeneity at the worker level, the baseline specification is expanded by considering a correlated random effects model in which the mean of the random effects component is parametrized using the Mundlak device (Mundlak (1978)). The Mundlak device amounts to parametrizing the mean for a random effects model by using the mean of time varying regressors.

To gain additional insights and to separately evaluate the predictive effect of holding a mortgage on different types of transitions, a multinomial logit model is estimated by dissagregating transitions into four different categories.

To provide some suggestive evidence pointing to a causal relation, the final set of estimates focuses on whether workers who have just given up a mortgage experience an increase in quit probabilities.

An important note on the extent to which results can be interpreted as causal must be made before continuing. If workers are effectively constrained by having a mortgage and are forward looking, there will necessarily exist an endogeneity problem given that the mortgage decision will be delayed until a job is found for which the expected probability of quitting in the future is low. This necessarily entails a problem for identification given that an unobservable job trait such as job satisfaction would affect both past and present mortgages as well as present quits. Moreover it is to be expected that the direction of the induced bias is away from zero. This type of reverse causality

problem has been addressed in the female participation literature by using housing prices or institutional changes.

4.1 Baseline

Baseline estimation uses a probit model as in Ippolito (2002), Galizzi and Lang (1998) or Shaw (1987). The specification is the following:

$$Q_{it} = 1(\phi md_{it} + x'_{it}\beta + \eta_t^{occ} + \eta_t^{region} + u_{it} > 0)$$
$$u_{it} \sim N(0,1)$$

Where 1(.) is the indicator function. md_{it} is a mortgage dummy taking value one if the worker has positive mortgage debt and 0 otherwise. x_{it} is the vector of controls defined above. Given that quits follow both a cyclical and an age pattern (with quit rates usually decreasing with age) time-region dummies η_t are included. The interaction with region is included so as to account for possibly different business cycle patterns for different regions. Lastly η_{occ} corresponds to a vector of occupational dummies based on twelve different occupation definitions from the NLSY constructed by aggregation of Current Population Survey three-digit codes. Given the panel structure of the data, clustered errors at the individual level are used in all specifications. Estimation of are presented in Table II. For each quit definition (Q_{All}, Q^J and Q^N) I present results both for the full sample and separately by gender.

TABLE II

BASELINE RESULTS: POOLED PROBIT. ALL QUITS.

	(1) Q^{All}	(2) Q^{All} Male	(3) Q^{All} Female	(4) Q^{Nj}	(5) Q^{Nj} Male	(6) Q^{Nj} Female	(7) Q^{J}	(8) Q^{J} Male	(9) Q^{J} Female
main									
Mortgage Dum.	-0.105**	-0.172***	-0.0504	-0.0949*	-0.139*	-0.0569	-0.103	-0.209**	-0.0177
	(0.0480)	(0.0661)	(0.0693)	(0.0522)	(0.0764)	(0.0725)	(0.0761)	(0.0988)	(0.114)
Spouse Wage	0.0396***	0.0146	0.0257**	0.0577***	0.00317	0.0349***	-0.0194	0.0278	-0.0155
	(0.00869)	(0.0188)	(0.0111)	(0.00953)	(0.0224)	(0.0119)	(0.0153)	(0.0263)	(0.0205)
Wage	-0.0126*	-0.0104	-0.0160	-0.0102	-0.00572	-0.0143	-0.0301	-0.0320	-0.0431
	(0.00753)	(0.00930)	(0.0123)	(0.00777)	(0.00827)	(0.0128)	(0.0221)	(0.0301)	(0.0387)
Tenure	-0.154***	-0.151***	-0.159***	-0.152***	-0.150***	-0.156***	-0.137***	-0.137***	-0.143***
	(0.00450)	(0.00666)	(0.00606)	(0.00518)	(0.00798)	(0.00679)	(0.00748)	(0.0102)	(0.0112)
Married	-0.107***	-0.0978***	-0.0736**	-0.143***	-0.154***	-0.0619	0.0161	0.0190	-0.0571
	(0.0249)	(0.0365)	(0.0359)	(0.0276)	(0.0420)	(0.0389)	(0.0381)	(0.0526)	(0.0573)
chblsty	0.217***	0.0202	0.415***	0.258***	-0.0579	0.513***	0.0983**	0.143**	-0.0662
	(0.0318)	(0.0446)	(0.0462)	(0.0350)	(0.0534)	(0.0483)	(0.0481)	(0.0610)	(0.0844)
Observations	30930	16043	14870	29125	15020	14076	26454	13987	12107
Pseudo R^2	0.136	0.154	0.128	0.142	0.170	0.132	0.172	0.194	0.170

Standard errors in parentheses

Standard Errors at the individual level. All dolar variables divided by 10000.

All specifications include controls, year-region and year-occupation dummies

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE III

BASELINE AVERAGE PARTIAL EFFECTS

	Q^{All}	Q^{J}	Q^{N}
Mortgage Dummy × Male	-4.82%***	-0.92%*	4.13%***
	(1.09)	(0.52)	(0.8)
Mortgage Dummy× Female	-1.09%	-0.54%	-0.48%
	(1.2%)	(0.55)	(1.01)

APEs of mortgage dummy on $Pr(quit)$
Standard Errors in parenthesis.

The first thing to note from Table II is the negative and significant coefficient of the mortgage dummy in column 1. This implies that agents who have a mortgage on their home have lower quit rates ceteris paribus. As can be seen from the comparison between columns 2 and 3 of Table II most of this difference comes from males. The same difference can be seen in quits to take another job (Q^J) and quits into inactivity or unemployment (Q_N). In the case of the effect on quits to take another job the effect of the mortgage dummy on quit rates is marginally significant both in the full sample and for males.

Regarding the other coefficients, there are few surprises. Tenure appears as negatively affecting quits, something consistent with the conclusions of Jovanovic (1979). The recent birth of a child has a negative and significant effect on female quits but no effect for males, as expected. The spouse income has a positive effect of quits, something consistent with the results of Shaw (1987). The weak effect of wage income is not surprising given that higher incomes at a given job may also imply higher income in other alternatives.

Note that, as usual in the case of nonlinear models, parameter interpretation cannot go beyond sign and significance. In order to obtain an adequate interpretation of the estimated effect of the mortgage dummy md_{it} on quit rates I provide average partial effects. In this case the interpretation of Average Partial Effects (APEs) corresponds to the difference in the averages over all observations between predicted probability $Pr(Q = 1)$ with $md_{it} = 0$ and $md_{it} = 1$. APEs of the mortgage dummy on quit rates corresponding to male and female groups are presented in the table below:

If we compare Table III to Figure III above we conclude that for covariates significantly decreases the influence of a mortgage on quit probability relative

to an unconditional mean comparison. This said, the conditional probability of quitting is lower for agents paying a mortgage, mainly for males. The yearly quit probability for male indebted agents is 4.82 percentage points lower than for other workers. If we take into account that the average yearly quit probability for males is 17% this effect is sizeable, reducing the quit probability by almost a third. The effect of the mortgage dummy on quits to take up another job is weaker, with a coefficient of -0.92%. This is roughly one sixth of the baseline probability of a quit to take a new job. Finally, the effect of the mortgage dummy on the probability of quitting into inactivity or unemployment Q^N is -4.13% and strongly significant. This is again roughly a third of baseline probability $Pr(Q^N = 1)$. The effect of having a mortgage on quits is smaller and not significant for females.

Note that these results match well with the discussion of the effect of mortgages on quits presented above. Indebted agents have lower quit probabilities. In particular, quits without a job lined up by males drive most of the result. The effect of mortgages on quit rates to take up another job are weaker, intuitively consistent with the ambiguous theoretical effect reported in Section 2.

4.2 Different Separations: Multinomial Model

So far the focus has been on the group of workers who either stay employed or quit and neglected other separations such as layoffs or ends of contract. Note that it would be hard to argue that holding mortgage has any causal effect on layoff probabilities. However, estimating the effect of holding a mortgages on other separations may be interesting in order to have an idea of the size of the reverse causality problem. If the reverse causality problem is strong enough, one could expect that workers employed in jobs where layoff probabilities are high may delay their housing investments decisions and this would be captured as a negative effect of the mortgage dummy on layoffs.

Another useful application of considering different types of transitions separately in this context is that it may enable to disentangle the predictive effect of holding a mortgage on both transitions out of employment (quits with no job lined up) and transitions between employers (quits with a new job lined up).

In order to explore these possibilities a multinomial logit model is estimated separately for all the sample, males and females in order to look at the predictive effect of mortgages on different forms of separations. Four transi-

tions are considered: Continuation (baseline), quit with a job lined up, quit with no job lined up and other separations such as layoffs or end of contract. The multinomial logit specification is based on variable S_{it} defined as:

$$S_{it} = \begin{cases} 0 & \text{Relationship continued} \\ 1 & \text{Worker quit with a new job lined up} \\ 2 & \text{Worker quit with no job lined up} \\ 3 & \text{Layoff and other separations} \end{cases}$$

Moreover, the usual multinomial logit specification is used. This is expressed as:

$$Pr(S_i = j) = \frac{exp(\phi_j md_{it} + x'_{it}\beta_j + \eta_{occ\,j} + \eta_{t\,j})}{1 + \sum_{k=1}^{3} exp(\phi_k md_{it} + x'_{it}\beta_k + \eta^k_{occ\,k} + \eta_{t\,k})}$$

Continuation is considered the reference category. The definitions for md_{it}, x_{it}, η_{occ} and η_t are the same as those presented above. The j lower index is present in the coefficient vectors because different parameter estimates are calculated for different transitions. The sum in the denominator is across all transitions other than continuation.

Results for multinomial logit estimation through maximum likelihood are presented in Table 8. Again, estimates for several covariates have been excluded in order to make the table readable.

TABLE IV

MULTINOMIAL LOGIT MODEL: DIFFERENT SEPARATIONS

	(1) All	(2) Males	(3) Females
Stay			
Mortgage Dum.	0	0	0
	(.)	(.)	(.)
Tenure	0	0	0
	(.)	(.)	(.)
Quit_with_JLU			
Mortgage Dum.	-0.220	-0.378*	-0.0403
	(0.150)	(0.202)	(0.213)
Tenure	-0.305***	-0.312***	-0.303***

	(0.0153)	(0.0215)	(0.0224)
Quit_NJLU			
Mortgage Dum.	-0.206**	-0.272*	-0.163
	(0.0964)	(0.142)	(0.127)
Tenure	-0.325***	-0.336***	-0.316***
	(0.0108)	(0.0171)	(0.0140)
Other_Separations			
Mortgage Dum.	-0.305***	-0.157	-0.447***
	(0.106)	(0.146)	(0.148)
Tenure	-0.445***	-0.468***	-0.413***
	(0.0182)	(0.0240)	(0.0258)
Observations	32457	16842	15618

Standard errors in parentheses

Clustered Errors

All specifications include controls, time and occupation dummies

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Regarding quits, results follow the estimation of previous probit regressions with the additional feature that mortgages seem not to affect significantly the probability of a quit with a new job lined up for women. Results for other separations are surprising showing that holding a mortgage predicts lower probabilities of experiencing a layoff or end of contract. This is counterintuitive, given that layoffs and ends of contract are factors largely outside of the worker's control, at least relative to quitting which is clearly a voluntary act. Despite this fact, the result is easy to interpret in the light of the endogeneity problem mentioned above. Workers in jobs where the probability of layoff or end of contract is larger will tend not to take on mortgages and it is probably this fact (and not a direct form of causality) which is driving the results for this transition.

4.3 Correlated Random Effects

As usual, an advantage of using panel data is the possibility of controlling for fixed unobserved heterogeneity. However, given the nonlinear character of the specifications used some qualifications must be made before estimation. Consistent estimation of fixed effects is not possible for the probit case unless

. This is associated to the fact that the usual strategies used in the linear case (first differences or within-groups estimation) are not possible in the nonlinear context. Using individual specific dummies, which could seem a natural alternative, leads to inconsistent estimation due to the incidental parameter problem. In a nutshell, the asymptotic argument $N \to \infty$ leads to an infinite increase in the number of parameters to be estimated. Given the model nonlinearity this would contaminate estimation of all other parameters, thus wrecking identification. Even when considering the logit model, in which a transformation may allow to deal with fixed effects, this transformation relies heavily on the functional form assumption. Moreover, estimation in the case of fixed effect logit only uses information on individuals with time variation in the Q_{it} variables.

As an alternative, I estimate a Correlated Random Effects (CRE) model to deal with unobserved heterogeneity. The CRE model estimated here parametrizes the mean of the random component following the Mundlak (1978) specification. The model to be estimated estimated is the following:

$$\begin{gathered} Q_{it} = 1(\phi md_{it} + \beta' x_{it} + \eta_{occ} + \eta_t + \alpha_i + v_{it} > 0) \\ v_{it} \sim N(0,1) \\ \alpha_i \sim N((\bar{x}_i^V, \bar{md}_i, \bar{\eta_{occ}})'\delta, \sigma_\alpha^2) \end{gathered}$$

Where $1(.)$ is the indicator function. In this case $\bar{x_i^V}$, $\bar{md}_i$ and $\bar{\eta_{occ}}$ correspond to the time averages of the x_{it}^V vector and md_{it} dummy for each individual. This parametrization allows to better control for unobserved heterogeneity relative to an independent random effects approach while saving on degrees of freedom relative to the specification proposed by Chamberlain. The reason to exclude education from the x_{it}^V vector, mentioned above, is due to the fact that its mean equals its value for most workers, which would amount to a multicollinearity problem in when estimating this model. Moreover, it is not faced with the same consistency problems present in non-linear fixed effect estimation. Estimation is based on the maximization of an integrated likelihood of the form:

$$\begin{gathered} ln \sum \int \Phi(\phi md_{it} + \beta' x_{it} + \eta_{occ} + \eta_t)^{Q_{it}} (1 - \Phi(\phi md_{it} + \beta' x_{it} + \eta_{occ} + \eta_t))^{(1-Q_{it})} dF(\alpha_i|\Omega_i) \\ \alpha_i \sim N((\bar{x}_i^V, \bar{md}_i, \bar{\eta_{occ}})'\delta, \sigma_\alpha^2) \end{gathered}$$

In the formula above Ω_i is the information set for individual i and $F(\alpha_i|\Omega)$ is the cdf for α_i. It is used to compute the means given in the parametrization for α_i. Results for the CRE estimation in the all quits case are presented in **??**

TABLE V

CORRELATED RANDOM EFFECTS: MUNDLAK SPECIFICATION

	(1) Q^{All}	(2) Q^{All} Male	(3) Q^{All} Female	(4) Q^{Nj}	(5) Q^{Nj} Male	(6) Q^{Nj} Female	(7) Q^{J}	(8) Q^{J} Male	(9) Q^{J} Female
main									
Mortgage Dum.	-0.139**	-0.124*	-0.0802	-0.0986	-0.0236	-0.0251	-0.185**	-0.232**	-0.156*
	(0.0555)	(0.0735)	(0.0525)	(0.0637)	(0.0886)	(0.0595)	(0.0858)	(0.109)	(0.0819)
fem_mrtgd	0.119***			0.141***			0.0644		
	(0.0373)			(0.0432)			(0.0580)		
Spouse Wage	0.0131	0.0162	0.0159	0.0204	0.0237	0.0228	-0.0178	0.00251	-0.0154
	(0.0130)	(0.0279)	(0.0129)	(0.0144)	(0.0332)	(0.0143)	(0.0228)	(0.0399)	(0.0226)
Wage	-0.00773	-0.00729	-0.00800	-0.00529	-0.00401	-0.00553	-0.0237	-0.0220	-0.0241
	(0.00621)	(0.00827)	(0.00633)	(0.00517)	(0.00648)	(0.00536)	(0.0217)	(0.0309)	(0.0220)
Tenure	-0.0304***	-0.0412***	-0.0306***	-0.0239***	-0.0519***	-0.0241***	-0.0379***	-0.0228	-0.0381***
	(0.00657)	(0.00921)	(0.00657)	(0.00787)	(0.0111)	(0.00786)	(0.0112)	(0.0147)	(0.0112)
Married	-0.0373	-0.0689	-0.0404	-0.0541	-0.120*	-0.0574	0.0412	0.0438	0.0387
	(0.0383)	(0.0560)	(0.0383)	(0.0429)	(0.0656)	(0.0429)	(0.0593)	(0.0822)	(0.0592)
Years of Educ.	-0.0267***	-0.0352***	-0.0276***	-0.0311***	-0.0394***	-0.0322***	-0.0111	-0.0269**	-0.0115
	(0.00533)	(0.00772)	(0.00532)	(0.00614)	(0.00901)	(0.00612)	(0.00792)	(0.0111)	(0.00794)
Observations	31018	16114	31018	29246	15137	29246	26736	14261	26736
Pseudo R^2									

Standard errors in parentheses

Standard Errors at the individual level. All dolar variables divided by 10000.

All specifications include controls, year-region and year-occupation dummies

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE VI

CRE AVERAGE PARTIAL EFFECTS

	Q^{All}	Q^{J}	Q^{N}
Mortgage Dummy × Male	-4.82%***	-0.92%*	4.13%***
	(1.09)	(0.52)	(0.8)
Mortgage Dummy× Female	-1.09%	-0.54%	-0.48%
	(1.2%)	(0.55)	(1.01)

APEs of mortgage dummy on $Pr(quit)$
Standard Errors in parenthesis.

Focusing on the coefficient on the mortgage dummy, it is clear that after controlling for unobserved heterogeneity the effect of holding a mortgage on the quit propensity remains negative and strongly significant for the total sample and males although it is only weakly significant for the female group. As in the pooled probit case, coefficient interpretation cannot be taken beyond sign and significance. Therefore, Average Partial Effects are calculated and shown in table 7.

Clearly, the predictive effect of the mortgage dummy on quit propensities continues to be negative for all groups even after controlling for unobserved heterogeneity.

In the case of quits with no job lined up, the Correlated Random Effects estimation (see Table 12 in Additional Tables) yields non-significant coefficient for women. This confirms what was observed in all previous results, both for the baseline specification and in the CRE model for all quits: the effect of mortgage on quit propensities seems to be consistently stronger for males than for females. It cannot be rejected that the probability of females to quit with no job lined up is different from 0.

4.4 Paying off the Mortgage

Under the hypothesis, workers who either give up their mortgage or end up paying it should, ceteris paribus, have higher quit probabilities than those who are still paying the mortgage given that they no longer face the constraints of monthly payments. Should this be the case it would be reasonable to expect that the subset of workers having a mortgage at t-1 and not having

it at t will experience an increase in the probability of quitting at t relative to those who still have a mortgage. In order to test this simple idea the estimation proposed is to use a probit with the form:

$$Q_{it} = 1(\theta nm_{it} + x'_{it}\beta + v_{it} > 0)$$
$$v_{it} \sim N(0,1)$$

The estimation sample in this case corresponds to workers having a mortgage at t-1, which implies most observations are left out. Variable nm_{it} is defined as follows:

$$nm_{it} = \begin{cases} 1 & \text{Worker stopped having a mortgage between t-1 and t.} \\ 0 & \text{Worker had a mortgage both at t and t-1.} \end{cases}$$

An immediate problem arising with this estimation strategy is that it may be capturing mobility decisions rather than a relaxation of the constraint imposed by the mortgage installments. To illustrate the point, suppose a worker in Mobile holds a mortgage on her home at $t-1$ and decides to move to Miami at t. Given that both Mobile and Miami are in the south region, the public version of the NLSY79 does not allow to identify this move as a geographical change. However, if the worker gives up the mortgage in Mobile at t (by, for example, selling off the house) quits her job and moves to Miami this will be captured as an nm_{it}=1 and $Q_{it} = 1$. The constraints imposed by the need to meet payments had no role in this decision. If the amount of people moving between cities in the sample is sizable (as it is expected, given that this corresponds to a young group of US workers), this may lead to obtaining a positive and significant estimate for θ due to mobility decisions only.

As a possible solution to this problem, the suggestion is to estimate a similar model but using a lag of nm_{it}. That is, focus on workers who had given up (or paid off) their mortgage at $t-2$ and evaluate their quit probabilities at t. This may partially isolate the mobility effect given that it is to be expected that a worker relinquishes his or her mortgage in the year that he or she moves.

Probit estimates in both cases are presented in the table 9.

As expected, columns 1 and 3 of Table 9 exhibit positive and significant coefficients meaning that the predicted probability of quitting is higher in the year a worker stops having a mortgage. This is hardly surprising and may be capturing mobility effects. Results for columns 2 and 4 are more interesting. In column 2, the effect is positive but not significant. In column 4, the

effect is positive as expected. Again, these results are consistent with the hypothesis and can be interpreted as capturing the causal effect of mortgages on quits as long as we consider the timing of the end of mortgage payments as conditionally exogenous.

4.5 Layoffs

5 Discussion and Conclusion

The estimations above show mortgage holders exhibit on average a lower propensity to quit their jobs even after controlling for relevant covariates at the worker, household and job level. Moreover, this is also the case after controlling for unobserved heterogeneity by considering a random effects model in which the mean of the unobserved heterogeneity term is parametrized using the Mundlak specification. This is the case whether we consider all quits together or quits declared as being into unemployment or inactivity. In the correlated random effects context, which is considered the preferred specification given that it deals with unobserved heterogeneity at the worker level, the estimation of the predictive effect of the mortgage on quit probabilities is negative for both males and females, with marginal effects being -4,64% and -1,875% respectively.

All results seem to suggest a larger effect for males than for females. In the light of the hypothesis this is not surprising given that males usually have the largest fraction of income in the household and therefore, the consequence of a quit (be it through uncertainty or income drop) on the possibility of successfully meeting mortgage payments should be larger in the case of males.

Note that these effects are sizable given that the unconditional probability of quitting is around 19% over the whole estimation sample.

Unfortunately, part of this result may be driven by endogeneity of the households' mortgage decisions. In fact, should the hypothesis be true, forward looking workers will postpone the decision to take a mortgage until they find a match in which their propensity to quit is lower and thus avoid the constraints imposed by the mortgage. Moreover, this implies the interpretation of the results presented above must be cautious, as no clear causal relationship can be established with certainty. Moreover, the fact that the effect for males is larger than the effect for females could also be driven by this reverse causality problem: Conditional on the male income being larger on average than the

income of females, it is likely that the mortgage decision is delayed until the male member of the household finds a better job.

Multinomial logit estimation presented in section 3.3 also coincides with what would be expected should the hypothesis be true. The fact that there appears to be significant predictive effect of mortgages on other forms of separation such as end of contract or layoff is not surprising given that workers with higher layoff risk will probably delay taking a mortgage.

Despite this, it is clear that instrumentation in the context of other datasets which include a higher level of disaggregation in geographical location variables may well be possible and this would constitute the natural next step in the attempt to confirm the hypothesis. With this additional information, both the use of housing price variations or differences in regulations either across regions or in time space (as in Del Boca et al. 2003) may be sufficient to pinpoint a causal relationship. This would clearly constitute the next step in any attempt to continue research along the lines discussed here.

In any case, results are consistent with the hypothesis although they can hardly be taken to prove it beyond reasonable doubt. If the endogeneity problem of the mortgage dummy is based on the reverse causality problem mentioned above, results should constitute an upper bound for the effect.

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6 Appendix 1

To show that the effect of M on reservation wage $\underline{w}$ is negative I start from equation 1 and apply the implicit function theorem.

$$H \equiv u(\frac{\underline{w} + w_s - M}{2}, \overline{L}) - u(\frac{w_s - M}{2}, T) = 0$$

$$\frac{\partial H}{\partial \underline{w}} = \frac{u_c(\frac{\underline{w} + w_s - M}{2}, \overline{L})}{2}$$

$$\frac{\partial H}{\partial M} = -\frac{u_c(\frac{\underline{w} + w_s - M}{2}, \overline{L})}{2} + \frac{u_c(\frac{w_s - M}{2}, T)}{2}$$

$$\frac{d\underline{w}}{dM} = -\frac{\frac{\partial H}{\partial M}}{\frac{\partial H}{\partial \underline{w}}}$$

The term $\frac{\partial H}{\partial \underline{w}}$ is positive as utility is strictly increasing in consumption. This implies that:

$$sign(\frac{d\underline{w}}{dM}) = -sign(\frac{\partial H}{\partial M})$$

Note that if leisure and consumption are complements then $\frac{u_c(\frac{\underline{w} + w_s - M}{2}, \overline{L})}{2} > \frac{u_c(\frac{\underline{w} + w_s - M}{2}, \overline{L})}{2}$ and therefore $\frac{d\underline{w}}{dM} < 0$.

Regarding the ambiguous effect of mortgage payments on the wage level leading the agent to change jobs note that, from expression 2:

$$pu(\frac{\overline{w_B} - w_s - M}{2}, \overline{L}) + (1-p)u(\frac{w_s - M}{2}, \overline{L}) = u(\frac{1 + w_s - M}{2}, \overline{L}) \qquad (3)$$

Applying the implicit function theorem again we soon get to:

$$sign(\frac{dw_B}{dM}) = -sign(pu_c(\frac{\overline{w_B} - w_s - M}{2}, \overline{L}) + (1-p)u_c(\frac{w_s - M}{2}, \overline{L}) - u_c(\frac{1 + w_s - M}{2}, \overline{L}) \qquad (4)$$

Note that the sign on the right hand side of expression **??** depends both on the utility function, the values of p, M and $\overline{w_B}$. Even under the same utility

function different probabilities of success p and different values of M may lead to different effects of M on w_b

Suppose that the utility function