"Mom, Dad: I'm Staying"

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July 2020

Abstract

Young individuals are currently living with their parents more than at any other point in time, while also struggling to become homeowners. In this paper, I show how the conditions they faced when first entering the labor market affect their housing tenure in the long term. Considering two large European surveys that cover up to 33 countries from 1994 to 2018 results confirm that an increase in the unemployment rate at the time of graduation (1) has a positive and persisting effect on the probability of living with parents and (2) leads to a worsening on affordability ratios for homeowners and renters. I also make use of an OLG model to link negative income shocks at early stages in life with changes in housing tenure at an aggregate level. Recent changes in tenure decisions at the European level are consistent with model predictions. This set of outcomes contributes to improving policy design with regards to housing access for younger generations as to the current affordability crisis.

Keywords: Housing, labor markets, long-term effects

JEL Classification: R20, R21, J24

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1   Introduction

In 2018 more than two-thirds of young Europeans (16-29 years old) were living with their parents (Eurostat, data for EU-19). This rate was higher than at any other point in the 20th century. As evidenced in Figure 1, it reached minimum values just before the 2008 crisis but a change in trend took place right after. As a counterpart, those living in a house that they own reached minimum levels. Both of these phenomena are closely related to another prevailing challenge in European cities: that of housing affordability, understood as the share of resources households dedicates to meet housing costs. In many southern European countries, more than half of households declare that housing costs are a "heavy burden", particularly in urban areas and rental markets (Pittini et al. (2019), Eurostat).

Figure 1: Share of population between 16 and 29 years old living with their parents in the EU-19.
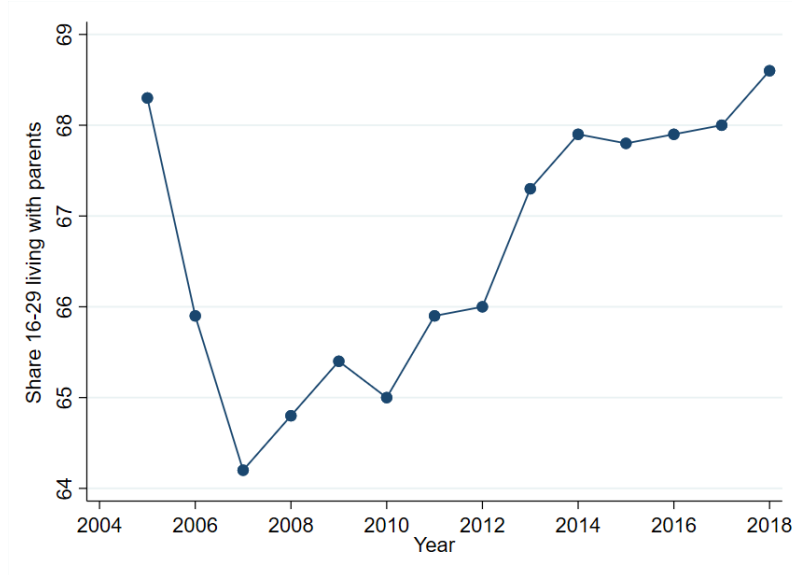
Source: Eurostat.

When it comes to wealth distribution understanding the dynamics of housing access is quintessential. Housing has a major role in wealth because of its relevance to the households' portfolio. In Europe housing is the single largest asset, accounting on average for more than half of households' wealth (Mathä et al., 2017). Additionally, recent studies show how housing booms and busts can affect wealth inequality (Martínez-Toledano, 2019). Wealth inequality is becoming an increasingly relevant issue in social sciences as there is new evidence on its effect on aggregate consumption (Krueger et al., 2016) and growth (Piketty, 2014).

This paper addresses the question of how early labor market conditions can impact housing tenure decisions in the long term. It also examines if this can explain the recent increase in the share of young people living with their parents. For that, I develop an overlapping generation model with a housing ladder and heterogeneous rent elasticities. This model allows tracking the impacts that generation-specific shocks can have on housing markets, both for allocation and affordability. For empirical analysis, I use micro-data of two large European surveys: the European Community Household Survey (ECHP) and the

European Union Statistics on Income and Living Conditions (EU-SILC). Combined, they cover up to 33 countries from 1994 to 2018 and over ten million individual observations. The identification of causal effects is based on Oreopoulos et al. (2012) and relies on considering graduation time as exogenous. As educational choices are usually long-termed, individuals have little room to manipulate graduation time.

Up to date, several studies have determined that graduating during a recession can have long-lasting impacts on labor market outcomes. The first study to mention is Bowlus et al. (2003), who establishes that the local unemployment rate has a long-lasting impact on earnings for High School graduates in the United States. Later, Kahn (2010) determined that such a shock can also have scarring effects on job quality for college graduates. These effects have also been documented for Japan (Genda et al., 2010) and Canada (Oreopoulos et al., 2012). More recently, Schwandt and Von Wachter (2019) expand the study for the US including several educational levels, gender, and race. In Europe, research on this topic has been done for Norway (Raaum and Røed (2006), Liu et al. (2016)), Austria (Brunner and Kuhn (2014)), Belgium (Cockx and Ghirelli (2016)), and Spain (Fernández-Kranz and Rodríguez-Planas (2018)). Moreover, Kawaguchi and Murao (2014) studies the persistence of the unemployment rate at graduation time for 20 OECD countries. However, no study tackles this matter on a European scale.

The theoretical model in this paper builds on those by Carozzi (2020) and Ortalo-Magne and Rady (2006). These OLG models tract the impact of different shocks on housing allocation. More specifically, Carozzi (2020) develops a model to relate changes in housing sales compositions with shocks on credit constraints, applied to the UK housing market. However, these models assume perfect elasticity for prices and rents, which may constraint the analysis. Additionally, these models do not contemplate income shocks specific only to a share of the agents and do not analyze affordability outcomes.

Results confirm the positive and scarring effects that entering into the labor market in bad economic conditions have on the probability of living with parents and on affordability ratios for home-owners and renters. They also confirm the long-lasting effect on career outcomes, with graduates having lower earnings, lower employment probability, and lower employment quality. Finally, a theoretical exercise illustrates that rent elasticity can play a pivotal role in housing allocations. This provides a possible explanation for the results found.

This research contributes to the existing literature in several ways. First, it links causally initial labor market conditions and the probability of leaving the parental home. Second, it extends the existing literature on the long term effect of initial labor market conditions to a European Union level of study. By studying the entire EU, it takes advantage of the large heterogeneity in economic conditions and provides valuable policy-making insights to two of the most pressing social issues in Europe: labor market conditions and housing access for young households. Third, it expands the literature on OLG models to housing tenure and housing affordability. By evaluating scenarios with different rent elasticities, it shows its importance when housing allocations adjust to income shocks.

The paper is organized as follows, Section 2 focuses on describing the data used while providing some descriptive statistics, as well as stating the empirical strategy. Section 3 presents the results of the main specification and some heterogeneous analysis. Section 4 provides the housing ladder model, where a set of propositions are derived. Finally, Section 5 presents some concluding remarks.

2 Data and Empirical Strategy

For this research I have gained access to the micro-data of two major European datasets: the European Union Statistics on Income and Living Conditions (EU-SILC) and the European Community Household Panel (ECHP). The EU-SILC is designed and oversight by Eurostat, and it is compulsory for all EU Member States. Despite the survey is ultimately carried out by each individual state, Eurostat defines a common framework ensuring a harmonized set of variables. Both surveys provide cross-sectional information on various topics such as income, labor and housing conditions both at the household and at the individual level. Additionally, they also provide longitudinal data, allowing to measure changes over time over a four year period.

The ECHP originally covered the countries of Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, the Netherlands, Austria, Portugal, Sweden, and the United Kingdom, for the period 1994 to 2001. After it was discontinued in 2001, the survey was replaced by the EU-SILC which covered almost the same topics. In addition, the EU-SILC progressively included various other European nations, reaching up to 33 countries in the sample by 2018. A final map of all countries included and their incorporation date is depicted in Figure 2.

Figure 2: Data Availability
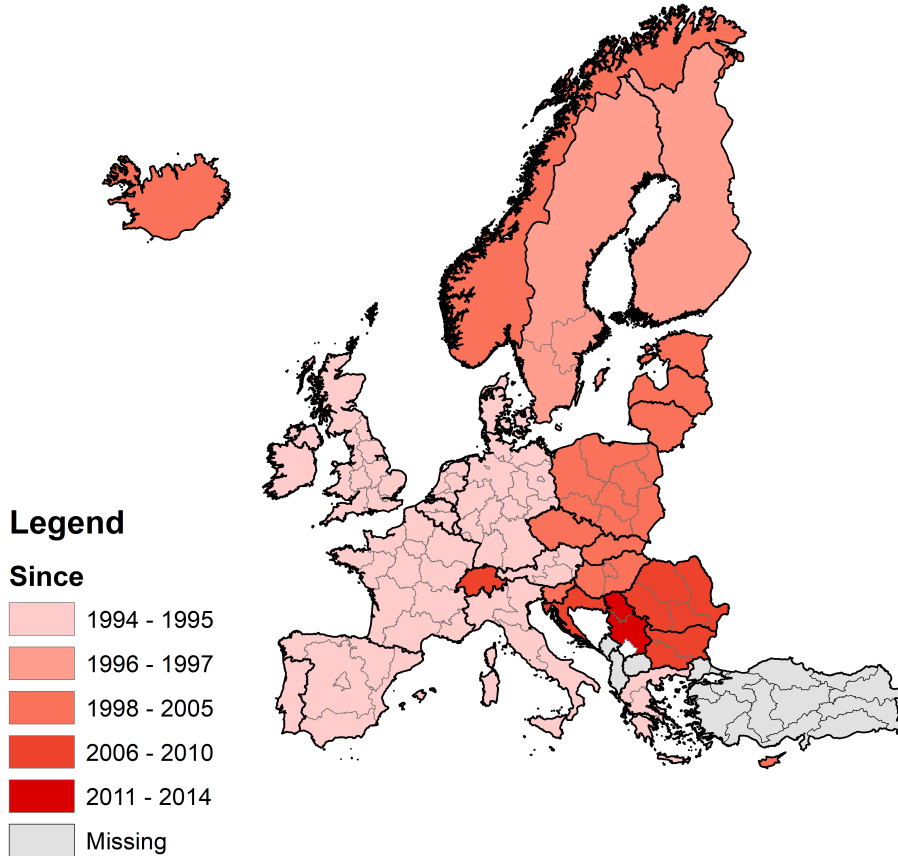
Notes: Europe with the (current) NUTS1 borders, along with the data availability. There are some exceptions to the data availability. First as the ECHP finished in 2001 and the EU-SILC only started in 2004, there is no data for the years 2002 and 2003.

As mentioned before, the deployment of the surveys was gradual between the Eu-

ropean countries, but except some exceptions, most of the countries were added either in 1994 (when the ECHP began) or in 2004 (when the EU-SILC began). Figure 2 following graph illustrates the data availability as well as the NUTS1 boundaries in Europe.

National level unemployment is available from the European Central Bank (ECB), data is generally available from 1960. Additionally, as unemployment rates can be calculated under different criteria across countries, I also use the International Labour Organization (ILO) estimates for national unemployment rates, which provide data for all countries in the sample starting from 1991.

2.1 Descriptive Statistics

For the analysis I will focus only on native population with higher education[1].

Thus, to identify a graduation year and country, I exclude all individuals that were not born in the same country as they are being interviewed. Additionally, I exclude those that have graduated in the same year that the interview, as many variables are measured with respect to the previous year of the interview, and it will create measurement error.

In Table 1, I present summary statistics of the sample for the main variables of interest. I separate the variables into two groups, those that refer to the labor market, and those that refer to housing arrangements. The first group includes employment rate, different measures for earnings both at a personal and at a household level, the number of hours worked in a week and a temporary employment indicator. As for the housing decisions, I consider the living arrangement as a set of three excluding options. These are (1) being a homeowner without any parent present in the household, (2) being a renter without parents present, and (3) living with at least one parent[2]. Finally, I also include a measure of affordability, to indicate the effort that the household has to make to meet its housing costs.

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[1]As the educational systems in Europe can vary greatly between countries, I have segmented the different possible educational levels into three broad categories. First the lowest possible educational attainments: primary education and first Stage Secondary education. Second, superior education among which is undergrad studies. Thirdly, all the rest of the possible educational attainments, which mainly consist of second stage secondary education, and all other professional and technical education. Hereafter when referring to college graduates I will refer to the second group.

[2]In the rest of the paper, when using the term Homeowner it will refer to being a homeowner without any parent in the household. The analogous is valid for the case of Renter.

Table 1: Descriptive Statistics for Graduation Cohorts across Europe

Labor Outcomes	Full Sample	By Gender		One year after grad.
		Male	Female	
Employed	0,54	0,56	0,51	0,64
Personal monthly gross income €	1.806	2.148	1.451	1.411
Personal annual net income €	11.714	12.124	9.283	6.633
Household Annual net Income €	37.842	39.349	36.318	34.744
Average weekly hours worked	21,1	23,4	18,7	24,9
Temporary employment	0,06	0,05	0,07	0,24
Housing Arrangement				
Owner	0,77	0,77	0,77	0,23
Renter	0,12	0,12	0,13	0,21
With Parents	0,06	0,07	0,07	0,52
Affordability	0,17	0,16	0,18	0,20

Notes: All values are converted to euros and then deflated to harmonic price index (HPI- calculated by the ECB) with base year 2018. Personal Annual net Income and Household Annual Net income are measured with respect to the year previous to the interview, while Personal monthly gross income si current income. Temporary Employment represent the share of the cohort that is working under a temporary contract. Owner represents the share of the cohort living in an owned house without any parent present. Renter represents the share of the cohort living in a rental unit without any parent present. "with Parents" indicates the share of the cohort living with at least one parent. Affordability is calculated as the total housing expenses over the household's annual net income.

2.2 Empirical Strategy

For the baseline specification I follow the literature as in Schwandt and Von Wachter (2019)and Oreopoulos et al. (2012) and work with a cell-based model in which I collapse the outcome at the current country of residence (c), cohort of graduation (g) and calendar year (t).

This has been the standard procedure, as this analysis does not rely on the use of individual-level controls and so it matches the variable of interest level of variation that is cohort-country year. With respect to previous literature, the data provides an advantage in the sense that it is possible to identify exactly the year of graduation of an individual. This allows to avoid using proxy measures for the year of graduation (as the Mincerian approach[3]), which, in a context with great heterogeneity (as the different educational systems in Europe constitute), it reduces the probability of measurement error.

The baseline specification is as follows:

$$(1) \qquad Y_{c,g,t} = \alpha + \beta_e u_{g,c} + \gamma_e + \delta_c + \eta_g + \theta_t + \epsilon_{c,g,t}$$

Where $u_{g,c}$ refers to the unemployment rate of the given country[4] at the graduation year, this is the main variable of interest. e refers to potential labor market experience years[5]. β_e varies across potential experience, so we can see the effect of u on each different

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[3]The Mincerian year of graduation is often calculated as the sum of the year of birth, plus 6, plus the years of reported education.

[4]Country refers to the country of current residence.

[5]Potential experience is calculated as calendar year minus graduation year.

year of experience. For this specification, I present individual coefficients for each of the first ten years after graduation, but I create a dummy variable for those potential years equal to or larger than eleven. This last coefficient should indicate the long term effect of the initial unemployment rate.

The equation presents fixed effects at the potential experience, country, cohort, calendar year. Errors are clustered at the cohort-country level in order to account for group-specific correlation. Cells are weighted by their corresponding cell size. Given the presence of experience, country, cohort, and time fixed effects, then β_e captures changes in labor and housing outcomes that derive from an increase in country-cohort specific unemployment rates. In this specification, there is no control for the current unemployment rate, which means that β_e captures the effect of the unemployment rate at the time of graduation given the later evolution of the labor market.

2.2.1 Potential Threats

This strategy can have two major potential threats. The first one refers to endogenous graduation timing. Individuals can potentially shift their graduation according to the conditions that the labor market have at the time of their intended graduation. If this were the case, the estimates would be biased to zero. As to deal with this concern is that I focus on college graduates. As Figure 18 in Annex B shows, while unemployment rate at graduation time does affect the probability of being a full-time student for recent low and medium educated graduates, the effect is zero for college graduates. This indicates that, despite an individual's concerns about the state of the economy at their time of graduation, completing high-level education translates into entering the labor market.

The second potential threat arises from endogenous migration. If individuals choose in order to avoid the economic conditions in their place of residence when graduation, then by assigning current place of residence as graduation place, then individuals would probably be assigned better economic conditions than what they actually face. This would lead to an attenuation bias on the results. This has been documented for the US, as in Schwandt and Von Wachter (2019) and Wozniak (2010), in which individuals facing harsh labor market condition at the time of graduation in their home state decide to move to another state. For this study, this does not pose an important concern, as mobility across European countries is not as large as in the case of across state migration in the US. For example, as of 2019, an average of only 3.9% of the population in a given EU country was born in another EU nation.

3 Results

3.1 Results on Housing Tenure Outcomes

One of the main objectives of this paper is to establish if the effects that are found in the labor market are also present in the housing decisions. For the purpose of this study, I will focus on whether the individual lives with his/her parents (labeled as "with Parents"[6]), whether is living in an owned unit with no parent present (labeled as "Owner"[7]), or living

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[6]This label is defined as whether the individual is living with at least one person that can be identified as "own" / step / adopted / foster parent or guardian.

[7]Owner refers to living in a dwelling that is owned by one member of the household, without any parent being present.

with no parents in a rental unit (labeled as "Renter"[8]).

For that, Figure 3 shows the effect of the unemployment rate on various housing outcomes for the entire sample. Results indicate that a one percentage point increase at the time of graduation increases the probability of staying in the parental home by 1.43 percentage points one year after graduation, and when compared to the mean in Table 1 implies an increase of 2.8%. Even though the results seem to become less strong over time, the effect remains significant up to ten years after graduation, with the accumulated effect being 11.6 percentage points. Detailed results with the coefficients' values are presented in Table 4 in the Annex.

Figure 3: Effect of a one-point increase in Unemployment Rate at graduation time on living with parents.
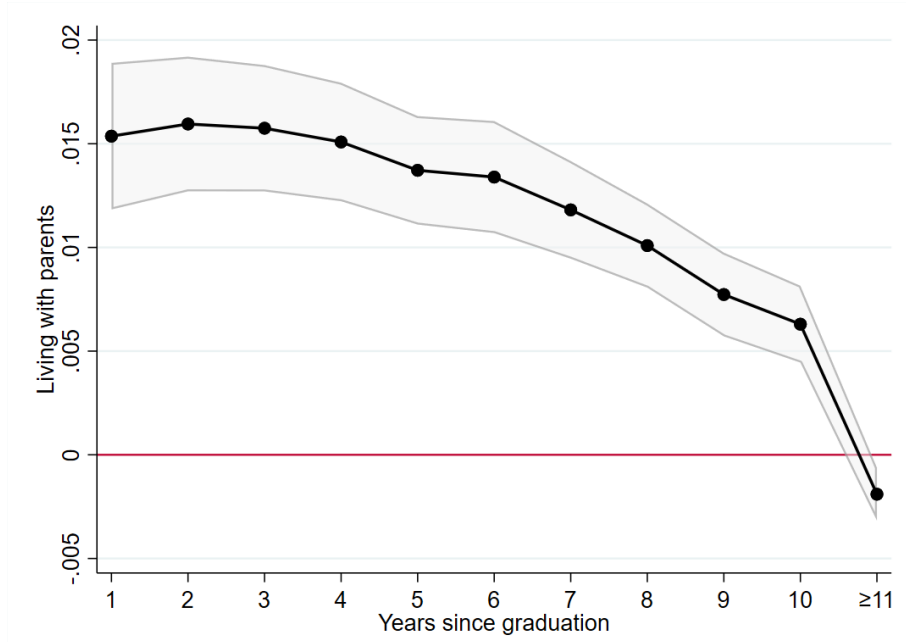
Notes: Effect of a one point increase in the unemployment rate on the probability of living with parents, measured in the previous year. Results are based on Equation 1. Data from ECHP and EU-SILC.

While young households choose to remain with their parents, it is necessary to see which option, whether renting or becoming homeowners, they are giving up. Results indicate that it is more likely a combination of the two. Worse economic conditions when graduating lead to a lower probability of renting with no parent present, with the effect being of 0.99 percentage points (4.6% when compared to the mean) one year after graduation. This effect follows a similar pattern to that of the living with parents, with the strongest coefficients being right after graduation. The effect is no longer significant approximately eight years after graduation.

Finally, while a one-point increase in the unemployment rate leads to a lower fraction of homeowners of 0.38 percentage points in the first year after graduation, it implies a 1.56% decrease with respect to mean in Table 1, and its effect still significant after 10 years. Most notably, when compared to the effect on other housing options, the effect is not stronger immediately after graduation, but rather around six years after, when after

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[8]Households could potentially live in rent-free provided accommodation, either by family or by the state, but especially for young individuals this is not a significant option.

that it becomes less significant. This could be pointing towards a possible mechanism of savings accumulation, in which cohorts that entered the labor market in bad times, accumulate less savings every year than their peers, and cannot afford a down-payment.

Figure 4: Effect of a one-point increase in Unemployment Rate at graduation time on tenure status.
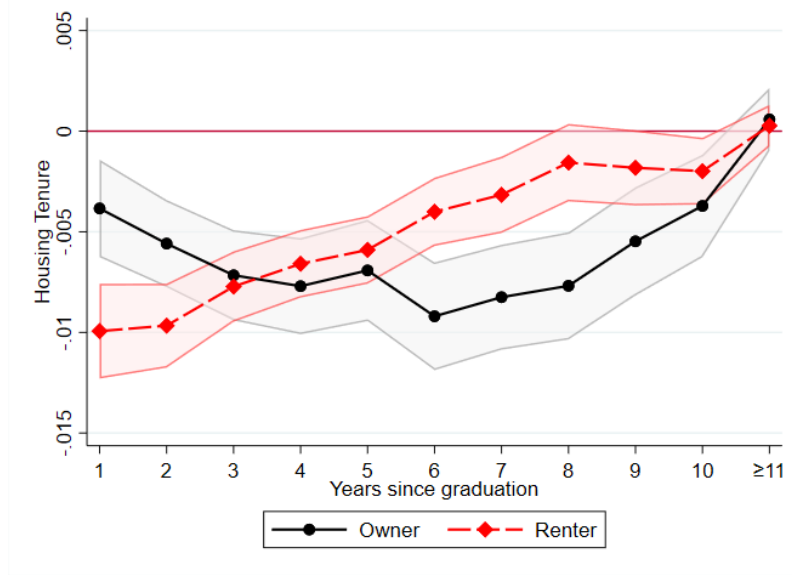
Notes: Effect of a one point increase in the unemployment rate on various housing outcomes. Owner refers to living in owned dwelling by one member of the household, without any parent being present. Similarly, Renting refers to living in a dwelling that is being rented by the households but without any parent present. Finally, with Parents refers to living in a dwelling where at least one parent is present, irrespective of the tenure status. Results are based on Equation 1. Data from ECHP and EU-SILC.

3.2 Results on Housing Affordability Outcomes

As mentioned before, many European cities are facing affordability problems, especially in their urban areas. For that, it is important to study whether initial labor market conditions can be behind an increase in affordability problems. Affordability is generally calculated as the coefficient between yearly housing costs[9] and household yearly income. Then, higher levels of this ratio indicate a larger effort from the household to meet its housing living expenses.

Results in Figure 6 show that an increase in the unemployment rate at the time of graduation increase the affordability ratio that young individuals face, both for those living in rental as those living in owned units. The effect is of 0.3 percentage points one year after graduation in the affordability ratio for renters, and over a 10 years period, it implies an increase in the affordability ratio of 3.3 percentage points. As for affordability to those that own their unit, the effect implies an increase of 0.1 percentage points one year after graduation and an accumulated effect of 0.15 percentage points over a 10 year period.

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[9]Due to data availability, the measure used here is housing costs, which include not only the rent or mortgage paid but also other housing costs, such as structural insurance, regular maintenance and repairs, cost of utilities (for rental units) and other services and charges. While including these other factors could introduce undesired sources of variation, in any case, the majority of the housings costs are constituted by the principal payment of rent or mortgage.

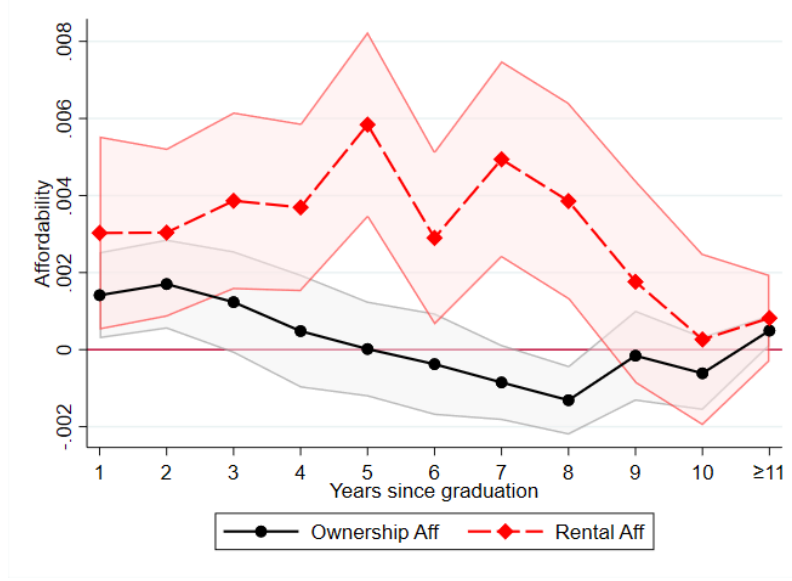**Figure 5:** Effect of a one-point increase in Unemployment Rate at graduation time on affordability.

Figure 6: Affordability for Owners and Renters

Notes: Effect of a one point increase in the unemployment rate on various housing affordability. Affordability is calculated as the yearly housing costs over the household's yearly income. Results are based on Equation 1. Data from EU-SILC.

Now, being the affordability calculated as the ratio between rent (or mortgage) paid and the household's income, the variation could either come from any of these two variables. However, results in Figure 19 in the Annex show that while the effect on housing costs are null remains close to zero, there is a negative and significant effect on household income for both owners and rents. These results are in line with those previously presented and indicate that the worst affordability problems are coming mainly from a decrease in household income.

3.3 Results on Labor Outcomes

Using graduation time as exogenous, we study the effect of the initial labor market conditions at the graduation time on various outcomes later in life. Figure 7 shows the coefficients of β_e for each experience year. As it is possible to see an increase in the unemployment rate at the time of graduation has an impact on labor market outcomes.

Results indicate that a rise in unemployment at the time of graduation leads to lower earnings, concretely, a one percent increase in the unemployment rate at the graduation time leads to a 10% decrease in earnings in the first year after graduating. While this effect fades over time, it is still present after 10 years of graduating. Results indicate that the accumulative effect of a one-point increase in the unemployment rate at graduation in earnings after ten years is about 38% of average annual earnings. It is important to notice that as the surveys capture all individuals (and not only those that entered the labor market), then the effect also captures those individuals that did not enter the labor market, as well as those with longer unemployment spells.

Figure 7: Effect of a one-point increase in Unemployment Rate at graduation time on annual earnings and household income.
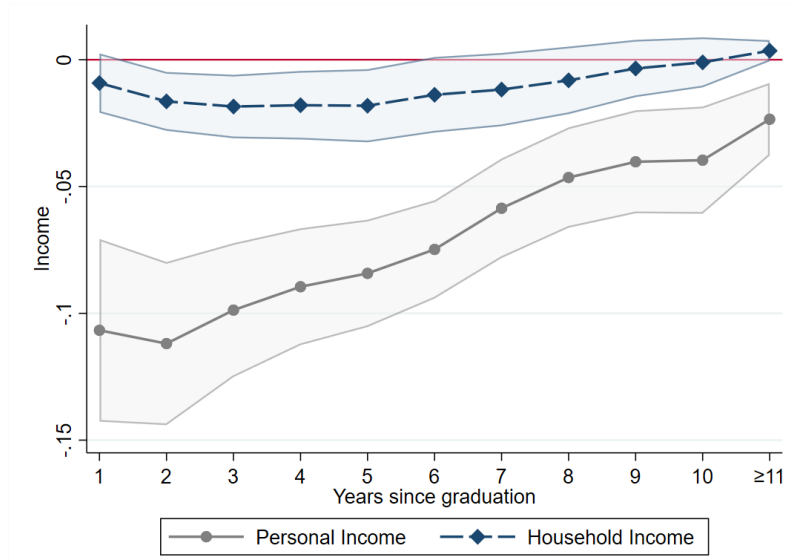
Notes: Effect of a one point increase in the unemployment rate on the Log Annual Personal Earnings, and Net Household Income, both measured in the previous year. Results are based on Equation 1. Data from ECHP and EU-SILC.

With respect to previous studies, the results are somewhat larger. The closest study, as it uses various educational levels and several cohorts is Schwandt and Von Wachter (2019), where they find that a one-point increase in the unemployment rate leads to a loss of 3,8% in earning during the first three years after graduation. Although once they control for endogenous graduation timing these estimates are increased slightly. For Oreopoulos et al. (2012) the effects of a 3 points increase in the unemployment rate leads to a 6% loss in earning during the first year after graduation. However, in the case of (Kahn, 2010) the author finds that a one percentage point increase in the regional unemployment rate leads to a 9,2% loss in annual earnings. In spite of this, it is important to state that the setting between this study and others are significantly different, as these papers focus on North America and in the case of Oreopoulos et al. (2012) and Kahn (2010) only focuses on male college graduates. Additionally, this paper deals with the world crisis in 2008, which could potentially have had larger effects than previous recessions.

The data derived from the surveys allows studying the effect of graduating during a bad economic time in other labor outcomes of interest.

First, exposure to a higher unemployment rate at graduation time leads to lower annual household income. Also, it is interesting to see that this effect is of a lower magnitude than that of personal income. This attenuation could potentially be due to the fact that household income also captures the parents' income if the individuals have not yet moved. Additionally, household income also includes state transfers and other family income. Therefore the lower effect on household income could be indicating a potential mechanism to reduce the impact. In this case, results are similar in magnitude to those of Schwandt and Von Wachter (2019), with a reduction in 1,0% in the household income one year after graduation for each one percentage point increase in the unemployment rate the year before.

As for other outcomes, a higher unemployment rate at the time of graduation leads to

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a reduced probability of being employed. Then a one-point increase in the unemployment rate at the time of graduation leads to a decrease in the probability of being working by 1,2 percentage points in the first year after graduation. When compared to the mean one year after graduation this effect implies a reduction of 1,9%.

Another outcome is that, when restricting the sample only to those that are currently working, these individuals have a higher probability of being employed under a temporary contract rather in an indefinite one. A one-point increase in the unemployment rate at graduation time leads to a 0,9 percentage points increase in the probability of working on a temporary contract in the first year, which implies an increase of 3,7%.

Finally, when again restricting the sample to those that are working by the time of their interview, being exposed to a higher unemployment rate leads to a lower labor intensity, with individuals working fewer hours per week. In this case, a one percentage point increase in the unemployment rate leads to a 4,5% decrease in the number of hours worked on average per week.

Table 3 in the Annex present the results in detail, where the coefficients for different potential experience years are clear.

3.4 Robustness

In this section, I test whether the results previously showed are robust to different specifications and measures. First I test whether using an alternative measure for the national unemployment rate provokes any change in the results. The International Labour Organization (ILO) unemployment rate should provide a more harmonic measure of unemployment across countries than that of the ECB or National Statistics institutes, the caveat with this measure is that it is only available since 1991. Figure 23 in Annex D replicates the main results using the ILO unemployment rate, along with the baseline results.

Second, a potential problem could arise from collapsing the long term effect from eleven or more years of potential experience into a single coefficient. Potentially, by collapsing coefficients, we may be losing some dynamics that happen in the medium to long term. Figure 22 in Annex D replicates the main results for the the main specification using different thresholds for the long term effects, providing individual coefficients up to twenty years after graduation. Results show that the effect persists over time, with each new coefficient being closer to zero than the one before. This points that the effect does tend to fade over time.

3.5 Mediation Analysis

Mediation analysis is often used to determine the mechanisms behind the relationship between a treatment and its outcome. The idea is to be able to identify the "indirect effect" that operates through a mediator variable, and the "direct effect" that contemplates the rest of the mechanisms. A basic diagram is presented in Figure 8. In this diagram is possible to identify a, which is the effect of the treatment X on mediator M, b the effect of mediator M on outcome Y, and c' the direct effect of treatment X on outcome Y.

Figure 8: Basic mediation diagram.
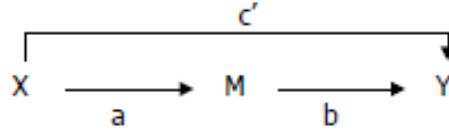

Source: Newsom (2002)

If the effect of the treatment variable works entirely through the mediator, then it is called full mediation. Mediation analysis has been used thoroughly across social sciences, and in economics some recent examples can be found in Huber (2015) to find the mechanisms behind the decrease in gender wage gap for the US. A key point in the mediation analysis is to ensure that the indirect effect is statistically significant. A valid strategy is to use bootstrap as pointed by Memon et al. (2018).

A potential application for this study would help to clarify the mechanisms in which the unemployment level at the time of graduation affects the housing outcomes. In this case, the mediation variable is the individual's income. In the setting of this research this translates into Equations 2.

(2)
$$Parents_{c,g,t} = \alpha + \beta_e u_{g,c} + \kappa_e inc_{g,c} + \gamma_e + \delta_c + \eta_g + \theta_t + \epsilon_{c,g,t}$$
$$inc_{c,g,t} = \mu + \pi_e u_{g,c} + \rho_e + \sigma_c + \tau_g + \upsilon_t + \epsilon_{c,g,t}$$

Following Sobel (1982) approach, the indirect effect can be estimated roughly as the product of the coefficients from the partial regression effect for M predicting Y and the simple coefficient for X predicting M. In the case of Equations 2, this implies that the indirect effect of income on staying with parents is equal to the product of κ_e and π_e. The direct effect of unemployment at the time of graduation on living with parents is given by the coefficient β_e. Figure 9 shows the coefficients of applying Equation 2 into our dataset.

Figure 9: Mediation of personal income on living with parents
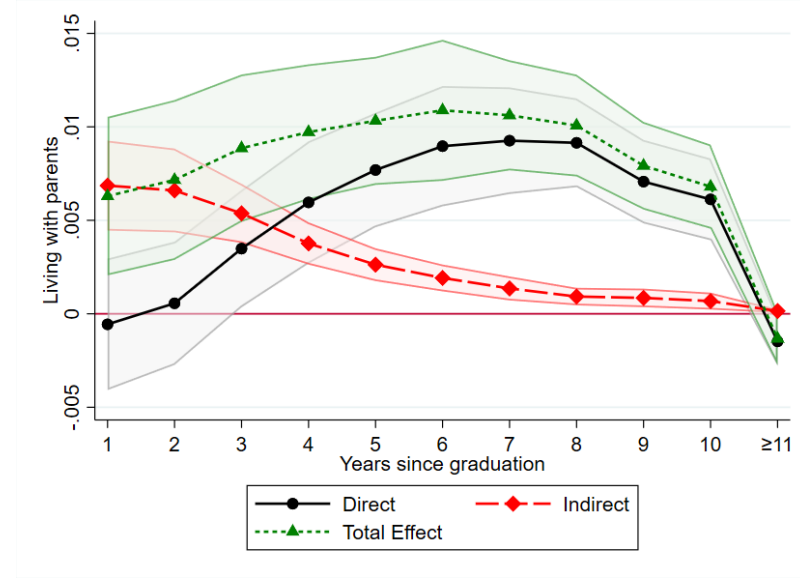
Notes: Effect of a one point increase in the unemployment rate on living with parents using a as a mediator personal income. Standard errors are bootstrapped. Data from ECHP and EU-SILC.

Results using individuals income suggest that almost the totality of the effect on the probability of living with parents in the very first years after graduation is explained by the income effect. In the first years after graduation the direct effect is not statistically different from zero, which causes that the total effect and the indirect effect to have very similar coefficients. This results point that worse economic conditions are mostly affecting through an income channel on the first years after graduation.

3.6 Heterogeneity Analysis

Given the different characteristics that the sample presents it is useful to analyze the results for different subsamples at a time. This provides a further impact on how initial labor conditions can affect more vulnerable individuals. For visualization purposes, I will focus only on the probability of living with parents.

First, as Figure 10 shows, results differ slightly on gender dimension. Impacts on living with parents are higher for males and also more persistent in time. While for men a one percentage point in unemployment rate at the time of graduation translates into a 1.77 pp increase in the probability of living with parents one year after graduation, for women that value is of 1.30 pp. While for men's the effect with respect to the mean represent a 3.29% increase, for women is of 2.66%. The reason behind the lower effect on female could be explained due to lower female workforce participation. As this is a shock in the labor market, female individuals that were not counting on entering the labor market regardless, may not be affected by the shock.

Figure 10: Results by gender on labor and housing outcomes
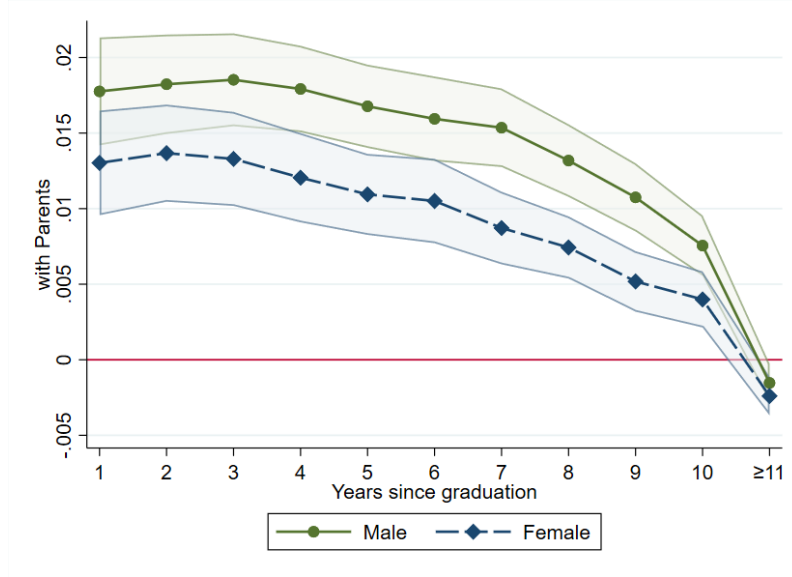
Notes: Effect of a one point increase in the unemployment rate on the probability of living with Parents. Understood as living in a dwelling where at least one parent is present, irrespective of the tenure status. Results are based on Equation 1. Data from ECHP and EU-SILC.

As housing opportunities that young population face varies dramatically when initially living in a city or in a rural[10] environment, it is also important to shed light on the heterogeneous results on this matter. As for the effect on the probability of living with parents, it appears as if the effect on those individuals that are in rural areas is larger than for those in urban ones. While the effect is of 1.85pp in the case of rural areas, is of 0.90pp in urban setting one year after graduation. The effect when compared to the mean 3.2% and 1.92% in each case.

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[10]Due to data availability, this analysis, in particular, restricts the sample only to those countries and years that provide data for urban density, which excludes all countries before 2005 and particularly the Netherlands through the entire sample, and Germany and France for the years 2016 and 2017.

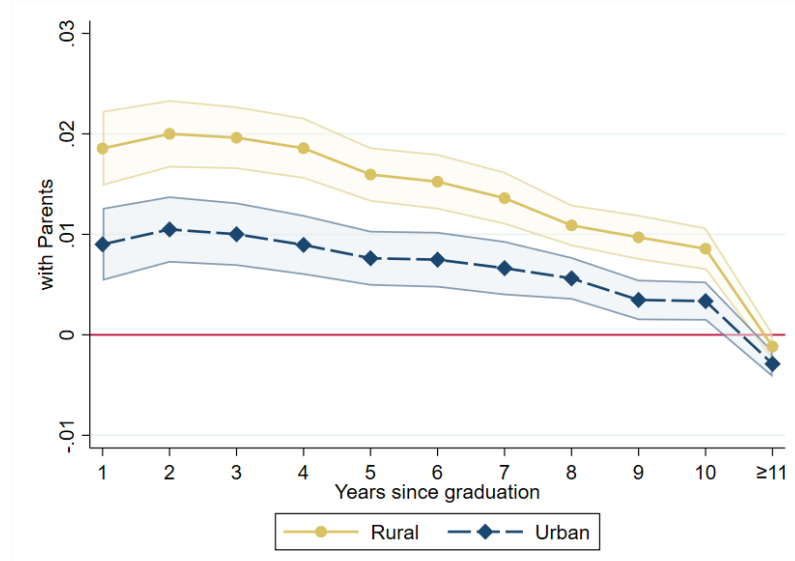**Figure 11:** Results by urban density on labor and housing outcomes

Notes: Effect of a one point increase in the unemployment rate on the probability of living with Parents. Understood as living in a dwelling where at least one parent is present, irrespective of the tenure status. Results are based on Equation 1. Data from ECHP and EU-SILC.

The final heterogeneity analysis is done by the size of the rental market. For that I will follow a criteria by designing a country as of "Large Rental market" if the share of households living in rental units is larger than the median for the rest of the sample in 2018, then countries with "Small Rental Market" are those that area below the median [11]. Results show that while the initial effect is larger for countries with smaller rental markets, in those countries with smaller rental market,s the effects is more persistent in time.

A potential explanation for this could be that the choice that individuals have to make when leaving the parental home has different characteristics in each case. In countries with large rental markets. individuals can choose between buying or renting a unit. However, if due to their worse economic conditions after graduating they have not save enough for buying a unit, then the rental market can still be an attractive option for leaving the parental home. In this case, the rental market could be absorbing those individuals that otherwise would have been homeowners.

As for those countries with small rental markets, then the dilemma faced by young households could be to stay in the parental home or to buy a unit. As buying a unit depends both on current income and past savings, then a shock with such scarring effect as those depicted in this paper, can certainly affect the possibility of becoming a homeowner in a larger extent than the possibility of renting a unit. Then, results are in line with those previously shown, where the effect on homeowrnsip is longer lasting than in renting.

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[11]The countries with large rental markets are: France, Switzerland, Germany, Austria, Denmark, the United kingdom, and the Netherlands.

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Figure 12: Results by size of rental market
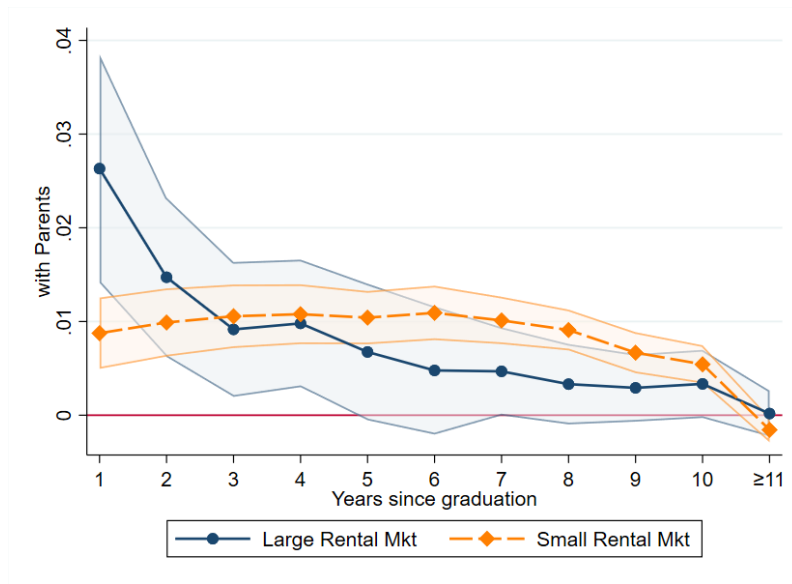
(a) Living with parents

Notes: Effect of a one point increase in the unemployment rate on the probability of living with Parents. Understood as living in a dwelling where at least one parent is present, irrespective of the tenure status. Results are based on Equation 1. Data from ECHP and EU-SILC.

3.7 Additional Results

While this research focuses only on college graduates, in Section E of the Annex, results are shown for all educational levels. This allows identifying the different effects that the unemployment rate at the time of graduation has on different educational levels.

Initial unemployment conditions can have impacts on other outcomes that are also correlated to housing tenure, a clear example of this is family formation. Results show that worse initial labor market conditions lead to a lower probability of being married. However it could be the case that, while not being formally married, individuals still are in a formal relationship, nevertheless, results also show a lower probability of living under a consensual union. Finally, it could be that individuals do not live under any legal arrangement but still being a couple, but again result shows that there is a lower probability of living in cohabitation with a partner. Overall, individuals are less likely to form a couple (either formal or not) when the unemployment rate is higher at their time of graduation.

These impacts can also be extended to another important event in any individual's life, as it is becoming a parent. Results indicate that a higher unemployment rate at the time of graduation reduces the probability of being a parent. These results in family formation are significant even 10 years after graduating. While the coefficient indicates that a one percentage point increase in the unemployment rate at the time of graduation decreases the probability of becoming a parent by approximately 0.9 percentage point one year after graduation, the effect is of 5.5% when compared to the mean. The accumulated effect over 10 years is a reduction of approximately 11 percentage points. These results are broadly in line with previous literature that shows the negative relationship between the unemployment rate at the time of graduation and childbearing and marriage. Detailed results are presented in Figure 20 and Table 5 in the Annex.

As initial unemployment conditions can have impacts on important outcomes such

as income, housing tenure, and family formation, it is possible that they also impact an individual's health. Overall, initial unemployment conditions do not seem to have a significant impact on an individual's health. The first graph shows the results for individuals declaring a "Bad" or "Very Bad" self-perceived health condition. Unemployment rate at the time of graduation does not have significant results on the share of a cohort having a chronic illness, or the share of the cohort that the declares being limited in their daily activities due to their health, neither on the probability of having an unmet medical examination in the last year. Detailed results are presented in Figure 21 and Table 6 in the Annex.

These results are in line with previous literature as in the case of Cutler et al. (2015), where authors find that graduating in high unemployment periods in Europe does not have a significant effect on health outcomes for individuals with at least 10 years of education. For previous studies in the US case, Schwandt and Von Wachter (2019) finds that college graduates do not have a reduction in health insurance coverage from graduating during bad times.

4   Discussion

In this section, I develop a theoretical framework to study the effects of an income shock in younger generations has in housing markets. This model builds on the work by Carozzi (2020) and Ortalo-Magne and Rady (2006), where authors propose a tractable model with income and housing heterogeneity with no uncertainty, and with outside options for rental. The framework for this research, adds the possibility of income shocks in young households. For that, I assume an OLG with no uncertainty, where agents live for two periods with heterogeneity in income but not on housing quality, and the total mass of agent is equal to 1 in each age.

I show that in steady states with lower income for young households and with a non binding outside option, a lower share of them are homeowners and more are living in rental units. This is because these young households are priced out by the older, wealthier agents, and then marginal buyers are then forced to rent. Additionally, I show that in steady-state with lower income for young households and a binding outside option for rental, a larger fraction of them will live with their parents.

The model proposes a set of predictions that will be tested with the micro-level data in section 4.

Incomes

Agents are born with no wealth but heterogeneous in their income.

Let $e_a(i)$ be he endowment at age $a \in (1,2)$ of type $i \in [0,1]$ such that $e_a(i) \to \mathbb{R}^+$ continuous and increasing. For notation purposes we can also write $e(i) = e_1(i)(1+r) + e_2(i)$

Assumption 1: $e_1(i)$ *can be written as* $e_1(i) = \psi e_2(i)$ *where* $\psi \in (0,1)$.

Housing Stock

Agents can either: live with their parents, rent, own, or become landlords (owning more than one unit, living in one and renting the other one). The housing stock for

ownership is fixed so $\overline{S} = S^o$. Prices are depicted with p_t, which are prices for housing at time t, and R_t is the rent paid in advance at time t.

An important assumption is that $\overline{S} < 2$ so no all agents can rent or own a unit, therefore some are forced to live with parents.

Borrowing Constraints

They enter the model via down-payment requirements. Let γp_t be amount borrowed for housing at time t. Then $(1-\gamma)p_t$ is the amount borrowed for housing at t, and $(1-\gamma)p_t$ is the down-payment. Finally, γ represents the maximum LTV ratio.

We impose a restriction in which a household can only have one mortgage at a time. Additionally, we assume: $r < min[\gamma, 1-\gamma]$ so that households can always pay their debt in the SS. There is no default.

Affordability

Agents will pay different sums with respect to each housing tenure choice, in particular they will pay 0 when living with parents, R when renting, and $p(1-\gamma)$ when being homeowners.

Agents dedicate different shares of their income to meet their housing costs, define this ratio for young agents as Aff^{yh} where $h \in [p, r, o]$ for those living with parents, renting, and homeowners respectively.

$$\text{The } Aff^{yh} \text{ will be equal to } \begin{cases} 0 & \text{if living with parents.} \\ \frac{R}{e_1(i)} & \text{if renting.} \\ \frac{p(1-\gamma)}{e_1(i)} & \text{if owner.} \end{cases}$$

Preferences

Preferences are established over a housing and a numeraire good. Let U_{c_t, h_t} be the household's utility, that can be expressed as $U_{c_t, h_t} = c_t + u_h(\tau_t)$ where c_t is the consumption of the numeraire good, and $u_h(\tau_t)$ residential choice in t. Housing tenure decision can be expressed as: $\tau_t = (\tau_{r,t}, \tau_{o,t})'$.

$$\text{The utility derived from this decision is } u_h(\tau_t) = \begin{cases} 0 & \text{if living with parents.} \\ uv_o & \text{if renting.} \\ v_o & \text{if owner.} \end{cases}$$

As $u < 1$ then the utility from renting is lower that of being owner. Finally, there is a utility discount: β, and an interest rate r; and we assume that $\beta(1 + r) \geq 1$

Supply of Rental

The supply of rental units comes form landlords agents, who own more than one unit, living in one and and renting the other one. Let $\lambda_t(i, a)$ denote the number of units rented by agents of age a, type i at time t. There is no guarantee of $rp = R$ in equilibrium as there are no deep pocketed investors.

There is an outside option for rental, which can be understood as tourists or a reserve value of leaving the accommodation empty. Landlords will decide to rent to young households as long as the rent that they perceive from the them (R^y) is larger than the rent from the outside option (R^o), then the market rent (R) will be: $R = max[R^y, R^o]$.

Timing and Decisions

The timing of the decisions is the following for households: 1.Derive utility. 2. Receive endowment. 3. Pay Interest. 4. Receive Interest. 5.Trade housing. 6. Derive utility from consumption.

Every period agents decide: to buy or not units, to become landlords, where to reside next, and to consume or save. They choose $c_t, h_{t+1}, \tau_{t+1}, \lambda_{t+1}$. But as only households with more than one unit are landlords, then λ_{t+1} is given by h_{t+1}. So, $\lambda_{t+1}(i, a) = \sum h_{t+1}(i, a) - 1$ if $h_{t+1} > 0$ and 0 otherwise. Additionally, as all consumption happens in the last period and the first unit is always owner occupied, then with h_{t+1} and τ_{t+1} all decisions are characterized.

State Variables

Let:

- $b(i, a)$ be the non-housing net wealth s.t. $i, a \to \mathbb{R}$.

- $h(i, a)$ be the housing wealth s.t. $i, a \to \tau_t$.

- $V^a(b, h)$ agents value function at age a.

$\implies V^a(b, h) = max_{(\tau', h)} c + u_h(\tau) + \beta V^{a+1}(b, h)$

Policy functions are $\tau'(i, x, a)$ and $h'(i, x, a)$ which map the type, age, and state of the economy, to the optimal decision. The law of motion for individual non-housing wealth is:

$b' = (1 + r)(e_a(i)(1 - 1[\tau' = 0]) + b - c - P(h' - h) + R(\lambda - \tau_r))$

Long-Term Equilibrium

Regarding the housing market we can identify the following features:

- $\mathbb{P}_t = n(R_t, p_t)$ set of prices

- $b_t(i, a)$: gross savings

- $h_t(i, a)$: housing allocations in age/type space:$[0, 1] \times [1, 2]$

- $\tau_t(i, a)$: housing decisions

$\implies$ Housing market clearing:

- $D_1^R(\mathbb{P}_t) + D_2^R(\mathbb{P}_t) + D_{out}^R(\mathbb{P}_t)1\{R^y < R^o\} = S^R(\mathbb{P}_t)$
  Demand for rental (from age one and two) and the demand from outside option for rental (if binding) is equal to supply of rental.

- $S^R(\mathbb{P}_t) + D_1^O(\mathbb{P}_t) + D_2^O(\mathbb{P}_t) = S^o$
  Demand for owner (from age one and two) , plus supply of rentals must be equal to supply of owner housing.

Where $S^R(\mathbb{P}_t)$ is supply of rented units, $D_a^h(\mathbb{P}_t)$ is the demand of h tenure $(Rent, Owner)$ by agent age a buying or renting in t. It is clear here that supply of owners is exogenous and fixed, while supply of rental is endogenous.

Parameter Conditions

To ensure that credit constraints are binding for all agents (which implies that incentives for home ownership are always present) and that the Steady State equilibrium has a lifetime transition following a housing ladder (where old potential buyers outbid young ones), the the following conditions must apply:

- $v_o > e(1)r/(1-\gamma)$: owner occupation is always worth the user cost of housing.

- $uv_l > R$: renting is always worth the rental price

- $e_1(2 - S^o) > e_1(1)r/(1-\gamma)$: becoming a landowner of a unit is profitable.

  Now in order to make the SS with a housing ladder structure we impose that:

- $e_2(0) > e_1(2 - S^o)$: Only young agents are priced out.

- $e_2(1) < (1+r)(1 - (1-\gamma)^{-1})e_1(2 - S^o)$: Landlords cannot rent out two properties. (this point to be defined)

Steady State

In the steady state is possible to state the following price bonds exists:

- $R = e_1(2 - S^o)$

- $P \geq e_1(2 - S^o)(1-\gamma)^{-1}$ and $P \leq e(2 - S^o)(1-\gamma)^{-1}$

The intuition behind this is the following. For rents, if they were higher there would be a larger share than $2 - S^o$ living with their parents, and if was lower, a larger share than $2 - S^o$ would be able to afford renting, in any case there would not be equilibrium in the rental market. As for prices, if they were lower than $e_1(2 - S^o)(1-\gamma)^{-1}$, then a mass larger than $2 - S^o$ individuals would be able to own, and markets do not clear. Similarly, if prices are larger than $e(2 - S^o)(1-\gamma)^{-1}$, then the share of agents that can afford would be lower than S^o would mean owner market does not clear. A more detailed proof is in Appendix A.1.
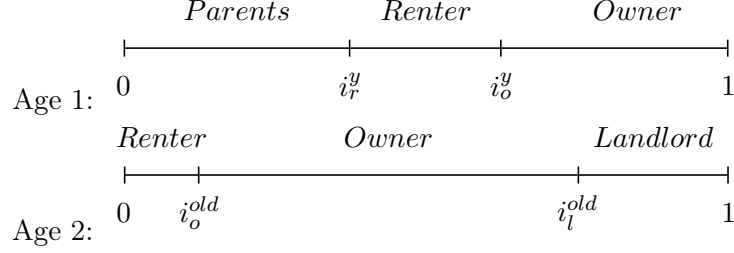
Allocations

We define thresholds in the type distribution of agents that determine the distribution of households across units:

- i_r^y, i_o^y: thresholds for which beyond young agents can afford to rent and own.

- i_r^{old}, i_l^{old}: thresholds for which beyond old agents can afford to own and be landlords (own a unit and rent the other).

The value for each of the thresholds are estimated in Appendix A.2, and they can be depicted in the following way:

Figure 13: Allocations for Steady State

	Parents	Renter	Owner

Age 1: 0 i_r^y i_o^y 1

	Renter	Owner	Landlord

Age 2: 0 i_o^{old} i_l^{old} 1

The position of these thresholds depend entirely on the model parameters. But it is possible, by using the assumptions and the price ordering such that $R(1-\gamma)^{-1} < P$, to prove that the SS allocations will be similar to those shown by Figure 13, with the following relationship between thresholds:

- $i_r^y < i_o^y < 1 < i_l^y$
- $i_r^{old} < i_o^{old} < i_l^{old}$
- $i_h^{old} < i_h^y \ \forall \ h = [R, O]$

- $i_o^{old} < i_r^y$
- $i_o^y < i_l^{old} < 1$

The proofs for this thresholds inequalities are in Appendix A.2. Then the housing market[12] equilibrium conditions are:

- $3 - i_o^{old} - i_o^y - i_l^{old} = S^o$.
  Which can be read as the demand from old households to own $(1 - i_o^{old})$ plus the demand from young households to own $(1 - i_o^y)$ plus the demand from landlords to own their owner-occupied unit $(1 - i_l^{old})$ must be equal to the total supply of owner housing (S^o).

- $i_o^{old} + i_o^y - i_r^y = 1 - i_l^{old}$.
  Which can be read as the demand from old households to rent (i_o^{old}) plus the demand from young households to rent $(i_o^y - i_r^y)$ must be equal to the total supply of rental housing $(1 - i_l^{old})$.

Proposition Case 1: outside option non-binding

A lower ψ leads to a steady state in which less young households are *Owner* and more young households are *Renter*, and less old households are *Renter*. The shock will leads to higher average affordability ratio for young *Owner* and lower ratio young *Renter*. As for housing costs, while rents fully capitalize the shock while prices only capitalize it partially. This new SS can be depicted as shown by Figure 14.

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[12]Given these thresholds we can use them to also depict the demands for different types of housing: $D_1^R = i_o^y - i_r^y$; $D_2^R = i_o^{old}$; $S^R = 1 - i_l^{old}$; $D_1^O = 1 - i_o^y$; $D_2^O = 1 - i_o^{old}$

Figure 14: Short term changes in allocations for a lower ψ
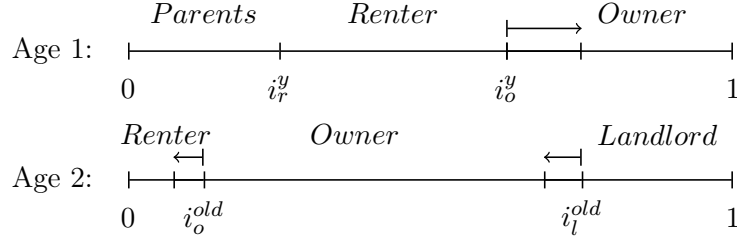
Notes: This picture depicts the changes in the SS caused by a drop in ψ. With lower incomes, young marginal owners households are forced to rent, while as rents adjust fully to the new income, the share living with aprents remains the same.

Proof: See Appendix A.3.

Rents adjust fully to the new income, as they are solely determined by the young agents income, therefore they fall in the same proportion as ψ. Prices in contrast, do not absorb fully the shock as they also depend on the income by old agents. With rents adjusting to the new income, the marginal renter does not change, and neither does the share living with their parent. As prices drop less than the young agents income, the previous marginal owner can no longer afford prices, and now less young agents will be homeowners.

As for older agents, there will be less living in rental units, as they see rents fall but their income remain unchanged. This increases the share of older agents living in owned units. The share of agents becoming landlords will increase or decrease depending on whether the drop in demand from rental units from older agents is larger than the increase in demand for rental units from younger agents. The share of landlord adjust so that rental market is in equilibrium.

As for the affordability, young renters see both rents and income fall in the same proportion, so the affordability ratio should not change. However, the new steady state includes individuals with higher income, that in the previous steady state would have own a unit. These "wealthier" agents will have lower affordability ratio, and that causes the average affordability for renters to fall. As for owners, agents have a drop in income but a drop not as large in prices, this will push average affordability up.

Proposition Case 2: outside option binding

A lower ψ leads to a steady state in which less young households are *Owner* and more households are living with *Parents*, while less old households are *Renter*. This also leads to higher average affordability ratio young *Owner*, and in potentially also in *Renter*. Prices will partially capitalize the shock, and rents will capitalize the shock depending on how binding is the outside option.

Additionally, in the particular case when the outside option is fully binding (that is that rents do not capitalize anything of the shock) the average affordability for young *Renter* will be higher than for young *Owner*. Also it is possible to show that the share of *Landlords* increases. This shifts in the steady state m can be depicted as shown by Figure 15.

Figure 15: Transitions shifts in allocations for a lower ψ
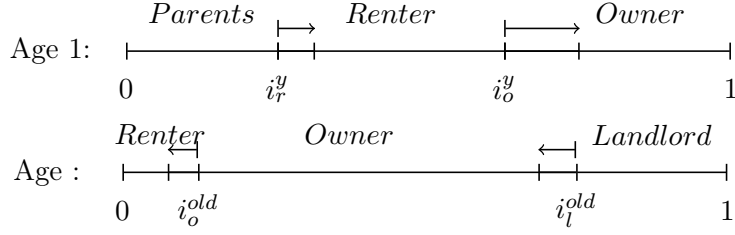
Notes: This picture depicts the changes in the SS caused by a drop in ψ when the outside option is binding. With lower incomes, young marginal owners are forced to rent, while as are forced to rent.

Proof: See Appendix A.4.

Rents are now determined by the outside option, so they will fall in proportion to how binding is the outside option. Prices will partially capitalize the shock, not falling as much as incomes. The marginal renter will now be determined by that individuals whose income is equal to the outside option, an income higher than the new equilibrium rents, therefore there will be more individuals living with their parents. Again as As prices drop less than the young agents income, the previous marginal owner can no longer afford prices, and now less young agents will live with parents.

As for older agents, there will be less living in rental units, as they see rents fall but their income remain unchanged. This increases the share of older agents living in owned units. The share of agents becoming landlords will increase or decrease depending on whether the drop in demand from rental units from older agents is larger than the increase in demand for rental units from younger agents, as those units previously used by renting young agents, are now rented to the outside option. The share of landlord adjust so that rental market is in equilibrium.

As for the affordability ratios, young renters experience a drop in their income but not a equally proportional drop in the rents, if the relative drop in rents is lower than the relative drop in prices, then the average affordability for renters will go up. As for owners, agents have a drop in income but a drop not as large in prices, this will push average affordability up.

In the particular case when the outside option rent is equal to the rent in the initial steady state, rents do not capitalize anything of the shock, the average affordability ratio for renters will increase, and it will be higher than for homeowners. This is because while income fall both for owners and renters, while prices for owners do adjust (although not fully), in this case rents remain the same. There will also be more landlords as princes go down (which makes it cheaper to buy a unit) and rents remain the same, making it more attractive to become a landlord. The rental market is in equilibrium as there is also more demand for rental units coming from young agents.

4.1 Calibration

In order to study the transition period between steady states I use a numerical analysis of the response of the features of the model that are of interest, namely, allocations for young individuals and affordability outcomes.

In each period a N individuals are born in each cohort. Income and parameters satisfy conditions presented on the Parameter Conditions section, which leads to a steady

state characterized as Figure 13. The shock of interest is an unexpected reduction in ψ in period 0. The transition allows prices and rents to adjust as to ensure equilibrium in rental and ownership market across all the transition.

The set of parameters are provided in Table 2, and they follow those in Carozzi (2020). Housing stock S^o is equal to 1600, which implies that 400 individuals (40% of the young population) will be living with their parents. Income distributions are uniform in all periods. The initial value of ψ is 0.3, which means that old agents income is three times as much of those of the younger individuals. This is broadly in line with data, and ensures that young agents are outbid by older ones even with high levels of γ. I show the case of ψ dropping up to 0.2. In Table 2 depicts all the values for the parameters in the transition analysis. I will study two types of scenarios, one in which the outside option is non-binding and one in which the outside option is fully binding.

Table 2: Transition analysis: parameters values

Parameters	Value
Income Period 2,3	U(3,20)
ψ_i	0.3
ψ_f	0.2
v	400
μ	0.5
S^o	1600
r	0.01
γ	0.7

The transition towards a steady state with a lower ψ with a non-binding outside option is depicted in Figure 16. The left graph shows the allocations for young individuals, and the right one depicts the affordability ratios for young individuals. In line with predictions of the model, the number of young agents living with their parents remains unchanged, while there is a trade-off between ownership and renting. The final state is reached within four periods, in which markets adjust in such a way as there is always equilibrium. The periods immediately after the shock there is a spike in the share of renters (and a low point in ownership) as prices tend to adjust more slowly than individuals incomes. As for the graph on the right, it depicts the evolution of the affordability ratios. After reaching the new steady state, rental households have lower affordability ratios, as there are new "wealthier" renters. As for owners, the average affordability ratio goes higher, as prices fall less than young agents income.

Figure 16: Transitions after an income shock on young individuals, with non binding outside option.
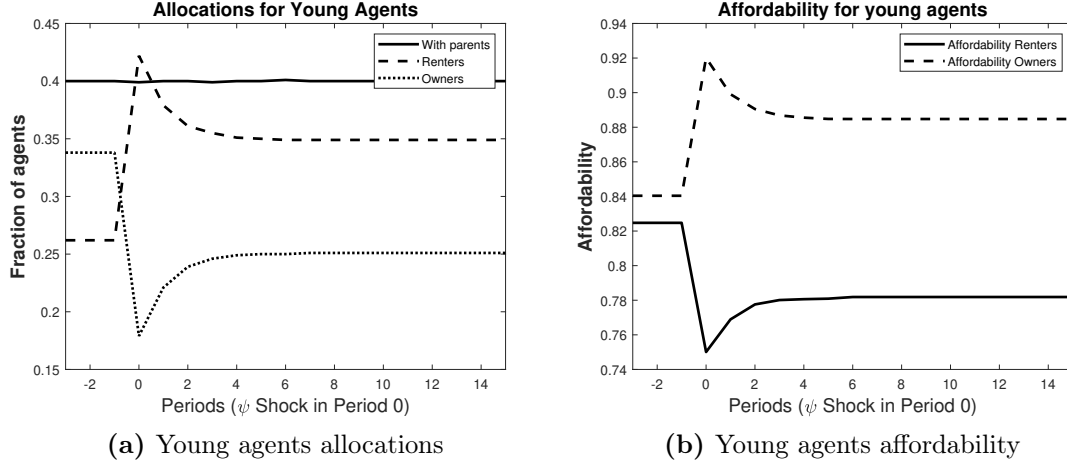
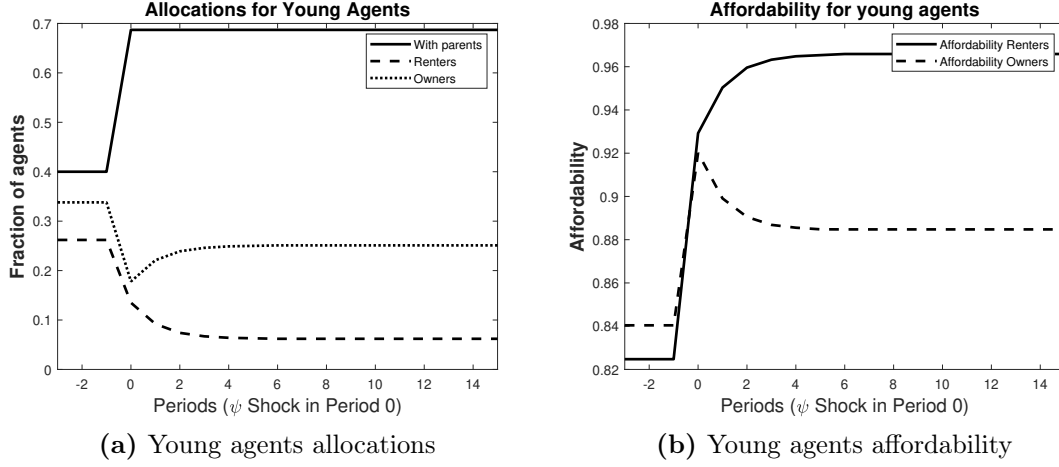**(a)** Young agents allocations   **(b)** Young agents affordability

Notes: The left panel depicts the transition for the allocation of young individuals, while the right panel shows the transition for the average affordability ratio.

The transition for the case in which the outside option is fully binding is shown in Figure 17. The left graph shows the allocations for young individuals, while the right one shows the transition for the affordability ratios. In line with predictions of the model, the number of young agents living with their parents increases, while there is a decrease in the number of young agents living in rental units and in owned units. The size of the increase in the share of young individuals living with parents will be linked to how binding is the outside option. The more inflexible the rents are, the more younger agents will be forced to live with their parents. While the final equilibrium is reached within two periods for agents living with parents, for rental and ownership agents, as markets need to be in equilibrium it takes up to four periods to reach the final allocation.

As for the average affordability it is possible to see that the ratio increases both for renters and owners, and in line with the predictions, is larger for renters. The transition reaches its final steady state allocations and affordability in four periods. In period zero the share of renters peaks (as the share of owners reaches its minimum) because prices do not adjust immediately (as to maintain equilibrium in the markets), making ownership unaffordable for a greater share of young agents.

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Figure 17: Transitions after an income shock on young individuals, with binding outside option.

(a) Young agents allocations   **(b)** Young agents affordability

Notes: The left panel depicts the transition for the allocation of young individuals, while the right panel shows the transition for the average affordability ratio.

These results, and more particularly those in which the outside option is binding, are similar to those found in the empirical section of the paper.....

5 Concluding Remarks

In this paper, I have estimated the long-term effects of an increase in the unemployment rate at the graduation time, for a large sample of individuals across all Europe, both in labor as in housing outcomes. Using an empirical strategy that controls for effects arising from regional, time, cohort, potential experience, and educational attainment, it is possible to identify the effect that initial conditions in the labor market can affect later outcomes. Additionally, as the shock is exogenous, results can be interpreted in a causal way.

Results show that being exposed to a greater unemployment rate at graduation time leads to an increase in the probability of living with parents, a positive effect that is still significant ten years after graduation. effects also show worse affordability outcomes for those being homeowners or renters. This shock also leads to lasting effects on personal earnings, with the magnitude being larger to those previously found in the literature. In line with previous literature, the effect in non-significant in health status when restricting to college graduates. However, initial labor market conditions do have a significant effect on family formation, with individuals less likely to be in a relationship, either formal or not, as well as becoming a parent.

Given that the sample size and extension of the surveys used are particularly large, it provided the opportunity for a heterogeneous analysis. This allows determining that the effect is stronger for men than for women, while stronger on rural environments than in urban ones. Results also differ with respect to the size of the rental market, with individuals facing different options depending on the context.

Using an overlapping generation model with housing ladder, I am able to replicate the recent trends in the housing market, and link these changes to shocks in income for younger generations. In my framework, younger generations are unable to afford to own a

unit, so in the margin, they opt for renting and as older households outbid young ones, a larger fraction of them can own. The framework also shows that rent elasticity can play a major role on determining housing allocation after income shocks.

This research helps in understanding the long term effect of economic recession on general well-being. This will be particularly useful for future generations, like those affected by the economic downturn caused by the SARS-CoV-2 outbreak. A deeper understating of these effects will help shape policy-making in order to alleviate the negative impacts on these generations.

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Appendix

A   OLG Model

A.1   Price bonds

- $R = e_1(2 - S^o)$.
  Proof (by contradiction):

  - Assume that $R < e_1(2 - S^o)$, and considering that $u_v > e_(2 - S^o)$, then households that are not able to occupy would rent, so a mass larger that $2 - S^o$ would be willing to rent in age 1, and in age 1 and 2. Which would create and excess demand, so $R \geq e_1(2 - S^o)$.

    Now assume that $R > e_1(2 - S^o)$ then a mass larger that $2 - S^o$ of young households would be homeless by the end of each period. So rental markets would not clear, then $R \leq e_1(2 - S^o)$.

    Then $R = e_1(2 - S^o)$.

  Additionally:

- $P \geq e_1(2 - S^o)(1 - \gamma)^{-1}$ and $P \leq e(2 - S^o)(1 - \gamma)^{-1}$.
  Proof(by contradiction):

  - Assume $P < e_1(2 - S^o)(1 - \gamma)^{-1}$, which is equal to $P(1 - \gamma) < e_1(2 - S^o)$. This implies that a mass of agents age 1 that can buy a unit is $m_o^1 > 1 - (2 - S^o)$, but as older agents outbuy younger $(e_2(0) > e_1(2 - S^o))$, then $m_o^2 = 1$. This implies that $m_o = m_o^1 + m_o^2 > S^o - 1 + 1 = S^o$. So more can afford to own than the actual offer of, so the solution is that $P \geq e_1(2 - S^o)(1 - \gamma)^{-1}$.

  - Assume $P > e(2 - S^o)(1 - \gamma)^{-1}$, which is equal to $P(1 - \gamma) > e(2 - S^o)$. This implies that a mass of agents that can afford buying is: $m_o < 2 - (2 - S^o) = S^o$. Then markets do not clear, so $P \leq e(2 - S^o)(1 - \gamma)^{-1}$.

A.2   Thresholds

So the thresholds for young agents are:

- $i_r^y = e_1^{-1}(R)$

- $i_o^y = e_1^{-1}(p(1 - \gamma))$

- $i_l^y = e_1^{-1}(p(1 - \gamma) + p)$

And the thresholds for old agents are:

- $i_r^{old} = e^{-1}(R)$

- $i_o^{old} = e^{-1}(p(1 - \gamma) + (1 + r)R)$

- $i_l^{old} = e_1^{-1}(p(1 - \gamma) + (1 + r)p - R)$

Proof: $i_r^y < i_o^y < 1 < i_L^y$

This conditions follows from the relation on prices $R < (1 - \gamma)p$. If we consider also the previous mentioned restriction $e_2(0) > e_1(2 - S^o)$ and the price bound $R = e_1(2 - S^o)$, the we have that $i_r^{old} < 0$, which means old agents always afford renting. And to prove that $1 < i_l^y$ NOT FINISHED

Proof: $i_r^{old} < i_o^{old} < i_l^{old}$

This conditions is true given the prices ordering $p < (1 - \gamma)p$ and what we know about

period one decision from condition $i_o^y > i_o^{old}$. Consider the statement NOT FINISHED

Proof: $i_h^{old} < i_h^y \ \forall \ h = [R, O]$

This can be proved using $e_1(i) < e_2(i) \ \forall \ i$. Then to show that $i_o^{old} < i_o^y$, we note that $i_o^y = e_1(p(1-\gamma))$. Proceeding by contradiction, if $i_o^{old} > i_o^y$, then marginal buyer of owners units were already owners in the period before, and then:

$$e(i_o^{old}) = e_1(i_o^{old})(1 + r) + e_2(i_o^{old}) = (1 - \gamma)p + rp$$
$$e_1(i_o^{old}) > (1 - \gamma)p$$
$$e_2(i_o^{old}) > (1 - \gamma)p > rp$$

Now note that the three equations cannot be simultaneously true (as $r > 1 - gamma$), then $i_o^{old} > i_o^y$ is not true. Then $i_o^{old} \leq i_o^y$. It is possible to rule the equality case analogously, making that $i_o^{old} < i_o^y$.

The proof for $i_r^{old} < i_r^y$ is similar.

Proof: $i_o^{old} < i_r^y$???

Proof: $i_o^y < i_l^{old} < 1$

It is possible to prove that $i_o^y < i_l^{old}$ suing that no landlords can rent more than one unit (expression HERE). Proceed by contradition, if $i_o^y > i_l^{old}$, the landlords in period 2 were renters in period 1:

$$i_l^{old} < i_o^y$$
$$e(i_l^{old}) = p(1 - \gamma) + p + (1 + r)R$$

Which means that:

$$e_1(i_l^{old}) < p(1 - \gamma)$$
$$e_2(i_l^{old}) > p(1 - \gamma) + (\gamma(1 + r) - 1)p + (1 + r)R$$

Which given the price bounds means that $e_2(i_l^{old}) > (1 + r)(1 - (1 - \gamma)^{-1})e_1(2 - S^o)$ which contradicts the last assumption stated in 2.10. NOT FINISHED

The statement $i_l^{old} < 1$ is given by the existence of rental markets, proven in the appendix.

A.3 Proof Proposition Case 1

The case with non binding outside option can be characterized as one in which $R_f > R^o$ with R_f being the rent after the income shock. That is that the rent in the new steady state is still larger than the outside option rent.

As a general tool for the proofs, first lets assume $g_a(x) = \dfrac{\partial e_a^{-1}(x)}{\partial x}$ and $g(x) = \dfrac{\partial e^{-1}(x)}{\partial x}$. With both functions being positive.

Additionally as $e_1(i) = \psi e_2(i)$ we can say that $e_1^{-1}(i) = e_2^{-1}(\frac{1}{\psi} i)$.

A. To prove the changes in housing tenure we need to derive the thresholds for housing allocation:

1. First the thresholds regarding agents living with parents i_r^y,

$$\frac{\partial i_r^y}{\partial \psi} = \frac{\partial e_1^{-1}(R)}{\partial \psi} = \frac{\partial e_2^{-1}(\frac{1}{\psi}R)}{\partial \psi}$$

Which gives:

$$\frac{\partial e_1^{-1}(R)}{\partial \psi} = g_2\left(\frac{1}{\psi}R\right)\left[\frac{-R}{\psi^2} + \frac{\partial R}{\partial \psi}\right]$$

As in equilibrium and with the outside option non binding $R = e_1(2 - S^o) = \psi e_2(2 - S^o)$ then:

$$\frac{\partial e_1^{-1}(R)}{\partial \psi} = g_2\left(\frac{1}{\psi}R\right)\left[\frac{-\psi e_2(2 - S^o)}{\psi^2} + \frac{e_2(2 - S^o)}{\psi}\right]$$

Which means that $\frac{\partial i_r^y}{\partial \psi} = 0$. Then there are the same share of young individuals living with their parents.

2. The second threshold determines the share of young agents living with as homeowners i_o^y. Given the threshold's value:

$$\frac{\partial i_o^y}{\partial \psi} = \frac{\partial e_1^{-1}(p(1 - \gamma))}{\partial \psi}$$

Now this can be rewritten as:

$$\frac{\partial e_2^{-1}(\frac{1}{\psi}p(1 - \gamma))}{\partial \psi} = g_2\left(\frac{1}{\psi}p(1 - \gamma)\right)\left[\frac{-p}{\psi^2} + \frac{\partial p}{\partial \psi}\frac{1}{\psi}\right](1 - \gamma)$$

Two options:

1- Given the equilibrium conditions: $p \geq e_1(2 - S^o)(1 - \gamma)^{-1}$ and $p \leq e_2(2 - S^o)(\psi(1 + r) + 1)(1 - \gamma)^{-1}$ then p can be rewritten as: $p = e_2(2 - S^o)(\psi(1 + r) + 1)(1 - \gamma)^{-1}z$ with $\frac{\psi}{\psi(1 + r) + 1} \leq z \leq 1$. Then the equation can be rewritten as:

$$g_2(.)\left[\frac{-e_2(2 - S^o)(\psi(1 + r) + 1)(1 - \gamma)^{-1}z}{\psi^2} + \frac{\partial e_2(2 - S^o)(\psi(1 + r) + 1)(1 - \gamma)^{-1}z}{\partial \psi}\frac{1}{\psi}\right](1 - \gamma)$$

That can be simplified and then:

$$g_2(.)\left[\frac{-e_2(2 - S^o)z}{\psi}\right] < 0 \rightarrow \frac{\partial i_o^y}{\partial \psi} < 0$$

2-Assume $\frac{\partial p}{\partial \psi} < \frac{p}{\psi^2}$ then $\frac{\partial i_o^y}{\partial \psi} < 0$

3. The third thresholds determines the share of old agents living in owned units i_o^o:

$$\frac{\partial i_o^o}{\partial \psi} = \frac{\partial e^{-1}(p(1 - \gamma) + R(1 + r))}{\partial \psi}$$

Which gives:

$$\frac{\partial i_o^o}{\partial \psi} = g(p(1-\gamma) + R(1+r)) \left[\frac{\partial p}{\partial \psi}(1-\gamma) + \frac{\partial R}{\partial \psi}(1+r) \right]$$

As we know that $g(.)$ is always positive and from the market clearing conditions that $\left[\frac{\partial p}{\partial \psi}(1-\gamma) + \frac{\partial R}{\partial \psi}(1+r) \right] > 0$ then :

$$\frac{\partial i_o^o}{\partial \psi} > 0$$

Which implies that there are less old households living in rental units.

4. Finally we can derive the rental market equilibrium, $i_o^y + i_o^o + y_r^y = 1 - i_l^o$, wrt ψ:

$$\frac{\partial i_o^y + i_o^o + y_r^y}{\psi} = \frac{\partial 1 - i_l^o}{\partial \psi}$$

As we know that $\frac{\partial i_o^y}{\partial \psi} < 0$, $\frac{\partial i_o^o}{\partial \psi} > 0$, and $\frac{\partial i_r^y}{\partial \psi} = 0$, the sign of $1 - i_l^o$ will depend on which effect dominates, if the increase in rental units from young agents or the drop in rental units from older agents.

B. The second part of the proposition refers to the affordability ratios, so to prove the changes in affordability ratios we need to rove first that:

$$\frac{\psi_f}{\psi_i} = \frac{R_f}{R_i} < \frac{P_f}{P_i}$$

The first part is derived from the fact that $R = e_1(2 - S^o)$ when outside option not binding, so:

$$\frac{R_f}{R_i} = \frac{e_{f1}(2 - S^o)}{e_{i1}(2 - S^o)} = \frac{\psi_f e_2(2 - S^o)}{\psi_i e_2(2 - S^o)} = \frac{\psi_f}{\psi_i}$$

The second part can be proved rewriting p using the market equilibrium conditions so that $p = e_2(2 - S^o)(\psi(1+r) + 1)(1-\gamma)^{-1}z$ with $\frac{\psi}{\psi(1+r) + 1} \le z \le 1$. Then:

$$\frac{p_f}{p_i} = \frac{e_2(2 - S^o)(\psi_f(1+r) + 1)(1-\gamma)^{-1}z}{e_2(2 - S^o)(\psi_i(1+r) + 1)(1-\gamma)^{-1}z}$$

Which is equal to $\frac{\psi_f(1+r) + 1}{\psi_i(1+r) + 1} > \frac{\psi_f}{\psi_i}$.

This follows the intuition behind that while on one hand rents fully capitalize the income shock, as they are determined solely by young agents income, prices on the other hand, do not fully capitalize the shock as they are also determined by older agents income (which are unaffected), therefore falling less than rents.

The affordability in the steady state for young agents can be illustrated in the following way:
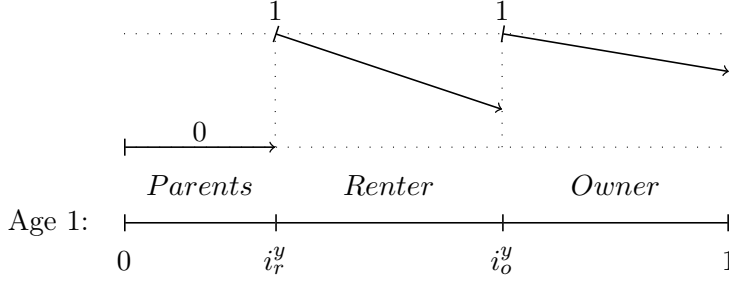
Now calculate the average affordability for renters and owners, before and after the income shock. As mentioned before the affordability refers to the ratio between what agents pay for their housing tenure and its income.

Define Aff_i^{yr} and Aff_f^{yr} as the initial and final average affordability of renters, which can be calculated as the average between the two extremes of affordability ratios:

$$Aff_i^{yr} = \frac{\frac{R_i}{e_{i1}(i_r^y)} + \frac{R_i}{e_{i1}(p_i(1-\gamma))}}{2} = \frac{1}{2} + \frac{R_i}{2p_i(1-\gamma)}$$

$$Aff_f^{yr} = \frac{1}{2} + \frac{R_f}{2p_f(1-\gamma)}$$

The ratio has two parts, the first one refers to the marginal renter located in i_r^y that will dedicate all of its income to renting and therefore have and affordability ratio equal to one. The second one is the "wealthiest" renter, that just below the marginal owner, that will have an income approximately the same the marginal owner, but will pay only R for its income. The average affordability for renters after the income shock is calculated in an analogous way, but now with the final rents and prices. Now it can be proved that:

$$Aff_i^{yr} > Aff_f^{yr} \iff \frac{1}{2} + \frac{R_i}{2p_i(1-\gamma)} > \frac{1}{2} + \frac{R_f}{2p_f(1-\gamma)} \iff \frac{p_f}{p_i} > \frac{R_f}{R_i}$$

With the last inequality being proved before.

In a similar way it is possible to check the changes in average affordability for young homeowners:

$$Aff_i^{yo} = \frac{\frac{p_i(1-\gamma)}{e_{i1}(i_o^y)} + \frac{p_i(1-\gamma)}{e_{i1}(1)}}{2} = \frac{1}{2} + \frac{p_i(1-\gamma)}{2e_{i1}(1)}$$

$$Aff_f^{yo} = \frac{1}{2} + \frac{p_f(1-\gamma)}{2e_{f1}(1)}$$

In a similar way to renters, the average affordability is the average between the marginal owners affordability ratio, which dedicates all of its income to down-payment and therefore is one. And the "wealthiest" homeowner, which has an income equal to $e_1(1)$. Now to prove that affordability ratios increases after the shock we need to prove that:

$$Aff_i^{yo} < Aff_f^{yo} \iff \frac{1}{2} + \frac{p_i(1-\gamma)}{2e_{i1}(1)} < \frac{1}{2} + \frac{p_f(1-\gamma)}{2e_{f1}(1)} \iff \frac{p_f(1-\gamma)}{p_i(1-\gamma)} > \frac{e_{f1}(1)}{e_{i1}(1)}$$

With the last term $\frac{e_{f1}(1)}{e_{i1}(1)}$ being equal to $\frac{\psi_f}{\psi_i}$, which confirms the last inequality as

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$\frac{p_f}{p_i} > \frac{\psi_f}{\psi_i}$ has already been proved.

A.4   Proof Proposition Case 2

The case for binding outside option can be characterized as one in which $R_f < R^o$, that is that the rent from the final steady state is lower than the outside option one.

A. The proof of the case when the outside option is binding is very similar to the previous case. In fact the poof for the effect on i_o^y, i_o^o and i_l^o are the same.

As for the changes in the share of agents living with their parents i_r^y:

$$\frac{\partial i_r^y}{\partial \psi} = \frac{\partial e_1^{-1}(R)}{\partial \psi} = \frac{\partial e_2^{-1}(\frac{1}{\psi}R)}{\partial \psi}$$

Which gives:

$$\frac{\partial e_1^{-1}(R)}{\partial \psi} = g_2\left(\frac{1}{\psi}R\right)\left[\frac{-R}{\psi^2} + \frac{\partial R}{\partial \psi}\right]$$

As with the outside option binding $R = R^o$ (with R^o exogenous) then $\frac{\partial R^o}{\partial \psi} = 0$ and:

$$\frac{\partial e_1^{-1}(R)}{\partial \psi} = g_2\left(\frac{1}{\psi}R\right)\left[\frac{-R^o}{\psi^2}\right]$$

Which means that $\frac{\partial i_r^y}{\partial \psi} < 0$. Then there are more young individuals living with their parents.

B. Now it is possible to prove that with the outside option binding, the average affordability for renters can increase.

As in the previous part, the average affordability for renters before and after the shock is:

$$Aff_i^{yr} = \frac{1}{2} + \frac{R_i}{2p_i(1-\gamma)}$$
$$Aff_f^{yr} = \frac{1}{2} + \frac{R^o}{2p_f(1-\gamma)}$$

So therefore:

$$Aff_i^{yr} < Aff_f^{yr} \iff \frac{1}{2} + \frac{r_i}{2p_i(1-\gamma)} < \frac{1}{2} + \frac{R^o}{2p_f(1-\gamma)} \iff \frac{R^o}{R_i} > \frac{p_f}{p_i}$$

So the average affordability ratio will increase as long as rents absorb less of the shock than prices. In the particular case for $R^o = R_i$ we will have that:

$$Aff_i^{yr} < Aff_f^{yr} \iff 1 > \frac{p_f}{p_i}$$

The intuition behind this is that young renters will have lower income, but as rents do not adjust, this will increase the affordability ratio for those already renting.

Additionally, for the case in which the outside option is fully binding, we can prove that after the shock, the average affordability for renters will be higher than those of owners:

$$Aff_f^{yr} > Aff_f^{yo} \iff \frac{1}{2} + \frac{R^o}{2p_f(1-\gamma)} > \frac{1}{2} + \frac{p_f(1-\gamma)}{2e_{f1}(1)} \iff \frac{R^o}{p_f(1-\gamma)} > \frac{p_f(1-\gamma)}{e_{f1}(1)}$$

As we know, even when the outside option is binding, rents and prices must comply with $R < p(1-\gamma)$, which allows us to say that:

$$\frac{R^o}{p_f(1-\gamma)} > \frac{p_f(1-\gamma)}{e_{f1}(1)} > \frac{R^o}{e_{f1}(1)} \iff \frac{e_{f1}(1)}{p_f(1-\gamma)} > 1$$

Which the last part we know to be true as the wealthiest young household must be able to afford a down-payment for a unit.

B   Potential Endogeneity

The specification in Equation1 treats the entering in the labor market, determined by the time of graduation as exogenous. However, individuals may decide to extend their education so to avoid unfavorable labor market conditions. This potential endogeneity would attenuate the results toward zero. If additionally there is selection into timing, then the bias could go either way.

The following graph shows the probability of self defining as a student given the unemployment rate at the graduation time of the last educational level attained.

As expected the effect is negligible in college graduates and stronger for medium education level individuals.

Figure 18: Effect of a one-point increase in Unemployment Rate at graduation time on being a student.
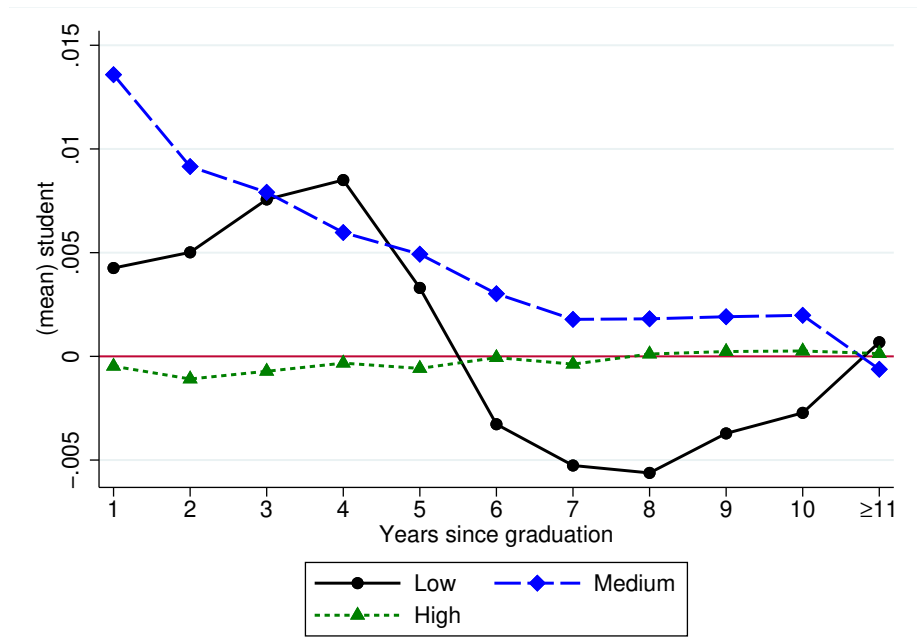
C Detailed Results

Table 3: Effect of a one-point increase in Unemployment Rate on labor outcomes

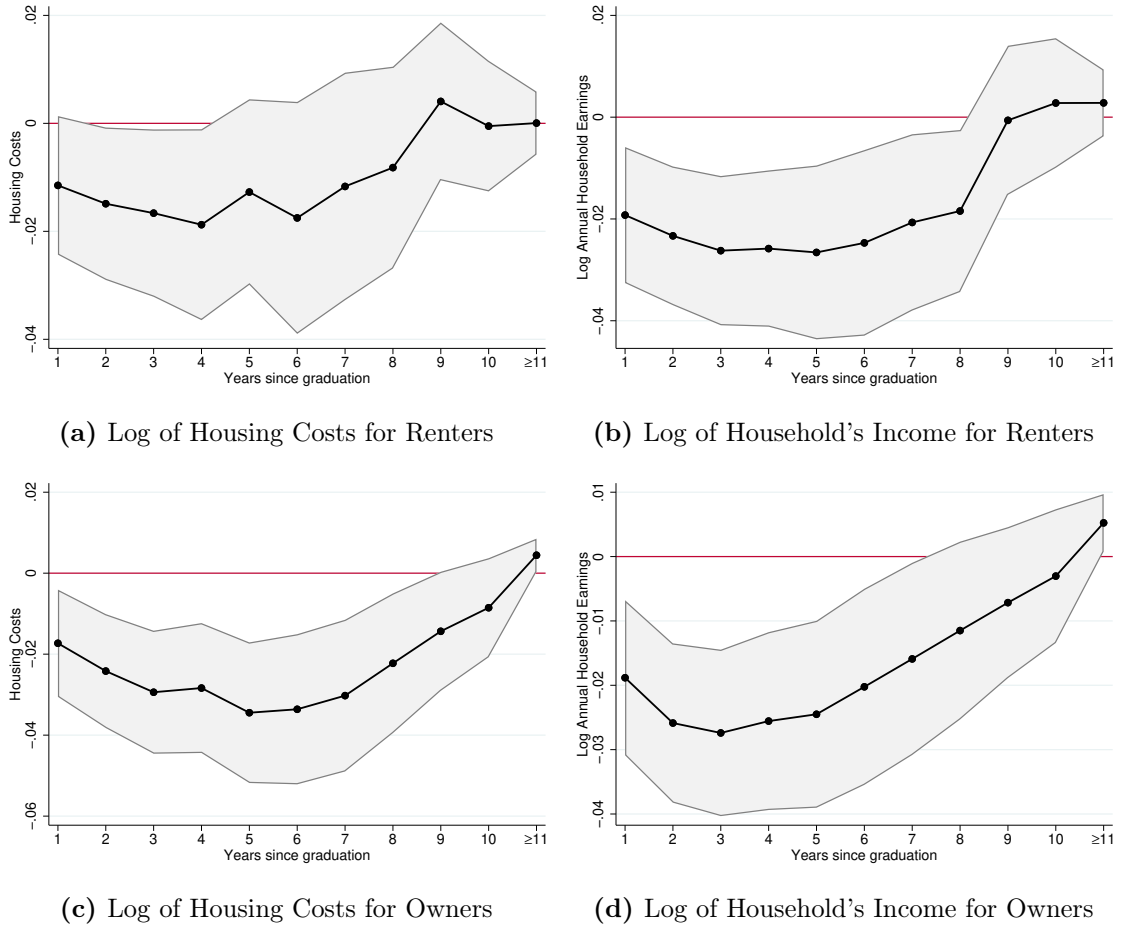| Potential & Experience	Log Personal Earnings	Log Households Earnings	Working	Temporary Employment
1	-0.107***	-0.009	-0.012***	0.009***
	(0.018)	(0.006)	(0.001)	(0.002)
2	-0.112***	-0.016***	-0.010***	0.010***
	(0.016)	(0.006)	(0.001)	(0.001)
3	-0.099***	-0.018***	-0.008***	0.010***
	(0.013)	(0.006)	(0.001)	(0.001)
4	-0.090***	-0.018***	-0.007***	0.007***
	(0.012)	(0.007)	(0.001)	(0.001)
5	-0.084***	-0.018**	-0.007***	0.006***
	(0.011)	(0.007)	(0.001)	(0.001)
6	-0.075***	-0.014*	-0.005***	0.005***
	(0.010)	(0.008)	(0.001)	(0.001)
7	-0.059***	-0.012	-0.006***	0.005***
	(0.010)	(0.007)	(0.001)	(0.001)
8	-0.046***	-0.008	-0.005***	0.004***
	(0.010)	(0.007)	(0.001)	(0.001)
9	-0.040***	-0.003	-0.004***	0.004***
	(0.010)	(0.006)	(0.001)	(0.001)
10	-0.040***	-0.001	-0.004***	0.003***
	(0.011)	(0.005)	(0.001)	(0.001)
11	-0.023***	0.004*	-0.003***	0.001
	(0.007)	(0.002)	(0.001)	(0.000)
Constant	7.073***	10.130***	0.757***	0.041***
	(0.045)	(0.013)	(0.004)	(0.004)
Observations	13,554	18,092	18,157	17,288

Notes: Significance is indicated by * $p<0.1$, ** $p<0.05$, and *** $p<0.01$. Standard errors, in parentheses, are clustered at the cohort-region level. Effect of a one point increase in the unemployment rate on annual personal earnings. Results are based on Equation 1. Data from ECHP and EU-SILC.

Table 4: Effect of a one-point increase in Unemployment Rate on Housing outcomes

Potential & Experience	With Parents	Owner	Renter
1	0.015***	-0.005***	-0.010***
	(0.002)	(0.001)	(0.001)
2	0.016***	-0.006***	-0.010***
	(0.002)	(0.001)	(0.001)
3	0.016***	-0.008***	-0.008***
	(0.002)	(0.001)	(0.001)
4	0.015***	-0.008***	-0.007***
	(0.001)	(0.001)	(0.001)
5	0.014***	-0.008***	-0.006***
	(0.001)	(0.001)	(0.001)
6	0.013***	-0.010***	-0.004***
	(0.001)	(0.001)	(0.001)
7	0.012***	-0.009***	-0.003***
	(0.001)	(0.001)	(0.001)
8	0.010***	-0.008***	-0.002*
	(0.001)	(0.001)	(0.001)
9	0.008***	-0.006***	-0.002*
	(0.001)	(0.001)	(0.001)
10	0.006***	-0.004***	-0.002**
	(0.001)	(0.001)	(0.001)
11	-0.002***	0.001	0.001
	(0.001)	(0.001)	(0.001)
Constant	0.085***	0.736***	0.149***
	(0.004)	(0.005)	(0.003)
Observations	18,157	18,157	18,157

Notes: Significance is indicated by * $p<0.1$, ** $p<0.05$, and *** $p<0.01$. Standard errors, in parentheses, are clustered at the cohort-region level. Effect of a one point increase in the unemployment rate on housing outcomes. Results are based on Equation 1. Data from ECHP and EU-SILC.

Figure 19: Effect of a one-point increase in Unemployment Rate at graduation time on housing affordability.

(a) Log of Housing Costs for Renters

(b) Log of Household's Income for Renters

(c) Log of Housing Costs for Owners

**(d)** Log of Household's Income for Owners

Notes: Effect of a one point increase in the unemployment rate on various housing affordability. Affordability is calculated as the yearly housing costs over the household's yearly income. Results are based on Equation 1. Data from EU-SILC.

Table 5: Effect of a one-point increase in Unemployment Rate on Family Formation outcomes

Potential & Experience	Consensual Union	Married	Being a Parent	Cohabitation
1	-0.007***	-0.004***	-0.009***	-0.011***
	(0.002)	(0.001)	(0.001)	(0.001)
3	-0.007***	-0.006***	-0.011***	-0.013***
	(0.001)	(0.001)	(0.001)	(0.001)
5	-0.006***	-0.005***	-0.011***	-0.011***
	(0.001)	(0.001)	(0.002)	(0.001)
7	-0.007***	-0.005***	-0.012***	-0.010***
	(0.001)	(0.001)	(0.002)	(0.001)
10	-0.005***	-0.004***	-0.009***	-0.006***
	(0.002)	(0.001)	(0.002)	(0.001)
11	0.004***	0.001	0.001	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	17,232	17,549	17,549	17,545

Notes: Significance is indicated by * p<0.1, ** p<0.05, and *** p<0.01. Standard errors, in parentheses, are clustered at the cohort-region level. Effect of a one point increase in the unemployment rate on Family Formation outcomes. Results are based on Equation 1. Data from ECHP and EU-SILC.

Figure 20: Results for Family Formation Outcomes
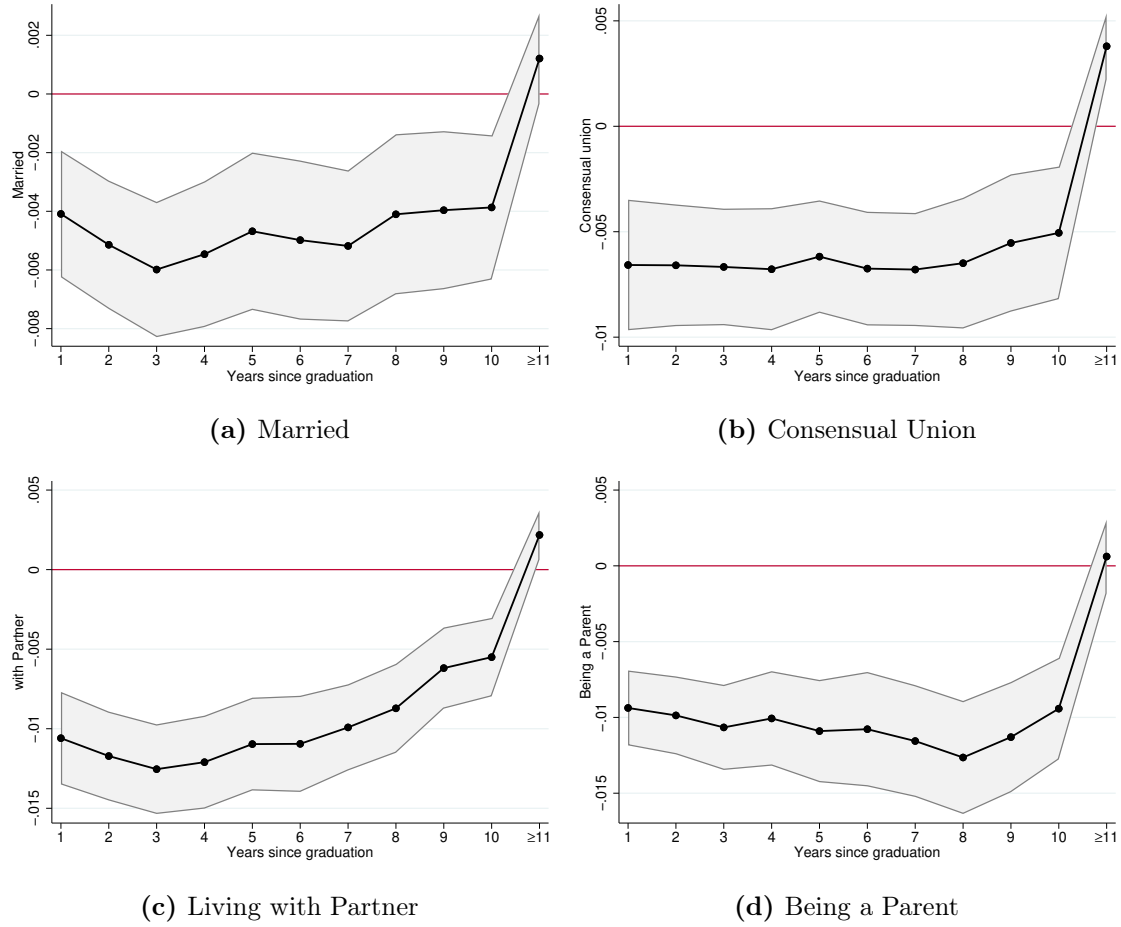
(a) Married

(b) Consensual Union

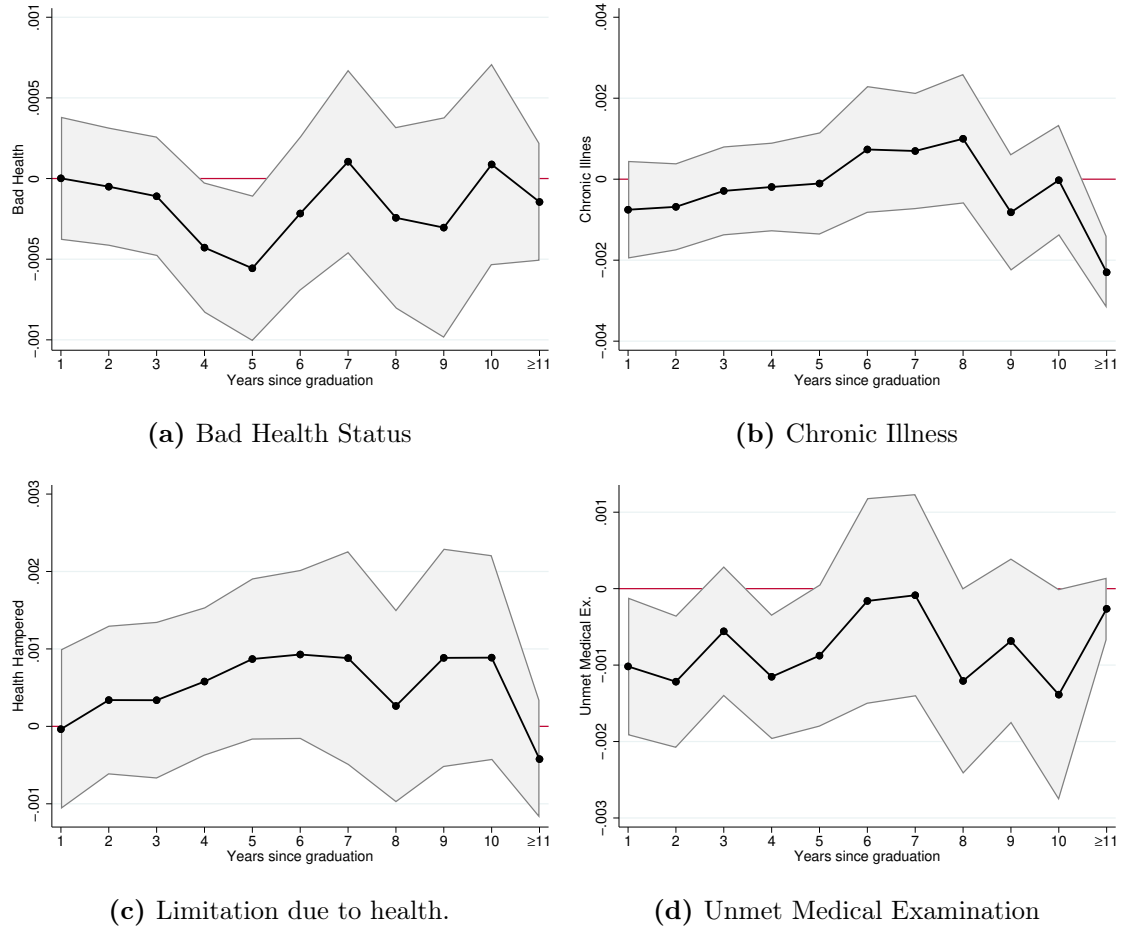**(c)** Living with Partner

(d) Being a Parent

Notes: Effect of a one point increase in the unemployment rate at the time of graduation on various outcomes. Married refers to whether the individual is married on a legal basis or not. Consensual union refers to whether the individual is living a consensual union, with or without legal basis. Living with Partner refers to whether there is a cohabitation status with their partner for the ECHP, or whether the individual's partner is a part of the household for EU-SILC. Being a Parent refers to whether the individual can be identified as "own" / step / adopted / foster parent or guardian of another member of the household. Results are based on Equation 1. Data from ECHP and EU-SILC.

Table 6: Effect of a one-point increase in Unemployment Rate on Health outcomes

Potential & Experience	Bad Health Status	Chronic Illness	Health Hampered	Unmet Medical Examinations
1	0.000	-0.001	-0.000	-0.001**
	(0.000)	(0.001)	(0.001)	(0.000)
3	-0.000	-0.000	0.000	-0.001
	(0.000)	(0.001)	(0.001)	(0.000)
5	-0.001**	-0.000	0.001	-0.001*
	(0.000)	(0.001)	(0.001)	(0.000)
7	0.000	0.001	0.001	-0.000
	(0.000)	(0.001)	(0.001)	(0.001)
10	0.000	-0.000	0.001	-0.001**
	(0.000)	(0.001)	(0.001)	(0.001)
11	-0.000	-0.002***	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	17,529	17,188	17,529	14,338

Notes: Significance is indicated by * $p<0.1$, ** $p<0.05$, and *** $p<0.01$. Standard errors, in parentheses, are clustered at the cohort-region level. Effect of a one point increase in the unemployment rate on Family Formation outcomes. Results are based on Equation 1. Data from ECHP and EU-SILC.

Figure 21: Results for Health Outcomes

(a) Bad Health Status

(b) Chronic Illness

(c) Limitation due to health.

(d) Unmet Medical Examination

Notes: Effect of a one point increase in the unemployment rate at the time of graduation on various health outcomes. Bad health status refers to whether the person self perceives her health status as "Bad" or "Very Bad". Chronic illness refers to whether the individuals declares having any chronic illness. Limitation due to health refers to if the person declares having any sort of limitation in their daily activity due to their health. Unmet Medical examination refers to whether the person declares not being able to meet a needed medical examination in the last year. Results are based on Equation 1. Data from ECHP and EU-SILC, except for Unmet Medical Examination which is only available for the EU-SILC base.
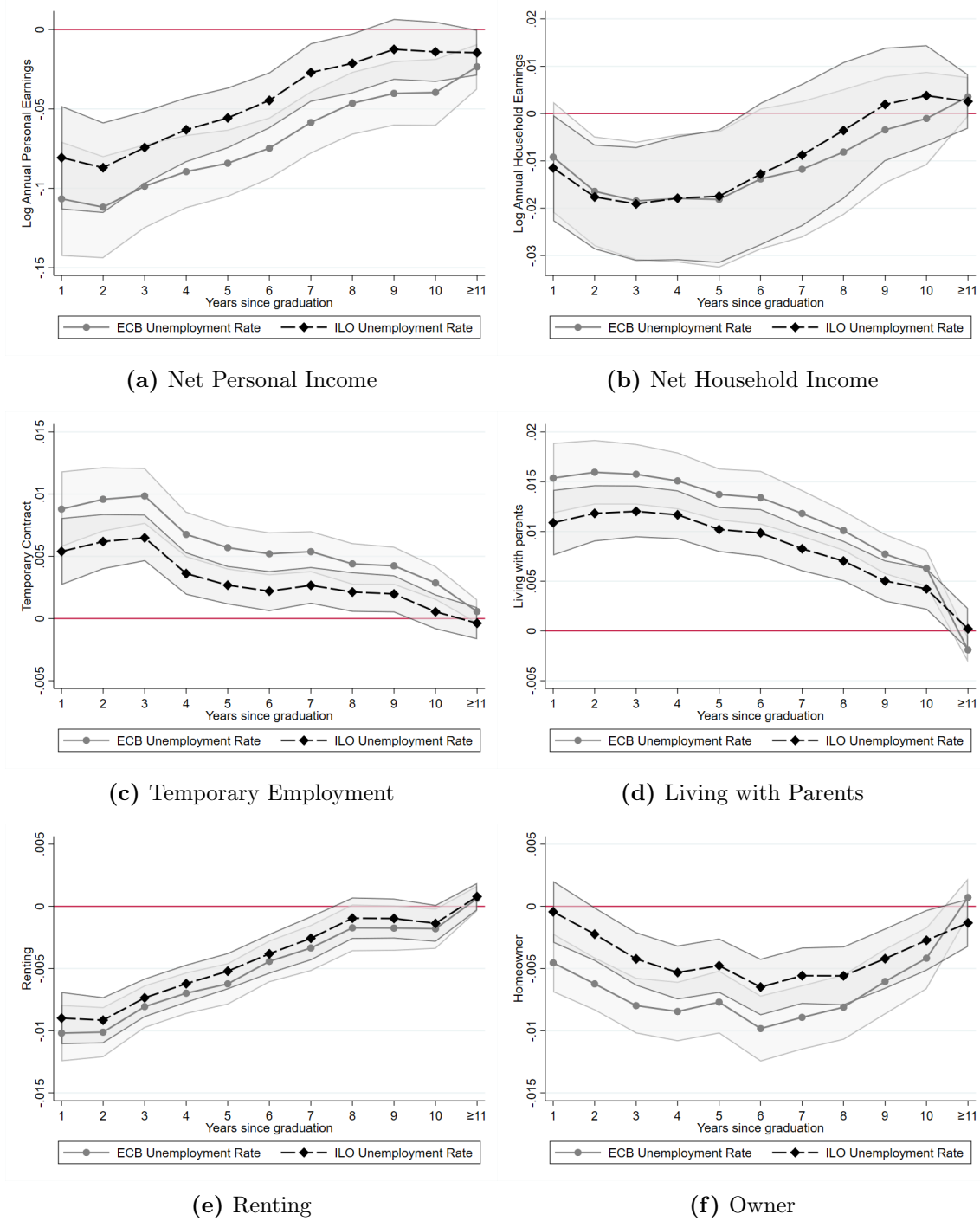
D Robustness

Figure 22: Effect of a one point increase in the unemployment rate on living with parents, using different thresholds.
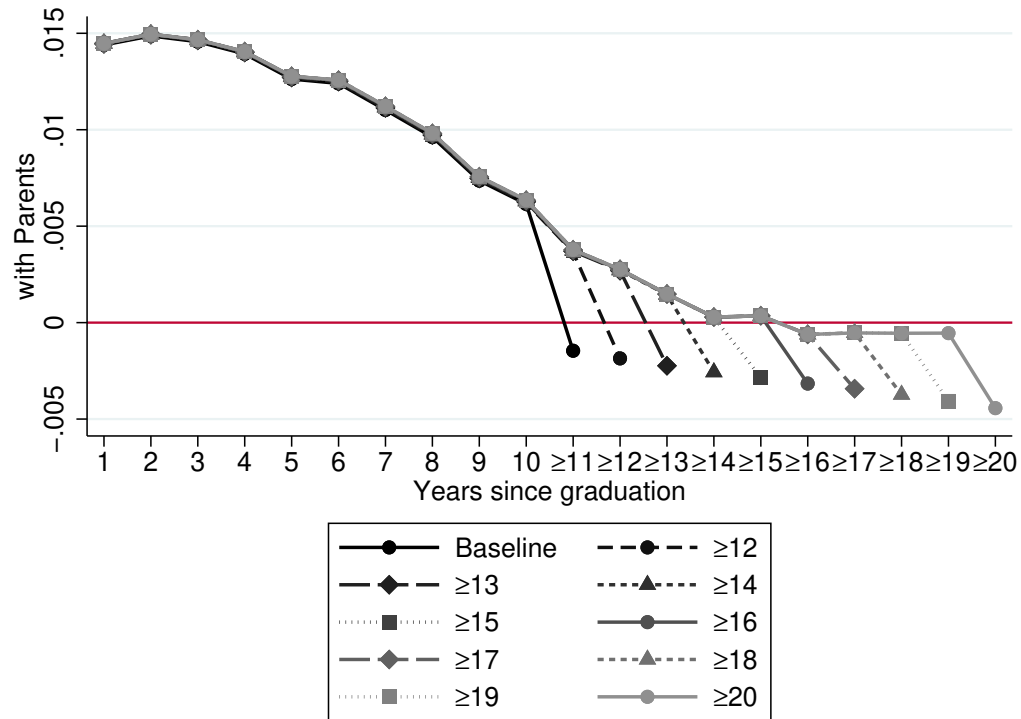
Notes: Effect of a one point increase in the unemployment rate on probability of living with parents. Results are based on Equation 1. Data from ECHP and EU-SILC.

Figure 23: Effect of a one-point increase in Unemployment Rate at graduation time on various outcomes using ECB and ILO Unemplyment Rates.

(a) Net Personal Income

(b) Net Household Income

(c) Temporary Employment

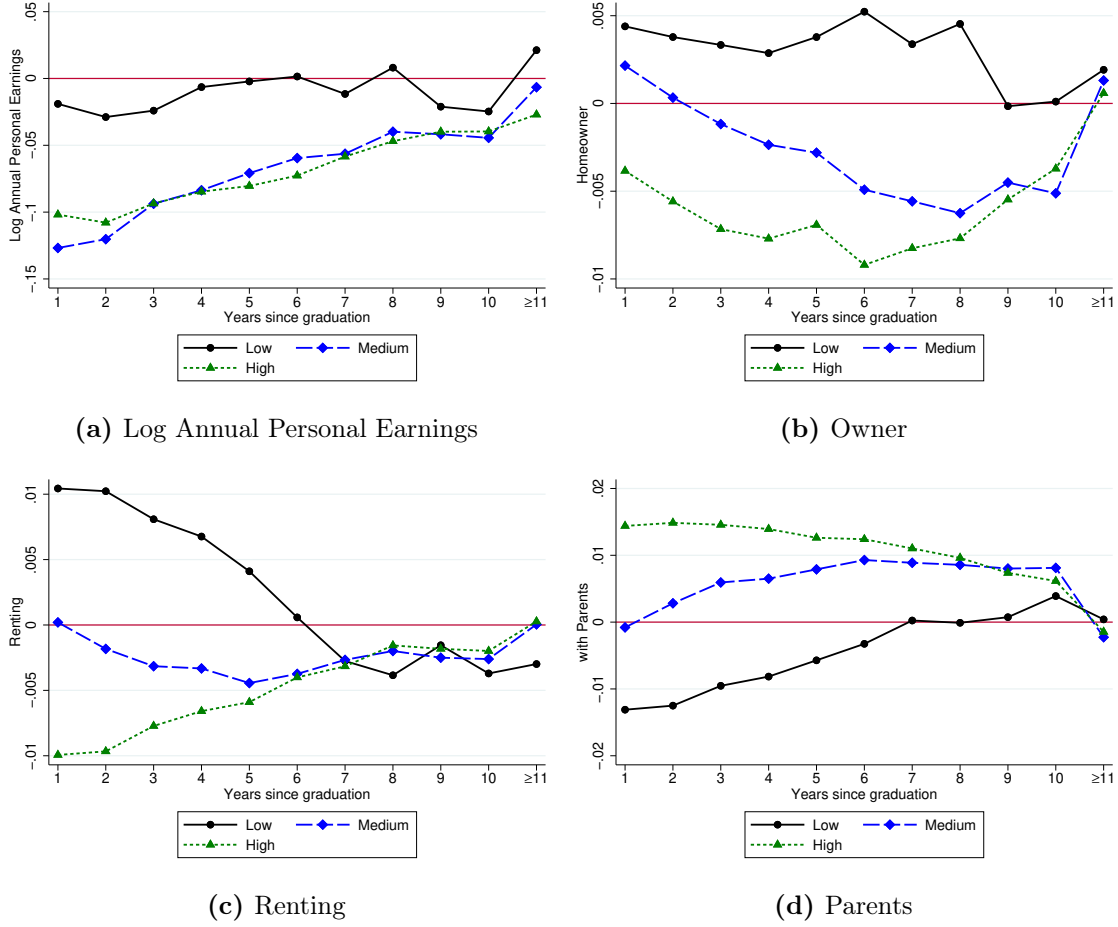**(d)** Living with Parents

(e) Renting

(f) Owner

Notes: Effect of a one point increase in the unemployment rate on various outcomes. Results are based on Equation 1. Data from ECHP and EU-SILC.

E   Results using all educational levels

When analyzing the result in terms of educational level achieved, there are some noticeable differences. First, lower educated individuals are less affected by an increase in the unemployment rate when finishing their education. In terms of the possibility of becoming a homeowner, the exposure to higher levels of unemployment when graduating

does not seems to affect in a different way according to each educational level. However, in the decision of renting and living with parents there are some differences. In particular, low educated individuals are more likely to rent by themselves rather than living with their parents when unemployment increases. This could be a potential labor market response. In the other hand, higher educated individuals are more likely to stay with their parents rather than rent by themselves. Again this could be a potential response mechanism, in where higher educated individuals can afford to spend longer time unemployed and being supported by their families and lower educated population can not afford such thing.

Figure 24: Results by education levels on labor and housing outcomes

(a) Log Annual Personal Earnings

(b) Owner

(c) Renting

(d) Parents

Notes: Effect of a one point increase in the unemployment rate at the time of graduation on various outcomes. Owner refers to living in owned dwelling by one member of the household, without any parent being present. Similarly, Renting refers to living in a dwelling that is being rented by the households but without any parent present. Finally, with Parents refers to living in a dwelling where at least one parent is present, irrespective of the tenure status. Results are based on Equation 1. Data from ECHP and EU-SILC.