The Ins and Arounds in the U.S. Housing Market

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Abstract

In the U.S., 15 percent of households move in a given year. This result is based on data from the Panel Study of Income Dynamics on gross flows within and between the two segments of the housing market — renter-occupied properties and owner-occupied properties. The gross flows between these two segments are four times larger than the net flows. From a secular perspective, housing turnover exhibits a hump-shaped pattern between 1970 and 2000, which this paper attributes to changes in the age composition of the U.S. population. At higher frequencies, housing turnover is procyclical and tends to lead the business cycle and real house prices. By taking a two-segment view of the U.S. housing market and by documenting carefully the empirics of turnover within and between these segments, the paper provides important moments for and gives empirical guidance to the design, calibration, and evaluation of micro-founded, dynamic, and quantitative models of the U.S. housing market.

JEL Codes: E30, E32.

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1 Introduction

There has been extensive empirical work on job and worker flows in the labor market (see Davis and Haltiwanger, 1999; Shimer, 2005; Elsby, Michaels and Solon, 2009; Elsby, Hobjin and Şhayin, 2013). This research has revealed substantial heterogeneity and large gross flows underlying the comparatively smaller aggregate net flows in the labor market. Housing tenancy changes by households can similarly be described in terms of a flows-between-states approach. We view the housing market as consisting of two distinct segments — renter-occupied housing and owner-occupied housing — that households can transition within and between over time. This paper is a pure measurement paper, in which we document and describe, from this two-state perspective, the flows in the U.S. housing market.

Our principal data source is the Panel Study of Income Dynamics (PSID), which tracks annual data on household moves, housing tenure (own versus rent), and other household characteristics from 1968 to 1997. The data are available biennially from 1999 to 2009. Specifically, we tabulate and analyze household transitions from homeownership to renting, renting to homeownership, moving from one rental property to another, or moving from one owner-occupied property to another. For these disaggregate gross flows in the housing market, we document their long-run average properties, their secular trends, their cyclical behavior, and their covariation with a few demographic and socioeconomic characteristics. The strength of the PSID is its panel structure. The survey follows the same households over time, so an individual household's tenancy status both before and after a move is known, information which is necessary to track a household's transitions between housing market segments. Another strength of the PSID is that the so-called event history supplement from 2001 onwards allows us to quantify potential problems of time aggregation, i.e., researchers missing underyearly housing turnover in yearly data. To the extent possible, we compare our results with data from the American Housing Survey (AHS) and the Current Population Survey (CPS). Our results show:

1. Over the course of one year, on average, approximately 15 percent of Americans move at least once; over the course of two years, almost 25 percent move. Over half of these moves, both over the course of one year and over the course of two years, are moves

within the rental segment. A bit more than a quarter of all moves are moves between the two housing market segments.

2. Gross flows between the two housing market segments are four times larger than net flows.

3. Housing turnover exhibits a hump-shaped secular pattern, peaking somewhere in the late 1970s and then secularly declining until the beginning of the 2000s. The trend thereafter is less clear due to different results from different data sets (PSID and AHS versus CPS). This hump shape parallels and is likely caused by the hump-shaped time path of the share of young households in the U.S. population who are more transient than the old.

4. Housing turnover is volatile, its fluctuations are largely driven by fluctuations in the within-segment flows. There is little contemporaneous covariance between the gross flows, both within and across segments, over the business cycle.

5. Housing turnover overall is procyclical, but largely unrelated to vacancy rates in both the owner-occupied and the renter-occupied segments. The exception is that higher turnover terminating in the owner-occupied segment is correlated with lower homeowner vacancy rates.

6. Housing turnover, especially the one originating in the renter-occupied segment, leads the business cycle and real house price movements.

7. Moves from homeownership into the rental segment are the only flow category out of the four that is unrelated to overall economic activity. Perhaps surprisingly, these moves are not just older households downsizing for retirement.

8. Altogether, the turnover rates between the two housing market segments display a rich and varied dynamic correlation pattern with overall economic activity: moves within the rental segment come first, then moves from the rental segment to the owner-occupied segment, and then moves with the owner-occupied segment, which are contemporaneous with the business cycle.

Our long-run results about declining housing turnover rates parallel a recent literature on declining interstate migration rates: Saks, Smith and Wozniak (2011); Partridge et al. (2012); Kaplan and Schulhofer-Wohl (2013); Saks, Smith and Wozniak (2014). This literature attributes the observed decline in long-range migration mostly to secular changes in economic conditions. Some, like Saks, Smith and Wozniak (2014), explicitly parallel declining household mobility with declining labor market mobility, as documented, for example, in Davis et al. (2010); Decker et al. (2014); Davis and Haltiwanger (2014), who argue that the U.S. economy has experienced a general decline in dynamism. For our data, we find that the observed downward, really hump-shaped, pattern in housing turnover can largely be explained by an age composition effect: the fraction of the young in the U.S. population and thus natural renters — the most transient part of the population — has displayed a similar hump shape over roughly the same time period. This age composition effect is similar to the explanation for the Great Moderation by Jaimovich and Siu (2009).

Looking at higher frequencies, housing turnover is procyclical, i.e., moving appears to be something that happens in times of higher economic activity. This supports a story where people move because of better realized or expected economic opportunities. Also, when the economy is expanding, bearing the transaction costs related to moving is less onerous because households can take advantage of these additional economic opportunities. Procyclical turnover is also consistent with financial frictions — getting a mortgage might be easier in booms. The data do not support a story where moving occurs when economic opportunities are low, that is, a story where moving would constitute an alternative activity to production. Saks and Wozniak (2011) document similar procyclicality in long-distance migration in the U.S. and also attribute it to cyclically changing economic benefits to moving. Anenberg and Bayer (2013) find procyclicality in intra-city homeownership-to-homeownership moves and attribute this procyclicality to good financial conditions in booms that make it easier to hold two homes simultaneously for a transitional period.

There are also clear cyclical phases in housing turnover. At the early signs of better economic times, people start to move within the rental segment, perhaps to try out a new job, or to live in a better neighborhood. Then they move from the rental segment into the owner-occupied segment, and only when the boom is established, will people move again within the

owner-occupied segment, presumably into better houses and/or better neighborhoods. Of course, this does not mean that in one business cycle a household moves multiple times. This sequence may well play out over more than one cycle. The results suggest, however, that the more established a boom phase is, the more likely households are to move into and within the segment of the housing market that requires a larger financial commitment and has higher costs of reversal, that is, the owner-occupied segment. Finally, the finding that moves from the owner-occupied segment to the rental segment are acyclical is inconsistent with the notion that homeowners are forced to move and downsize during economic downturns.

The fact that housing turnover leads the business cycle and house prices suggests that households start buying houses because of positive expectations or good news about economic activity or real house price gains which then, in turn, leads to actual subsequent demand-pressure on house prices. The data are less consistent with the view that real price gains (house equity gains) have to occur before households move; in this case, we would see turnover variables, especially those originating in the owner-occupied segment, be positively correlated with but lagging house prices. The data are also not consistent with the view that lower house prices cause households to move in the first place.

Vacancy rates are largely unrelated to housing turnover, which perhaps constitutes a challenge for at least simple search-and-matching models of the housing market. And to the extent that they are related, a larger number of vacancies does not seem to induce larger turnover, but rather, the other way around, higher turnover activity leads to less vacancies.

In terms of modeling, our results support viewing the housing market as being composed of two distinct segments. Indeed, the rental segment behaves very differently from the owner-occupied segment both cyclically and over longer time horizons. Furthermore, the dynamic correlograms we document, as well as the variance decomposition of housing turnover that finds a relatively small importance of the covariance terms between disaggregate housing flows, suggest that a successfully micro-founded model of the housing market is unlikely to be a near-linear, frictionless, one-shock model. Instead, our results support a multi-shock view of the housing market with a rich set of shocks, perhaps originating statistically independently in the two segments of the housing market, and/or a model with frictions and very rich internal propagation dynamics. Almost certainly, the model will also have to include

some kind of forward-looking, perhaps news shock about upcoming macroeconomic activity, in order to explain the leading pattern of moves originating in the rental market. Finally, the acyclical behavior of the moves from home ownership to renting suggests that separations from the owner-occupied segment of the housing market can likely be modeled as exogenous relative to economic activity. Overall, these stylized facts about housing turnover have clear implications for the physical environment of micro-founded, dynamic and quantitative models of the housing market. They also provide important moments for their calibration and evaluation.

The dominant theoretical paradigm of modeling the housing market and integrating it into quantitative macroeconomic models has been a search and/or matching framework: Wheaton (1990); Piazzesi and Schneider (2009); Caplin and Leahy (2011); Genesove and Han (2012); Burnside, Eichenbaum and Rebelo (2013); Diaz and Jerez (2013); Gan and Zhang (2013); Head, Lloyd-Ellis and Sun (2014), to name just a few contributions. However, we believe it is fair to say that these theoretical endeavors have had much less empirical underpinnings to work with than the sister literature in the labor market. This paper is an attempt to fill this gap in the literature as comprehensively and systematically as possible. This is not to say that there are no existing empirical studies regarding housing turnover and its cyclical properties: Dieleman, Clark and Deurloo (2000); Wheaton and Lee (2009); Winkler (2011); Anenberg and Bayer (2013); Coulson and Grieco (2013) are a few examples. Some of these studies also use the PSID, but none have been as comprehensive in documenting the rich dynamic patterns of gross flows in a two-state housing market. Overall, the complaint by Dieleman, Clark and Deurloo (2000) that "...the literature on variations in the rate of turnover across local housing markets is not extensive," is probably still valid.

The remainder of the paper proceeds as follows. Section 2 discusses the data and our empirical methodology. Section 3 presents the results. Section 4 concludes and two appendices provide additional results and robustness checks.

2 Data and Methodology

2.1 PSID

Our main data source in this paper is the Panel Study of Income Dynamics (PSID), which began in 1968 with 4,800 households. Sixty percent of the initial PSID households belong to a cross-national sample from the 48 contiguous states, while the remaining 40 percent are a national sample of low-income families taken from the Survey of Economic Opportunity (SEO). We focus our analysis primarily on the non-SEO part of the PSID. The PSID waves occurred annually through 1997 and biennially thereafter. The panel structure of the PSID facilitates tracking household moves over time—especially changes in a household's tenancy status, owner versus renter.[1]

We base our analysis primarily on two PSID questions:

1. Has a household moved since the previous wave?

2. What is the tenancy status of the household in the current wave?

Focusing on households that are present in consecutive waves, we combine the answer to the first question in the current wave with the answers to the second question in the current and the previous wave to determine whether a household has moved and, possibly, changed its housing tenure status.[2] From the responses to the two questions above we count the incidence of four types of household moves: own-to-own (O2O), own-to-rent (O2R), rent-to-own (R2O), and rent-to-rent (R2R), an empirical strategy which follows from the two-state view of and the flow approach to the housing market taken in this paper.[3]

[1]Note that between 1 and 2 percent of PSID households report neither owning nor renting their dwelling in a given year. An inspection of the data suggests that many of these households are college-aged and likely living in university residence halls. We do not include these households in our analysis.

[2]The PSID asks about the tenure status regarding the house that the respondent is currently residing in. Therefore, if the household normally rents, but owns a vacation home, it is counted as a renter.

[3]A very small share of households in our sample (roughly 0.6 percent) report not having moved, but indicate that their housing tenure status changed. This may be partially the result of simple reporting error, but some households may have purchased a property that they previously were leasing, perhaps through rent-to-own programs, and/or sold a property they had owned and then leased it back. In any event, we count such households as non-movers.

2.1.1 Annual Moves

Formally, let m_{it} be an indicator variable that equals 1 if household i moved between period $t-1$ and t, where t denotes the current PSID wave, and is 0 otherwise. Similarly, let τ_{it} equal 1 if household i owned its home in period t and equal 0 if the household rented its home. The four types of household moves are then defined as follows (we classify everybody else as a non-mover):

$$O2O_{it} \equiv \begin{cases} 1 & \text{if } m_{it} = 1 \ \& \ \tau_{it} = 1 \ \& \ \tau_{i,t-1} = 1 \\ 0 & \text{otherwise}, \end{cases} \tag{1}$$

$$O2R_{it} \equiv \begin{cases} 1 & \text{if } m_{it} = 1 \ \& \ \tau_{it} = 0 \ \& \ \tau_{i,t-1} = 1 \\ 0 & \text{otherwise}, \end{cases} \tag{2}$$

$$R2O_{it} \equiv \begin{cases} 1 & \text{if } m_{it} = 1 \ \& \ \tau_{it} = 1 \ \& \ \tau_{i,t-1} = 0 \\ 0 & \text{otherwise}, \end{cases} \tag{3}$$

$$R2R_{it} \equiv \begin{cases} 1 & \text{if } m_{it} = 1 \ \& \ \tau_{it} = 0 \ \& \ \tau_{i,t-1} = 0 \\ 0 & \text{otherwise}. \end{cases} \tag{4}$$

This approach generates annual data for four types of annual housing turnover between 1969 and 1997.[4] Housing *turnover rates* are calculated by summing the number of moves by type and dividing this amount by the total number of households (owners plus renters). In the baseline analysis, we use the PSID weights for each household in these summations (suppressed in the notation below). The O2O turnover rate, for instance, is defined as:

$$O2O_t \equiv \frac{\sum_i O2O_{it}}{O_t + R_t} \ , \tag{5}$$

where O_t and R_t are, respectively, the (weighted) sum of respondents in period t that were owners/renters in $t-1$. The other turnover rates, $O2R_t$, $R2O_t$ and $R2R_t$ are defined analo-

[4]We need consecutive tenure status information to compute housing turnover disaggregated by tenure status, which is why our turnover data start in 1969 and not in 1968.

gously. The total turnover rate is then:

$$TOR_t \equiv O2O_t + O2R_t + R2O_t + R2R_t. \tag{6}$$

Occasionally, as in the labor market literature, we will also analyze *flow rates*, which are household moves relative to their tenure status. That is, in equation (5) the denominator would be replaced by O_t for flows originating in the homeowner segment, and R_t for flows originating in the rental segment. Intuitively, turnover rates give the sample probability that a household moves, flow rates give the conditional sample probability that an owner/renter moves.

When we analyze the cyclical properties of these housing turnover or flow rates, e.g., their comovement with GDP, it is important to note that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last wave, we need to make the timing of our GDP measure consistent with the PSID. To this end, we construct annual real GDP for 1969, i.e., the GDP number we pair with the 1969 PSID turnover data, as the average of the quarterly GDP data in 1969:2, 1969:1, 1968:4, and 1968:3 (based on the FRED data with series identifier GDPC96).

2.1.2 Biennial Moves

In robustness checks, we study biennial housing turnover rates, because they allow us to investigate housing turnover for a longer time period, given that the PSID changed the frequency of its waves from annual to biennial starting in 1997. The biennial turnover rates (and flow rates) are calculated analogously to the annual turnover rates. Using the notation from the previous section, we define a new two-year move indicator m_{it}^2 as follows:

$$m_{it}^2 = \begin{cases} 1 & \text{if } m_{it} = 1 \text{ or } m_{i,t-1} = 1 \\ 0 & \text{if } m_{it} = 0 \text{ and } m_{i,t-1} = 0\,. \end{cases} \tag{7}$$

We thus record a two-year move if and only if the household moved between $t-2$ and t. As in the annual case, this two-year moving variable is combined with information on the

household's tenancy status to create the disaggregate moving rates. Similar to the one-year moving data, households must have no moving data missing in period t and period $t-1$ as well as no missing housing tenancy data for periods t and $t-2$. Two-year household moves by type are then defined as follows:[5]

$$O2O_{it}^2 \equiv \begin{cases} 1 & \text{if } m_{it}^2 = 1 \ \& \ \tau_{it} = 1 \ \& \ \tau_{i,t-2} = 1 \\ 0 & \text{otherwise} , \end{cases} \tag{8}$$

$$O2R_{it}^2 \equiv \begin{cases} 1 & \text{if } m_{it}^2 = 1 \ \& \ \tau_{it} = 0 \ \& \ \tau_{i,t-2} = 1 \\ 0 & \text{otherwise} , \end{cases} \tag{9}$$

$$R2O_{it}^2 \equiv \begin{cases} 1 & \text{if } m_{it}^2 = 1 \ \& \ \tau_{it} = 1 \ \& \ \tau_{i,t-2} = 0 \\ 0 & \text{otherwise} , \end{cases} \tag{10}$$

$$R2R_{it}^2 \equiv \begin{cases} 1 & \text{if } m_{it}^2 = 1 \ \& \ \tau_{it} = 0 \ \& \ \tau_{i,t-2} = 0 \\ 0 & \text{otherwise} . \end{cases} \tag{11}$$

This approach generates data for four types of biennial housing turnover. Between 1970 and 1997 these data are available annually, and biennially thereafter. Housing turnover rates are calculated like before.[6]

2.1.3 Sample Construction

To be in the annual sample from 1969 to 1997, a household had to be present in two consecutive waves, and they had to have no missing data regarding their housing tenure status in these two waves as well as, in the current wave, information on whether they moved. Households belonging to or derived from the SEO sample are excluded from our baseline analysis, as are households from the immigrant and Latino samples that were added to the PSID for short periods in the 1990s.[7] Altogether the annual turnover rates are based on

[5] Later in the paper we suppress the 2-superscript for simplicity.

[6] O_t and R_t are, respectively, the number of respondents in period t that were owners/renters in $t-2$.

[7] To be in the SEO sample, a household in 1966 had to have income below twice the poverty line and the household head had to be 60 years of age or younger. Real household income in 2000 dollars in 1969 in the

91,738 household-year observations (out of 103,736 possible ones).[8]

The strength of the PSID is its panel structure. The survey follows the same households over time so that an individual household's tenancy status both before and after a move is known, information which is necessary to track a household's possible transitions between housing market segments. Such analysis is not possible with purely cross-sectional data.

A potential concern with the PSID, given the panel nature of the data, is that it might undercount household moves—households that move between waves are harder to track and re-interview. Lillard and Panis (1998) argue that the sample attrition in the PSID appears to be random. To date, however, no one has specifically studied the relationship between sample attrition and household moves in the PSID.

Another potential concern with the PSID is time aggregation. That is, we can only record from the annual PSID waves whether a household moved at least once (or not at all) in a given year. If there was a lot of underyearly moving activity in the sample in a given year, we would therefore underestimate housing turnover. Therefore, from 2001 to 2008, we also compute annual turnover rates, using the supplemental household event history data.[9] Among other things, these data track all household moves—even moves in the years (2002, 2004, and so on) in which the PSID was not conducted. They even track underyearly moves, if they occurred. The event history data do not, however, contain information about households' housing tenancy, so we cannot use these data to construct disaggregate turnover rates between the two housing segments. Nevertheless, the event history data allow us to gauge the importance of time aggregation in housing turnover, at least for the years 2001 to 2008. To do so, we compute two time series of turnover rates: one, where we count a household as moving if the household moved at least once in a given year. This approach corresponds to what we can observe in the main PSID files. In the other series of turnover rates we count every move. On average from 2001 to 2008, the difference in turnover rates is small, 3.3 percentage points, relative to the 19 percent average turnover rate.[10] The

SEO sample was 21,682 compared to 35,629 in the non-SEO sample.

[8]The biennial turnover sample from 1970 to 2009 is based on a total of 110,410 household-year observations (out of 132,802 possible ones). The sample is longer, but the informational requirements to be in the sample are tighter.

[9]The event history data, are available from 2001 on in the supplemental data portion of the PSID website http://simba.isr.umich.edu/Zips/zipSupp.aspx.

[10]The average turnover rate from the event history data is not directly comparable to the one from the

maximum difference over the eight years we observe is 4.6 percentage points. A visual inspection of the two time series reveals that they are essentially a level shift of each other. We conclude that underyearly moves are quantitatively small and their share relative to all moves is fairly constant over time.

Finally, and to the extent possible, we compare our PSID results to results derived from two other data sets: the American Housing Survey (AHS) and the March Supplement of the Current Population Survey (CPS).

2.2 AHS

The AHS is a survey about housing units rather than households like the PSID. Moreover, there was a redesign of the national sample in 1985, and the U.S. Census Bureau explicitly cautions users of the AHS data about their incompatibility between the years prior to 1985 and thereafter. An additional problem is that the data are available annually from 1973 to 1981, but only biennially from 1983 to 2009, thus leaving researchers with two separate time series pieces. The AHS turnover rates are, however, always annual turnover rates, even when the data are available only biennially.

Nevertheless, we construct total turnover rates from the AHS for a broad comparison with the results from the PSID.[11] In particular, we focus on the data on tenure of a given housing unit by tenure status of recent movers. These data are from the national sample of the AHS. A recent mover in the AHS is defined as having moved in the year prior to the interview. Finally, to make the AHS data as comparable as possible to the household-based PSID data, we restrict our analysis to moves where the householder is the same in the previous and present unit.[12] When we compute turnover rates, we use the total number of occupied units surveyed in the AHS in the denominator.

main PSID files, where we can and do condition on a household providing housing tenure information in two consecutive years. Also, we use unweighted data here because we do not have weights in the even years due to the biennial frequency of the PSID starting in 1997.

[11] Given the aforementioned problems with the AHS data we do not analyze disaggregate turnover rates.

[12] We take the historical tabulated AHS data from https://www.census.gov/housing/ahs/data/national.html and use Table A-3 for the surveys prior to 1985, and Table 2-10 for the sample afterwards. From Table A-3 we use the row "Same householder in present and previous unit" as total turnover (the AHS appendix states that these numbers exclude moves from outside the U.S.), and from Table 2-10 we use "Householder moved during the past year from within the United States" and count all those with previous tenure in houses, apartments and manufactured/mobile homes as the denominator.

When we analyze the cyclical properties of the housing turnover rates from the AHS, it is important to note that most of the AHS interviews take place in the second half of a year, so that unlike with the PSID we use annual real GDP for a given calendar year (based on the FRED data with series identifier GDPCA) paired with the corresponding AHS turnover rate. For the cyclical analysis only, missing years of AHS turnover rates are linearly interpolated to give us an uninterrupted annual time series.

Despite these caveats about the AHS, the results are broadly consistent with what we find using the PSID data.

2.3 CPS

The March CPS asks survey participants about their current tenancy status along with whether they changed residences in the year prior to the interview. The survey does not include information on households' previous tenancy status, so we can compute total annual turnover rates, but not disaggregate turnover rates between the two segments of the housing market. When we compute these total turnover rates, we condition on all households for which we have moving information, just as with the PSID. The range of the CPS sample is 1981-2009, with missing data points in 1985 and 1995, when the CPS does not seem to contain any moving information.[13] For the purpose of computing cyclical components of the housing turnover rates from the CPS, we linearly interpolate these two missing data points.

When we analyze the cyclical properties of the housing turnover rates from the CPS, it is important to note that these interviews take place in March of a given year, so that, similar to our approach with the PSID, we construct the annual real GDP for 1981, i.e., the GDP number we pair with the 1981 CPS move data, as the average of the quarterly GDP data in 1981:1, 1980:4, 1980:3, and 1980:2 (based on the FRED data with series identifier GDPC96).

We perform additional analysis using data from the CPS-HVS (the Housing Vacancy Survey) on the rental vacancy rate,[14] and the owner vacancy rate.[15]

[13] We ignore the infrequent moving data prior to 1981.
[14] U.S. census, http://www.census.gov/housing/hvs/data/histtabs.html, Table 1.
[15] U.S. census, http://www.census.gov/housing/hvs/data/histtabs.html, Table 2.

Table 1: Average Housing Turnover Rates - PSID

	TOR	O2R+R2O	R2O-O2R	O2O	O2R	R2O	R2R
Annual	15.31%	4.05%	0.89%	3.13%	1.58%	2.47%	8.13%
relative	-	0.265	0.058	0.204	0.103	0.161	0.531
Biennial	23.69%	6.90%	1.61%	6.13%	2.65%	4.25%	10.66%
relative	-	0.291	0.068	0.259	0.112	0.180	0.450

Notes: This table displays the time average of the annual (first two rows) and biennial (rows three and four) turnover rates from the weighted non-SEO sample of the PSID. The underlying sample for the annual rates is 1969-1997. The sample for the biennial rates is 1970-2009. TOR (first column) is the average fraction of households that reported a move in the last year/in the last two years. The second column, O2R+R2O, displays the average fraction of PSID respondents that moved between the owner-occupied and the rental segment of the housing market. The third column, R2O-O2R, is the net inflow rate from the rental into the owner-occupied segment. The last four columns display the movements, respectively, within the owner-occupied segment, from the owner-occupied into the rental segment, from the rental into the owner-occupied segment, and within the rental segment. Rows two and four display all the numbers as a fraction of TOR (first column).

3 Results

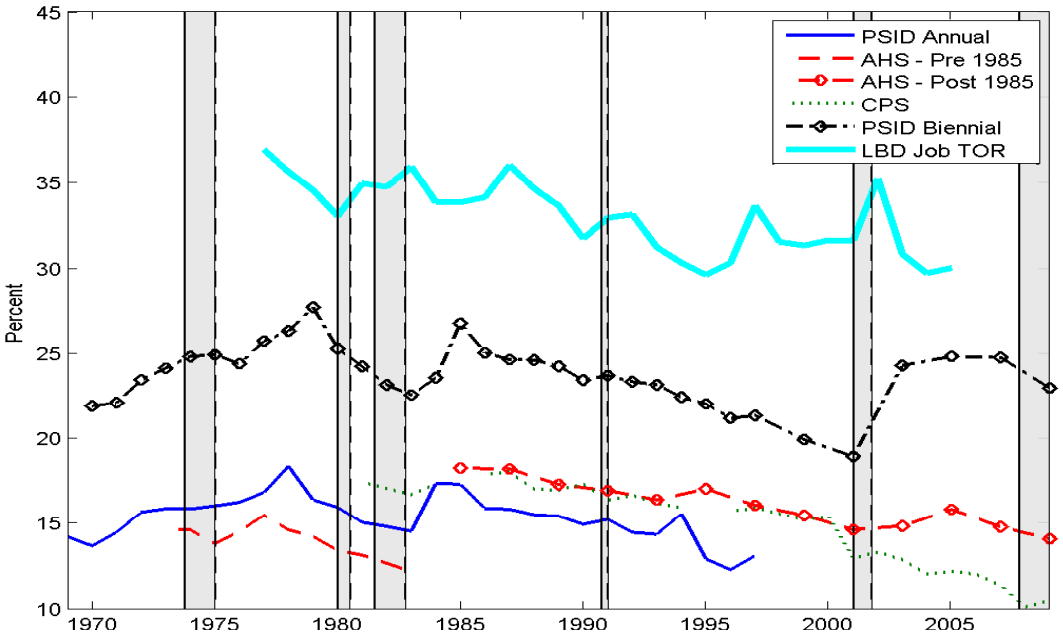
3.1 The Housing Market On Average

Table 1 shows that in a given year, approximately 15 percent of U.S. households change their primary residence at least once. Over a two-year time span, almost a quarter of Americans move at least once. Of these moves only between 25 and 30 percent are moves between the owner-occupied housing segment and the rental segment, O2R or R2O moves, the rest do not involve changes in housing tenure. Roughly half of all annual moves are moves within the rental segment (R2R). Twenty percent of moves are O2O transitions, while 16 percent of moves are from rental tenure to owner-occupied tenure and only 10 percent of moves are in the opposite direction. Overall, renters are the more transient households.

There is also substantial excess turnover for the moves between segments, in the sense that the gross flows between the owner-occupied housing and the rental segment are about four times larger than the net flows: 4.05 percent versus 0.89 percent in annual data, 6.90 percent versus 1.61 percent in biennial data. Just as in the labor market, gross flows relative to net flows are large within the housing market and between its submarkets.[16]

[16]Using the annual job turnover rates (from 1977-2005) from Davis et al. (2010), we see, however, that

FIGURE 1: TURNOVER RATES FROM VARIOUS DATA SOURCES IN COMPARISON



Notes: This figure displays the time series of the total annual turnover rates (1969-1997), computed from the weighted non-SEO sample of the PSID (the blue solid line); the total annual turnover rates (annually from 1973-1981, biennially from 1983-2009), computed from the AHS (the red dashed line); the total annual turnover rates (1981-2009, with interruptions in 1985 and 1995 due to missing data), computed from the CPS (the green dotted line); the total biennial turnover rates (annually from 1970-1997, biennially from 1999-2009), computed from the weighted non-SEO sample of the PSID (the black dash-dotted line with diamonds); and the annual job turnover rates (annually from 1977-2005, from the Longitudinal Business Database) from Davis et al. (2010) (the light blue solid line). In terms of sample size: the average denominator for the PSID rates is approximately 3,200, for the pre-1985 AHS sample it is 76,600, for the post-1985 100,300 and for the CPS 173,200.

Behind these time averages there are interesting long-run secular movements and short-run cyclical movements in housing turnover. We will discuss each in turn.

3.2 Long-run Trends

Housing turnover exhibits a small upward trend during the 1970s, then a secular decline until the beginning of the new millennium, the year 2001 to be precise, followed by a stabilization and/or a renewed uptick in housing turnover during the first decade of the 2000s. Figure 1 makes this point for various turnover measures calculated from the PSID. Our baseline turnover rate is computed from the annual weighted non-SEO sample of the PSID from

the difference between gross and net flows is much larger (almost 15 times) in the labor market.

1969-1997 (the blue solid line). Figure 1 also shows annual moving rates from the AHS (the dashed red line) and the CPS, with some interruptions due to missing data (the dotted green line). Not only do these alternative data sets broadly confirm the average amount of annual housing turnover found in the PSID, but also its long-run trend behavior from the 1980s on, with one notable exception: in the CPS the downward trend strongly continues into the 2000s, whereas it is halted in the AHS and reversed in the PSID.[17] The PSID data on moves over two years show the same behavior as the PSID data on one-year moves, albeit at a higher average level.[18]

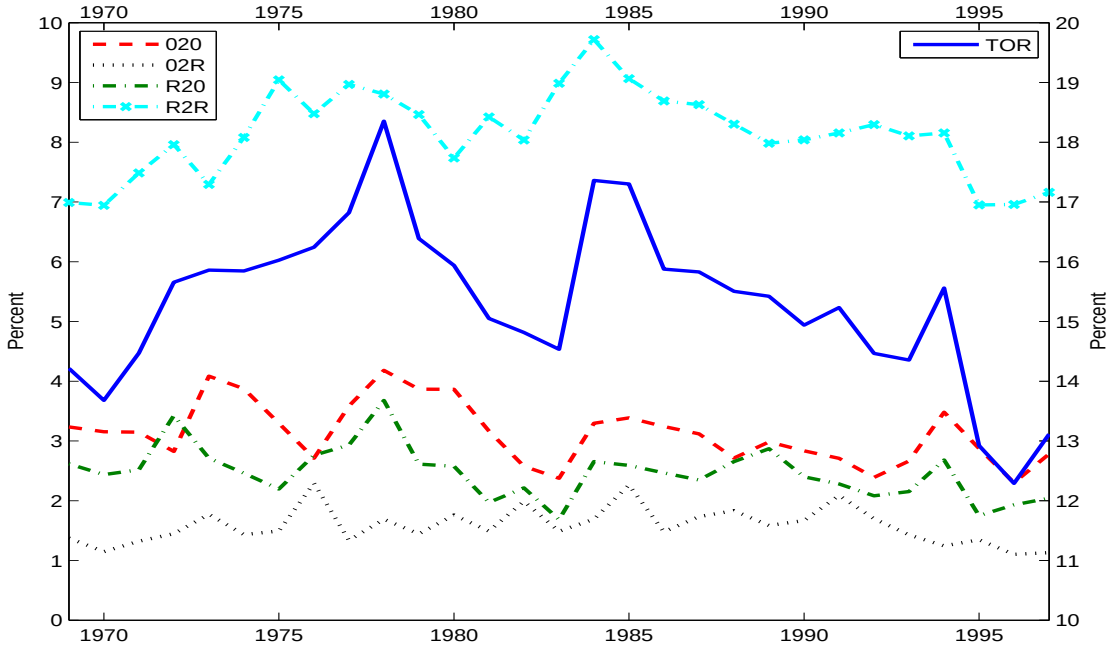
To compare the secular behavior of housing turnover to turnover in the labor market, we also show the annual job turnover rate from the Census Longitudinal Business Database (LBD) starting in 1977 and provided in Davis et al. (2010) in Figure 1. These data also exhibit a secular decline during roughly the same period when housing turnover declined. We cannot and do not claim here that the two phenomena are related — Davis et al. (2010) interpret their findings as declining dynamism in the U.S. business sector.[19] Also, for a smaller segment of the U.S. economy, the manufacturing sector, where data on job turnover go back further to the beginning of the 1970s, there is no evidence of an increase in turnover before the secular decline (in fact, job turnover is stably high during the first half of the 1970s), nor is there evidence of a rebound in the 2000s. But the comparison with the job turnover data does make possible an assessment of the magnitude of the secular movement in housing turnover, which is in fact somewhat larger than in job turnover. In particular, the percentage decline in the baseline annual housing turnover rate in the PSID is 34 percent from its maximum in 1978 to 1997, when the series ends. In absolute terms, the total annual housing turnover rate in the PSID fell from 18.4 percent to 13.1 percent. The percentage decline in the biennial PSID series from its maximum in 1979 to 2001 is 38 percent (27.7 percent to 18.9 percent); for the turnover data from the AHS the number is 22 percent (going

[17] Also, it is important to keep in mind the structural break in 1985 in the AHS data, which almost certainly exaggerates the increase in housing turnover that occurred after the recession in the early 1980s. Also, because of this structural break, the AHS graph does not invalidate the hump-shaped pattern found in the PSID.

[18] Figure 11 in Appendix A shows that these findings are robust to using alternative PSID samples: the SEO sample, the combined SEO and the non-SEO sample, and the raw (unweighted) sample.

[19] Saks, Smith and Wozniak (2014) find a connection between declining interstate moving rates and declining labor market turnover.

Figure 2: Disaggregate Housing Turnover Rates from the Non-SEO PSID Sample by Housing Tenure - Weighted



Notes: This figure displays the time series of the total annual turnover rates (1969-1997), computed from the weighted non-SEO sample of the PSID (the blue solid line), on the right axis. For the same time horizon and sample the left ordinate has, respectively, the O2O flows (the dashed red line), the O2R flows (the black dotted line), the R2O flows (the green dash-dotted line), and the R2R flows (the light blue dash-dotted line with crosses).

from 18.3 percent in 1985 (max) to 14.6 percent in 2001); and for the turnover data from the CPS it is 33 percent (going from 18.0 percent in 1987 (max) to 13 percent in 2001). Finally, the percentage decline in annual job turnover from 1977 to 2001 is 16 percent, decreasing from 36.9 percent to 31.6 percent.[20]

Figure 2 reveals a somewhat heterogeneous picture for the disaggregate gross flows O2O, O2R, R2O, and R2R, underlying the hump-shaped behavior of overall housing turnover from 1970 onwards. Flows into the owner-occupied segment, O2O and R2O, peak in the late seventies (1978) just like the overall turnover rate, before their secular decline, and R2R flows peak in the mid eighties (1984). Unsurprisingly, given the dominance of moves within the

[20]Had we eliminated the more high-frequency fluctuations from the turnover rates and isolated their long-run trends (by means of an HP-filter with smoothing parameter 400 for annual data and 25 for biennial data), the numbers would be smaller, but still in line with the findings on the raw data: the smooth trend of the PSID annual turnover rates declined by 20 percent from its maximum to 2001, the PSID biennial turnover rates declined by 27 percent, and the job turnover rates by 14 percent.

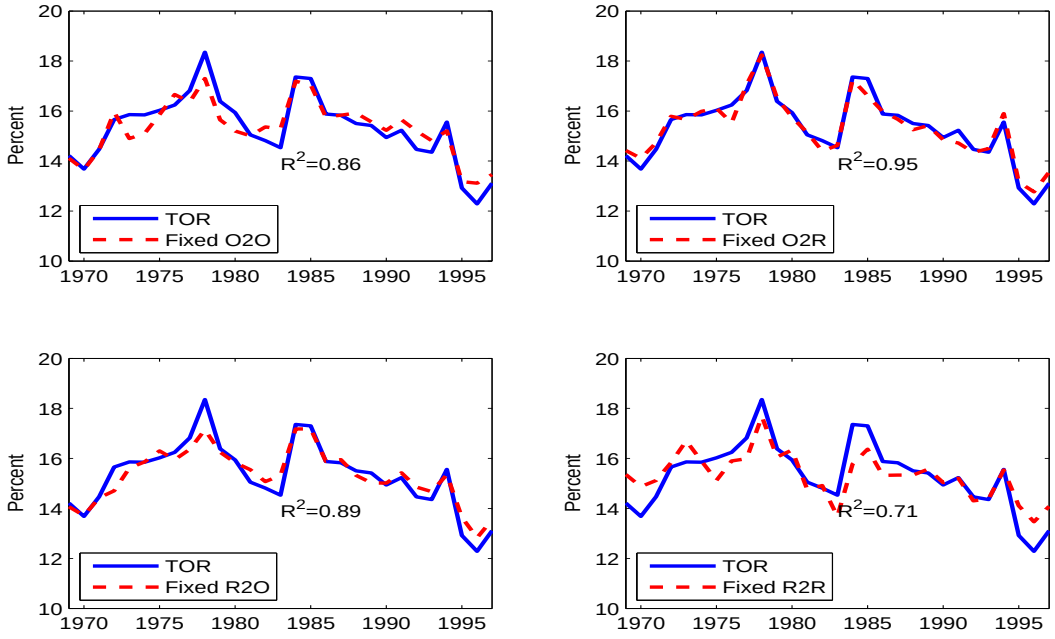
same tenure situation, the total turnover rate broadly follows the behavior of R2R and O2O moves. In contrast, there is no discernible trend in the flows from owner-occupied tenure into the rental tenure status. The decline in O2O flows is 41 percent from peak to 1997, 59 percent for R2O flows and 31 percent for R2R flows. These changes are comparable to or even higher than the decline in the overall turnover rate.[21]

Appendix A provides two robustness checks for these findings on the long-run behavior of disaggregate housing market flows. Figure 12 repeats Figure 2, but with flow rates. The long-run behavior of the four types of gross flows in the housing market is roughly the same when measured with this alternative statistic. The declines in O2O, R2O, and R2R are of similar magnitude, and the O2R flow rate is again essentially constant. Figure 13 repeats Figure 2, but with biennial turnover rates and extending the sample to 2009. The percentage decline in O2O from 1979 (the peak) to 2001 is 33 percent, for R20 it is 39 percent from 1978 to 2001, and for R2R 53 percent from 1985 to 2001. Also, Figure 13 shows that the uptick in the overall moving rate since the beginning of the 2000s was mainly driven moves with unchanged tenancy status (O2O and R2R).

Next we ask which of the four housing flow types has contributed most to the low-frequency movements of overall housing turnover. Figure 3 compares the baseline total annual turnover rate series from the PSID with four synthetic series, which each fix in turn one of the four disaggregate turnover rate series at its average level. The more the synthetic series deviates from the original true series, the more important is the left-out component for the low-frequency movements of overall housing turnover. Figure 3 also displays R^2 measures between the original and the counterfactual time series. The picture is clear: the R2R moves contribute most to the low-frequency movements of overall housing turnover; without them the time series of housing turnover becomes visibly flatter. Also recall that the percentage decline of the baseline annual housing turnover rate in the PSID was 34 percent from its maximum in 1978 to 1997. This decline is dampened to 25 percent, when we take out O2O moves, to 30 percent, when we take out O2R moves, and to 24 percent and 23 percent, when we eliminate, respectively, R2O and R2R moves. To summarize: R2R moves have the

[21]Declines in absolute numbers are: O2O: 4.1 percent to 2.8 percent; R2O: 3.7 percent to 2.0 percent; R2R: 9.7 percent to 7.2 percent.

FIGURE 3: CONTRIBUTION OF DISAGGREGATE TURNOVER RATES BY HOUSING TENURE TO THE TOTAL HOUSING TURNOVER RATE



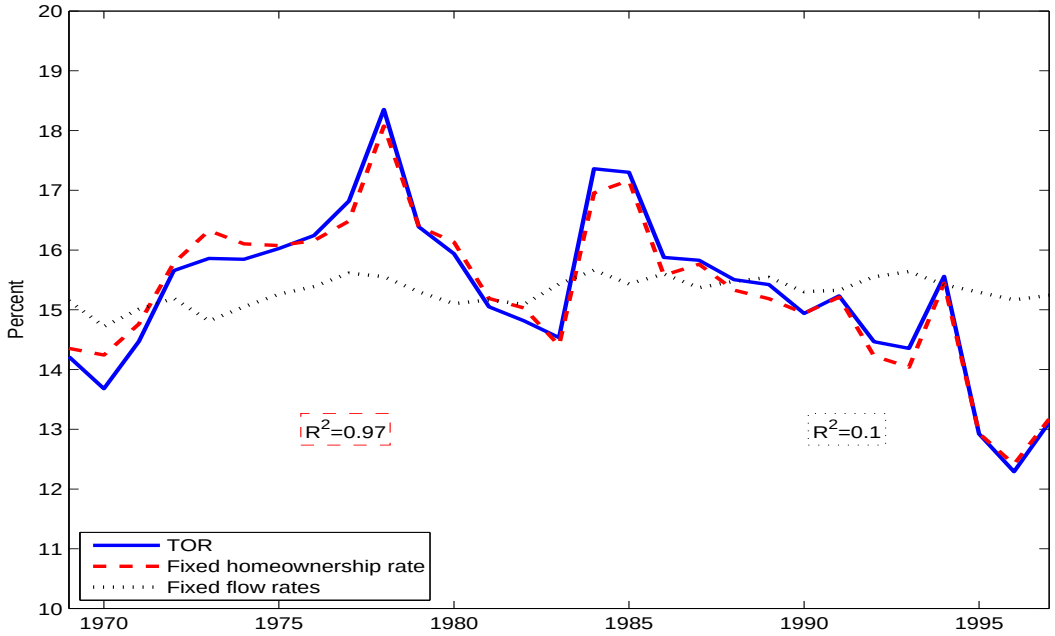
Notes: This figure displays the time series of the total annual turnover rates (1969-1997), computed from the weighted non-SEO sample of the PSID, the baseline sample (the blue solid lines), together with counterfactual turnover rates (the dashed red lines), where, each in turn, the four disaggregate turnover rates, O2O, O2R, R2O, and R2R, have been fixed at their respective time series average. The R^2 in the graphs provide a measure for how well the counterfactual turnover rate explains the overall turnover rate. The lower the R^2 the more important the left-out disaggregate turnover rate is to overall turnover.

highest explanatory power for overall housing turnover, followed by O2O and R2O moves with roughly equal importance. O2R moves have a negligible impact.[22]

It appears that the low-frequency movements of overall housing turnover are at least somewhat explained by low-frequency movements in the disaggregate turnover series by housing tenure. The natural question that then arises is what part of the observed hump-shaped movement of housing turnover is due to secular changes in tenure composition, i.e., due to changes in the homeownership rate? It is easy to see that movements in the total turnover rate can be decomposed into movements in the four tenure-specific flow rates and

[22]When we base this analysis solely on long-run trend components, extracted with an HP(400) filter, the results are very similar. Also, Figure 14 in Appendix A gives the same picture from the other side, namely, when we fix all but one of the disaggregate turnover series at their time series mean. R2R moves alone explain over fifty percent of the variance in the total turnover series. Finally, Figure 15 in Appendix A repeats Figure 3 for the moving rates over two years with very similar results. There it can also be seen that the apparently sudden uptick in the overall moving rate in the 2000s is strongly driven by the uptick in R2R moving rates during that time period.

FIGURE 4: CONTRIBUTION OF HOMEOWNERSHIP RATES AND FLOW RATES TO THE TOTAL HOUSING TURNOVER RATE



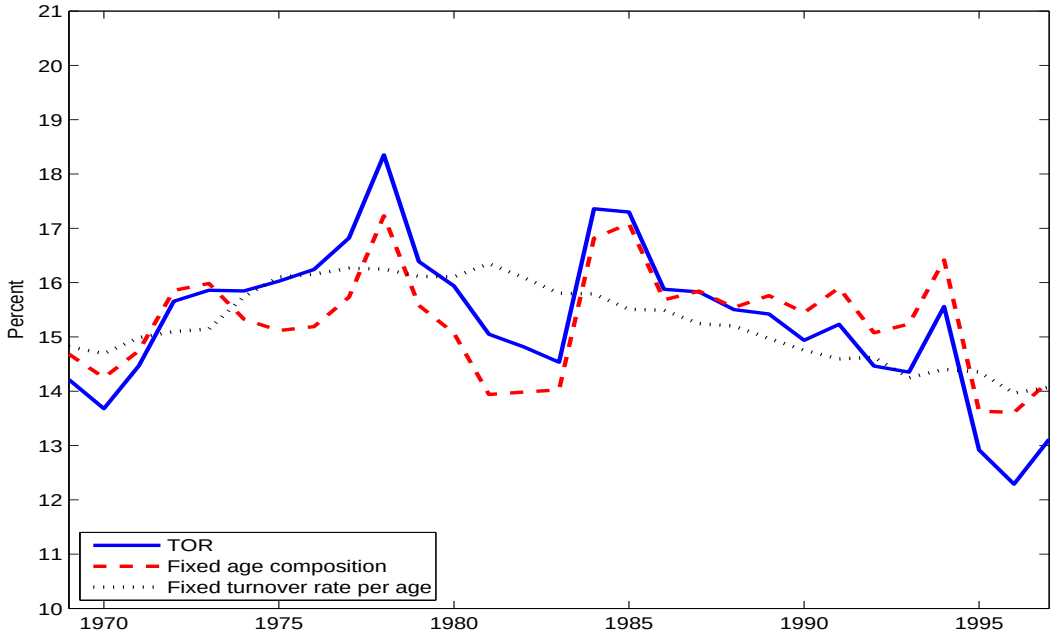
Notes: This figure displays the time series of the total annual turnover rates (1969-1997), computed from the weighted non-SEO sample of the PSID (the blue solid line), together with two counterfactual turnover rates, where, (i) the homeownership and therefore the rental tenure rates are fixed at their time series average (the dashed red line), and (ii) the disaggregate flow rates for O2O, O2R, R2O, R2R moves are fixed at their respective time series average (the black dotted line). The R^2 in the graphs provide a measure for how well the counterfactual turnover rate explains the overall turnover rate. The higher the R^2 the less important the fixed component is for explaining the movements in the overall housing turnover rate.

the tenure shares as follows:

$$TOR_t \equiv \frac{O2O_t + O2R_t + R2O_t + R2R_t}{O_t + R_t} = \frac{O2O_t}{O_t}\frac{O_t}{O_t + R_t} + \frac{O2R_t}{O_t}\frac{O_t}{O_t + R_t} + \frac{R2O_t}{R_t}\frac{R_t}{O_t + R_t} + \frac{R2R_t}{R_t}\frac{R_t}{O_t + R_t}. \quad (12)$$

Recall that $\frac{O2O_t}{O_t}$ is the O2O flow rate, and so on, and $\frac{O_t}{O_t+R_t}$ is the homeownership rate. Equation 12 suggests the following simple decomposition: compute synthetic total turnover rates fixing, each in turn, the homeownership rate, and thus implicitly the rental tenure rate, at its time series average, letting the flow rates move over time, and then fixing the flow rates, letting the homeownership rate move. Figure 4 displays the original total turnover rate from the baseline PSID sample alongside these two synthetic turnover rate series. It also displays the explanatory power that each synthetic turnover rate series has in explaining movements

Figure 5: Contribution of the Age Composition to the Total Housing Turnover Rate



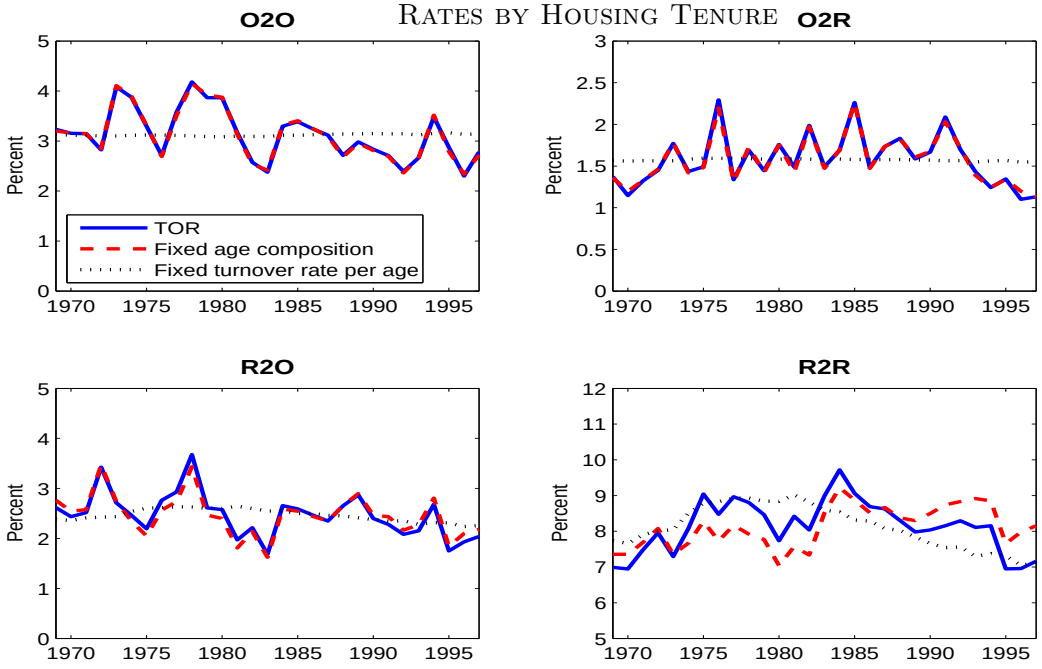
Notes: This figure displays the time series of the total annual turnover rates (1969-1997), computed from the weighted non-SEO sample of the PSID (the blue solid line), together with two counterfactual turnover rates, where: (i) the age composition in the PSID in three age classes (household head is below 35, 35-50 or above 50) has been fixed at its time series average (the red dashed line), and (ii) the turnover rates conditional on these same three age classes have been fixed at their respective time series average (the black dotted line).

in the original turnover rate series, measured by R^2. The result is clear: housing turnover in the U.S. is essentially not influenced by changes in the homeownership rate over the time period studied.[23]

The result in Figure 4, however, does *not* mean that the hump-shaped dynamics we observe in the total housing turnover rate are not the result of a composition effect. To the contrary, Figures 5 and 6 show that after controlling for secular changes in the age composition of the PSID, and thus presumably of the U.S. population, total housing turnover loses much of its systematic low-frequency movements. Figure 5 displays a similar exercise as the one in Figure 4, except that the total housing turnover rate (blue solid line) is decomposed into two synthetic ones, where, respectively, (i) the age composition in the PSID in three age classes (age of the household head is below 35, 35-50, or above 50) has been fixed at its time series average, letting turnover rates conditional on age move (the red dashed line),

[23]This is true also for the biennial turnover rates from 1971 to 2009.

Figure 6: Contribution of the Age Composition to the Disaggregate Turnover Rates by Housing Tenure



Notes: See notes to Figure 5; this figure repeats the same age-decomposition exercise, just separately for O2O, O2R, R2O, and R2R flows.

and (ii) the turnover rates conditional age have been fixed at their respective time series average, letting the age composition move (the black dotted line). We see that fixing the age composition of the PSID effectively detrends the original total turnover rate series. Fixing the age-specific turnover rates leads to a smooth hump-shaped line, with a peak in 1981, that is essentially the low-frequency component of the original total turnover rate series.[24] When we eliminate the age composition effect and thus effectively purge turnover of its hump-shaped trend, the percentage decline from 1978 to 1997 of 34 percent in the unfiltered series shrinks to a decline of only 19 percent.

Figure 6, which conducts the same age-decomposition exercise as in Figure 5, just separately for O2O, O2R, R2O, and R2R flows, as well as Figure 16 in Appendix A, which depicts the movements over time of the share of the three age groups in the PSID,[25] clarify the issue further. The hump shape of the R2R flows (lower left panel in Figure 6) is caused

[24]The unfiltered series does not have its peak in 1981 due to cyclical factors, related to the recession in the early 1980s and the procyclicality of housing turnover (see Section 3.3).

[25]The three age groups in the PSID show, quantitatively and qualitatively, very similar patterns over time compared with the CPS population share data.

by the hump-shaped development of the population share of the young in the U.S.[26]

Jaimovich and Siu (2009) document this hump-shaped development of the share of the young in the U.S. population as well, and relate it to the Great Moderation. Something similar is happening here: 69 percent of all R2R moves are done by the youngest age group, and conditional on moving, 66 percent of the moves done by the youngest age group are R2R moves. Finally, as we show in Figure 10 in Section 3.4.1, the age-specific turnover rates display little of a secular trend. Therefore, just as in Jaimovich and Siu (2009) where the underlying hump-shaped change in the population share of the age group that tends to have high labor supply elasticities explains the hump shape in aggregate volatility, changes in the population share of the young — who mostly move within the rental segment of the housing market — explain the secular trend in housing turnover.

Figures 17 and 18 in Appendix A, which parallel Figures 5 and 6, repeat the age decomposition exercise for the two-year move series and extend the sample to 2009. The result is identical for the pre-2000 part: it is the hump shape in the share of the young households that causes a large part of the secular movement in turnover rates. The recent uptick in housing turnover since 2000, however, is not explained by age composition shifts, because the age-specific turnover rates for O2O and R2R moves display a similar increase (see Figure 19 in Appendix A).

To summarize: from the beginning of the 1970s to the beginning of the new millennium, turnover in the U.S. housing market displayed a hump shape with a peak somewhere in the late 1970s or early 1980s. This hump shape is driven mostly by a hump-shaped pattern for R2R moves, i.e., the moves within the rental segment of the housing market, and that hump shape, in turn, is caused by similar dynamics in the share of young households in the U.S. population. Housing turnover, therefore, might in part be related to the same demographic forces that potentially caused the Great Moderation.

[26]Since the changing age composition does not explain the secular trends in R2O and O2O moves, however, the story of secularly declining economic opportunities from the interstate migration literature may well be relevant. The secular behavior of overall housing turnover, however, is dominated by R2R moves and thus by the changing age composition of the U.S. population.

Table 2: Business Cycle Statistics of Housing Turnover Rates

	TOR	O2X	R2X	X2O	X2R	O2R+R2O	R2O-O2R
Lead 2	0.28	-0.23	0.53	0.08	0.37	0.30	0.37
Lead 1	0.58	0.35	0.55	0.64	0.16	0.53	0.66
Contemp.	0.32	0.68	-0.04	0.66	-0.32	0.30	0.32
Lag 1	-0.28	0.16	-0.50	-0.02	-0.47	-0.30	-0.20
Lag 2	-0.58	-0.48	-0.44	-0.61	-0.17	-0.35	-0.46
Mean	15.31%	4.71%	10.61%	6.60%	9.71%	4.05%	0.89%
Std	0.89%	0.46%	0.65%	0.68%	0.51%	0.48%	0.42%
CV	0.058	0.097	0.061	0.121	0.053	0.119	0.473

Notes: This table displays for the annual turnover rates, i.e., flows as a fraction of the total population, from the weighted non-SEO sample of the PSID various business cycle statistics. The underlying sample is 1969-1997. The columns are: total turnover rate (TOR=O2O+O2R+R2O+R2R), turnover originating in the owner-occupied segment (O2X=O2O+O2R), turnover originating in the rental segment (R2X=R2O+R2R), turnover terminating in the owner-occupied segment (X2O=O2O+R2O), turnover terminating in the rental segment (X2R=O2R+R2R), the gross turnover for moves between the segments (O2R+R2O), and the net inflow from the rental segment into the owner-occupied segment (R2O-O2R). The first five rows display the dynamic correlogram of the various turnover rates, filtered by an HP-filter with smoothing parameter 400, with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. To reflect that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last interview, we construct the annual real GDP for 1969, i.e., the GDP number we pair with the 1969 PSID move data, as the average of the quarterly GDP numbers in 1969:2, 1969:1, 1968:4, and 1968:3. 'Lead' and 'Lag' refer to the housing turnover rate relative to the real GDP business cycle. The last three rows display, respectively, the time series average ('Mean'), standard deviation ('Std'), both in percentage points, and the time coefficient coefficient of variation, 'CV', i.e., 'Std' divided by 'Mean', which is unitless. In comparison, the standard deviation of the cyclical component of real GDP is 1.40 percent.

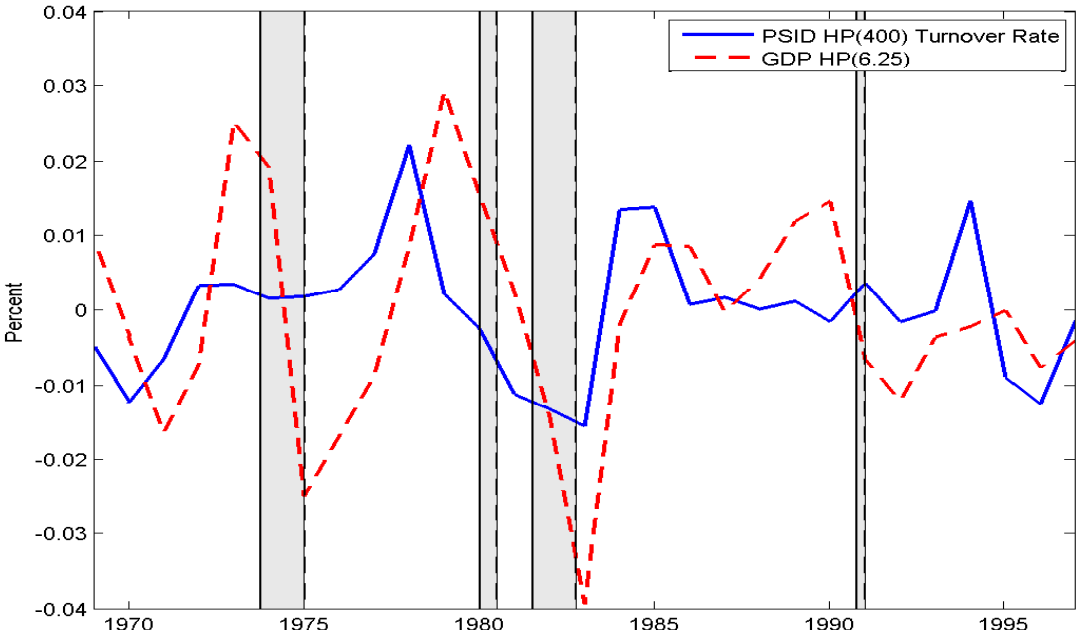
3.3 Cyclical Fluctuations

Housing turnover is procyclical and volatile.[27] Table 2 documents this for turnover rates from the baseline annual non-SEO PSID sample (1969-1997). It displays dynamic correlograms and volatility measures for the total housing turnover rate, the gross flow rates out of and into the owner-occupied segment as well as the rental segment, the gross turnover rate for moves between the segments, and the net flow rate between the segments. As the baseline cyclical indicator we use HP(6.25)-filtered annual real GDP (see Uhlig and Ravn (2002)).[28]

[27]We have also looked at persistence, but, for the sake of brevity, we will generally not report autocorrelation numbers. However, the cyclical component of the total annual housing turnover rate has a first-order correlation coefficient of 0.33, the same as annual real GDP.

[28]To detrend the turnover rates we use an HP-filter with smoothing parameter 400. The turnover rates have secular movements, but visual inspection also shows that as fractions (unfiltered) they are already

FIGURE 7: TIME SERIES OF THE CYCLICAL COMPONENT OF TOTAL HOUSING TURNOVER



Notes: This figure displays the cyclical component of the annual total turnover rate from the weighted non-SEO sample of the PSID together with the cyclical component of annual real GDP and the NBER recession dates. The underlying sample is 1969-1997. See notes to Table 2 for details about the computation of the cyclical components, and how annual GDP is constructed.

The total turnover rate is contemporaneously mildly procyclical with a correlation coefficient with cyclical GDP of 0.32. It has an even stronger positive correlation on the first lead before the business cycle: 0.58. Figure 7 visualizes these findings. Other interesting dynamic patterns emerge from the more disaggregate gross flows. In particular, flows related to the owner-occupied segment, those that either originate or terminate in the owner-occupied segment, tend to be procyclical with the peak correlation being contemporaneous. Flows related to the rental segment tend to be acyclical or even countercyclical contemporaneously, but lead the business cycle with a positive correlation—especially the flows originating in the rental segment. Both the gross flows and the net flows between the two segments are contemporaneously mildly procyclical, 0.30 and 0.32, with a stronger leading component. As

somewhat "detrended". We therefore choose a stiffer filter than the 6.25 value. The idea behind this is essentially the same as the reason why Shimer (2005) uses a higher smoothing parameter for the quarterly unemployment rate than the usual 1,600 value. In any event, the broad results are not affected by this choice as Tables 9 and 10 in Appendix B show, where we use, respectively, an HP smoothing parameter of 6.25 and infinity for the turnover rates.

Table 3: Business Cycle Statistics of Housing Turnover and Flow Rates

	Turnover Rates				Flow Rates			
	O2O	O2R	R2O	R2R	O2O	O2R	R2O	R2R
Lead 2	-0.22	-0.03	0.39	0.42	-0.18	0.00	0.33	0.27
Lead 1	0.40	-0.05	0.70	0.20	0.43	-0.03	0.68	0.05
Contemp.	0.72	0.01	0.37	-0.36	0.71	-0.00	0.42	-0.38
Lag 1	0.24	-0.12	-0.30	-0.46	0.20	-0.15	-0.24	-0.31
Lag 2	-0.54	0.07	-0.48	-0.22	-0.56	0.05	-0.47	-0.13
Mean	3.13%	1.58%	2.47%	8.13%	4.44%	2.24%	8.38%	27.55%
Std	0.43%	0.25%	0.38%	0.46%	0.61%	0.35%	1.21%	1.20%
CV	0.136	0.156	0.154	0.056	0.137	0.156	0.144	0.044

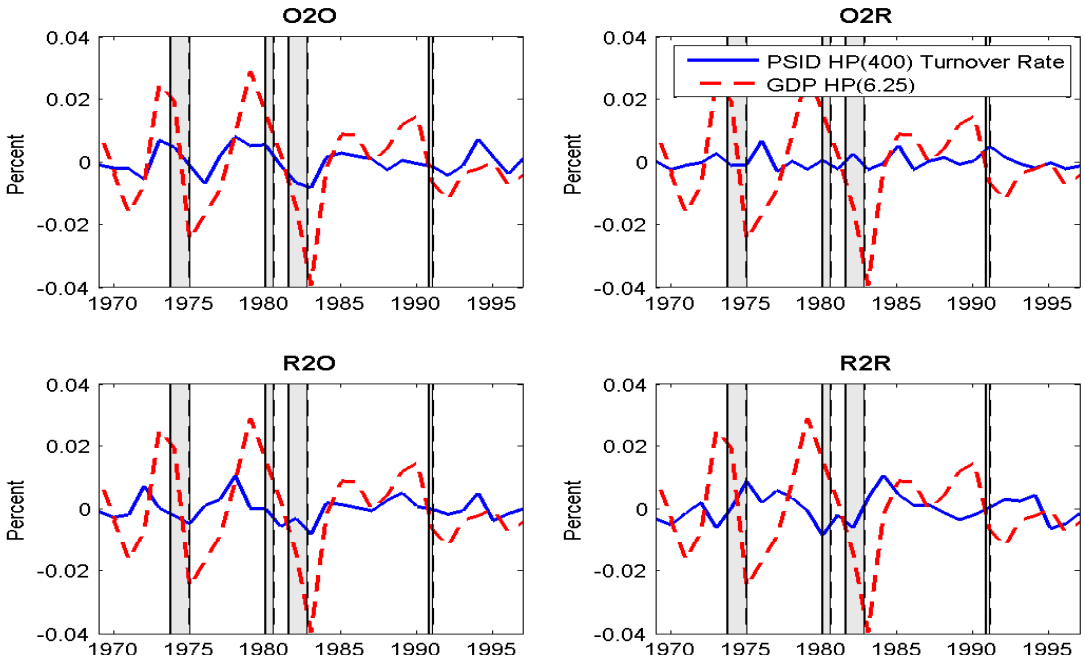
Notes: This table displays various business cycle statistics for the annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates (left panel), i.e., flows as a fraction of the total population, and for the annual disaggregate (O2O, O2R, R2O, and R2R) flow rates (right panel), i.e., flows as a fraction of the population in a certain segment, from the weighted non-SEO sample of the PSID . The underlying sample is 1969-1997. See the notes to Table 2 for a description of the business cycle statistics, and how annual GDP is constructed.

for volatility, all these rates, in absolute, i.e., percentage point terms ('Std' in Table 2), have between a third to a half of the volatility of detrended GDP (1.40 percent), but relative to their time series average ('CV' in Table 2), they are all much more volatile than GDP, some by an order of magnitude.

Since the total turnover rate, TOR, is simply the sum of the disaggregate turnover rates, O2O, O2R, R2O, and R2R, a variance decomposition will reveal how much the individual move types contribute to the fluctuations in overall housing turnover. Covariances in total contribute 25 percent to the overall business cycle variance of housing turnover, with the largest individual contribution coming from the covariance term between O2O and R2O moves (17 percent). For the rest, we have roughly a quarter-quarter-quarter split: 23 percent for O2O moves, 26 percent for R2R moves, and another 26 percent for the moves between segments, R2O and O2R.

Table 3 shows the same business cycle statistics as Table 2 but separately for O2O, O2R, R2O, and R2R moves, both expressed as turnover rates (left part of the table), and as flow rates (right part of the table). O2O flows are strongly procyclical.

FIGURE 8: THE CYCLICAL COMPONENTS OF THE DISAGGREGATE TURNOVER RATES



Notes: This figure displays the cyclical component of the annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates from the weighted non-SEO sample of the PSID together with the cyclical component of annual real GDP and the NBER recession dates. The underlying sample is 1969-1997. See notes to Table 2 for details about the computation of the cyclical components, and how annual GDP is constructed.

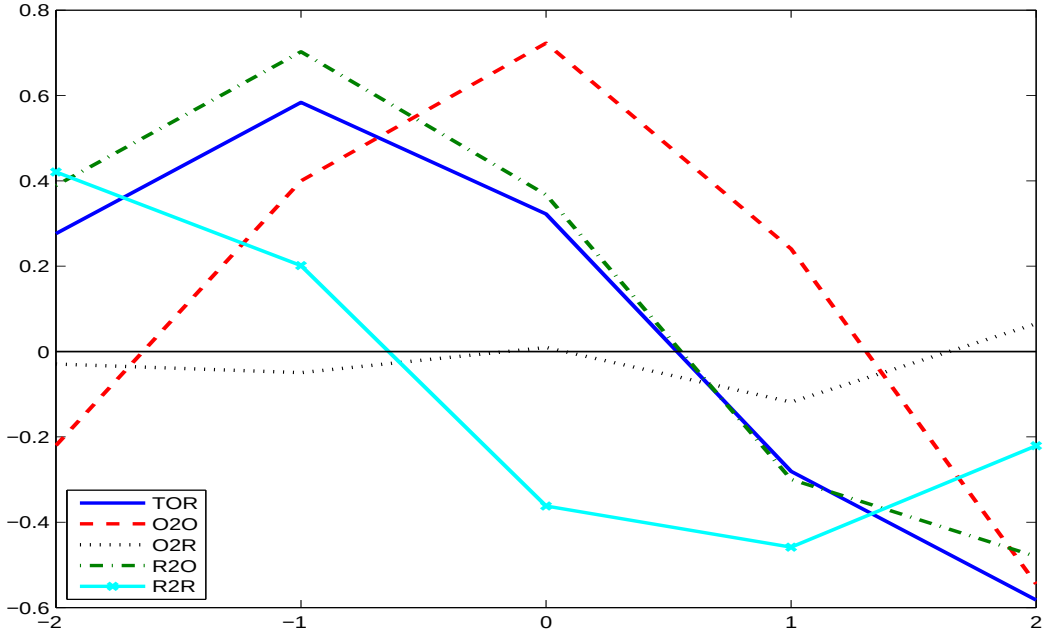
O2R flows are acyclical at any lead or lag, R2O flows are procyclical with a strong leading component, and R2R flows lead the business cycle and tend to become countercylical contemporaneously and at lags.[29]

Figures 8 and 9 visualize these findings. Figure 8 displays the time series of the cyclical components of the disaggregate turnover rates, O2O, O2R, R2O, and R2R, together with the time series of the cyclical component of annual real GDP and the NBER recessions. The procyclicality of O2O and R2O moves is clearly visible in these graphs. Figure 9 displays

[29]Appendix A provides a series of robustness checks for these findings: Table 9 uses 6.25 as the smoothing parameter for the HP-filter applied to the turnover rates. Table 10 uses a linear deterministic filter for the turnover rates. Table 11 focuses on the SEO sample of low-income households. Table 12 combines the SEO and the non-SEO sample. Table 13 uses the raw PSID counts (from the non-SEO sample) instead of the PSID weights to compute housing flows. Table 14 is the same as the baseline exercise, except that turnover rates are transformed by the natural logarithm, and Table 15 compares the results for total turnover rates from the PSID with those from the AHS and the CPS. The results are robust, with the exception of the SEO sample, where housing turnover has little to no cyclical regularities. Apparently, for lower income households moving is on net largely unrelated to aggregate economic activity, although, on average, they tend to be a bit more transient than richer households (we find the same pattern, to a lesser degree, when we split the non-SEO sample into households below and above median real household income in 2000 dollars; results are available on request). Perhaps countercyclical transfer payments to these lower income households provide a counterveiling effect to the otherwise procyclical mechanics in housing turnover. In any event, adding the SEO sample to the non-SEO sample does not invalidate our baseline findings.

the rich dynamic correlation pattern between housing turnover and the business cycle: first comes R2R, then R2O, then O2O; only O2R moves have evidently no relationship with the overall cycle, and not much volatility either. Indeed, separations from the owner-occupied segment into the rental segment appear to be roughly constant over time.

FIGURE 9: DYNAMIC CORRELOGRAM OF THE DISAGGREGATE TURNOVER RATES WITH GDP



Notes: This figure displays the dynamic correlograms for the cyclical component of the annual total and disaggregate (O2O, O2R, R2O, and R2R) turnover rates from the weighted non-SEO sample of the PSID with the cyclical component of annual real GDP. The underlying sample is 1969-1997. Blue solid line: O2O+O2R+R2O+R2R; red dashed line: O2O; black dotted line: O2R; green dash-dotted line: R2O; light blue solid line with crosses: R2R. '-2' means turnover rates leading GDP by two years, and so on. See notes to Table 2 for details about the computation of the cyclical components, and how annual GDP is constructed.

These results suggest that moving tends to happen in times of higher economic activity, supporting a story where people move because of better realized or expected economic opportunities. Also, when the economy is expanding, bearing the transaction costs of moving is less onerous because households can take advantage of these additional economic opportunities. Procyclical turnover is also consistent with financial frictions — getting a mortgage is arguably easier in booms. The data do not support a story, however, where moving occurs as an outside option to directly productive activities when economic opportunities are few.

In addition, there are clear phases in housing turnover: at the early signs of better economic times, people start to move within the rental segment, perhaps to try out a new job, or to live in a better neighborhood. Next, individuals trade up from the rental segment

into the owner-occupied segment, and only when the boom is established, do people move again, presumably into better houses and/or better neighborhoods. Of course, we are not claiming that in one business cycle a household moves three times. This sequence may well play out over more than one cycle. The results show, however, that the more established a boom phase is, the more likely people are to move into the segment of the housing market that requires a larger financial commitment and has higher costs of reversal. Finally, the fact that O2R moves are acyclical is inconsistent with the notion that homeowners are forced to move and downsize during economic downturns.

In terms of modeling, the dynamic patterns we uncover suggest that a good micro-founded model of the U.S. housing market needs a rich set of statistically independent shocks, as it is difficult for a near-linear, frictionless, one-shock model to produce these heterogeneous correlograms. The variance decomposition above supports this view: the small importance of the covariance terms suggests a multi-shock world. The model will almost certainly also need to include a forward-looking, perhaps news shock about upcoming economic activity, in order to explain the leading pattern of moves originating in the rental segment of the housing market. Finally, the acyclical O2R moves suggest that separations from the owner-occupied segment can likely be modeled as exogenous relative to economic activity.

To provide additional robustness checks, Table 4 shows dynamic correlograms for turnover rates with other indicators of the business cycle, cyclical private consumption, the civilan unemployment rate, and the year-over-year output growth rate. The results are similar to, if not stronger than our baseline findings. O2O moves are contemporaneous with the business cycle, R2O and R2R moves lead it, and O2R moves are acyclical. The last three panels of Table 4 compare the turnover rates with real house prices, the rental vacancy rate, and the owner vacancy rate. Turnover tends to lead house prices, especially the moves from the rental segment into the owner-occupied segment. Given that R2O moves also lead economic activity, the data seem to suggest that households start buying houses because of good news or positive expectations about economic activity and/or future real house price gains, which then leads to demand-induced pressure on house prices.[30]

[30]Bachmann, Berg and Sims (forthcoming) show that respondents in the Michigan Survey of Consumers are more likely to buy houses when they expect future house price increases.

Table 4: Additional Business Cycle Statistics of Housing Turnover Rates

	TOR	O2O	O2R	R2O	R2R	TOR	O2O	O2R	R2O	R2R
	Correlation with Consumption					Correlation with the Unemployment Rate				
Lead 2	0.24	-0.34	0.02	0.22	0.58	-0.37	0.02	0.04	-0.51	-0.31
Lead 1	0.57	0.19	0.02	0.72	0.32	-0.42	-0.47	0.16	-0.61	0.06
Contemp.	0.43	0.74	-0.05	0.50	-0.24	-0.11	-0.52	0.06	-0.32	0.51
Lag 1	-0.03	0.51	-0.15	-0.04	-0.42	0.42	0.04	0.05	0.24	0.55
Lag 2	-0.52	-0.35	0.06	-0.41	-0.35	0.49	0.56	-0.14	0.27	0.24
	Correlation with Output Growth					Correlation with Real House Prices				
Lead 2	-0.25	-0.54	0.03	-0.32	0.29	0.31	0.09	-0.05	0.43	0.16
Lead 1	0.26	-0.26	-0.05	0.27	0.54	0.28	0.34	-0.27	0.63	-0.14
Contemp.	0.55	0.44	0.08	0.59	0.12	0.03	0.36	-0.17	0.35	-0.48
Lag 1	0.27	0.67	-0.16	0.22	-0.22	-0.31	0.08	0.09	-0.12	-0.64
Lag 2	-0.18	0.15	-0.15	-0.18	-0.25	-0.50	-0.31	0.10	-0.48	-0.32
	Correlation with the Rental Vacancy Rate					Correlation with the Owner Vacancy Rate				
Lead 2	0.27	0.12	0.08	0.20	0.20	-0.21	-0.01	-0.16	-0.19	-0.15
Lead 1	0.21	0.15	0.19	0.13	0.07	-0.19	-0.18	0.16	-0.32	-0.01
Contemp.	0.08	-0.03	0.17	0.09	0.02	-0.12	-0.40	0.33	-0.26	0.17
Lag 1	0.12	-0.06	0.15	0.24	0.02	0.13	-0.36	0.26	0.09	0.38
Lag 2	0.15	-0.07	0.20	0.31	-0.02	0.37	-0.04	0.16	0.35	0.37

Notes: This table displays for the annual turnover rates, i.e., flows as a fraction of the total population, from the weighted non-SEO sample of the PSID various business cycle statistics. The underlying sample is 1969-1997. In the columns in each panel are: total turnover rate (TOR=O2O+O2R+R2O+R2R), and the four annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates. The first five rows in each panel display the dynamic correlogram of the various turnover rates, filtered by an HP-filter with smoothing parameter 400, with various aggregate variables: log annual real personal consumption expenditures (FRED series identifier PCECC96), filtered by an HP-filter with smoothing parameter 6.25; the civilian unemployment rate (FRED series identifier UNRATE), filtered by an HP-filter with smoothing parameter 400; annual real GDP log differences (FRED series identifier GDPC96); a log real home price index from http://www.econ.yale.edu/ shiller/data/Fig2-1.xls, second column, filtered by an HP-filter with smoothing parameter 6.25; the rental vacancy rate (U.S. census, http://www.census.gov/housing/hvs/data/histtabs.html, Table 1), filtered by an HP-filter with smoothing parameter 400; the owner vacancy rate (U.S. census, http://www.census.gov/housing/hvs/data/histtabs.html, Table 2), filtered by an HP-filter with smoothing parameter 400. To reflect that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last interview, we construct the annual data for 1969, i.e., the aggregate variable we pair with the 1969 PSID move data, as the average of the quarterly (in the case of the unemployment rate, monthly) numbers in 1969:2, 1969:1, 1968:4, and 1968:3. 'Lead' and 'Lag' refer to the housing turnover rate relative to the aggregate variable. In comparison, the standard deviation of the cyclical component of real consumption expenditures is 1.17 percent, of real GDP growth rates 2.01 percent and of real home prices 3.58 percent. The standard deviation of the cyclical component of the unemployment rate is 0.99, of the rental vacancy rate 0.44 and of the owner vacancy rate 0.16.

Table 5, which shows that real house prices are contemporaneously procyclical, is consistent with this view. The data are, however, not consistent with the view that real house price gains, i.e., house equity gains, have to occur prior to households moving. If this were the case, we would see turnover variables that are positively correlated with but lagging real house prices, especially the turnover rates originating in the owner-occupied segment.[31] The data are also inconsistent with the view that lower house prices cause households to move in the first place.

Table 5: Business Cycle Statistics of House Prices and Vacancy Rates

	Real House Prices	Rental Vacancy Rate	Owner Vacancy Rate
Lead 2	-0.10	0.10	-0.14
Lead 1	0.44	0.11	-0.27
Contemp.	0.58	0.04	-0.07
Lag 1	0.15	0.08	0.19
Lag 2	-0.14	0.06	0.20
Mean	-	7.16%	1.57%

Notes: This table displays various business cycle statistics for real house prices, the rental vacancy rate and the owner vacancy rate. The first five rows display the dynamic correlogram with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. The last row displays the time series average (in percentage points). For the sources of these aggregate variables and the construction of their cyclical components see the notes to Table 4.

A similar, albeit weaker direction of causality is painted by the correlogram between the housing turnover rates and the owner vacancy rate (Table 4). In times of high O2O moves, which, we have learned, are times of higher economic activity, the owner-occupied segment has a smaller number of vacancies. In contrast, the data do not support a story where lots of vacancies in the owner-occupied segment lead to more turnover activity terminating in that segment (the R2O moves are also negatively correlated with owner-occupied vacancies). Instead, there seems to be an underlying factor, namely, economic activity, that makes households move, which then leads to both higher house prices and lower vacancy rates. Finally, housing turnover is largely unrelated to vacancies in the rental market (Table 4),

[31]The fact that O2O moves come somewhat later than R2O moves in relation to real house prices might indicate a small role for the housing equity channel.

which, in turn, are unrelated to economic activity (Table 5). Taken together, Tables 4 and 5 cast some doubt on a simple search-and-matching view of the housing market, as vacancy rates and thus presumably tightness in the housing market are largely unrelated to both economic activity and housing turnover. And to the extent that vacancies in the owner-occupied segment and turnover are related, a larger number of vacancies does not seem to induce larger turnover, but rather, higher turnover activity leads to less vacancies.

Table 6: Business Cycle Statistics of Housing Turnover Rates - Two-Year Flow Information

	TOR	O2O	O2R	R2O	R2R	TOR	O2O	O2R	R2O	R2R
	Two-Year Turnover Rates					Extrapolated One-Year Turnover Rates				
Lead 1	-0.10	-0.18	0.08	-0.40	0.19	0.26	-0.12	-0.00	0.39	0.33
Lead 2	0.05	-0.21	0.45	0.07	0.07	0.42	0.38	-0.02	0.63	0.11
Contemp.	0.34	0.47	-0.37	0.67	-0.11	0.16	0.58	0.01	0.30	-0.36
Lag 1	-0.37	-0.14	-0.26	-0.39	-0.23	-0.32	0.07	-0.09	-0.32	-0.39
Lag 2	-0.20	-0.39	0.39	-0.19	-0.01	-0.44	-0.49	0.05	-0.45	-0.14
Mean	23.69%	6.13%	2.65%	4.25%	10.66%	15.03%	3.18%	1.58%	2.38%	7.95%
Std	1.53%	0.74%	0.27%	0.53%	0.76%	1.02%	0.44%	0.22%	0.33%	0.48%
CV	0.064	0.120	0.103	0.125	0.073	0.068	0.138	0.142	0.139	0.061

Notes: This table displays for turnover rates, i.e., flows as a fraction of the total population, from the weighted non-SEO sample of the PSID various business cycle statistics. In both cases we use biennial flow information. In the left panel, we use the biennial data on biennial flows from the PSID (the underlying sample is 1971-2009), filtered by an HP-filter with a smoothing parameter of 25, which follows from the formula in Uhlig and Ravn (2002), given that the annual turnover rate was detrended with a smoothing parameter of 400. In the right panel, we run from 1970-1997, where we have annual information in the PSID on both annual and biennial flows, a simple regression of annual turnover rates on biennial turnover rates. For the later period after 1997 we use this model and the biennial information on biennial flows to predict the annual turnover rates for the years when the PSID occured. We linearly interpolate the data for the non-PSID years. We combine these synthetic turnover rates from after 1997 with the baseline turnover rates for 1969-1997. In the columns in each panel are: total turnover rate (TOR=O2O+O2R+R2O+R2R), and the four annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates. The first five rows in each panel display the dynamic correlogram of the cyclical component of the various turnover rates with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. Note that in the left panel we use only every other year from the annually filtered series GDP series, because the PSID turnover rates are at the biennial frequency. The last three rows display, respectively, the time series average ('Mean'), standard deviation ('Std'), both in percentage points, and the time coefficient coefficient of variation, 'CV', i.e., 'Std' divided by 'Mean', which is unitless.

Finally, Table 6 shows dynamic correlograms for the housing turnover rates when we use two-year move information. Since the PSID's annual frequency ends in 1997, thus far we

have limited the analysis to the annual data on annual turnover rates from 1969 to 1997. Thereafter, the PSID provides only biennial data on biennial turnover rates. But for the 1969 to 1997 period we can construct annual data on biennial turnover rates. Table 6 uses this information in two ways. The left panel combines the biennial data on biennial turnover rates from after 1997 with biennial data on biennial turnover rates prior to 1997, leading to an extended sample of biennial turnover rates (from 1971 to 2009) relative to our baseline sample.

The right panel estimates a simple econometric model of annual turnover rates on biennial turnover rates from 1969 to 1997, and then, using these estimates, extrapolates annual turnover rates for the years the PSID occurred after 1997. We linearly interpolate the data to fill in non-PSID years. When we combine these synthetic annual turnover rates from after 1997 with the actual annual turnover rates from the baseline sample for the years 1969-1997, we get an extended sample of annual turnover rates (for 1969 to 2009). The results in Table 6 are very similar to our baseline results.

3.4 Special Topics

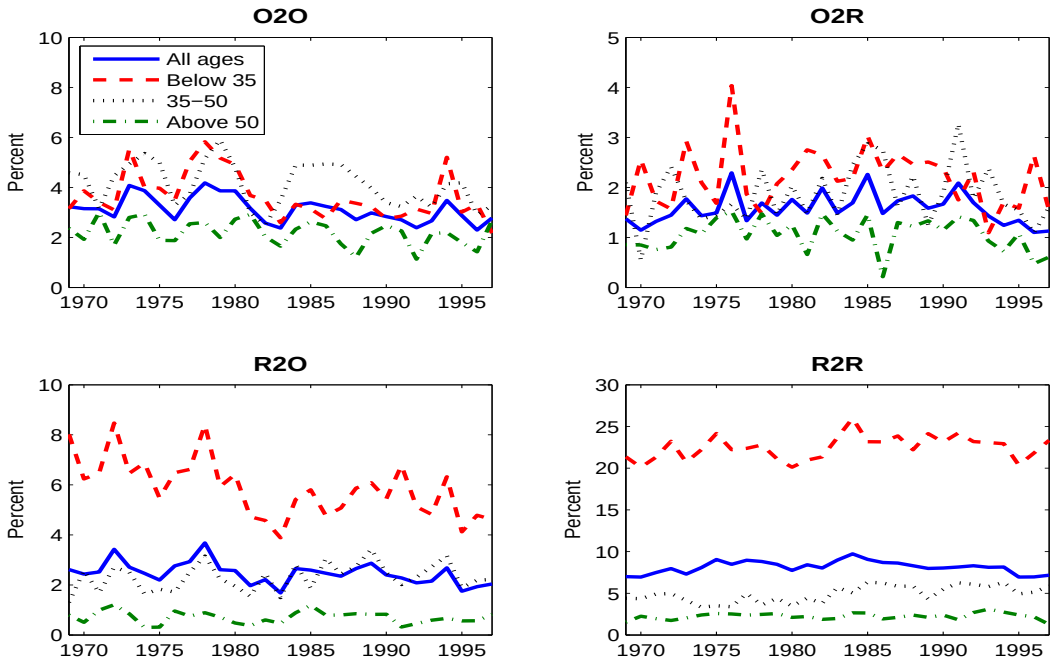
3.4.1 Turnover by Age of the Household Head

Figure 10 and Table 7 summarize housing turnover in the PSID by age of the household head.[32] Perhaps unsurprisingly, age-specific overall turnover rates, i.e., total moving activity in an age group as a fraction of the age-specific population, on average, declines with age, from 34 percent for the group of 34-years-old and below, to 13 percent for the 35 to 49-years-old, and 6 percent for the households that are 50-years-old and above. This is also true for most disaggregate turnover rates, O2R, R2O, and R2R — especially and starkly for R2R. O2O moves constitute the obvious exception, as younger households are less likely to own a house in the first place. Still, the young are the most transient.

Housing turnover is also more volatile (in an absolute sense) for younger households, although the difference across age groups is not nearly as stark as the difference in the average turnover rate. In terms of comovement, the basic patterns that we saw in the full

[32] All respondents in the baseline sample provided age information for the household head, so our sample for analyzing the age-specific turnover rates is the exact same as our baseline sample.

FIGURE 10: AGE-SPECIFIC DISAGGREGATE TURNOVER RATES BY HOUSING TENURE



Notes: This figure displays the time series of the total annual turnover rates (1969-1997), computed from the weighted non-SEO sample of the PSID (the blue solid line), together with the age-specific turnover rates for three age classes: household head is below 35 (the red dashed line); 35-50 (the black dotted line); and above 50 (the green dash-dotted line). The age-specific turnover rates are the number of respondents in a given move type (O2O, O2R, R2O, or R2R) divided by the total population in an age group.

sample show up at every age group as well. Overall turnover is procyclical, a bit less so in the oldest age group, O2O moves are contemporaneously procyclical, moves originating in the rental segment tend to lead the business cycle, and O2R moves are acyclical across the board. This means that while a changing age composition helps us understand the long-run behavior of aggregate housing turnover (as discussed in Section 3.2),[33] the changing age composition over our sample period does not seem to affect the cyclical behavior of turnover in the housing market.

[33]The lower right panel of Figure 10 shows that the age-specific R2R turnover rates are actually fairly constant over the sample, so that, as we have pointed out above, the observed hump shape in the overall R2R turnover rate is largely the result of an age composition effect.

Table 7: Business Cycle Statistics of Housing Turnover Rates by Age Group

	TOR	O2R+R2O	R2O-O2R	O2O	O2R	R2O	R2R
			Age of household head 34 and below				
Lead 2	0.23	0.06	0.27	-0.09	-0.23	0.20	0.34
Lead 1	0.53	0.42	0.50	0.38	-0.17	0.55	0.20
Contemp.	0.16	0.37	0.26	0.44	0.05	0.36	-0.33
Lag 1	-0.28	-0.08	-0.04	0.10	-0.02	-0.07	-0.40
Lag 2	-0.36	-0.23	-0.36	-0.37	0.17	-0.35	-0.10
Mean	34.21%	8.06%	3.67%	3.66%	2.19%	5.86%	22.50%
Std	1.76%	0.94%	1.16%	0.80%	0.56%	0.89%	1.24%
CV	0.051	0.117	0.316	0.217	0.256	0.152	0.055
			Age of household head 35 to 49				
Lead 2	0.33	0.34	0.06	-0.04	0.19	0.29	0.38
Lead 1	0.61	0.47	0.20	0.48	0.19	0.49	0.25
Contemp.	0.34	0.24	0.13	0.57	0.08	0.27	-0.18
Lag 1	-0.17	-0.29	-0.05	0.17	-0.17	-0.25	-0.26
Lag 2	-0.58	-0.38	-0.13	-0.46	-0.21	-0.37	-0.31
Mean	13.22%	4.16%	0.44%	4.14%	1.86%	2.30%	4.92%
Std	1.49%	0.74%	0.73%	0.79%	0.53%	0.51%	0.68%
CV	0.112	0.179	1.668	0.192	0.287	0.223	0.139
			Age of household head 50 and above				
Lead 2	-0.03	0.34	0.31	-0.34	0.01	0.51	0.01
Lead 1	0.21	0.36	0.43	-0.04	-0.05	0.63	0.05
Contemp.	0.36	0.03	0.17	0.42	-0.09	0.16	0.06
Lag 1	-0.14	-0.36	-0.36	0.21	0.01	-0.57	-0.16
Lag 2	-0.49	-0.25	-0.36	-0.28	0.08	-0.49	-0.24
Mean	6.19%	1.76%	-0.36%	2.20%	1.06%	0.70%	2.24%
Std	0.64%	0.37%	0.38%	0.48%	0.30%	0.24%	0.36%
CV	0.103	0.211	-1.081	0.217	0.279	0.336	0.162

Notes: This table displays various business cycle statistics for the annual age-specific turnover rates, i.e., flows as a fraction of the total age-specific population, from the weighted non-SEO sample of the PSID. Age is the age of the household head. The underlying sample is 1969-1997. In the columns are: total turnover rate (TOR=O2O+O2R+R2O+R2R), gross turnover for moves between the segments (O2R+R2O), the net inflow from the rental segment into the owner-occupied segment (R2O-O2R), and the four annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates. See the notes to Table 2 for a description of the business cycle statistics, and how annual GDP is constructed.

3.4.2 A Closer Look at O2R

Why are O2R moves acyclical? This is a question that remains to be addressed. One hypothesis is that these moves are largely driven by the elderly and empty-nesters downgrading from owning to renting, which might happen independently of the state of the economy. While this may be part of the explanation, the evidence supporting this claim is mixed, as shown in Table 8. Contrasting O2R moves with moves originating in the rental segment of the housing market, we see that in almost a third of the O2R moves the household head is old, whereas for an R2R or R2O move the probability of the household head being old is significantly lower (13 percent). But this also means that the remaining two-thirds of all O2R moves are done by younger and middle-aged households who are unlikely to move for retirement reasons. In addition, 32 percent of O2O moves are done by an old household head, so in this regard O2R moves do not appear to be different from O2O moves.

Finally, cutting the data a different way (not displayed in the table), we find that conditional on being old and moving, the move type composition of the elderly is 35 percent O2O, 17 percent O2R, 11 percent R2O, and 36 percent R2R. This breakdown is quite similar to the move type composition of middle-aged households, who, again, presumably do not move for retirement reasons. Only the young have a very different move type pattern with almost two-thirds of their moves being R2R. The acyclicality of the O2R moves, therefore, does not appear to be merely people moving into retirement. O2R moving behavior seems to be a deeper property of the housing market, which, in terms of modeling, suggests exogenous separation shocks from home ownership.

Table 8: Age-composition of Disaggregate Moves by Housing Tenure

	O2O	O2R	R2O	R2R
Age of household head 34 and below	29.49%	35.36%	59.71%	69.48%
Age of household head 35 to 49	38.08%	34.05%	27.28%	17.81%
Age of household head 50 and above	32.43%	30.58%	13.01%	12.71%

Notes: This table displays the average age composition conditional on a certain disaggregate move type (O2O, O2R, R2O, and R2R). The underlying sample is the weighted non-SEO sample of the PSID from 1969-1997.

4 Conclusion

To the best of our knowledge this is the first paper to empirically document jointly the long-run average, the secular movements, and the cyclical behavior of gross housing turnover within and between the two segments of the U.S. housing market — owner-occupied and rental — in a systematic and comprehensive fashion. We do so by employing a two-state gross flow approach with the longitudinal household data from the Panel Study of Income Dynamics. Gross flows within and between the two segments are large, on average, and gross flows between segments are four times larger than net flows. Housing turnover experienced a hump-shaped development between 1970 and 2000, which we attribute to a similar pattern of changes in the age composition of the U.S. population. In addition, turnover in the U.S. housing market is procyclical and tends to lead the business cycle and real house prices.

The purpose of this paper is ultimately to provide empirical guidance to the design, calibration and evaluation of micro-founded, dynamic, and quantitative models of the housing market, thus giving the macroeconomic housing literature a similar empirical underpinning that the macroeconomic labor literature has always enjoyed. Given that the secular trend in housing turnover is largely explained by a composition effect, these housing market models should probably focus on explaining the cyclical dynamics of housing turnover as their first-order task.

References

Anenberg, Elliott, and Patrick Bayer. 2013. "Endogenous Sources of Volatility in Housing Markets: The Joint Buyer-Seller Problem." NBER Working Paper No. 18980.

Bachmann, Rüdiger, Tim Berg, and Eric Sims. forthcoming. "Inflation Expectations and Readiness to Spend: Cross-Sectional Evidence." *American Economic Journal: Economic Policy.*

Burnside, Craig, Martin Eichenbaum, and Sergio Rebelo. 2013. "Understanding Booms and Busts in Housing Markets." Northwestern University mimeo.

Caplin, Andrew, and John Leahy. 2011. "Trading Frictions and House Price Dynamics." *Journal of Money, Credit and Banking*, 43: 283–303.

Coulson, Edward, and Paul Grieco. 2013. "Mobility and Mortgages: Evidence from the PSID." *Regional Science and Urban Economics*, 43: 1–7.

Davis, Steven, and John Haltiwanger. 1999. "Gross Job Flows." In *Handbook of Labor Economics.* , ed. O. Ashenfelter and D. Card, 2711–2805. Amsterdam: Elsevier Science North-Holland.

Davis, Steven, and John Haltiwanger. 2014. "Labor Market Fluidity and Economic Performance." The Federal Reserve Bank of Kansas City - Jackson Hall Conference.

Davis, Steven, Jason Faberman, John Haltiwanger, Ron Jarmin, and Javier Miranda. 2010. "Business Volatility, Job Destruction, and Unemployment." *American Economic Journal: Macroeconomics*, 2: 259287.

Decker, Ryan, John Haltiwanger, Ron Jarmin, and Javier Miranda. 2014. "The Role of Entrepreneurship in US Job Creation and Economic Dynamism." *Journal of Economic Perspectives*, 28: 3–24.

Diaz, Antonia, and Belen Jerez. 2013. "House Prices, Sales, and Time on the Market: A Search-theoretic Framework." *International Economic Review*, 53(3): 837–872.

Dieleman, Frans, William Clark, and Marinus Deurloo. 2000. "The Geography of Residential Turnover in Twenty-seven Large US Metropolitan Housing Markets, 1985-95." *Urban Studies*, 37: 223–245.

Elsby, Michael, Bart Hobjin, and Ayşegül Şhayin. 2013. "Unemployment Dynamics in the OECD." *Review of Economics and Statistics*, 95: 530–548.

Elsby, Michael, Ryan Michaels, and Gary Solon. 2009. "The Ins and Outs of Cyclical Unemployment." *American Economic Journal: Macroeconomics*, 1(1): 84–110.

Gan, Li, and Qinghua Zhang. 2013. "Market Thickness and the Impact of Unemployment on Housing Market Outcomes." NBER Working Paper No. 19564.

Genesove, David, and Lu Han. 2012. "Search and Matching in the Housing Market." *Journal of Urban Economics*, 72: 31–45.

Head, Allen, Huw Lloyd-Ellis, and Hongfei Sun. 2014. "Search, Liquidity and the Dynamics of House Prices and Construction." *American Economic Review*, 104(4): pp. 11721210.

Jaimovich, Nir, and Henry E. Siu. 2009. "The Young, the Old, and the Restless: Demographics and Business Cycle Volatility." *American Economic Review*, 99(3): pp. 804–826.

Kaplan, Greg, and Sam Schulhofer-Wohl. 2013. "Understanding the Long-Run Decline in Interstate Migration." Minneapolis, MN: Federal Reserve Bank of Minneapolis Research Department Working Paper 697.

Lillard, Lee A., and Constantijn W.A. Panis. 1998. "Panel Attrition from the Panel Study of Income Dynamics." *Journal of Human Resources*, 33(2): 437–57.

Partridge, Mark, Dan Rickman, Rose Olfert, and Kamar Ali. 2012. "Dwindling U.S. Internal Migration: Evidence of Spatial Equilibrium or Structural Shifts in Local Labor Markets?" *Regional Science and Urban Economics*, 42: 375388.

Piazzesi, Monika, and Martin Schneider. 2009. "Momentum Traders in the Housing Market: Survey Evidence and a Search Model." *American Economic Review*, 99(2): pp. 406–411.

Saks, Raven, and Abigail Wozniak. 2011. "Labor Reallocation over the Business Cycle: New Evidence from Internal Migration." *Journal of Labor Economics*, 29: 697–739.

Saks, Raven, Christopher Smith, and Abigail Wozniak. 2011. "Internal Migration in the United States." *Journal of Economic Perspectives*, 25(3): 173–196.

Saks, Raven, Christopher Smith, and Abigail Wozniak. 2014. "Declining Migration within the U.S.: the Role of the Labor Market." NBER Working Paper No. 20065.

Shimer, Robert. 2005. "The Cyclical Behavior of Equilibrium Unemployment and Vacancies." *American Economic Review*, 95(1): 25–49.

Uhlig, Harald, and Morten O. Ravn. 2002. "On Adjusting the HP-filter for the Frequency of Observations." *Review of Economics and Statistics*, 84(1): 371–80.

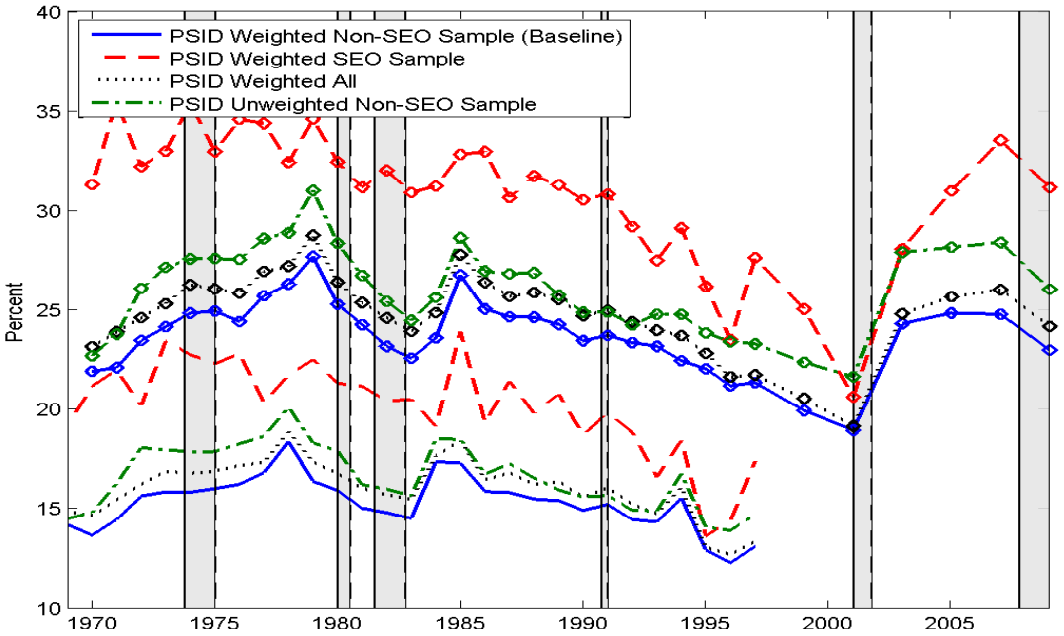
Wheaton, William. 1990. "Vacancy, Search, and Prices in a Housing Market Matching Model." *Journal of Political Economy*, 98(6): 1270–1292.

Wheaton, William, and Nai Jai Lee. 2009. "The Co-movement of Housing Sales and Housing Prices: Empirics and Theory." Cambridge, MA: MIT mimeo.

Winkler, Hernan. 2011. "The Effect of Homeownership on Geographic Mobility and Labor Market Outcomes." mimeo.

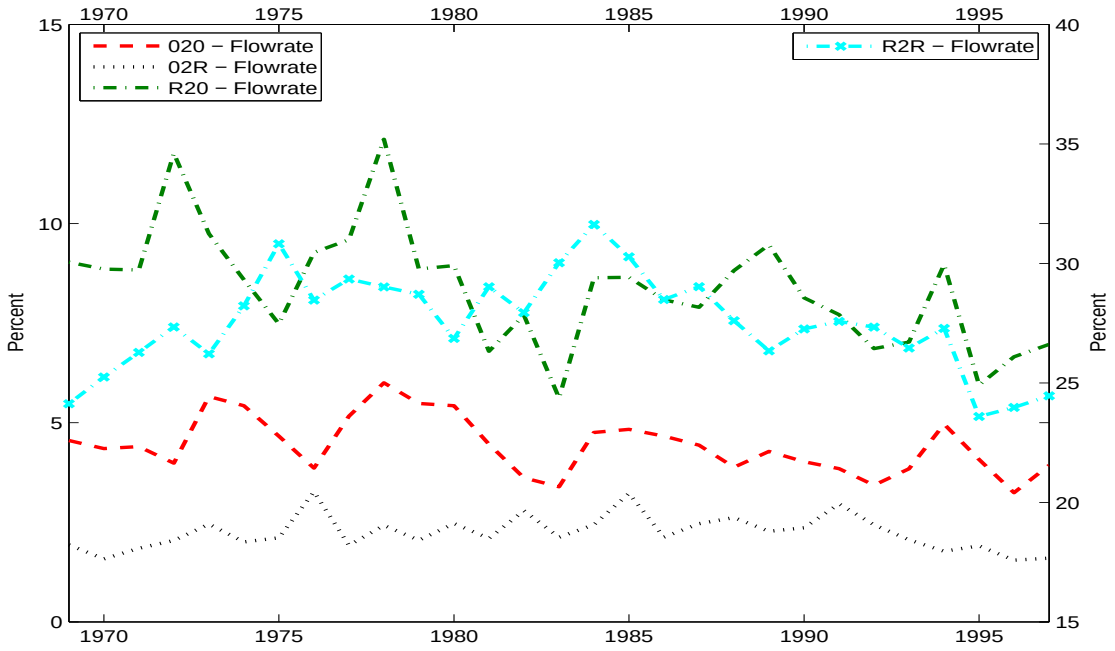
A Additional Figures

Figure 11: Total Housing Turnover Rates from Various PSID Samples in Comparison



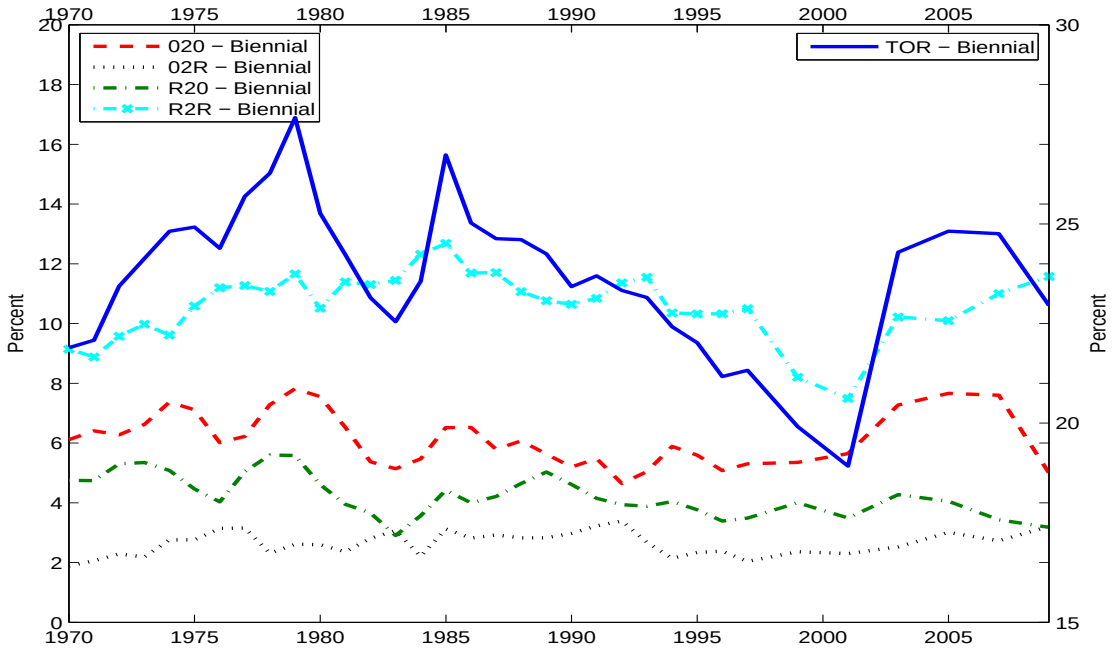
Notes: This figure displays the time series of the total annual turnover rates (1969-1997), computed from the weighted non-SEO sample of the PSID (the blue solid line); computed from the weighted SEO sample of the PSID (dashed red line); computed from the weighted total sample of the PSID, non-SEO and SEO combined, (dotted black line); computed from the unweighted non-SEO sample of the PSID (dashed-dotted green line). In addition, the figure displays the time series of the total biennial turnover rates (annually from 1970-1997, biennially from 1999-2009) for the same four samples as the annual data. The biennial series are marked with diamonds.

FIGURE 12: DISAGGREGATE FLOW RATES BY HOUSING TENURE FROM THE NON-SEO PSID SAMPLE - WEIGHTED



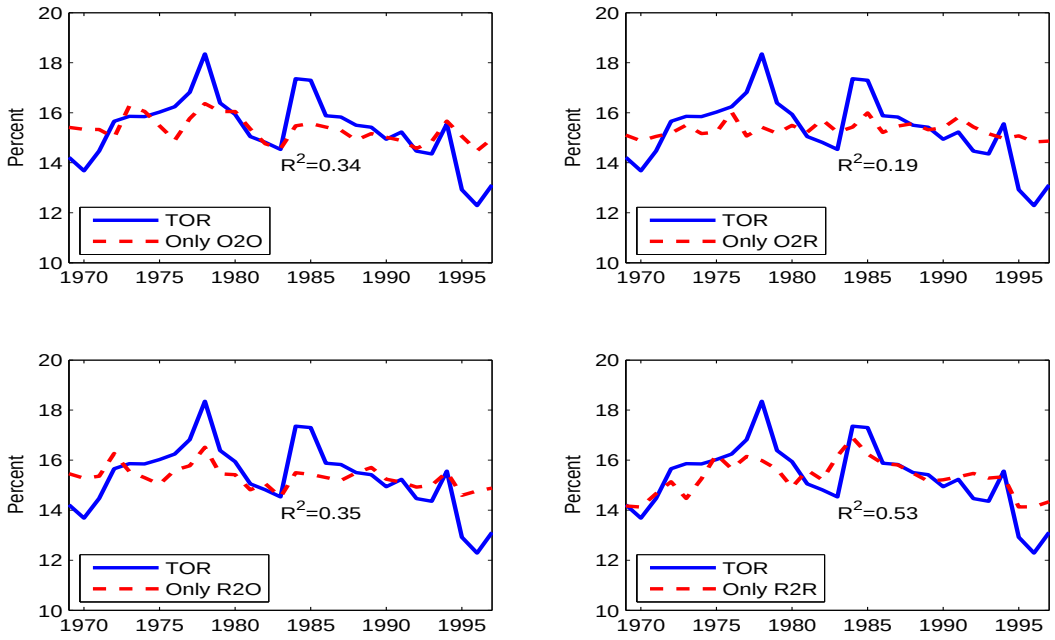
Notes: This figure displays the time series of the R2R annual flow rates (1969-1997), computed from the weighted non-SEO sample of the PSID (the light blue dash-dotted line with crosses), on the right ordinate. For the same time horizon and sample the left ordinate has, respectively, the O2O flows (the dashed red line), the O2R flows (the black dotted line), and the R2O flows (the green dash-dotted line).

Figure 13: Disaggregate Turnover Rates by Housing Tenure Biennial from the Non-SEO PSID Sample - Weighted



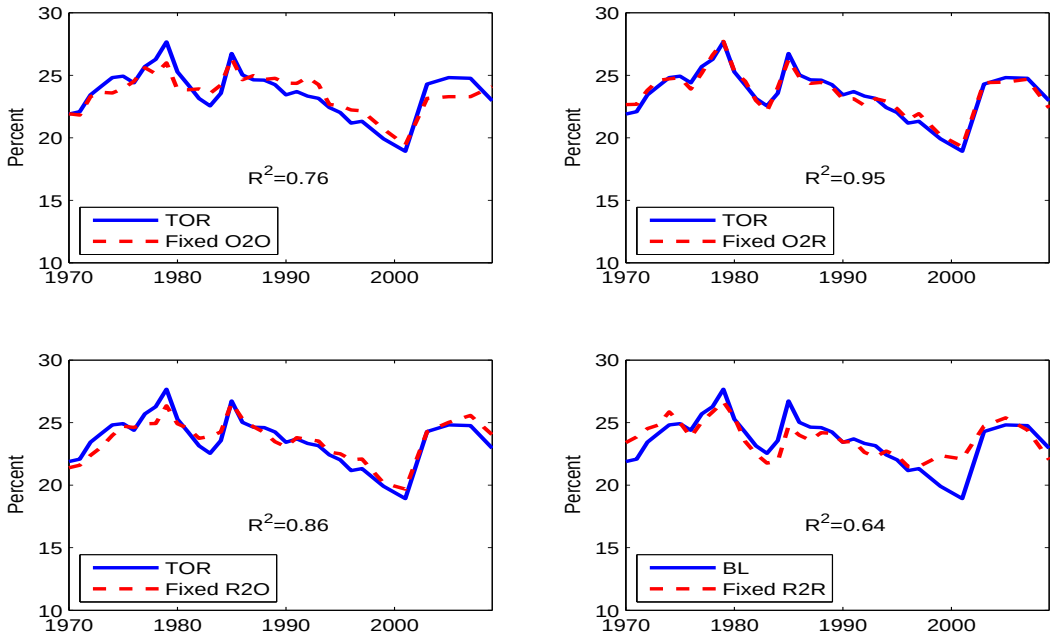
Notes: This figure displays the time series of the total biennial turnover rates (annually from 1970-1997, biennially from 1999-2009), computed from the weighted non-SEO sample of the PSID (the blue solid line), on the right ordinate. For the same time horizon and sample the left ordinate has, respectively, the O2O flows (the dashed red line), the O2R flows (the black dotted line), the R2O flows (the green dash-dotted line), and the R2R flows (the light blue dash-dotted line with crosses).

FIGURE 14: CONTRIBUTION OF DISAGGREGATE TURNOVER RATES BY HOUSING TENURE TO THE TOTAL HOUSING TURNOVER RATE



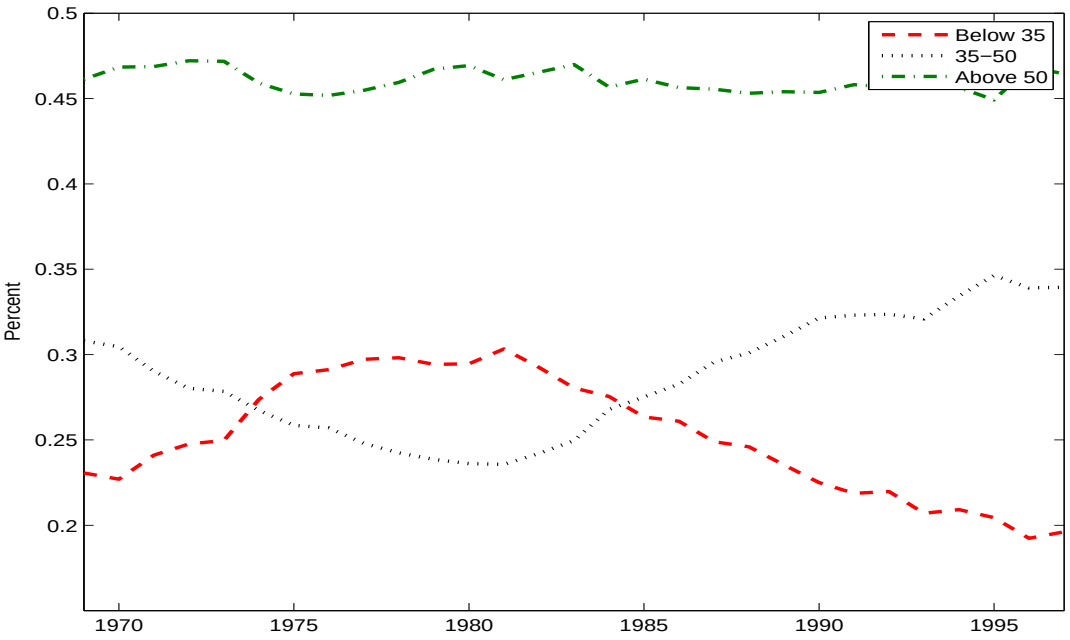
Notes: This figure displays the time series of the total annual turnover rates (annually from 1969-1997), computed from the weighted non-SEO sample of the PSID (the blue solid lines), together with counterfactual turnover rates (the dashed red lines), where, each in turn, all but one of the four disaggregate turnover rates, O2O, O2R, R2O, and R2R, are fixed at their respective time series average. The R^2 in the graphs provide a measure for how well the counterfactual turnover rate explains the overall turnover rate. The higher the R^2, the more important the disaggregate turnover rate.

FIGURE 15: CONTRIBUTION OF DISAGGREGATE TURNOVER RATES BY HOUSING TENURE TO THE TOTAL HOUSING TURNOVER RATE - BIENNIAL



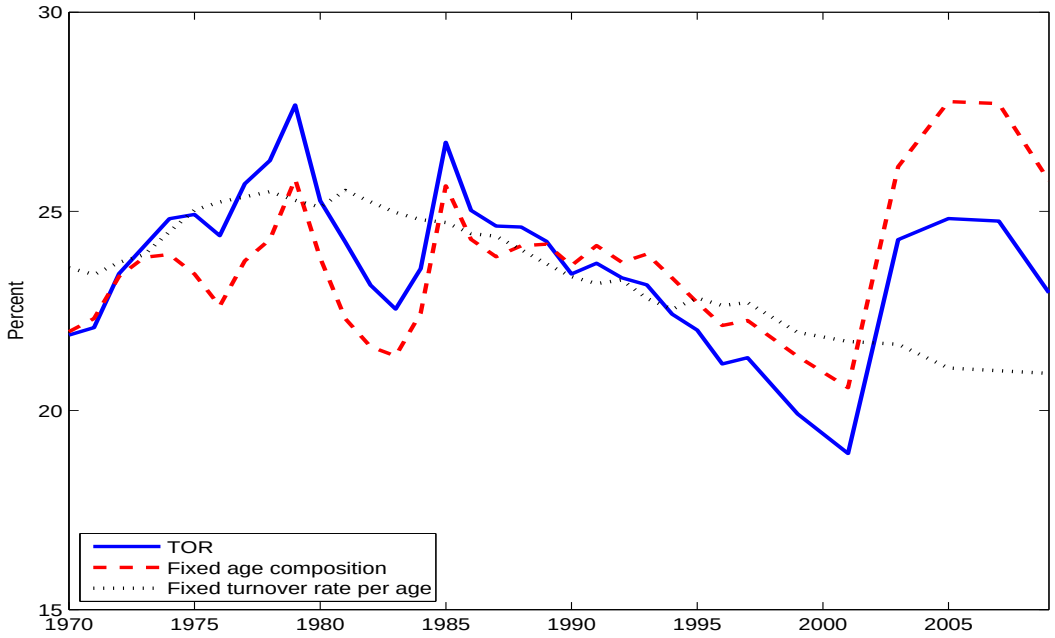
Notes: This figure displays the time series of the total biennial turnover rates (annually from 1970-1997, biennially from 1999-2009), computed from the weighted non-SEO sample of the PSID (the blue solid lines), together with counterfactual turnover rates (the dashed red lines), where, each in turn, the four disaggregate turnover rates, O2O, O2R, R2O, and R2R, are fixed at their respective time series average. The R^2 in the graphs provide a measure for how well the counterfactual turnover rate explains the overall turnover rate. The lower the R^2, the more important the left-out disaggregate turnover rate.

FIGURE 16: AGE COMPOSITION OF THE PSID



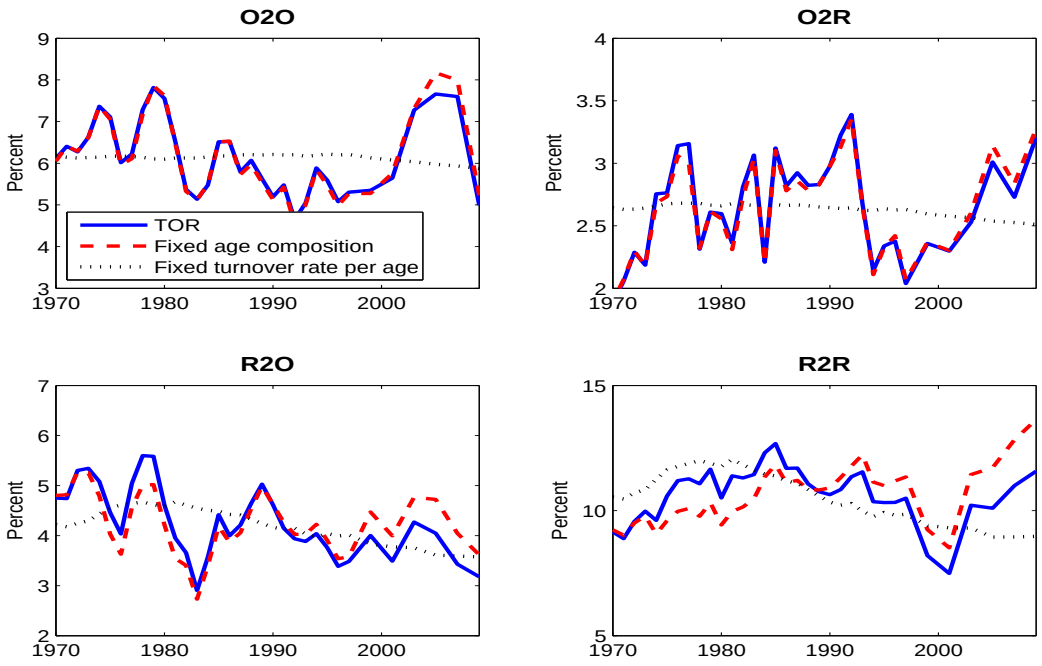
Notes: This figure displays the age shares of household heads in the PSID, below 35, 35-50, and above 50, computed from the weighted non-SEO sample.

Figure 17: Contribution of the Age Composition to the Total Housing Turnover Rate - Biennial



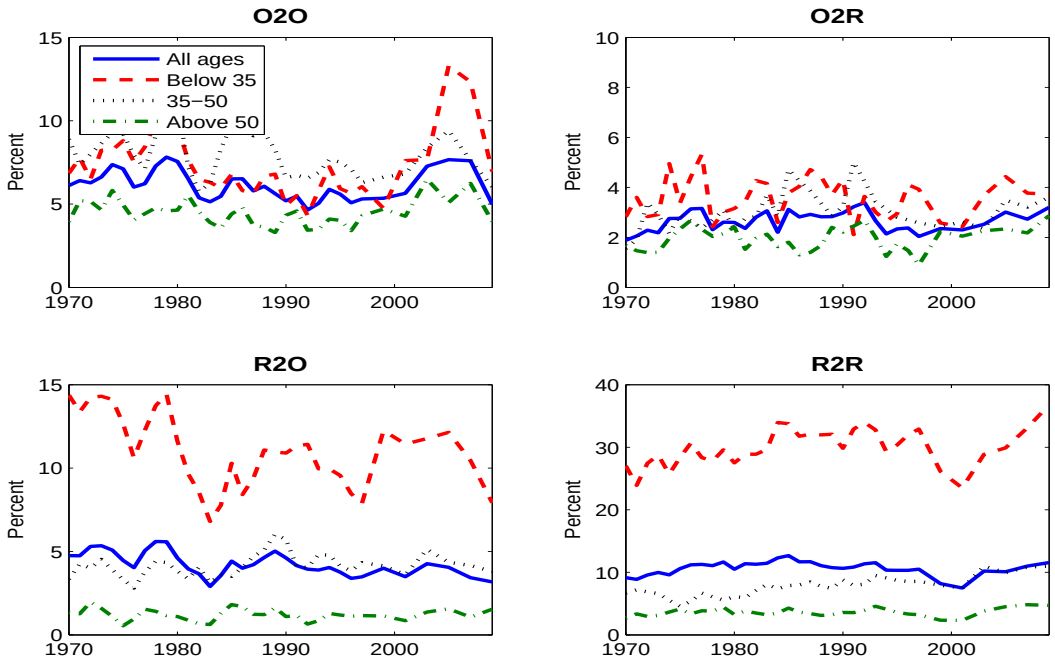
Notes: This figure displays the time series of the total biennial turnover rates (annually from 1970-1997, biennially from 1999-2009), computed from the weighted non-SEO sample of the PSID (the blue solid line), together with two counterfactual turnover rates, where, (i) the age composition in the PSID in three age classes (household head is below 35, 35-50, and above 50) has been fixed at its time series average (the dashed red line), and (ii) the turnover rates conditional on these same three age classes have been fixed at their respective time series average (the black dotted line).

FIGURE 18: CONTRIBUTION OF THE AGE COMPOSITION TO THE DISAGGREGATE TURNOVER RATES BY HOUSING TENURE - BIENNIAL



Notes: See notes to Figure 17; this figure repeats the same age-decomposition exercise, just separately for O2O, O2R, R2O, and R2R flows.

FIGURE 19: AGE-SPECIFIC DISAGGREGATE TURNOVER RATES BY HOUSING TENURE - BIENNIAL



Notes: This figure displays the time series of the total biennial turnover rates (annually from 1970-1997, biennially from 1999-2009), computed from the weighted non-SEO sample of the PSID (the blue solid line), together with the age-specific turnover rates for three age classes: household head is below 35 (the red dashed line); 35-50 (the black dotted line); and above 50 (the green dash-dotted line).

B Additional Tables

Table 9: Business Cycle Statistics of Housing Turnover Rates - PSID non-SEO Turnover Rates Detrended with an HP(6.25) Filter

	TOR	O2R+R2O	R2O-O2R	O2O	O2R	R2O	R2R
Lead 2	0.17	0.22	0.31	-0.30	-0.06	0.32	0.38
Lead 1	0.55	0.45	0.60	0.34	-0.07	0.64	0.20
Contemp.	0.33	0.24	0.26	0.72	0.00	0.30	-0.39
Lag 1	-0.32	-0.37	-0.24	0.24	-0.15	-0.38	-0.45
Lag 2	-0.60	-0.37	-0.47	-0.55	0.04	-0.51	-0.16
Mean	15.31%	4.05%	0.89%	3.13%	1.58%	2.47%	8.13%
Std	0.68%	0.41%	0.36%	0.36%	0.22%	0.31%	0.34%
CV	0.044	0.101	0.400	0.116	0.141	0.127	0.042

Notes: This table displays for the annual turnover rates, i.e., flows as a fraction of the total population, from the weighted non-SEO sample of the PSID various business cycle statistics. The underlying sample is 1969-1997. In the columns are: total turnover rate (TOR=O2O+O2R+R2O+R2R), the gross turnover for moves between the segments (O2R+R2O), the net inflow from the rental segment into the owner-occupied segment (R2O-O2R), and the four annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates. The first five rows display the dynamic correlogram of the various turnover rates, *filtered by an HP-filter with smoothing parameter 6.25*, with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. To reflect that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last interview, we construct the annual real GDP for 1969, i.e., the GDP number we pair with the 1969 PSID move data, as the average of the quarterly GDP numbers in 1969:2, 1969:1, 1968:4, and 1968:3. 'Lead' and 'Lag' refer to the housing turnover rate relative to the real GDP business cycle. The last three rows display, respectively, the time series average ('Mean'), standard deviation ('Std'), both in percentage points, and the time coefficient coefficient of variation, 'CV', i.e., 'Std' divided by 'Mean', which is unitless.

Table 10: Business Cycle Statistics of Housing Turnover Rates - PSID non-SEO Turnover Rates Detrended with a linear Trend

	TOR	O2R+R2O	R2O-O2R	O2O	O2R	R2O	R2R
Lead 2	0.26	0.31	0.34	-0.19	0.02	0.40	0.34
Lead 1	0.49	0.52	0.61	0.40	0.01	0.71	0.20
Contemp.	0.26	0.29	0.29	0.70	0.04	0.37	-0.19
Lag 1	-0.17	-0.24	-0.20	0.24	-0.06	-0.28	-0.26
Lag 2	-0.43	-0.31	-0.45	-0.53	0.07	-0.47	-0.14
Mean	15.31%	4.05%	0.89%	3.13%	1.58%	2.47%	8.13%
Std	1.26%	0.54%	0.45%	0.45%	0.31%	0.39%	0.73%
CV	0.082	0.134	0.498	0.143	0.195	0.157	0.089

Notes: This table displays for the annual turnover rates, i.e., flows as a fraction of the total population, from the weighted non-SEO sample of the PSID various business cycle statistics. The underlying sample is 1969-1997. In the columns are: total turnover rate (TOR=O2O+O2R+R2O+R2R), the gross turnover for moves between the segments (O2R+R2O), the net inflow from the rental segment into the owner-occupied segment (R2O-O2R), and the four annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates. The first five rows display the dynamic correlogram of the various turnover rates, *filtered by linear, deterministic trend*, with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. To reflect that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last interview, we construct the annual real GDP for 1969, i.e., the GDP number we pair with the 1969 PSID move data, as the average of the quarterly GDP numbers in 1969:2, 1969:1, 1968:4, and 1968:3. 'Lead' and 'Lag' refer to the housing turnover rate relative to the real GDP business cycle. The last three rows display, respectively, the time series average ('Mean'), standard deviation ('Std'), both in percentage points, and the time coefficient coefficient of variation, 'CV', i.e., 'Std' divided by 'Mean', which is unitless.

Table 11: Business Cycle Statistics of Housing Turnover Rates - PSID SEO Sample

	TOR	O2R+R2O	R2O-O2R	O2O	O2R	R2O	R2R
Lead 2	-0.15	-0.09	0.26	0.20	-0.33	0.10	-0.27
Lead 1	0.10	-0.00	0.01	0.43	-0.01	0.00	-0.07
Contemp.	0.20	0.17	-0.06	-0.03	0.22	0.06	0.16
Lag 1	0.23	0.19	0.19	-0.30	0.01	0.23	0.29
Lag 2	-0.09	-0.14	0.10	-0.30	-0.23	-0.03	0.11
Mean	20.13%	4.20%	1.33%	2.0%	1.4%4	2.78%	13.89%
Std	1.39%	0.70%	0.67%	0.49%	0.37%	0.58%	1.08%
CV	0.069	0.166	0.502	0.243	0.255	0.209	0.078

Notes: This table displays for the annual turnover rates, i.e., flows as a fraction of the total population, from the weighted *SEO sample* of the PSID various business cycle statistics. The underlying sample is 1969-1997. In the columns are: total turnover rate (TOR=O2O+O2R+R2O+R2R), the gross turnover for moves between the segments (O2R+R2O), the net inflow from the rental segment into the owner-occupied segment (R2O-O2R), and the four annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates. The first five rows display the dynamic correlogram of the various turnover rates, filtered by an HP-filter with smoothing parameter 400, with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. To reflect that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last interview, we construct the annual real GDP for 1969, i.e., the GDP number we pair with the 1969 PSID move data, as the average of the quarterly GDP numbers in 1969:2, 1969:1, 1968:4, and 1968:3. 'Lead' and 'Lag' refer to the housing turnover rate relative to the real GDP business cycle. The last three rows display, respectively, the time series average ('Mean'), standard deviation ('Std'), both in percentage points, and the time coefficient coefficient of variation, 'CV', i.e., 'Std' divided by 'Mean', which is unitless.

Table 12: Business Cycle Statistics of Housing Turnover Rates - PSID Combined Non-SEO and SEO Samples

	TOR	O2R+R2O	R2O-O2R	O2O	O2R	R2O	R2R
Lead 2	0.20	0.25	0.40	-0.17	-0.09	0.38	0.30
Lead 1	0.54	0.49	0.62	0.47	-0.03	0.66	0.15
Contemp.	0.34	0.31	0.29	0.69	0.06	0.36	-0.27
Lag 1	-0.18	-0.23	-0.13	0.17	-0.11	-0.22	-0.28
Lag 2	-0.54	-0.36	-0.41	-0.59	-0.00	-0.46	-0.15
Mean	16.05%	4.07%	0.96%	2.96%	1.56%	2.52%	9.02%
Std	0.85%	0.45%	0.39%	0.38%	0.24%	0.35%	0.41%
CV	0.053	0.111	0.401	0.127	0.152	0.138	0.046

Notes: This table displays for the annual turnover rates, i.e., flows as a fraction of the total population, from the weighted *combined non-SEO and SEO sample* of the PSID various business cycle statistics. The underlying sample is 1969-1997. In the columns are: total turnover rate (TOR=O2O+O2R+R2O+R2R), the gross turnover for moves between the segments (O2R+R2O), the net inflow from the rental segment into the owner-occupied segment (R2O-O2R), and the four annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates. The first five rows display the dynamic correlogram of the various turnover rates, filtered by an HP-filter with smoothing parameter 400, with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. To reflect that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last interview, we construct the annual real GDP for 1969, i.e., the GDP number we pair with the 1969 PSID move data, as the average of the quarterly GDP numbers in 1969:2, 1969:1, 1968:4, and 1968:3. 'Lead' and 'Lag' refer to the housing turnover rate relative to the real GDP business cycle. The last three rows display, respectively, the time series average ('Mean'), standard deviation ('Std'), both in percentage points, and the time coefficient coefficient of variation, 'CV', i.e., 'Std' divided by 'Mean', which is unitless.

Table 13: Business Cycle Statistics of Housing Turnover Rates - PSID Unweighted non-SEO Sample

	TOR	O2R+R2O	R2O-O2R	O2O	O2R	R2O	R2R
Lead 2	0.34	0.32	0.31	-0.16	0.07	0.35	0.48
Lead 1	0.61	0.59	0.68	0.37	0.01	0.70	0.27
Contemp.	0.29	0.33	0.36	0.68	0.03	0.38	-0.37
Lag 1	-0.27	-0.26	-0.09	0.26	-0.23	-0.20	-0.52
Lag 2	-0.59	-0.36	-0.45	-0.54	0.04	-0.45	-0.27
Mean	16.64%	4.59%	1.41%	3.46%	1.59%	3.00%	8.59%
Std	1.05%	0.55%	0.47%	0.47%	0.22%	0.46&	0.53%
CV	0.063	0.120	0.330	0.135	0.141	0.153	0.062

Notes: This table displays for the annual turnover rates, i.e., flows as a fraction of the total population, from the *unweighted* non-SEO sample of the PSID various business cycle statistics. The underlying sample is 1969-1997. In the columns are: total turnover rate (TOR=O2O+O2R+R2O+R2R), the gross turnover for moves between the segments (O2R+R2O), the net inflow from the rental segment into the owner-occupied segment (R2O-O2R), and the four annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates. The first five rows display the dynamic correlogram of the various turnover rates, filtered by an HP-filter with smoothing parameter 400, with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. To reflect that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last interview, we construct the annual real GDP for 1969, i.e., the GDP number we pair with the 1969 PSID move data, as the average of the quarterly GDP numbers in 1969:2, 1969:1, 1968:4, and 1968:3. 'Lead' and 'Lag' refer to the housing turnover rate relative to the real GDP business cycle. The last three rows display, respectively, the time series average ('Mean'), standard deviation ('Std'), both in percentage points, and the time coefficient coefficient of variation, 'CV', i.e., 'Std' divided by 'Mean', which is unitless.

Table 14: Business Cycle Statistics of Housing Turnover Rates - PSID non-SEO Turnover Rates Logged

	TOR	O2R+R2O	O2O	O2R	R2O	R2R
Lead 2	0.26	0.28	-0.22	-0.05	0.36	0.42
Lead 1	0.57	0.51	0.38	-0.02	0.66	0.20
Contemp.	0.32	0.32	0.72	0.04	0.42	-0.36
Lag 1	-0.26	-0.27	0.25	-0.11	-0.26	-0.43
Lag 2	-0.55	-0.34	-0.53	0.09	-0.47	-0.20
Std	5.73%	11.75%	13.57%	14.48%	15.04%	5.56%

Notes: This table displays for the annual turnover rates, i.e., flows as a fraction of the total population, from the weighted non-SEO sample of the PSID various business cycle statistics. The underlying sample is 1969-1997. In the columns are: total turnover rate (TOR=O2O+O2R+R2O+R2R), the gross turnover for moves between the segments (O2R+R2O), the net inflow from the rental segment into the owner-occupied segment (R2O-O2R), and the four annual disaggregate (O2O, O2R, R2O, and R2R) turnover rates. The first five rows display the dynamic correlogram of the various turnover rates, *transformed by a natural logarithm* and filtered by an HP-filter with smoothing parameter 400, with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. To reflect that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last interview, we construct the annual real GDP for 1969, i.e., the GDP number we pair with the 1969 PSID move data, as the average of the quarterly GDP numbers in 1969:2, 1969:1, 1968:4, and 1968:3. 'Lead' and 'Lag' refer to the housing turnover rate relative to the real GDP business cycle. The row displays the time series standard deviation (in percentage points).

Table 15: Business Cycle Statistics of Housing Turnover Rates - PSID, AHS and CPS

	PSID	AHS	CPS
Lead 2	0.28	0.21	0.14
Lead 1	0.58	0.31	0.54
Contemp.	0.32	0.40	0.56
Lag 1	-0.28	0.19	0.24
Lag 2	-0.58	-0.31	-0.10
Mean	15.31%	15.46%	15.53%
Std	0.89%	1.10%	0.42%
CV	0.058	0.071	0.027

Notes: This table displays for the annual total turnover rates, i.e., flows as a fraction of the total population, from the unweighted non-SEO sample of the PSID, and for the turnover rates from the AHS and from the CPS various business cycle statistics. The underlying sample for the PSID rates is 1969-1997, for the AHS it is annual from 1973-1981, biennial from 1983-2009, and for the CPS it is 1981-2009, with missing data points in 1985 and 1995. For the purpose of computing cyclical components, we have linearly interpolated the missing values in the AHS and the CPS. The first five rows display the dynamic correlogram of the various turnover rates, filtered by an HP-filter with smoothing parameter 400, with log annual real gross domestic product (FRED series identifier GDPC96), filtered by an HP-filter with smoothing parameter 6.25. To reflect that most of the PSID interviews take place in the second quarter of a given year, and because the PSID asks about moves between the current and the last interview, we construct the annual real GDP for 1969, i.e., the GDP number we pair with the 1969 PSID move data, as the average of the quarterly GDP numbers in 1969:2, 1969:1, 1968:4, and 1968:3. For the AHS, since the bulk of the interviews takes place in the second half of the year we use the calendar year's GDP to pair it up with the turnover data (FRED series identifier GDPCA). For the CPS, since the interviews are from the March supplement, we define the annual real GDP for 1981 as the average of the quarterly GDP numbers in 1981:1, 1980:4, 1980:3, and 1980:2. 'Lead' and 'Lag' refer to the housing turnover rate relative to the real GDP business cycle. The last three rows display, respectively, the time series average ('Mean'), standard deviation ('Std'), both in percentage points, and the time coefficient coefficient of variation, 'CV', i.e., 'Std' divided by 'Mean', which is unitless.