On the Positive Slope of the Beveridge Curve in the Housing Market*

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Abstract

The co-movement of buyers and vacancies, i.e. the Beveridge Curve, is a key determinant of the cyclical properties of the housing market, as it determines the sign of the correlation between prices and key measures of liquidity such as vacancies (i.e. houses for sale), sales, and time-to-sell. As recent work has shown, to account for the core stylized facts of the housing market, search and matching models must be consistent with a positively correlated co-movement of buyers and vacancies, i.e. with an upward-sloping Beveridge Curve. This paper provides evidence that buyers and vacancies are positively correlated along the housing cycle, i.e. the Beveridge Curve on the housing market is upward sloping. Using data on vacancies and time-to-sell, we construct a series for buyers and estimate the slope of the Beveridge Curve. This approach requires only one minimal structural assumption: the existence of a matching function. Our findings confirm the positive relationship between buyers and vacancies over the business cycle, i.e. an upward sloping Beveridge Curve. In addition, we provide an estimate of the elasticity of vacancies with respect to buyers. We find that a one percent increase in vacancies is associated with around a two percent increase in buyers, confirming recent findings that buyers are more volatile than houses for sale. We hope that this estimate will help future researchers in this area.

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1 Introduction

A defining feature of the housing market is the presence of search frictions: it takes time for buyers to find a home, and for sellers to find a buyer. Furthermore, the market has pronounced business cycle fluctuations: prices and measures of liquidity such as sales, vacancies (i.e. houses for sale), and time-to-sell exhibit significant volatility. Due to the frictional nature of the market, the cyclical properties of sales and time-to-sell are determined by the behavior of vacancies and buyers: when the market features relatively more buyers, more houses are sold and they sell faster; when there are relatively few buyers, few houses are sold and we observe longer time-to-sell. Thus, the cyclical co-movement of buyers and vacancies, i.e. the Beveridge Curve, is a key determinant of the mechanics of the housing market dynamics over the business cycle.

The importance of the Beveridge Curve in the housing market is highlighted by the varied levels of success in the recent literature in explaining housing market dynamics. Most of the existing literature has attempted to explain housing market dynamics without paying close attention to the joint behavior of buyers and vacancies—for example Caplin and Leahy (2011), Diaz and Jerez (2013), Novy-Marx (2009), Ngai and Sheedy (2020).[1] As a result, papers in the literature fail to account jointly for the three stylized facts in the housing market: prices are (i) positively correlated with sales and (ii) vacancies, but (iii) negatively correlated with time-to-sell.[2] As Gabrovski and Ortego-Marti (2019) show, these stylized facts imply that the slope of the Beveridge Curve is positive, i.e. buyers and vacancies are positively correlated. This is in sharp contrast to most search models of the housing market à la Diamond-Mortensen-Pissarides (DMP), which naturally generate a downward-sloping Beveridge Curve. This is why, with the exception of Gabrovski and Ortego-Marti (2019), models in the literature are in general unable to match the observed sign of the co-movement between the key variables in the housing market. The ability to generate an upward-sloping Beveridge Curve is key to account for the stylized facts in the housing market. This requires a mechanism that leads to a larger measure of buyers in the market when more houses are listed for sale, for example as in Gabrovski and Ortego-Marti (2019).[3]

[1] Since the seminal work in Arnott (1989) and Wheaton (1990), the literature on search and matching models of the housing market also includes, among others, Anenberg (2016), Burnside *et al.* (2016), Gabrovski and Ortego-Marti (2019, 2021a,b,c,d) , Garriga and Hedlund (2020), Genesove and Han (2012), Head *et al.* (2014, 2016), Kotova and Zhang (2020), Krainer (2001), Ngai and Tenreyro (2014),Ngai and Sheedy (2020), Novy-Marx (2009), Piazzesi *et al.* (2020) and Smith (2020).

[2] These facts have been reported by many studies. For example, see Genesove and Mayer (1997, 2001), Glaeser and Gyourko (2006), Krainer (2001), Krainer *et al.* (2008), Ortalo-Magne and Rady (2006), Stein (1995) and Diaz and Jerez (2013). See Gabrovski and Ortego-Marti (2019, 2021b) and the discussion therein for a review of the stylized facts from the literature.

[3] Some papers in the literature feature both entry of buyers and sellers, but they may be viewed as

In spite of the importance of the co-movement in buyers and vacancies, surprisingly little is known about its sign and magnitude. To our knowledge Gabrovski and Ortego-Marti (2019) is the only existing work that points out evidence in favor of the positive sign of the Beveridge Curve.[4] The main reason behind the lack of evidence on the slope of the Beveridge Curve is that no data on buyers is available for the housing market. This is in contrast to the labor market literature, which has devoted much effort studying the Beveridge Curve since the seminal work of Beveridge (1944) (see Pissarides (2000)). In particular, many data sets measure unemployment and search intensity to get a precise estimate of the number of unemployed, i.e. *searchers* in the market. Unfortunately, there is no such analog when it comes to the housing market.

In this paper we provide additional evidence on the positive slope of the Beveridge Curve by combining available data on the time it takes to sell a house and vacancies. Our paper is related Gabrovski and Ortego-Marti (2019), who circumvent the issue of data availability of buyers using insights from search and matching theory. In that study the authors show that, when viewed through the lens of a benchmark search and matching model, the stylized facts of the co-movements of prices, sales, vacancies, and time-to-sell imply that buyers and vacancies must be positively correlated. Here we take an alternative, more direct approach to estimate the slope of the Beveridge Curve. We make one minimal structural assumption, namely, we *only* assume the existence of a matching function. Using the relationship between time-to-sell, vacancies and buyers given by the matching function, we combine data on time-to-sell and vacancies to back out the entire series of buyers. We then regress the constructed series for buyers on the data for vacancies to estimate the sign of the relationship. This estimation reveals a positive and clearly significant sign of the slope of the Beveridge Curve in the housing market. In addition, the regression result reports that a 1% increase in vacancies is associated with about 2% increase in the measure of buyers. We hope that these results will help future researchers in this area, and will contribute to future work in the calibration of search models of the housing market.

endogenous participation models. Papers with such an endogenous participation margin include Arefeva (2020), Garriga and Hedlund (2020), Han *et al.* (2021) and Head *et al.* (2014, 2016). However, as Gabrovski and Ortego-Marti (2021d) show, models with an endogenous participation in general suffer the same issue, they generate a downward-sloping Beveridge Curve once calibrated to U.S. data. For example, to the authors' credit, Head *et al.* (2014) report the behavior of buyers and also find that they are negatively correlated with vacancies (see their figure 4, page 1195). Intuitively, in these papers as more houses are listed for sale, more households enter the market and become buyers. The issue is that, conditional on becoming a buyer, households find houses faster when more houses are listed for sale, which depletes the stock of buyers. Therefore, whether buyers are positively or negatively correlated with vacancies depends on which effect dominates. Using a standard calibration the second effect (buyers find houses more quickly) clearly dominates and leads to a downward-sloping Beveridge Curve, as Gabrovski and Ortego-Marti (2021d) show.

[4] Piazzesi *et al.* (2020) cannot observe buyers, but they do find some evidence that in cities in the Bay area there is a positive correlation between online searches and houses for sale over the long-run.

2 Empirical Estimates

Backing out buyers. Unfortunately, no data is available on the number of buyers in the housing market. We circumvent this issue by drawing on the relationship between buyers, vacancies, and time-to-sell present in most search-theoretic models. This allows us to back out a series for buyers from the observable series for vacancies and time-to-sell. Specifically, the majority of the literature captures frictions through the means of a matching function à la Pissarides (2000). This function may be viewed as a production function for matches. It gives the number of matches, which we denote by $M(b, v)$, as a function of the measure of buyers b and vacancies v. This "black box" approach captures the fact that it takes time for buyers to find a suitable home and for sellers to find a buyer in a convenient way, and may be viewed as analogous to the standard production function commonly used in economics. As is standard in the literature, we assume that the matching function is Cobb-Douglas, i.e. $M(b, v) = \mu b^{1-\alpha} v^{\alpha}$. Under the assumption of random meetings, a seller finds a match for her vacancy at a Poisson rate $M(b, v)/v$, which implies that on average the time-to-sell (TTS) is given by the inverse of the matching rate, i.e. $TTS \equiv v/M(b, v)$. As a result, we can derive the following relationship between buyers, vacancies, and time-to-sell

$$b = v \left[\mu TTS\right]^{-\frac{1}{1-\alpha}} . \tag{1}$$

To back out our series for buyers, we set $\alpha = 0.16$, based on the empirical findings from Genesove and Han (2012), and normalize $\mu = 1$.

Empirical estimates. The data on vacancies (Houses For Sale) and time-to-sell (Median Months for Sale) are taken from the New Residential Sales Release reported by the U.S. Bureau of Census. The main advantage of the data is that it is available monthly starting from January 1975, which provides us with 540 observations (we end the sample at December 2019 to avoid bias related to the COVID-19 pandemic). We combine the data on vacancies and time-to-sell using the relationship in (1) to construct our series for buyers. Figure 1 depicts the constructed series for buyers along with the time series for vacancies. Graphically, one can readily observe that buyers and vacancies co-move closely, with buyers being a bit more volatile. Most notably, the two series exhibit similar dynamics during the 2007 market crash and subsequent recovery.

Since we are interested in the cyclical relationship between buyers and vacancies, we filter the two series to derive their cyclical components using an HP filter of the natural logs of buyers and vacancies with a smoothing parameter of $129,600$. Our results are robust to using alternative smoothing parameter values of 10^5 and $14,400$, which are commonly used in the literature. Figure 2 shows the cyclical relationship in two plots. The left panel depicts

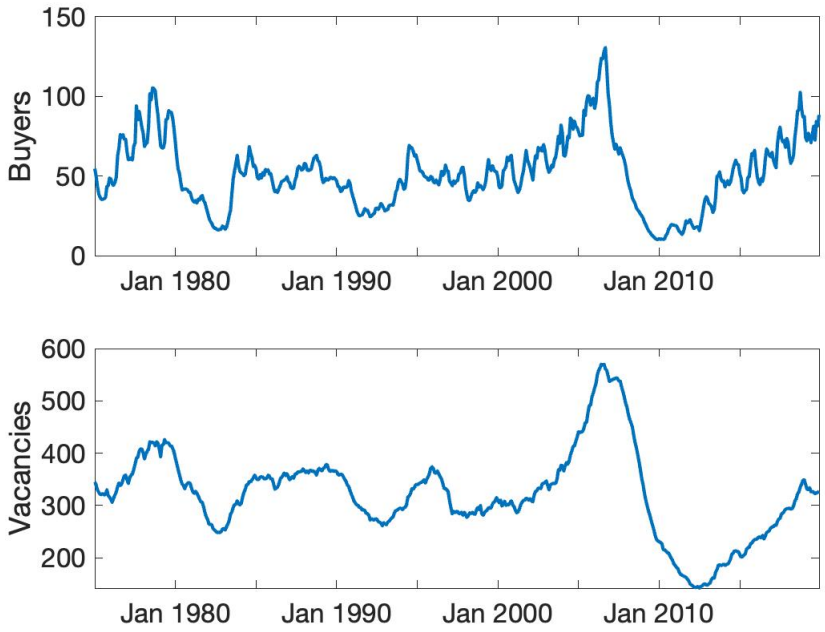


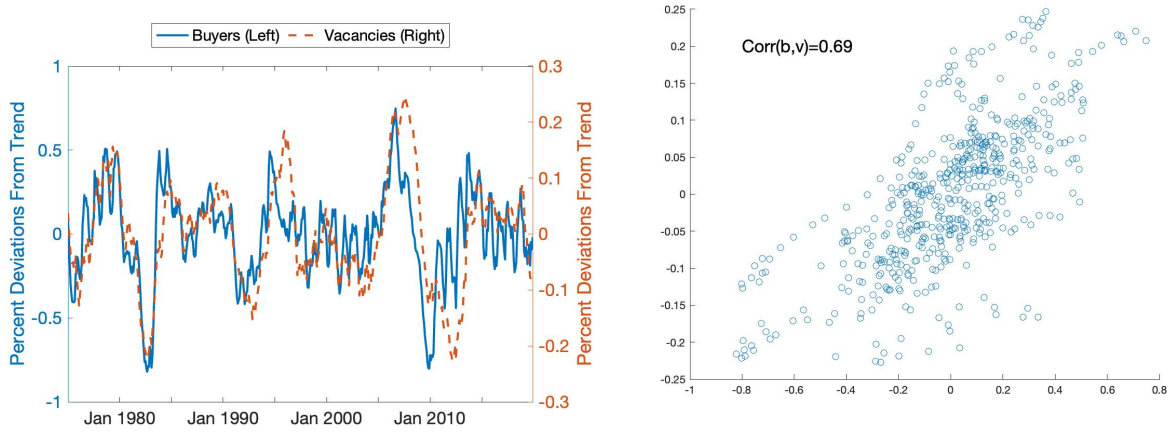
Figure 1: **Time series for buyers and vacancies.**
Note: *The data on vacancies is the Houses for Sale series from the New Residential Release reported by the U.S. Bureau of Census, at monthly frequency for the period of January* 1975 - *December* 2019. *The series for buyers is constructed combining data on vacancies and time-to-sell (Median Months for Sale) and equation (1).*

the time series for the cyclical components of buyers and vacancies. The figure confirms the close co-movement suggested by the raw series. The right panel depicts the scatter plot of the two variables and shows the strong and significant positive correlation between the two series. The estimate of the correlation coefficient is 0.69 with a standard error of 0.03.

To confirm the positive slope of the Beveridge curve, we estimate the following regression equation

$$\tilde{b}_t = c + \beta \tilde{v}_t + \varepsilon_t, \tag{2}$$

where tildes denote percent deviations from trend, c is a constant and β is the coefficient of interest. It represents the elasticity of buyers with respect to vacancies and governs the sign of the slope of the Beveridge Curve. We find an estimate of $\beta = 1.95$, with a standard error of 0.087, i.e. significant for any standard confidence level. This estimate implies that a 1% increase in vacancies is associated with about 2% increase in the measure of buyers. Interestingly, this confirms an additional finding in Gabrovski and Ortego-Marti (2019): to account for the stylized facts in the housing market buyers must be more volatile than vacancies.



(a) Cyclical Movements in Buyers and Vacancies

(b) Cyclical Components of Buyers and Vacancies, Correlation

Figure 2: **Cyclical Movements in Buyers and Vacancies.**
Note: *The left panel depicts the percentage deviation from trend for buyers and vacancies using the Hodrick-Prescott filter with a smoothing parameter* $129,600$. *The right panel shows the scatter plot of the two series. The correlation coefficient is* 0.69 *with a standard error of* 0.03.

3 Conclusion

The cyclical properties of the housing market are governed by the co-movement of buyers and vacancies, which determines the sign of the correlation between prices and key liquidity measures such as vacancies, sales, and time-to-sell. The slope of the Beveridge Curve has important implications for the mechanics of housing market dynamics. To account for the core stylized facts of the housing market, search and matching models must be consistent with an upward-sloping Beveridge Curve. In this paper we provide further evidence that buyers and vacancies are positively correlated along the housing cycle, i.e. the Beveridge Curve in the housing market is upward sloping. The positive slope of the Beveridge Curve was highlighted by Gabrovski and Ortego-Marti (2019), who show that the stylized facts of the housing market inevitably lead to a positive correlation between buyers and vacancies when examined through the lens of a benchmark search-theoretic model. The evidence provided this paper uses an alternative, more direct approach. First, we back out a series for buyers using data on vacancies and time-to-sell. We then use the constructed series to estimate the slope of the Beveridge Curve. Our findings confirm the positive relationship between buyers and vacancies over the business cycle, i.e. an upward sloping Beveridge Curve. In addition, we provide estimates of the elasticity of vacancies with respect to buyers and find that a 1% increase in vacancies is associated with a 2% increase in buyers. We hope that the findings in this paper will help future researchers working in this area.

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