The Causality and Simultaneity between Price and Trading Intensity in Existing Home Markets

by

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ABSTRACT

This paper empirically examines the relationship between trading intensity and price in the US existing home markets. In particular, I have tested two recent theories, the search model by Wheaton (1990) and the "downpayment" model by Stein (1995). The search model predicts that trading volume should positively affect real home price, while the "downpayment" model predicts that, with liquidity constraints, the change of home price should positively impact trading intensity.

In this paper, I have specified two relationships between trading intensity and price--a contemporaneous one and a lagged one. Using regional quarterly pooled time-series data from 1975 to 1994, the Granger causality test, Hausman test, and two-stage least square regressions are performed. The results show that there is no lagged causality from trading intensity to real price, yet trading intensity contemporaneously affects real price within a one quarter time period. Regarding the relationship between nominal price and trading intensity, the results show that while lagged nominal price affects current trading intensity, current nominal price alone does not affect trading intensity. The simultaneity between trading intensity and price is not found.

In addition to the interaction between trading volume and price, the regression results in this paper indicate that mortgage rate is strongly and negatively correlated to trading intensity, but not correlated to real price. Employment shows strong effect on real price, but not on trading intensity. The percentage change of employment, in contrast, impacts trading intensity, but not real price.

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I. Introduction

The relationship between price and trading volume in the existing owner-occupied single-family housing market (or home market) is intriguing for three reasons. First, the purchase of home is both a consumption and an investment for most households. A consumption market has a downward-sloping demand curve, that is lower price leads to higher sales volume; while in an investment market such as stock market, trading volume is often associated with the increase of price. Second, home market consists of two segments, new home market and existing home market. Unlike in the new home market where the seller sells the home for a profit, in the existing home market the seller often simultaneously buys another home as repeat buyer to adjust his consumption[1]. Third, the buyer could be either a first-time home buyer or a repeat buyer in the existing home market. Therefore we have three groups of participants in the existing home market: first-time buyer, repeat seller/buyer, and departing seller. The fact that these three groups of participants may have different behavior due to their different equity positions contributes to the complication of existing home market behavior in terms of trading volume and housing price.

While the studies on new home market related to new construction, prices, and cycle are relatively extensive, there are only a few studies on existing home market. This is inadequate giving the large size and dynamics of existing home market. For example, in 1990, about 3 million existing home units were sold in the US, where only 0.5 million new home were sold (NAR 1992). Over the last two decades, roughly 80% of annual home trading activities took place in the existing home market. During 1970-92, on average, the annual

[1] In some occasions the existing home seller could also depart the existing home market, either to buy a new home or leave the region's home market.

increase of existing home trading volume (4.4%) was faster than employment increases (1.9%) and household growth (1.9%). Meanwhile, trading volume fluctuated dramatically over the business cycles, so was the repeat sale price. The size and dynamics of this market are no doubt of great concerns for consumers, brokerage service industries, and financial lending and investment institutions.

Recently, a few studies have probed the behavior of existing home market. Wheaton (1990) develops a theoretical housing search and matching model for the resale market, in which housing price is positively affected by trading volume. Stein (1995) proposes a resale housing trading and price model with downpayment effects, which asserts that trading volume is positively affected by the change of housing price. Their theoretical models present two possible causal relationship directions: trading volume "causes" the price, and price "causes" trading volume. However, an empirical testing of this causality has not been performed. In addition, Wheaton and Stein's models target specifically on one segment of the existing home market: the repeat sellers and buyers, yet it has not been tested whether the empirical characteristics of the aggregate existing market are consistent with the theory. In an earlier paper, Rosen (1985) specifies an empirical model in which trading volume is a function of housing price related to permanent income, the expected change of price, etc., yet it is not a causality test. Rosen also specifies a housing price model, in which, however, trading volume is not an explanatory variable. Hence, the causality between trading volume and price has not been tested in the previous literature. Furthermore, the models by Wheaton (1990) and Stein propose a potential simultaneity between price and trading volume. If there is simultaneity, a least square regression could be misspecified in revealing the correlation between current price and trading volume. This simultaneity problem has not been addressed in the literature.

The purpose of this paper is to investigate the aggregate behavior of existing home market, in particular the causality and simultaneity between trading volume and price. These relationships will be examined in the context of important macro economic indicators including employment and mortgage rate. Four US census regions' quarterly data from 1975-94 will be pooled together in the tests. Following the introduction, this paper is organized as follows. Section II reviews Wheaton and Stein's theoretical home volume-price models. In Section III, the Granger-causality test, Hausman test, and two-stage least square regression procedures are discussed. Section IV will describe data, specify a set of testing models, and present and interpret regression results. Finally, Section V provides conclusion and suggestion for further studies.

II. Theories on Price and Trading Volume

In conventional housing price theories, price is determined by market fundamentals, such as household income, location, tax treatment, expected future appreciation, mortgage rate, construction costs, and vacancy rate. Trading volume is usually not considered as important and hence is rarely studied. This is in contrast to recent stock market studies in the finance literature, where the role of trading volume in affecting price and the reaction of trading volume to price changes are extensively examined. For example, some researchers find that trading volume is positively correlated with absolute price changes, trading volume is greater on the price up-ticks market than on down-ticks market, and so on (Karpoff, 1986, Wang 1994). Empirical tests have observed both contemporaneous and lagged causality between trading volume and price changes (Smirlock and Starks, 1987).

Regarding existing home market, Wheaton (1990) develops a theory analyzing the impact of trading volume and market vacancy rate on home price from housing search and matching perspective. He advances the search model for the existing home market by deriving that, if vacancy does not alter the matching technology[2] , housing price (P) is positively impacted by trading volume (T), but negatively impacted by vacancy rate. That is:

(1) $P = f(T), \delta P/\delta T > 0,$

The intuition behind equation 1 is that, in the existing home market, as buyers are also sellers, greater turnover or trading volume shortens the expected length of the search and sale, and therefore increase the reservation prices of buyer and seller. Market prices, which lie between the reservation price of buyers and sellers resulted from bargaining, will hence increase. Search in the housing market is somewhat different from that of stock market, where search for either stock buyers or sellers is relatively easy and costless.

Stein (1995) examines how the change of price impacts trading volume in the existing home market through "downpayment" impact. He develops a model to explain the observation that there is more intense trading activity in the rising market than in a falling market. Stein analyzes that, since downpayment is required for most housing purchase, and most families that trade are constraint movers in terms of liquidity, increasing housing price tends to increase householder's home equity and to relax the liquidity constraint of potential

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2 Wheaton states that the impact of greater turnover on housing price depends on the function of the matching rate. Here I consider a situation where the market is not extremely "tight", then it is reasonable to assume that vacancy rate plays no important role in the matching process. His formula has been re-denoted in this paper for consistence.

movers. Since housing purchase is a leveraged "investment" for many households, the relaxing of household liquidity constraint creates excess demand for housing, and hence pushes price up. Stein concludes that there is a very pronounced positive correlation between housing price (P) and trading volume (T), which can be re-denoted for simplicity as:

(2) $T = f(P \text{ or } DP)$, $\delta T/\delta P > 0$ or $\delta T/\delta DP > 0$

The above two theoretical models developed by Wheaton and Stein present potential causal relationship between trading volume and housing price with two opposite directions: trading-to-price and price-to-trading. It also suggests a potential simultaneity between trading volume and price. The potential causality and simultaneity, however, has not yet been rigorously tested in empirical studies. Related empirical work by Rosen (1986) indicates that the current change in the ratio of housing price to income is negatively correlated with trading volume, while the expected change of price, represented by lagged change of price, is positively correlated with trading volume. Stein (1995) runs a regression of volume against last year's percentage change in real prices and a liner time trend. He finds that the coefficient of the price change is positive and statistically significant (b=16, t-stat=4.9). The empirical models of Rosen and Stein, while reveal the correlation between trading volume and price, are not formal tests for causality and simultaneity. In addition, Stein's model is essentially a bivariate one, which may omit latent variables correlating with both trading and price. A recent empirical study by Follain and Velz (1995) on the price to trading intensity relationship yields inconclusive result [3].

[3] Follain and Velz (1995) claim that they find a negative sales volume and price relationship. However, their results are statistically insignificant when including city dummy variables.

It should be emphasized that Stein's (1995) model specification does not distinguish real vs. nominal price. In his regression, Stein uses the change of real price as an explanatory variable. The "downpayment" effect, in fact, should be associated with nominal price, because the liquidity problem could be eased with higher inflation and increase in nominal price even though there is no change in real price. In this paper, nominal price is specified for the test of Stein's model. Wheaton's (1990) model, on the other hand, explains how trading volume affects real price over time. So in the trading-to-price model, the real price is used. Notice also that trading volume is affected by both trading intensity and the size of market where trades occur. Wheaton and Stein's models explain the dynamics of intensity or liquidity, not mere the growth of size, so we use trading intensity in our tests.

III. Test Models

Providing causal hypotheses that can be confronted with data is one of the main tasks of economic theory. While its concept and testing technique are much debated, causality is in essence the confirmed predictability according to a law or a set of laws (Zellner, 1988). Merely descriptive relations are not causality, neither are theories without empirical evidences. Under the framework of a theory, the Granger-causality test is often applied. In its classical bivariate version, Granger-causality test essentially regresses one variable Y on lagged variables X and Y. Then it uses F-test to determine whether lagged information on one variable X has any statistically significant role in explaining another variable Y in the presence of lagged Y. The unrestricted equation is:

$$(3) \qquad Yt = a + \sum_{i=1}^{m} BXt\text{-}i + \sum_{j=1}^{n} CYt\text{-}j + e$$

The major critique on this procedure is that it does not capture the possibility that the correlation between X and Y is not because X causes Y, but they are both the effects of a common set of earlier causes, say W. Granger (1988) therefore expands his conventional bivariate testing procedure by including a vector of variable W, which provides a context within which the causality question is asked and tested. The unrestricted testing formula for X causing Y can be then written and denoted as equation 4. There is no theoretical grounds for the choice of optimal number of lags. In general, more lags and robust results from using various number of lags are preferred.

$$(4) \qquad Yt = a + \sum_{i=1}^{m} \boldsymbol{BXt\text{-}i} + \sum_{j=1}^{n} CYt\text{-}j + \sum_{k=0 \text{ or } 1}^{p} DWt\text{-}k + e$$

Notice that equation 4 tests the Granger-causality for lagged X on current Y, not the causality of current X to Y. However, in addition to the causality as a lagged relationship, there is a potential current relationship between price and trading intensity in the existing home market. Both Wheaton and Stein's models include the possibility of contemporaneous relationship. Equation 4 can not test the contemporaneous causality between X and Y due to the potential simultaneity problem. To explicitly test whether there is simultaneity, a standard Hausman test can be performed by specifying a set of instrumental variables. With a potential simultaneity problem, the two stage least square (2SLS) regression method can be used to reveal the direction of causality between trading volume and price. Similar to the Hausman test, the 2SLS regression requires a set of instrument variables which will be discussed in the following model specification section. For more detailed discussion on Granger test, Hausman test, and two-stage least square regression, see Berndt (1990).

IV. Data, Model Specification, and Results

We have compiled US regional quarterly data (Northeast, Midwest, South, and West regions) on existing home trading volume, repeat sale price, non-farm employment, and nominal mortgage rate from 1975.1 to 1994.3, all seasonally adjusted, from various sources.[4] Both nominal and real price data, converted by national CPI based on 1975.1 price level, are used in the tests. As compared to the national aggregate data, the regional data have more geographic details, and when pooled together we have 316 observations for statistical tests. The regional data also have longer time series as compared to most metropolitan data, so that they can better catch business cycles and structural patterns. As compared to the metropolitan data, regional data has a disadvantage since there is still aggregation at the regional level, so a single real estate market behavior can't be tested. However the availability of historical time series metropolitan-level existing home data is very limited. A recent study by Follain and Velz (1995) uses annual metropolitan data only for the period of 1986-89, which cover substantially shorter time period than our data set.[5]

A descriptive summary statistics of the variables are in Table 1. Among the four regions, the South region has the largest population and existing home trading volume, followed by Midwest region, West, and Northeast. Notice that we create a trading intensity index to normalize the population size effect over time. Trading intensity, measured in percentage, is trading volume divided by population. Compared to trading volume, the

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[4] Regional existing home trading volume data are provided by National Association of Realtor (NAR). Existing home repeat sales price data are provided by Fannie Mae. Employment data are provided by US Department of Labor Statistics. Mortgage and population data are compiled from National Economic, Environment, and Policy Data Bank.

[5] Even we extend the data series into current period, they cover only half of the periods that our data cover.

trading intensity index better reflects the market liquidity. From Table 1, we find that West region has a most active existing market in terms of trading intensity. The maximum trading volume is 2.25 per 100 people, that is roughly one of every ten households selling a home every year. The average trading volume in the West region is 1.5 per 100 people, which is compared to the lowest trading intensity 1.0 per 100 people in the Northeast region. The overall mean trading intensity is 1.35%, maximum 2.25%, and minimum 0.62%. Home real price is calculated by nominal price divided by national CPI index. During this period of 1975.1 to 1994.3, CPI index increased from 1 to 2.76. Home real and nominal price vary among four regions and over time, with overall mean real home price as US$46,770 (1975.1 as the base year price), mean nominal price $89,920.

A crude visual observation of Figure 1 about US regional existing home market reveals that trading intensity and real prices are positively correlated: they move up or down roughly together from 1975-94. To get a better sense of the relationship between trading intensity and price, we calculate their correlation for each of the region and the overall nation. As Table 2 shows, the correlation between trading intensity and real price overall is 0.41, with the Northeast region 0.61, Midwest 0.73, South 0.27, and West -0.14. The correlation between Trading intensity and the level of nominal price is relatively small, with overall 0.03, and varies from -0.35 for the West region to 0.48 for the Northeast region. This is understandable because nominal price goes up over time while trading intensity fluctuates. The change of nominal price, represented by the percentage change of nominal price between four quarters, has strong correlation with trading intensity. The correlation is 0.43 for the Northeast region, 0.82 for Midwest, 0.59 for South, 0.76 for West, and 0.54 for overall.

To further explore the relationship between trading intensity and price, we run two LS regressions with AR(1,4). One model regresses trading intensity TP on current nominal price PN, and trend and dummy variables. The trend variable is YEAR, simply the quarter and year of each observation; and the dummy variables include DN for North region, DM for Midwest region, DS for South region, and default for West region. The second model regresses real price P on trading intensity TP, with same trend and dummy variables. The regression results are reported in Table 2. Trading intensity TP and real price P are positively correlated. The coefficient of TP is 2.214, with a T-stat of 5.256, statistically significant at 99% level. Trading intensity TP and nominal price PN are also positively correlated, with coefficient of PN 0.01, statistically significant at 99% level with a T-stat of 2.722.

The above correlation matrix and regression results give us a good indication of the correlation between trading intensity and price. However, the potential simultaneity problem requires us to better specify the tests. More specific, we will examine the relationship in terms of lagged causality and contemporaneous causality by specifying three sets of models: Granger causality tests, Hausman tests, and two-stage least square regressions.

IV-1. Lagged causality test

As we discussed in Section III, the Granger-causality test requires a set of context within which the lagged causality of two variables is tested. The main macroeconomic context of home trading and price includes business cycle and cost of ownership. We use non-farm employment as the coincident business cycle indicator, and nominal mortgage rate as the cost of ownership indicator[6] . Given the context of lagged non-farm employment E and lagged nominal mortgage rate M, we test 10-quarter lagged causality between trading volume and price[7] .

The causality test consists of two unrestricted equations. Model 5 tests the causality from trading intensity TP to real price P. Model 6 tests the causality from nominal price PN to trading intensity TP. Notice that in both unrestricted equations, when the bolded variables in blankets are deleted, the equations become restricted models. F-tests can be performed to compare the restricted and unrestricted regression results and to test the null hypothesis.

$$(5)\qquad \mathbf{Pt} = C + \sum_{i=1}^{10} A1Pt\text{-}i + \boldsymbol{\sum_{k=1}^{10} A2TPt\text{-}k} + \sum_{l=1}^{10} A3Et\text{-}l + \sum_{m=1}^{10} A4Mt\text{-}m + a5DN + a6DM + a7DS$$

$$\mathbf{Pt} = C + \sum_{i=1}^{10} A1Pt\text{-}i + \sum_{l=1}^{10} A3Et\text{-}l + \sum_{m=1}^{10} A4Mt\text{-}m + a5DN + a6DM + a7DS$$

H0: A2=0, H1: H0 is not true.

$$(6)\qquad \mathbf{TPt} = C + \sum_{i=1}^{10} A1TPt\text{-}i + \boldsymbol{\sum_{j=1}^{10} A2PNt\text{-}j} + \sum_{k=1}^{10} a3Et\text{-}k + \sum_{l=1}^{10} A4Mt\text{-}l + a5DN + a6DM + a7DS$$

$$\mathbf{TPt} = C + \sum_{I=1}^{10} A1TPt\text{-}i + \sum_{k=1}^{10} a3Et\text{-}k + \sum_{l=1}^{10} A4Mt\text{-}l + a5DN + a6DM + a7DS$$

H0: A2=0, H1: H0 is not true.

Table 3 shows the regression results for nominal price-to-trading intensity causality and F-tests for all lagged nominal prices. There is clear evidence, represented by F-value of

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[6] . Nominal mortgage rate varies substantially over time. During 1975.1 to 1994.3, the mean nominal mortgage rate is 10.21%, the highest rate is 15.6%, and lowest rate is 6.61%.

[7] We have experimented different number of lags, including lagged 4, 6, 8 quarters, in the Granger causality test model structure and obtained consistent results.

1.940 which is significant at 95% confidence level, that the null hypothesis A2=0 in equation 5 should be rejected. Hence lagged nominal price impacts current trading intensity. On contrary, as indicated in table 3, lagged trading intensity does not impact current real prices. The F-stat is 0.649, which is statistically insignificant at 90% level. Hence the null hypothesis A2=0 in equation 6 can not be rejected.[8]

IV-2 Simultaneity test

The aforementioned Granger causality tests address the lagged relationship between trading intensity and price. They do not, however, test the current relationship between them. The significance of the correlation in table 2 are affected by the existence of potential simultaneity between trading intensity and price, shown in the identity equation 7 [9]:

(7) $PN = P * CPIX$

or $LNPN = LNP + LNCPIX$

To control for the potential simultaneity problem, we first apply Hausman test to test the simultaneity. Then we apply two stage least square (2SLS) to identify the direction of correlation. For the Hausman tests, the first test is whether there is simultaneity between trading intensity and nominal price, and the second test is on trading intensity and real price

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[8] Notice also from Table 3 that, if we include the current PN, E, M in equation 5, and current TP, E, M in equation 6 and run the regression again, we find that the coefficient of both current PN and current TP are statistically significant. These confirm our simple regression results in Table 2 regarding the positive correlation between TP and PN, P. The significance of lagged nominal price PN and the insignificance of lagged trading intensity TP are not altered by the inclusion of current variables. We have also run the causality tests without the employment and mortgage rate context. The results are that both lagged PN and lagged TP are statistically insignificant. However, the full model with macroeconomic context is a better specification for the causality model.

[9] We use both price and log price in the tests which yield similar results and same conclusions. In this paper we report only the results from regressions using price levels.

We now consider instrument variables. From LS regressions, we find that the level of employment (E) statistically affects real price, but not trading intensity; while the percentage change of employment (ΔE) affects trading intensity, but not the real price level. It makes sense because trading is an adjustment in housing consumption which is caused by household's economic or demographic changes, while the real price level reflects in part the size and density of the city measured by employment level according to micro urban spatial theory. Therefore we use both the level (E) and the percentage change of employment (ΔE) as two instrument variables. From the identity equation 7, we have a third instrument variable CPIX. Therefore we use instrument variables E, ΔE, CPIX, and other independent variables to fit nominal price PN. The fitted variable PNHAT is then added to the price-to-trading equation. The null hypothesis is that the coefficient of PNHAT a4 is zero. The procedure is represented in two least square models with autoregression corrections AR(1,4) in equation 8:

(8) PN = C + a1M + a2E + a3DE + a4DN + a5DM + a6DS + a7YEAR

Let the fitted PN as PNHAT

T = C + a1M + a2DE + a3PN + a4PNHAT + a5DN + a6DM + a7DS + a8YEAR

The results of models 8 are reported in Table 4. We find that the coefficient of fitted nominal price PNHAT is statistically insignificant at 90% level. The T-stat of coefficient is -1.051 for PNHAT, hence we can not reject the null hypothesis, indicating that the fitted value of nominal price has no added explanatory power. Therefore we conclude that there is no simultaneity between nominal price and trading intensity.

We then test the null hypothesis that there is simultaneity between trading intensity and real price. The model is similar to the above model, shown in equation 9:

(9) $TP = C + a1M + a2E + a3DE + a4CPIX + a5DN + a6DM + a7DS + a8YEAR$

Let the fitted TP as TPHAT

$PR = C + a1TP + a2TPHAT + a3M + a4E + a5DN + a6DM + a7DS + a8YEAR$

The results of model 9 are listed in Table 4. Basically, the results yield the same conclusion for nominal price. The coefficient of fitted trading intensity TPHAT is 0.099, which is statistically insignificant at 90% level, with a T-stat at 0.167. This indicates that the fitted value of trading intensity has no added explanatory power. Therefore we conclude that there is no simultaneity between trading intensity and real price.

IV-3. Two-stage least square regression

With the Hausman tests, we understand that there is no simultaneity between current price and current trading intensity. We now apply two-stage least square regressions to determine the directional relationship between current trading intensity and nominal/real prices, shown in equation 10 and 11, with a set of instrument variables. As described in Section IV-2, we have three basic instrument variables E, ΔE, and CPIX. Other instrument variables include current and lagged exogenous variables and lagged endogenous variables to account for the auto/serial correlation[10]. As shown in Table 5, the instrument variables include C, M, M(-1), E, E(-1), DE, DE(-1), CPIX, CPIX(-1), TP(-1), P(-1) or PN(-1), YEAR, DN, DM, DS.

(10) $TP = C + a_1PN + a_2M + a_3DE + a_4DN + a_5DM + a_6DS + a_7YEAR$, AR(1,4)

(11) $P = C + a_1TP + a_2M + a_3E + a_4DN + a_5DM + a_6DS + a_7YEAR$, AR(1,4)

[10] The inclusion of lagged variables in the instrument variable list is discussed in Berndt (1991).

The 2SLS regression results in table 5 clearly indicate that current trading intensity impacts current real price. The coefficient of trading intensity a_1 is 4.195 with a T-stat of 3.378, significant at 99% level. As table 5 shows, the significance of the coefficient of trading intensity in the 2SLS regression is similar to that in simple LS regression. We also run a 2SLS regression for trading intensity and nominal price. We find that the impact from nominal price to trading intensity is insignificant. The coefficient of nominal price is -0.0004, with a T-stat of -0.151, insignificant at 90%. Compare to the LS regression from nominal price to trading intensity, we find a much less significance in the coefficient of nominal price in the 2SLS regressions. Therefore we conclude from these empirical evidences that current trading intensity affects real price within a one quarter time period, but current nominal price does not impact trading intensity.

V. Conclusion

This paper empirically examines the relationship between trading intensity and price in the US existing home markets. In particular, we have tested two recent theories, the search model by Wheaton (1990) and the "downpayment" model by Stein (1995). The search model predicts that trading volume should positively affect real home price, while the "downpayment" model predicts that, with liquidity constraints, the change of home price should positively impact trading intensity.

In this paper, we have specified two relationships between trading intensity and price-- a contemporaneous one and a lagged one. Using regional quarterly pooled time-series data from 1975 to 1994, the Granger causality test, Hausman test, and two-stage least square regressions are performed. The results show that there is no lagged causality from trading intensity to real price, yet trading intensity contemporaneously affects real price within a one quarter time period. Regarding the relationship between nominal price and trading intensity, the results show that while lagged nominal price affects current trading intensity, current nominal price alone does not affect trading intensity. The simultaneity between trading intensity and price is not found.

In addition to the interaction between trading volume and price, the regression results in this paper indicate that mortgage rate is strongly and negatively correlated to trading intensity, but not correlated to real price. Employment shows strong effect on real price, but not on trading intensity. The percentage change of employment, in contrast, impacts trading intensity, but not real price.

For future research, we could further explore the timing structure of lagged impacts from real price to trading intensity. Notice also that the data we use on trading intensity and price are aggregate in nature in that they include both first-time and repeat home buyers. Therefore what we test is an aggregate behavior of the existing home market, rather than strictly target the repeat seller/buyers as the theoretical models assume. The inclusion of first-time home buyers may mix the causal relationship somewhat, because they are more likely to buy their home when the price is low, other things equal. Further research may aim to separate the first-time buyer and repeat seller/buyers to test the difference of their behaviors. Furthermore, we could compile more data on vacancy in order to provide a more complete "context" in testing the causality between trading intensity and price.

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Figure 1: Trading Intensity and Real Price, US Existing Home Market, 1975-94.

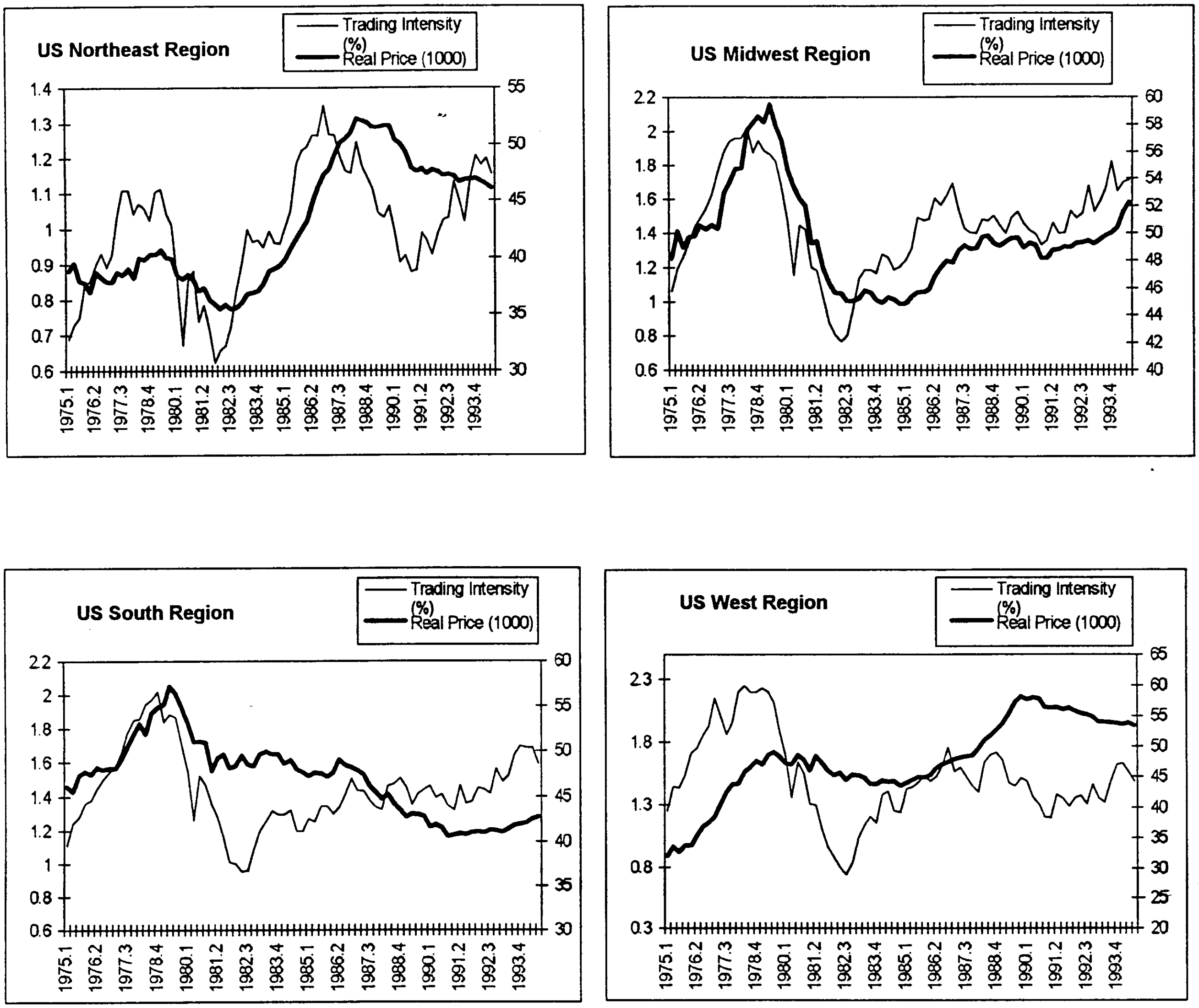

Table 1: Summary Statistics, 1975.1-1994.3, US existing home market, quarterly.

Region	Population POP	Trading Volume T	Trading Intensity TP* (%)	Real Price P	Nominal Price PN	CPI Index (1975.1=1) CPIX
Northeast						
mean	49,998,482	500,591	1.000	42.82	83.82	1.91
max	51,382,077	676,667	1.350	52.29	127.37	2.76
min	49,135,283	306,667	0.622	35.42	38.79	1.00
Midwest						
mean	59,157,886	860,127	1.453	49.61	94.00	1.91
max	61,408,379	1,183,333	2.021	59.46	144.38	2.76
min	57,816,592	450,000	0.765	44.83	48.16	1.00
South						
mean	80,044,534	1,148,523	1.436	46.94	87.91	1.91
max	90,711,825	1,523,333	2.019	57.19	118.09	2.76
min	68,971,353	743,333	0.953	40.57	45.60	1.00
West						
mean	47,358,141	709,662	1.512	47.69	93.95	1.91
max	56,847,557	933,333	2.249	58.10	147.57	2.76
min	38,210,514	333,333	0.737	32.06	32.06	1.00
Overall						
mean	59,139,761	804,726	1.350	46.77	89.92	1.91
max	90,711,825	1,523,333	2.249	59.46	147.57	2.76
min	38,210,514	306,667	0.622	32.06	32.06	1.00

Note: *trading intensity=trading volume*100/population. For sources see text.

Table 2: Least Square Regression and Correlation Matrix, US Existing Home Market, 1975-94.

Dependent Variable=P				Dependent Variable=TP			
Variable	Coefficient	T-stat	Prob.	Variable	Coefficient	T-Statistic	Prob.
C	1254.004	4.673	***	C	71.78682	2.201	**
TP	2.214442	5.256	***	PN	0.010005	2.722	***
DN4	-6.997626	-1.169		DN4	-0.255244	-1.233	
DM	-2.867729	-0.469		DM	0.057111	0.286	
DS	-7.920288	-1.235		DS	0.125395	0.610	
YEAR	-0.604581	-4.496	***	YEAR	-0.035956	-2.174	**
AR(1)	1.161927	42.780	***	AR(1)	1.017185	30.570	***
AR(4)	-0.182126	-6.989	***	AR(4)	-0.099232	-2.956	***

Adjusted R^2=0.982, DW-stat=2.180, N=284.

Adjusted R^2=0.915, DW-stat=1.926, N=284.

	Correlation Matrix		
Region	TP vs P	TP vs PN	TP vs DPN*
Northeast	0.61	0.48	0.43
Midwest	0.73	0.09	0.82
South	0.27	-0.15	0.59
West	-0.14	-0.35	0.76
Overall	0.41	0.03	0.54

Source: Regression and correlation calculation performed by author in EView, 1996.
*DPN is the quarterly percentage change (lag 4 quarters).

Table 3: Granger Lagged Causality Tests on Trading Intensity and Price, US Regions, 1975-94.

LS Regression: TP=f(PN(-),TP(-1),E(-),M(-),dummy)				LS Regression: P=f(P(-),TP(-1),E(-),M(-),dummy)			
Depedent variable is TP				Depedent variable is P			
Variable	Coeff.	T-stat	Prob.	Variable	Coeff.	T-stat	Prob.
C	0.897928	5.562	***	C	4.785256	3.007	***
TP(-1)	0.779073	10.036	***	TP(-1)	-0.748199	-1.135	
TP(-2)	-0.093144	-0.913		TP(-2)	0.919293	1.058	
TP(-3)	0.056975	0.554		TP(-3)	-0.487575	-0.558	
TP(-4)	0.062693	0.613		TP(-4)	0.01419	0.016	
TP(-5)	-0.089344	-0.899		TP(-5)	0.744369	0.889	
TP(-6)	0.205568	2.051	**	TP(-6)	-0.51534	-0.612	
TP(-7)	-0.097215	-0.957		TP(-7)	-0.486239	-0.569	
TP(-8)	-0.184071	-1.762	*	TP(-8)	-0.75506	-0.853	
TP(-9)	0.266422	2.446	**	TP(-9)	0.74922	0.812	
TP(-10)	-0.173937	-2.153	**	TP(-10)	0.199542	0.294	
PN(-1)	0.011684	2.098	**	P(-1)	1.107723	16.024	***
PN(-2)	-0.002838	-0.333		P(-2)	-0.020291	-0.203	
PN(-3)	-0.008809	-1.011		P(-3)	0.156429	1.605	
PN(-4)	-0.014592	-1.682	*	P(-4)	-0.040376	-0.420	
PN(-5)	0.002783	0.320		P(_5)	-0.379573	-3.923	***
PN(-6)	0.015176	1.758	*	P(-6)	0.079054	0.822	
PN(-7)	-0.002165	-0.249		P(-7)	-0.070157	-0.721	
PN(-8)	0.006984	0.819		P(-8)	0.292923	3.125	***
PN(-9)	-0.012098	-1.476		P(-9)	-0.171284	-1.906	*
PN(-10)	0.003009	0.536		P(-10)	0.006706	0.098	
E(-1)	-6.99E-06	-3.585	***	E(-1)	-2.51E-05	-1.558	
E(-2)	1.07E-05	3.142	***	E(-2)	1.09E-05	0.382	
E(-3)	-4.93E-06	-1.362		E(-3)	2.23E-05	0.726	
E(-4)	3.27E-06	0.909		E(-4)	-5.66E-06	-0.185	
E(-5)	2.92E-06	0.781		E(-5)	1.66E-05	0.533	
E(-6)	-9.07E-06	-2.381	**	E(-6)	-9.73E-06	-0.306	
E(-7)	4.72E-06	1.277		E(-7)	-2.35E-05	-0.749	
E(-8)	-3.15E-06	-0.862		E(-8)	1.21E-05	0.389	
E(-9)	4.62E-06	1.358		E(-9)	6.66E-06	0.230	
E(-10)	-2.33E-06	-1.293		E(-10)	-6.85E-06	-0.450	
M(-1)	-0.074872	-4.410	***	M(-1)	-0.316148	-2.163	***
M(-2)	0.06853	2.517	**	M(-2)	0.516656	2.301	**
M(-3)	-0.094505	-3.420	***	M(-3)	-0.699383	-3.038	***
M(-4)	0.094745	3.276	***	M(-4)	0.54665	2.259	**
M(-5)	-0.063018	-2.197	**	M(-5)	-0.213721	-0.894	
M(-6)	0.09526	3.365	***	M(-6)	0.147321	0.627	
M(-7)	-0.04383	-1.515		M(-7)	-0.129918	-0.536	
M(-8)	-0.015096	-0.512		M(-8)	0.096797	0.391	
M(-9)	0.010251	0.340		M(-9)	-0.202556	-0.793	
M(-10)	-0.004421	-0.219		M(-10)	0.158989	0.946	
DN	-0.105656	-3.497	***	DN	-0.240893	-0.979	
DM	0.039452	1.646	*	DM	0.321241	1.613	
DS	0.094041	1.968	**	DS	0.65858	1.710	*

Adjusted R^2=0.940, DW-stat=2.002 N=276
Redundant Variables PN(-1),...,PN(-10).
F-stat = 1.940, Prob = 0.041.

When including current PN, E,M,
coeff of PN is 0.014 (T-stat=3.012***)
Redundant Variables PN, PN(-1),...,PN(-10).
F-stat=2.752, Prob=0.002

Adjusted R^2=0.984, DW-stat=2.062, N=276
Redundant Variables TP(-1),..TP(-10)
F-stat = 0.6494, Prob = 0.7703.

When including current TP, E, M
Coeff. pf TP is 1.922 (T-stat=3.107***)
Redundant Variables TP,TP(-1),..TP(-10)
F-stat = 1.300, Prob = 0.225

Source: Granger tests performed by author in EView software, 1996.

Table 4: Hauseman Test Results, US Existing Home Markets, 1975-94.

Dependent Variable is TP				Dependent Variable is P			
Variable	Coeff.	T-Stat	Prob.	Variable	Coeff.	T-Stat	Prob.
C	8.983404	0.224		C	968.0926	3.644	***
M	-0.12266	-11.759	***	TP	1.720888	3.351	***
E	2.44E-07	0.885		TPHAT	0.098931	0.167	
DE4	1.72242	2.549	**	M	-0.25088	-1.856	*
CPIX	-0.4426	-1.897	*	E	1.05E-05	4.546	***
DN4	-0.41804	-4.930	***	DN4	-5.89696	-1.020	
DM	-0.01793	-0.193		DM	-4.86618	-0.799	
DS	-0.11788	-0.869		DS	-13.8891	-2.020	**
YEAR	-0.00277	-0.136		YEAR	-0.46336	-3.484	***
AR(1)	0.865396	20.214	***	AR(1)	1.152573	42.151	***
AR(4)	-0.02087	-0.552		AR(4)	-0.17232	-6.479	***

Adjusted R^2=0.948, DW-stat=2.004,N=284
Forecast:TPHAT
Mean absolute percentage error is 4.38%.

Adjusted R^2=0.984, DW-stat=2.279,N=272

Dependent variable is PN				Dependent variable=TP			
Variable	Coefficient	T-Stat	Prob.	Variable	Coefficient	T-Stat	Prob.
C	27572.96	0.015		C	98.42873	4.173	***
CPIX	-6.14595	-0.748		PN	0.006763	1.855	*
M	0.257319	1.090		PNHAT	-0.00368	-1.051	
E	6.61E-05	5.006	***	M	-0.12335	-11.430	***
DE4	-29.799	-2.754	***	DE4	2.042157	2.976	***
DN4	-3876.34	-0.016		DN4	-0.36599	-4.040	***
DM	-5623.65	-0.016		DM	0.010067	0.120	
DS	-18703.7	-0.016		DS	0.003735	0.042	
YEAR	0.862073	0.999		YEAR	-0.04835	-4.042	***
AR(1)	0.544862	10.382	***	AR(1)	0.87428	19.945	***
AR(4)	0.455041	8.659	***	AR(4)	-0.03151	-0.794	

Adjusted R^2=0.994, DW-stat=0.587, N=284
Forecast:P PNHAT
Mean absolute percentage error = 1.69%.

Adjusted R^2=0.945,DW-stat=1.996,N=272

Source: Regression performed by author in EView, 1996.

Table 5: Least Square and Two-stage Least Square Regression Results, US Existing Home Market, 1975-94.

2SLS				LS			2SLS				LS		
Dependent Variable is P				Dependent Variable is P			Dependent Variable is TP				Dependent Variable is TP		
Instrument List C,M,M(-1),E,E(-1),DE,DE(-1) CPIX, CPIX(-1) TP(-1),P(-1), YEAR,DN,DM,DS							Instrument List C,M,M(-1),E,E(-1),DE,DE(-1) CPIX, CPIX(-1) TP(-1),P(-1), YEAR,DN,DM,DS						
Variable	Coeff	T-Stat	Prob.	Coeff	T-Stat	Prob.	Variabl	Coeff	T-Stat	Prob.	Coeff	T-Stat	Prob.
C	967.8	3.400	***	1163.66	4.51	***	**C**	73.777	3.165	***	101.25	4.802	***
TP	4.19499	3.378	***	1.528	3.061	***	**PN**	-0.0004	-0.151		0.003	1.359	prob=0.175
M	0.0673	0.349		-0.295	-2.459	**	**M**	-0.1289	-12.466	***	-0.128	-12.71	***
E	9.87E-06	4.047	***	1.03E-05	4.539	***	**DE4**	1.9664	2.824	***	2.093	3.059	***
DN4	-7.01583	-1.327		-7.066	-1.444		**DN4**	-0.4135	-4.904	***	-0.366	-4.413	***
DM	-4.94094	-0.902		-3.598	-0.719		**DM**	0.0156	0.202		0.028	0.36	
DS	-13.0683	-2.146	*	-11.478	-2.115	**	**DS**	-0.0312	-0.385		0.0067	0.083	
YEAR	-0.46561	-3.275	***	-0.561	-4.342	***	**YEAR**	-0.0357	-3.015	***	-0.0498	-4.648	***
AR(1)	1.1332	38.809	***	1.162	42.745	***	**AR(1)**	0.8751	20.705	***	0.8734	20.95	***
AR(4)	-0.1565	-5.565	***	-0.186	-7.157	***	**AR(4)**	-0.0438	-1.203		-0.0387	-1.056	

Source: Regression performed by author in EView, 1996.