Volume Effect of Real Estate Asset in Korea

HyunWook Ryu and SangSu Keum

Shinhan University, Semyung University
Ryu7466@empas.com

Abstract

The informational role of trading volume has long been a subject in financial market. In stock market and/or derivatives market, for instance, the issue remains whether the market is efficient; meaning that information(s) from the past is delivered sequentially to the following trades, thus reflected in price. The purpose of this study is to attempt to test the relationship between the price index and trading volume in the housing market to see if the empirical findings could show any change in each other. Vector Auto Regressive model is used to analyze the endogenous variables. Empirical evidence presented in this study shows that trading volume a month before causes change in price index. It is inferred that housing volume traded could relay significant information to the trading process of housing asset.

Keywords: volume, information effect, housing market, EGARCH, Vector Autoregressive

1. Introduction

Understanding volume effect is important, and, for that, many studies have previously been conducted in financial sector in order to investigate the relationship between price and trading volume. Some scholars have supported efficient market hypothesis (EMH) in which existing prices reflect all relevant information, and prices adjust quickly to new information(s). Other scholars argue that trading volume delivers useful information to potential traders, meaning that there are informed traders in stock market (for instance) in sequential manner. Unfortunately, it is highly doubt to see that happen in real property market as it's traded in decentralized market structure where information asymmetry exists.

People trade asset(s) in the market. Central market represents informations available in a standard-format (in other words, under regulations); if so, one could argue that more information disclosure helps foster trade activity as it brings less risk to the market (Easley and O'Hara; 2000). Providing higher liquidity[1] to the relevant asset class, financial products are traded in centralized market. A higher liquidity means more attractive to investors, leading higher turnover in the market as Amihud(2000) and Brennan and Subrahmanyam(1996) supported this argument. For real estate asset, where trades are taken place in decentralized market structure, asymmetric information or inadequate disclosure of information(s) has always been primary barrier for investors.

Instead, changes in volume traded of housing, for example, are often related to changes in housing demand, though it is unclear whether the linkage exists. According to a big data analyzing firm[2] in Korea, the word 'volume' is associated with 'purchase', 'trade', 'housing',

---

[1] Liquidity is the service that makes quick exchange possible (Smidt, 1968)

[2] Social Matrix site provided by DaumSoft Corp. checked into all the Tweeter and Internet Blog accounts associated with typed keyword for one month period; the data provided is covered from Sept. 7 to Oct. 7 of 2015.

'apartment' in 3rd, 4th, 5th, and 7th respectively in ranking order. It is noted that, in the real investment market, participants utilize information from trading volume data.; thus it is appropriate to work on study on information effect of volume in real property market.

The rest of this paper provides previous literature review relating to information effect in financial sector, and describes methodology and data used. Empirical findings are discussed followed by conclusions.

2. Literature Review[3]

The attempt to investigate a volume effect goes back to 60s, in which many studies tried to figure out any correlation between price and trading volume in stock market. The results varied from data and/or approaching methodologies; no relation with weekly data (Grander and Mogenstern, 1963); positive correlation with monthly data (Rogalski, 1978).

In financial adage says "It takes volume to make prices move." The early empirical studies on the relationship between stock price and trading volume focuses either on the correlation between volume and price change or the absolute value of the price change. Many empirical studies supported that trading volume (or turnover) would drive prices with empirical findings. Ying(1966) conducted a series of statistical tests to six-year of daily trading volume data to price data, and concluded that prices varied with volume variation. Later, Copeland(1976) and Jennings *et. al*(1981) studied the mixture of distribution model to find out the relationship between trading volume and stock returns.

There were studies arguing for the sequential information arrival model stating that the level of trading volume increases probabilities of returns (Blume et al, 1994). Later, Chodia *et. al*(2000) found the relationship between trading volume and the predictability of stock returns.

Studies on volume effect provide insights with empirical provision(s) where the informational role could predict the future price movements. Easley, O'Hara and Srinivas(1998) argue that investors with private information about the future volatility could more be attracted to trade. They argue that the significance of information-based trading increases in assets with higher information asymmetries.

Measuring informational role would be important as, among other assets, real property markets are highly variable. Though extensive research has been conducted into theoretical and empirical aspects of the topic on hand, most shed lights on the financial markets in developed countries. With the investigated conclusions of this study, lessons and insights are obtainable through the case of emerging market.

In the real estate market, housing trading volume has been studied from the perspective of the co-movement between prices and trading volume. It's rather focused on private information from agents with bid-ask term in the market.

As the ability to predict price volatility is important for asset purchasing. an examination of the interrelations between price volatility and trading volume provide useful insights regarding informational contents of the market sentiments.

[3] Contents are partially retrieved and modified from Ryu(2013).

3. The Asset Defined and Methodology

3.1. Real Estate asset and Housing Market in Korea

Real estate is defined as 'property consisting of land and the buildings on it, along with its natural resources such as crops, minerals, or water, immovable property of this nature; an interest vested in this an item of real property; buildings or housing in general'. There are several different types of real estate assets as follows; (i)land, (ii)residential properties, (iii)commercial office properties, (iv)industrial properties, (v)retail properties, (vi)hotels and (vii)mixed use properties. Although characteristics of real estate property are different from financial products, those are all tradable assets in the market.

When the housing comes to an asset, it is normally known as long-term and lucrative investment from time and risk wise respectively.

**Exhibit 1. Housing price index from 1986 to 2015 (price index: 2013=100)**
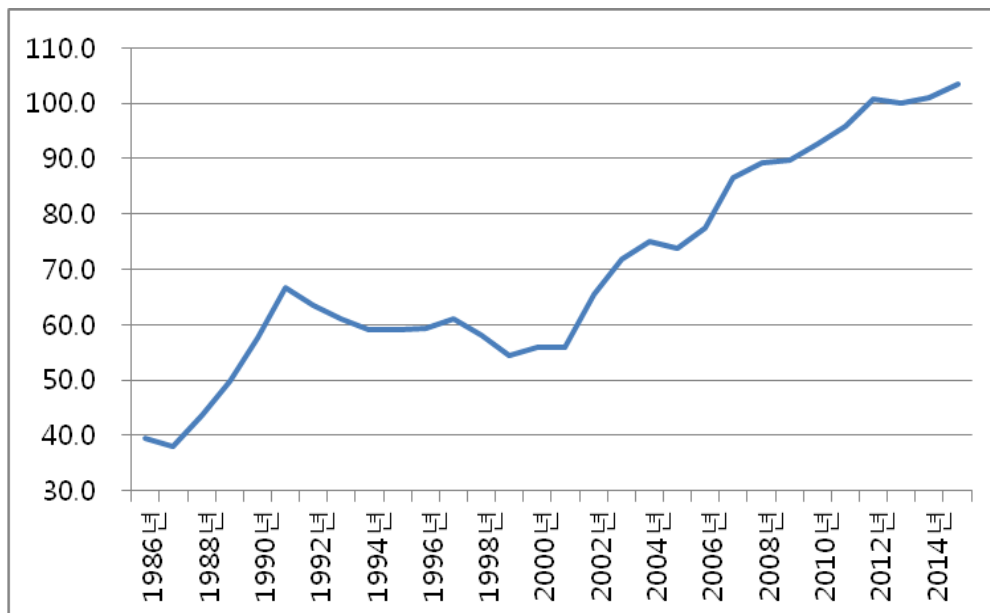
Republic of Korea is a country, in many times known as 'Miracle of Han river'; that is the term refers to the economic growth of Seoul (the capital city). Starting with less than 80 U.S. dollars per year for a per capita income in 1961, Korea became 11th largest economy in the world and a role-model for many developing countries.

Such rapid economic growth came without any capital from inside, but from developed countries around the Globe. Thus, the government naturally adapted to intervene the property market with its administrative authority, where most capital was funded from private sector and/or individuals. The 'miracle' lasted for approximately 35 years from 1961. Export-fueled economic growth brought the individuals huge increase in salary and wealth. Exhibit 1 shows the result with gradual increase in housing market while the government of Korea successfully carried out effective development plan. The market was damaged during the Asian financial crises in 1997.

After global financial crisis in 2008, economic downturn with low interest rate made financial markets unattractive, and the housing market continued to go up with floating money injected

Exhibit 2. Housing Price and Volume from 2006 to 2015 (price index: 2006=100)
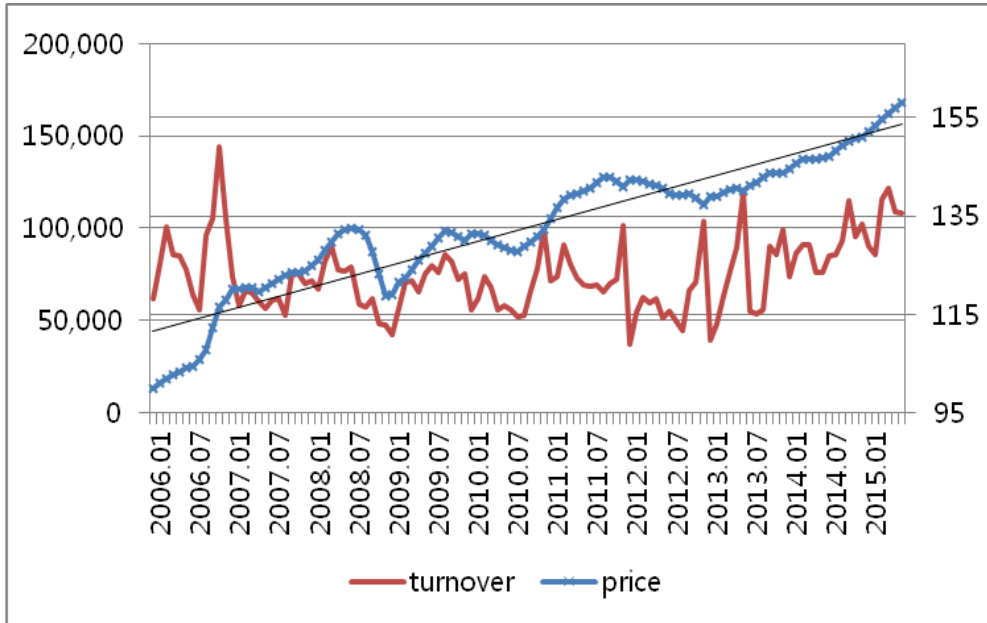
As in Lowe-Lee(2007), real estate has been the safest and most lucrative investment vehicle in Korea, and it takes the highest composition in total household assets. Rising property prices during 2000s have created housing assets inflated as Japan experienced in the 1980s and early 1990s. Government intervention continued; for instance, current administration has employed housing demand-driven policies such as low-interest mortgage rate and lower regulation for housing supply.

Exhibit 2 shows monthly units traded and price index in Seoul from 2006 to 2015. Note that housing volume traded leads the housing price, or the other way. In academia, the so-called 'anomaly' of positive correlation between trading volume and price has long been an issue to both financial and real estate markets. While residential investment is a highly cyclical component of GNP (Mankiw and Weil, 1989), moving towards same direction in subsequent market requires additional explanation.

By looking at the same phenomenon, some scholars argue with different approaches; a model with down-payment effects (Stein, 1995), a model with loss aversion (Genesove and Mayer, 2001), and a search and matching models (Wheaton, 1993). In house matching models where sellers and buyers meet, 'search' is necessary because there is imperfect information, possibly about which units are for sale and certainly about a unit's type. The model shows how decision makers with imperfect information behave as market dynamics.

While these various studies have approached positive correlation between price and volume, this study concentrates on asymmetric information approaches to the relevant market, which could influence the behavior of market participants.

3.2. The Model

People rely on information when making investment decision, and it's no different in real estate market. Since the market structure is decentralized, individuals rely on the experts (in many cases, realtors). Due to the fact that not much official information is disclosed, decision makers are often induced by trading volume figures released by either the government or trustworthy institutions.

Blume, Easley and O'Hara(1994) argued that large price changes is associated with relatively large volumes. This study attempted to estimating VAR (vector autoregressive) model on the lagged parameters. The relations between price index and

$$P_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i P_{t-i} + \sum_{i=1}^{k} \beta_i \, turnover_{t-i} + \varepsilon_t$$

trading volume are examined by using the following VAR equation.

where P is housing price index and *turnover* is housing volume traded.

Prior to measuring precise informational role of trading volume, one primary step would be to find the endogenous relationship between trading volume and price in broader perspective. The dependent variables are the monthly price index of housing in nation-wide.

This study attempt to shed light on information role of trading volume effect through dynamic relation between housing volume traded and price.

4. Empirical Analysis

4.1. Data and Descriptive Statistics

Retrieving data has always been challenge in real estate market due to the infrequency of transactions and heterogeneous data source. This study uses the national-level housing transaction data from the Government of Republic of Korea to examine the relationship between trading volume and price volatility. The transaction data gives monthly prices with housing volume traded, covering the period of January, 2006 to June, 2015. Total of 114 data are all available as of the moment. Table 1 presents the descriptive statistics of the sample data in housing market. In Korea, apartments are the largest sharein housing stock, and thus it conveniently reflects the entire market.

Table 1. Descriptive Statistics for Housing Data

Heading level	Price	Trading volume
Mean	132.6018	74432.46
Median	132.1500	72270.00
Maximum	158.1000	144274.0
Minimum	100.0000	37051.00
Standard Deviation	13.13621	19313.32
Skewness	-0.533390	0.743534
Kurtosis	2.958274	3.686665

In the illustrated statistics in Table 1., Mean data of price and trading volume are 132.6 and 74,432 units respectively; where price level of 100 is timed on January of 2006. The sample data is for the city of Seoul.

The price index is calculated by repeat-sales price index methods; that is, collected prices from different time periods in order to find matched-pairs. It is a direct measure of price changes for a given property over a period of time. Case and Shiller price index is one good example which utilizes such technique. The repeat-sales price index modelis as follows;

$$\ln P_s - \ln P_f = \left(\sum_{i=1}^{k} \beta_{i,s} \ln X_{i+} \gamma_s B_s + \varepsilon_s \right) - \left(\sum_{i=1}^{k} \beta_{i,f} \ln X_i + \gamma_f B_f + \varepsilon_f \right)$$

where P_s and P_f are the times of the first and second transactions, X_i is the attributes of a house, B_s and B_f are the dummy variables at the first and second transactions time to be estimated, and e_s and e_f are the error terms.

Trading volume data (or trading volume) is one of the most frequently used in asset pricing tests, especially in liquidity proxy. As the rationale, Amihud and Mendelson (1986) suggest that assets with higher spreads are allocated to portfolios with longer expected holding periods. Chordia, Subrahmanyam and Anshuman (2001) also employ trading volume data as a proxy of liquidity.

4.2. VAR

As time-series data is subjected to stationary tests, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for unit roots are conducted. ADF and PP tests are both procedures that account for temporally dependent and heterogeneously distributed errors by including lagged data. Unit root tests are conducted on the levels of the logarithms of trading volume and price indices.

Table 2 presents the results for the unit-root test prior to the main analysis. The hypothesis that the series data is nonstationary is not rejected, thus used first-differenced data. The time-series data are stationary as evidenced the t-statistics. The test suggests that the levels of trading volume and price indices must be first differenced to achieve stationarity.

Table 2. Stationary Test Results

Heading level		t-statistic	1st difference
Price	ADF	-1.96	-4.64***
	PP	-2.13	-4.45***
Trading volume	ADF	-5.32***	-9.32***
	PP	-5.31***	-26.59***

The Vector Autoregressive (VAR) model has often been a choice as a description of macroeconomic time-series data. It is flexible, easy to estimate and usually gives agood fit to macroeconomic data. VAR model is utilized for several merits; it allows directly test the Granger causality between price and turnover, and it enables to test exogenous variables for broader research. In this study, no exogenous variables are injected,

instead we test for cross-lag effects, and the own-lag effect seems to be highly significant. An autoregressive model of order two is estimated using adjusted differenced log price changes and trading volume:

$$\Delta P_{i,t} = \beta_{0,i} + \beta_{1,i}\Delta P_{i,t-1} + \beta_{2,i}\Delta P_{i,t-2} + \beta_{3,i}\Delta Q_{i,t-1} + \beta_{4,i}\Delta Q_{i,t-2}$$

where P is the housing price and Q is the housing volume traded.

No exogenous variables are included to show the certain relation between primary variables. The optimal number of lags is determined by the common selection order criteria. The likelihood-ratio test with Akaike (AIC) and Schwarz (SC) results are shown in the Table 3. The model with the lowest AIC value is chosen.

Table 3. VAR Estimation Test Results.

	Price	Trading volume
Price (-1)	0.810872^{***}	10.02362^{***}
	[8.45275]	[3.59602]
Price (-2)	-0.213272^{**}	-5.925616^{*}
	[-2.18997]	[-2.09407]
Trading volume (-1)	0.007757^{**}	-0.231414^{**}
	[2.40513]	[-2.46922]
Trading volume (-2)	-0.000200	-0.196267^{*}
	[-0.06392]	[-2.15598]
C	0.001557^{*}	-0.013676
	[2.02602]	[-0.61264]
Log likelihood		406.4110
Akaike information criterion		-7.142541
Schwarz criterion		-6.898439

This table reports the results of VAR estimates. The critical value for the statistics at the 5% and 1% are 2.86 and 3.43 respectively. The values within [ ] show t-statistics, and an *, **, *** denotes statistical significance at the 10%, 5%, 1% level.

In a two-lag VAR of monthly trading volume changes, the null hypothesis is the coefficients of the two lags of each trading volume are equal to zero. Estimation test results show an increase of one point in price a month ago results in a change in the trading volume at 1% significance level. Interestingly, an increase of one point in trading volume a month ago results in an increase of 0.007 points in price index at 5% significance level. Statistically significant coefficients of price change on trading volume have different signs; this would have to rely on market interpretation.

The VAR estimation results tell an interesting story; the coefficient of the one-lag of housing volume changes has positive correlation to the price. From the result, it does appear that there could be some sort of information delivered out to price.

5. Conclusions

People enjoy buying and selling financial assets in the markets. Leaving other merits (such as liquidity effect) aside, it's less riskier as the market keeps all the trades transparent with information disclosed.

Housing is investment good as well as consumption good. Unlike commercial properties which are in many cases invested via REITs (Real Estate Investment Trust), residential properties such as family homes and apartment buildings are much more difficult to get access to the 'inside information'. From such perspective, it has rather been sellers' market, or the market for informed traders. As decentralized market structure has long been a primary constraint for transacting the real estate assets, information inefficiency seems to be apparent to the relevant asset return. And, this becomes a highly significant matter as the economy is in recession where housing price and trading volume co-move down with higher transaction cost for both buyers and sellers.

From the perspectives of household portfolio, housing is a risky asset since it is traded in decentralized marketplace, meaning that there is an information asymmetry. Should trading volume play certain role to influence the rate of return via relaying any sort of information, not only does it vitalize investment activity in the relevant market, but it also deliver meaningful findings to the government. When it carries out stimulus economic plan, reducing transaction tax, for instance, would result in greater policy effect to the relevant sector. (when the government fixes its sight upon pricing control, it promotes subsidies and/or lowering interest rate in order to bolster demand-side)

This study investigates the relationship between housing volume and price to see if there is any informational role out of volume traded. The measure of the volume effect is derived in real terms and applied to a time-series VAR without exogenous variables to model. Using a VAR estimation approach, this study reveals the existence of possible feedbacks of informational role of trading volume. One result being certain out of this study is that the estimated effect of the change in trading volume derives the absolute change in price; meaning, trading volume data might deliver information(s). This empirical finding at least supports the sequential information arrival model, and partially make predict bidirectional causality between trading volume and price. People with better information are more attracted to the market as it can reduce transaction costs. Investigated relationship between housing volume traded and price volatility provides important information, especially to the government which may apply in policy-making process.

This study opens the door for additional research in the area such as liquidity effects. Better understanding of informational role of trading volume can be provided if a research is capable of utilizing more accurate explanatory data available. Additionally, accurate measurement of housing price index would be another concern to the shortcomings of the research on hands.

References

[1]   Y. Amihud and H. Mendelson, "Asset pricing and the Bid-Ask spread", Journal of Financial Economics ,vol. 17, **(1986)**, pp. 223-249.
[2]   D. Easley and M. O'Hara , "Market statistics and technical analysis: The role of volume", Journal of Finance, vol. 49, **(1994)**, pp. 153-182.
[3]   M. Brennan and A. Subrahmanyam, "Market microstructure and asset pricing: on the compensation for illiquidity in stock returns", Journal of Financial Economics, vol. 41, **(1996)**, pp. 441-464.

[4]   T. Copeland, "A model of asset trading under the assumption of sequential information arrival", Journal of Finance, vol. 31, **(1973)**, pp. 1149-1168.
[5]   T. Chordia and A. Subrahmanyam,"Commonality in liquidity", Journal of Financial Economics vol. 56, **(2000)**, pp. 3-28.
[6]   T. Chordia, A. Subrahmanyam and V. Anshuman "Trading activity and expected stock returns", Journal of Financial Economics, vol. 59, **(2001)**, pp. 3-32.
[7]   D. Easley, M. O'Hara and P. Srinivas,"Option volume and stock prices: evidence on where informed traders trade", Journal of Finance, vol. 53, **(1998)**, pp. 431-465.
[8]   D. Genesove and C. Mayer, "Loss aversion and seller behavior: evidence from the housing market", The Quarterly Journal of Economics, vol. 116, no.4, **(2001)**, pp. 1233-1260.
[9]   R. Jennings, L. Starks and J. Fellingham "An equilibrium model of asset trading with sequential information arrival", Journal of Finance, vol. 36, **(1981)**, pp. 143-161.
[10] Y. Lee, "A review of issues about transaction-based housing price index in Korea', Journal of the Korea Real Estate Analysts Association, vol. 13, **(2007)**, pp. 147-167.
[11] F. Lowe-Lee, "Korea's real estate market - Are we overreacting to skyrocketing property prices", Research reports, Korea Economic Institute of America, **(2007)**.
[12] S. Levitt and C. Syverson, "Market distortions when agents are better informed: the value of information in real estate transactions", The Review of Economics and Statistics, vol. 90, no. 4, **(2008)**, pp. 599-611.
[13] G. Mankiw and D. Weil, "The baby boom, the baby bust, and the housing market", Regional Science and Urban Economics, vol. 19, **(1989)**, pp. 235-258.
[14] H. Ryu "An empirical study on the housing market variation", Ph.D. dissertation, Department of Real Estate Study, Konkuk University, Korea, **(2013)**.
[15] S. Smidt , "A new look at the Random Walk Hypothesis", Journal of Financial and Quantitative Analysis, **(1968)**, pp. 235-261.
[16] W. Wheaton, "Vacancy, search and prices in a housing market matching model", Journal of Political Economy, vol. 98, no. 6, **(1993)**, pp. 1270-1292.
[17] C. Ying, "Stock market prices and volumes of sales", Econometrica, vol. 34, **(1966)**, pp. 676-686.
[18] D. Easley and M. O'Hara, "Information and the Cost of Capital", Working Paper, Johnson Graduate School of Management, Cornell University, **(2000)**.
[19] H. Ryu and S. Keum, "A study on turnover of housing asset", Advanced Science and Technology Letters, Business, vol. 114, **(2015)**, pp. 162-166.

Authors

HyunWook Ryu, Ph.D. Assistant professor, Dept. of Global Business, Shinhan University, Republic of Korea.

SangSu Keum, Ph.D. Professor, Dept. of Real Estate Study, Semyung University, Republic of Korea.