Real Estate Market Cyclical Dynamics - the Prime Office Sectors of Kuala Lumpur, Singapore and Hong Kong

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Abstract

This research helps us understand the real estate cycle and offers an analysis using a vector auto regression model. We study the key international cities of Hong Kong, Kuala Lumpur, and Singapore. We find four key outcomes. One, the real estate cycle is generally different from the underlying business cycle in local markets for the cities studies. Two, the real estate cycle is more exaggerated in the construction and development areas than in rents and vacancies. Three, the vacancy cycle tends to lead the rental cycle. And four, new construction completions tend to peak when vacancy is also peaking. We believe that future research should try to help us understand the linkages that drive these outcomes. For example, are rigidities in the local permit and construction markets responsible for the link between construction peaks and vacancy peaks?

Introduction

The real estate market is known to be cyclical. This cyclicality is a function of several intertwined underlying factors that interact to create the long and short-run real estate market cycles which cause capital values (CVs) and rentals to vary over time. This implies that the cycles and the numbers (CVs, rentals, cap rates, etc.) are signals which only the well-informed and insightful real estate analysts and investors can utilise to their advantage. Therefore one can safely say that the real estate market cyclicality can be a blessing or a curse to the market participants depending on their levels of sophistication and understanding of the cycles. Furthermore, given that real estate investors are infatuated with market numbers which have attracted many international investors to the real estate markets of some Asian cities, it is very important for these investors to have at least a certain minimum level of appreciation of the factors that create the numbers, especially CVs (the price that the market will pay for a unit of real estate asset) and rentals. This particular inquiry, known as price discovery, is taken from the literature on asset market micro-structure.

Price discovery is the process by which the opinions of market participants on the value of a real estate asset are synthesized into a single statistic – market price. In the real estate market context, Geltner and Miller (2000) denote price discovery to be the process by which asset market prices are formed through the discovery and incorporation of relevant information on asset values by market participants. Where two markets have a common component of value, the relevant price information is discovered first in one market and then transmitted to the second market (Geltner, MacGregor and Schwann, 2003). The process is enhanced by liquidity and information efficiency in the real estate market. Illiquidity fosters the widespread reliance on appraisals for real estate values which results in the problem of appraisal smoothing (appraisal lag).

This paper focusses on price discovery in the private direct real estate market where heterogeneous assets are traded in dispersed local markets, and transactions (especially prices) are shrouded in confidentiality. Such conditions increase information asymmetry to inhibit the process of price discovery in the real estate market. Thus, given the peculiar nature of the real estate asset and the market in which it is traded, demand and supply for real estate space could be moving towards, or away from, equilibrium at any moment owing to long lead times for space construction, as shown in the following equations:

$Q_D = f\,(R_t, \text{UNeed})$ (1)

$Qs = f\,(R_{t-1}, \text{Cost})$ (2)

$R_t = f\,(R_{t-1}, \text{VR})$ (3)

Demand (Q_D) is determined by the rental (R_t) of real estate space and the underlying need for space (for e.g. office employment). The supply of real estate space (Q_s) is influenced by the previous period's rental for space (R_{t-1}) and the relative cost of producing it. Similarly, rental is related to the previous period's rental (R_{t-1}) and the vacancy rate (VR).

Of scholarly interest is the capability of statistical, stochastic or empirical functions to generate and explain the process of the CVs and rental formation. These process-generating functions constitute the quantitative aspect of the real estate price discovery process where the information efficiency is analysed in detail. CVs and rents can be well-formed through the discovery and incorporation of relevant information, including the underlying real estate demand and supply, the macro- and micro- economic factors if available, by the market participants. On the whole, real estate sectors differ in information efficiency. Thus, there are varying temporal lead-lag relationships in the CV, rent and fundamental market factors for real estate sectors of the various cities in the Asia region.

The existence of autocorrelation for direct real estate as opposed to indirect real estate suggests that the former does not quickly respond to new information. Guirguis and Vogel (2006) highlight the importance of considering asymmetry in real house prices to avoid model misspecification. They reiterate that such prices exhibit some price rigidity, reacting more readily to positively lagged changes than to the negative lagged changes in prices. Consequently, the inherent market cyclicality of the real estate sector should reflect the adaptive behaviour of market participants, i.e. the real estate developers, landlords and tenants. We attempt to address these concerns through a formal modelling of a system of articulated supply, demand and construction models to throw more light on the real estate market cycle dynamics of Hong Kong, Kuala Lumpur and Singapore. The theoretical model for this purpose is envisaged to be a complete dynamic model system of the real estate space market, comprising a unique system of six linked equations that denote the relationship among supply, demand, construction, vacancy and rent over time, as well as price response slopes and lags (see Geltner and Miller, 2001; Rosen, 1984 and Wheaton, 1987). The complete dynamic model system of solely real estate variables will accordingly highlight the following key features:

- The real estate market cycle could be different from, and partially independent of, the underlying business cycle in the local or domestic economy. Such a key feature is consistent with the study by Leung and Chen (2006) that concludes that real estate cycles can be intrinsic. Their dynamic general equilibrium model demonstrates that the price of commercial real estate, denoted as "land" in the model, can display cycles even with constant fundamentals.
- The real estate market cycle may be more exaggerated in the construction and development industry than rents and vacancy.
- The vacancy cycle tends to lead the rental cycle slightly.
- New construction completions tend to peak when vacancy peaks.

The model can be specified and estimated through econometric technique like the vector auto regression (VAR) model. Other techniques that could be utilised to specify the model may include the well-known two-stage least-square model (2SLS) and seemingly unrelated regression (SUR) model, the dynamic factor model (DFM) by Forni *et al*. (2000 and 2001) and the spectral density model for the cyclical association of residential price and consumption by Sun *et al*. (2007). Another pertinent specification is Lettau and Ludvigson's (2004) vector error correction model (VECM) which utilizes US data in a permanent transitory variance decomposition framework to disaggregate the trend and cyclical effects that consumption has on asset values. We use the VAR model specification as it gives insights into the effect of the lagged values of all the variables in the model (Ho and Cuervo, 1999; Ho, 2005 and 2007). Such formal modelling should also enable the explicit and rigorous quantitative forecasts of say rents and CVs when the rest of the variables are forecasted beforehand.

The Theoretical Model

Studies by Abraham and Hendershott (1996), Wheaton (1990) and Sivitanidou (2002) conclude that the office sector is affected by wide deviations of prevailing rents (and other price variables) from the implicit long-run equilibrium rent. Such wide deviations subject the office sector to persistent disequilibria in_the short-run. Thus it is reasonable to expect that 'bad' and 'good' equilibria would prevail in the office, as well as the broad direct real estate, market. In the short to medium-run, excess demand/supply in a 'bad' office sector market equilibrium slowly adjust towards 'good' equilibrium in the long-run. The underlying dynamics of this slow adjustment process can be primarily attributed to several price and non-financial structural relationships in the market. These relationships may include real estate specific factors, macroeconomic factors and the self-adjusting error corrections at work in the short-run.

DiPasquale and Wheaton (1992, 1996) conceptualize a 4-quadrant representation of the two important linkages between two markets that are in long-run equilibrium to propose a dynamic model based on stock-flow theory. In the short run, tenants' space needs (demand) as well as the types, quantity and quality of available stock of space (supply) interact to determine the rents for real estate in the space market. The price for space as an asset (which invariably is the sum of the discounted values of all anticipated rentals) relative to the cost of replacing or constructing space is a major determinant of the annual flow of new stock to the real estate market in the long run According to their model, market prices should equate replacement costs in the long run where competitive equilibrium prevails in the space market.

In the long run, adjustments to stock occur slowly over time in response to short-term prices given the relatively long construction period. While the model is simple in terms of its variables, it poses problems when an attempt is made to link the short and long run effects as the model does not account for the intermediate stages of the market's movements towards its new equilibrium. Thus a dynamic system which depicts the intermediate adjustments of the market is required to address the limitation of the DisPaquale and Wheaton's (1992 & 1996) model.

The first two equations in a complete dynamic model system for the real estate space market should denote the supply side of the market. Eq (4) models construction completions and rents prevailing in the real estate space market at the commencement of construction projects.

$$C_t = \begin{cases} \varepsilon\left(R_{(t\text{-}L)}\text{-}K\right), if\ R_{(t\text{-}L)} > K \\ 0, otherwise \end{cases} \quad (4)$$

C(t) is the amount of new space completed in period *t*. $R_{(t-L)}$ is the rent prevailing in the market in *t-L* (*L* being the number of lags) while *K* is the trigger rent which is defined as the replacement cost rent above which new construction will be started. Furthermore Eq (4) assumes that there is no retirement of property, i.e. demolition rate is zero.

As buildings take time to construct, there is always a time lag between when construction decision is made and when new supply (building completions) reaches the market. For example, it takes about two years from the date approval is received from the competent authorities for an office development to be completed in Singapore. Therefore data series for total completions can be adjusted two years in advance to estimate the subsequent correlation with expected returns. The office space start rate can then be expressed as in Eq (5).

Office Space Start Rate = b_1Expected Returns Rate – Demolition rate (5)

The completion factor is assumed to be typically growing at say 5% per quarter during a steady economic state for a matured office sector such as Singapore. Demolition is assumed to be 'zero' (rather than growing much more slowly at say 2.5% per quarter) as all new developments arise from the redevelopment of 'green field' and 'brown field' sites from government land sales and private *en bloc* land sales. This is especially true of Singapore and

Hong Kong where there is chronic and acute land scarcity, and even of Kuala Lumpur which is experiencing land scarcity in the central business district.

In addition, substitution between residential and office spaces in Singapore can only occur in the few ‘white sites’ developments where the site can be put to only one or mixture of some or all of the permitted uses. The other and more frequent single use sites under government land sales comprise state land sales solely for private residential use, private commercial (office or retail or hotel) and private industrial use. This situation is similar to what exists in Hong Kong. The very limited substitution among land uses facilitates the adoption of a VAR approach in which the variables are regressed symmetrically at their respective lagged exogenous and endogenous variables.

ε in Eq (4) is the supply elasticity that determines the amount of new construction per dollar by which the current rent exceeds *K.* A higher ε indicates that development is relatively more responsive to rents, i.e. there will be more new supply of space for each dollar that rents rise above *K.* Eq (6) states that the total stock of space supply in *t*, labelled $S_{(t)}$, equals the previous year’s stock, $S_{(t-1)}$, plus the new construction completed in *t*.

$$S_{(t)} = S_{t\text{-}1} + C_t \qquad (6)$$

Eq (7) relates the amount of space that potential users would currently like to occupy, $D_{(t)}$, to the current rent level, $R_{(t)}$, and the current level of underlying need, $N_{(t)}$.

$$D_t = \alpha \text{-} \eta R_t + \tau N_t \qquad (7)$$

$N_{(t)}$ measures the need for space which, for the office market, represents the number of office employees working in the market. The parameter α is a constant or intercept for the model. The response sensitivity parameter η denotes the price elasticity of demand while the parameter τ denotes the quantity of space usage demanded per unit of underlying need. For e.g., if $N_{(t)}$ is the number of office employees, then τ represents the number of sq ft per employee.

Assuming that it takes one year for space users to realize the level of space usage demand (due, for example, to the time required to find the necessary space and/or get out of leases in the case of reductions in space demand), Eq (8) equates the amount of space actually occupied at time *t*, *OS(t)*, to the demand in the previous year, $D_{(t-1)}$.

$$OS_t = D_{t\text{-}1} \tag{8}$$

The ninth equation defines the vacancy rate, *v(t)*, as the fraction of the currently available stock of space that is currently unoccupied. It must be noted that the variables on the right-hand side of Eq (9) are the outputs from Eqs (6) and (8).

$$v_t = \frac{[S_t\text{-}OS_t]}{S_t} \tag{9}$$

Eq (10) depicts the rental pricing behaviour of landlords who are assumed to raise or lower rents in response to perceived contemporaneous vacancy rates. If current vacancy rates, v_t, are above the natural vacancy rate for the market, *V*, then landlords will reduce rents. If current vacancy rates are below the natural vacancy rate, *V*, then landlords will raise rents. The sensitivity of rental to vacancy rate deviations from *V* is denoted by the response parameter λ in Eq (10). It is assumed that it takes a year for landlords to respond effectively to changes in the market, perhaps owing to the difficulty in accurately interpreting the market or sluggish response to the market.

$$R_t = R_{t\text{-}1}\left(1 - \lambda\left\{\frac{[v_t\text{-}V]}{V}\right\}\right) \tag{10}$$

The VAR Model Estimation

According to Sims (1980) and Stock and Watson (2006) the VAR model is effective in analysing the inter-relationships between multiple time series. All variables (both exogenous and endogenous) within the VAR model are regressed symmetrically at their respective lagged variables. Thus, the VAR model is able to extend the univariate auto regression to multiple time-series variables. The VAR model can also be used to forecast economic relationships. The unrestricted VAR model of two time-series variables for example, can be expressed as:

$$Y_t = \beta_{10} + \beta_{11}Y_{t\text{-}1} + \dots + \beta_{1p}Y_{t\text{-}p} + \gamma_{11}X_{t\text{-}1} + \dots + \gamma_{1p}X_{t\text{-}p} + {}_{1t} \tag{11}$$

$$X_t = \beta_{20} + \beta_{21}Y_{t\text{-}1} + \dots + \beta_{2p}Y_{t\text{-}p} + \gamma_{21}X_{t\text{-}1} + \dots + \gamma_{2p}X_{t\text{-}p} + {}_{2t} \tag{12}$$

The β's and γ's are unknown coefficients; Y's and X's are vectors of endogenous variables at a period, say calendar year or quarter, t ; p denotes the number of lags while $_{1t}$ and $_{2t}$ are error terms assumed to be the independently identically distributed (i.i.d.) white noise that are contemporaneously correlated with each other. The VAR model generates coefficients proportionate to the number of variables. Including more variables increases the coefficients as a result of collinearity to bias the estimation error to reduce the precision of parameter estimates (i.e. forecast in this regard). Thus, it is advisable to include a smaller number of relevant variables. In addition, the determination of lag lengths is of crucial importance as different and long lag lengths can adversely impact the resultant coefficients.

We next turn our attention to a formal examination of the VAR model utilizing available quarterly data from JLL REIS-Asia. The historical data cover 15 direct real estate sub-markets of eight major Asian cities: Singapore (the Raffles Place CBD – Central Business District), Beijing, Shanghai, Hong Kong (the Central & major business districts), Bangkok, Manila (Makati CBD), Kuala Lumpur and Jakarta. The dataset, based on 240 prime CBD (central business district) office, residential and retail buildings of international Grade A investment quality, is reliable and authoritative asset-class research index for the prime direct real estate sectors of these Asian cities. Furthermore JLL REIS-Asia database comprises both valuation estimates and market transaction data. Valuation estimates by JLL's network of regional Asian offices are used when there is a dearth of rental and sales transactions for any particular quarter.

The data used for the study are from 4Q 1987 to 2Q 2009. Capital value (CV) and rental figures are denominated in US$ nominal terms to avoid introducing currency risk complexities into the analyses and to ensure that the markets for the sampled cities are compared on the same base. The real estate variables for the VAR model estimation include the CV based on NFA (net floor area in US$ per m^2), the net effective rent (net of the rent-free period and the fitting out cost in US$ per m^2 per year), net new construction in m^2, the initial yield (% p.a.) and the vacancy rate (% of stock) for prime office and luxury residential properties of the relevant cities.

The VAR model estimation is conducted for only three (out of 15) Asian cities' prime office markets of interest in this fast developing Asia region in an attempt to keep the model estimation to a relatively smaller and more manageable scale. These cities are Kuala Lumpur City Centre, Singapore Raffles Place CBD and the Hong Kong CBD. The choice of the three cities for the study is based on the fact that they are invariably at the same stage of being fast growing and mature urban economies although the real estate markets for Singapore and Hong Kong are at a more matured state relative to Kuala Lumpur. Another reason for including Kuala Lumpur in the sample is its proximity to Singapore. Table 1 defines the variable names for the VAR model estimation while Table 2 provides the summary statistics of the required data.

Table 1. Real Estate Variables for the VAR Model Estimation

Table 1 provides the variable names (and their descriptions) used for the estimation of the vector auto regression (VAR) model.

Variable	Description
HOR	Hong Kong Central office rent
HOV	Hong Kong Central office vacancy %
HC	Hong Kong Central office net new completions, % of stock
KOR	Kuala Lumpur City Centre Central office rent
KOV	Kuala Lumpur City Centre office vacancy %
KC	Kuala Lumpur City Centre net new completions, % of stock
SOR	Singapore Raffles Place office rent
SOV	Singapore Raffles Place office vacancy %
SC	Singapore Raffles Place net new completions, % of stock
HOCV	Hong Kong Central office capital value
HOY	Hong Kong Central office initial yield
KOCV	Kuala Lumpur City Centre office capital value
KOY	Kuala Lumpur City Centre office initial yield
SOCV	Singapore Raffles Place office capital value
SOY	Singapore Raffles Place office initial yield

The office CV, the quotient of the actual office rent and the initial yield, is the current market value for prime office space per year. This is a dynamic value as it changes over time in relation to the yield and rent.

CV or Asset Price = Current Market Rent/ Initial Yield (13)

Initial yield, also known as the overall capitalization rate, is the income rate for a total real property interest that reflects the relationship between a single year's net operating income expectancy and the total price or value of the real estate asset (property) being valued. The yield is essentially a combination of rental growth rates and rates of rental return. It is the implied growth rate that determines the CV or price of the property. This implied growth rate that is embedded in a particular real property transaction is a function of market expectations. Furthermore, the yield reflects the risk associated with a particular investment property. It is a dynamic, common market measure by which investment properties can be compared. The relationship between value, a single year's net rental income, the expected total return rate and assumed constant annual growth in rent, g, is depicted by the Gordon constant-growth model for a generic investment, Eq (14):

$$V = \frac{\$a}{r\text{-}g} \qquad (14)$$

where r is the expected total return (% p.a.) and $a is the first year's net income. Altyernatively, V can be expressed in another way by restating Eq (13) as:

$V = \frac{\$a}{Y}$, where y is the income yield, the initial income divided by the CV. (15)

Equating the Eq (14) to Eq (15) and simplifying gives Eq (16)

$$y = r - g \qquad (16)$$

Thus, the yield is the difference between the expected rate of total return and the anticipated rental income growth rate. This rule-of-thumb relationship serves as a useful criterion for verifying whether the rental growth rate for any particular period is line with market expectations.

It can be readily observed from Table 2 that Hong Kong office commands the highest mean annual rental per m^2 ($582) followed by Singapore ($484) and Kuala Lumpur ($139) although Hong Kong Office average CVs per m^2 ($11,575) is closely comparable to that for Singapore ($11,252) as reproduced below for expedience:

Office Rents, US$ per m^2 per year	**SOR**	**KOR**	**HOR**
Mean	484	139	582
Standard Deviation (SD)	±272	±44	±214
Coefficient of Variation	0.56	0.31	0.36
Office CVs, US$ per m^2	**SOCV**	**KOCV**	**HOCV**

Mean	11,252	1,831	11,575
Standard Deviation (SD)	±4,758	±422	±4,577
Coefficient of Variation	0.42	0.23	0.40

The relatively higher office mean CVs per m^2 for Singapore and Hong Kong reflect their much deeper office stock in comparison to Kuala Lumpur (with lower mean CVs). On the whole, the office rents for Singapore (±272) and Hong Kong (±214) are much more volatile than that for Kuala Lumpur (±44). On the basis of the coefficient of variation, Kuala Lumpur (0.31for rental and 0.23 for CV) is the least risky of the three cities, followed by Hong Kong (0.36 and 0.40 respectively) – Singapore (0.56 and 0.42 respectively) is the riskiest office market as measured by the coefficient of variation. These figures imply that Singapore and Hong Kong office sectors are more prone to cyclical fluctuations.

Table 2 Here

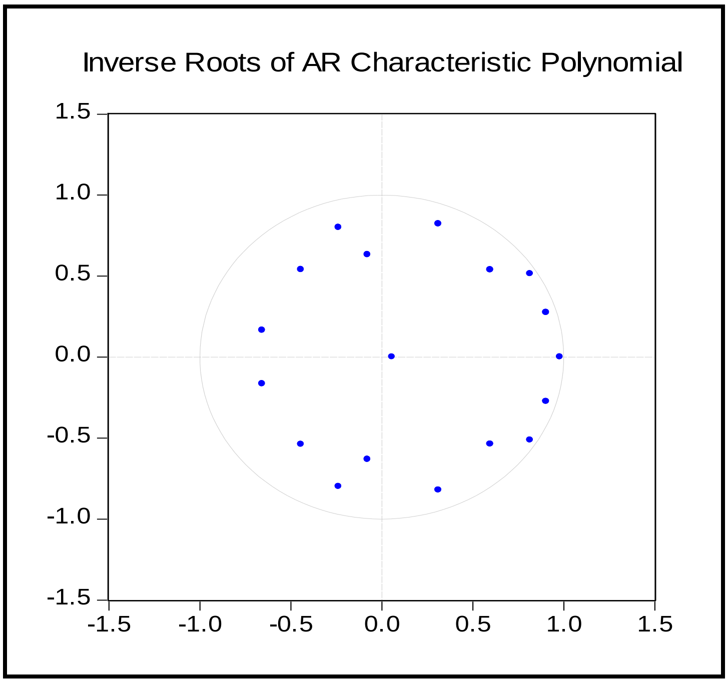
The results of the office rental VAR model estimation for Singapore, Kuala Lumpur and Hong Kong are presented in Table 3. Of interest are the estimated coefficients and t-statistics for the right-hand-side (endogenous) variables for the SOR, KOR and HOR models presented in the models' respective columns. The adjusted R-squared for each model exceeds 0.9 to imply good fits for the three office rental models, i.e. SOR, KOR and HOR. The corresponding low values of the Akaike and Schwarz information criteria indicate that the three office rental models are correctly specified. Rents and vacancies in the HOR model are negatively correlated as expected. The results in Table 3 show that HOR for any quarter is inversely related to the preceding quarter's vacancy rate (HOV(-1)). In other words, when vacancy rate increases/falls in Quarter 1, rent will fall/rise in Quarter 2. This inverse relationship between Hong Kong Office rent and vacancy is statistically significant at the 0.10 level of significance. Similar result Applies to the Kuala Lumpur office rental market although the statistically significant inverse relationship exists between office rent and the preceding two quarters' office vacancy rate (KOV(-2), Table 3). However, there appears to be no statistically significant relationship between vacancy and rent for the Singapore office rental market (Table 3). Similarly, the results in Table 3 reveal that new supply of office space (HOC, KOC and SOC) does not appear to have any statistically significant impact on office rental for the three markets. Another notable finding from the results in Table 3 is the positive statistically significant relationship between two consecutive quarters' rents for the three office markets (HOR(-1) – HOR; KOR(-1) – KOR and SOR(-1) – SOR). In other words, the rent for one quarter presages the rent for the succeeding quarter.

Table 3 Here

The results of the corresponding office CV VAR model estimation for Singapore, Kuala Lumpur and Hong Kong are presented in Table 4. The adjusted R-squared values are also found to be in excess of 0.9, implying good fits for the three office CV models, i.e. SOCV, KOCV and HOCV. Similarly, the corresponding low values of the Akaike and Schwarz information criteria indicate that the three office CV models are correctly specified. In the HOCV model, CVs and the initial yields are negatively correlated (apart from Hong Kong) as expected and significant for certain lagged relationships with other variables and CVs themselves. The other models for the rest of the endogenous variables are provided for reference.

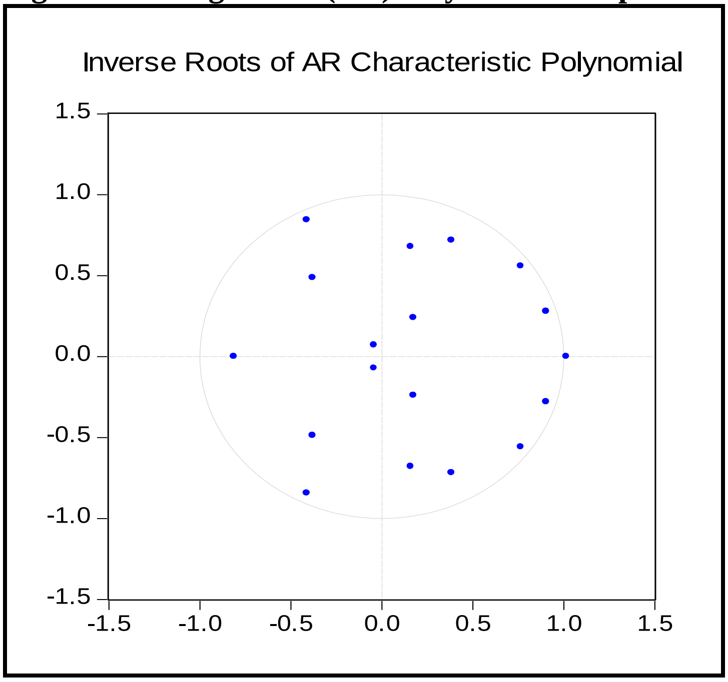
As a check on the appropriateness of the unrestricted VAR model of office rental, vacancy and net new completions for the three cities concerned, the diagnostic graph of the inverse roots of the characteristic polynomial is presented in Figure 1. The estimated VAR is stationary and stable, as all the roots have modulus less than one and lie inside the unit circle. A similar graph with the same favourable diagnostic result is exhibited in Figure 2 for the VAR model of office CV, the initial yield and net new completions for Singapore, Kuala Lumpur and Hong Kong.

Fig 1. Auto Regressive (AR) Polynomial Graph 1



(*Source: Authors and EViews6, 2011*)

Fig 2. Auto Regressive (AR) Polynomial Graph 2



(*Source: Authors and EViews6, 2011*)

The appropriate lag order of the unrestricted VAR office rental and CV model estimations and their endogenous variables for the three cities is based on several criteria as shown in

Tables 5 and 6. The selected lag order of two from each column criteria is highlighted and marked with asterisk "*" in Tables 5 and 6.

Table 5. VAR Lag Order Selection Criteria

We report the appropriate lag order of the unrestricted VAR office rental and CV model estimations and their endogenous variables for Singapore, Kuala Lumpur and Hong Kong based on several criteria (the LR, FPE, AIC, SC and HQ). *Denotes lag order selected by the criterion. Statistical significance is at the 0.05 level. Source: Authors, 2011; Eviews Version 6.

Endogenous variables: HOR HOV HC KOR KOV KC SOR SOV SC

Exogenous variables: C.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	86.21154	NA	6.49e-14	-4.825721	-4.413483	-4.689076
1	306.6035	303.0390	1.30e-17	-13.53772	-9.415337	-12.17127
2	**464.1210**	**127.9829***	**4.49e-19***	**-18.32006***	**-10.48753***	**-15.72380***

LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 6. VAR Lag Order Selection Criteria

This table continues to report the appropriate lag order of the unrestricted VAR office rental and CV model estimations and their endogenous variables for Singapore, Kuala Lumpur and Hong Kong based on several criteria (the LR, FPE, AIC, SC and HQ). *Denotes lag order selected by the criterion. Statistical significance is at the 0.05 level. Source: Authors, 2011; Eviews Version 6.

Endogenous variables: HOCV HOY HC KOCV KOY KC SOCV SOY SC

Exogenous variables: C

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-31.20584	NA	9.98e-11	2.512865	2.925103	2.649510
1	180.9492	**291.7132***	3.34e-14	-5.684326	**-1.561944***	-4.317873
2	**307.7132**	**102.9957**	**7.91e-15***	**-8.544575***	**-0.712049**	**-5.948314***

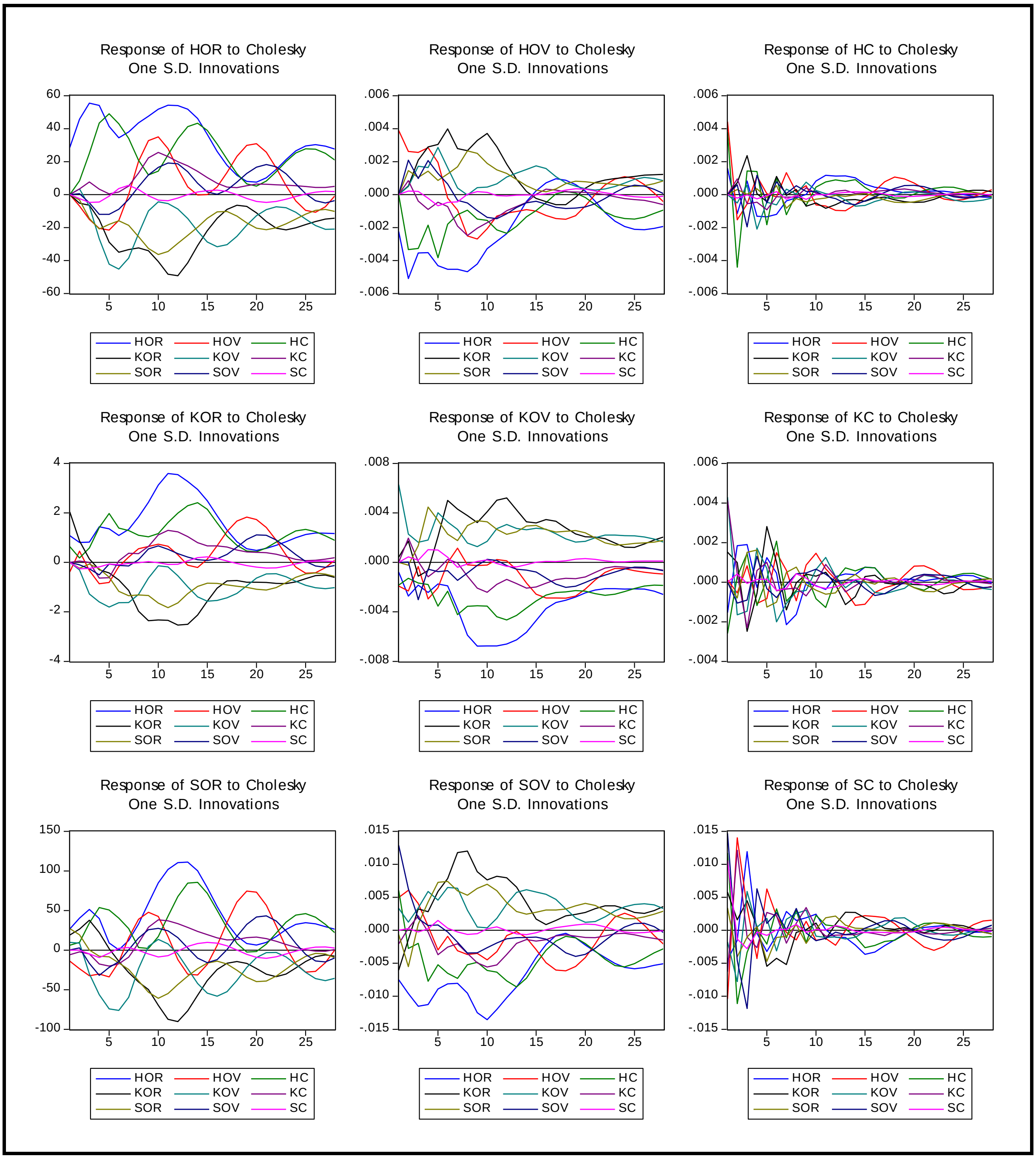
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

(*Source: Authors and EViews6, 2011*)

As a final step, we present the impulse response functions to simulate the behaviour of the real estate cyclical market dynamics in Figures 3, 4 and 5. The impulse response function helps to trace the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables through the dynamic lag structure of the estimated and stationary VAR. A period of 28 quarters (i.e. 7 years) is specified to mirror a typical medium term real estate market cycle. As expected, the impulse responses (Figure 3) 'die out' to zero for the stationary VAR models utilising the endogenous variables consisting of HOR, HOV, HC, KOR, KOV, KC, SOR, SOV and SC. The corresponding accumulated responses presented in Figure asymptote to some non-zero constant. Similarly, the impulse responses are observed in Figure 5 to 'die out' to zero for the stationary VAR models estimated for the endogenous variables, comprising the HOCV, HOY, HC, KOCV, KOY, KC, SOCV, SOY and SC . The corresponding accumulated responses are observed in Figure 6 to asymptote to some non-zero constant.

Fig 3. Impulse Response Functions for the Endogenous variables – HOR, HOV, HC, KOR, KOV, KC, SOR, SOV & SC

Fig 3 presents a series of graphs depicting the impulse response functions that simulate the behaviour of the real estate cyclical market dynamics by tracing the effect of a one-time shock to one of the innovations on the current and future values of the endogenous variables. The associated dynamic lag structure of the estimated and stationary VAR is also depicted. A period of 28 quarters (i.e. 7 years) is specified to mirror a typical medium term real estate market cycle. Source: Authors and EViews6, 2011.



Response of HOR to Cholesky
One S.D. Innovations
60
40
20
0
-20
-40
-60
5 10 15 20 25
HOR HOV HC
KOR KOV KC
SOR SOV SC
Response of HOV to Cholesky
One S.D. Innovations
.006
.004
.002
.000
-.002
-.004
-.006
5 10 15 20 25
HOR HOV HC
KOR KOV KC
SOR SOV SC
Response of HC to Cholesky
One S.D. Innovations
.006
.004
.002
.000
-.002
-.004
-.006
5 10 15 20 25
HOR HOV HC
KOR KOV KC
SOR SOV SC
Response of KOR to Cholesky
One S.D. Innovations
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-2
-4
5 10 15 20 25
HOR HOV HC
KOR KOV KC
SOR SOV SC
Response of KOV to Cholesky
One S.D. Innovations
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.000
-.004
-.008
5 10 15 20 25
HOR HOV HC
KOR KOV KC
SOR SOV SC
Response of KC to Cholesky
One S.D. Innovations
.006
.004
.002
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-.002
-.004
5 10 15 20 25
HOR HOV HC
KOR KOV KC
SOR SOV SC
Response of SOR to Cholesky
One S.D. Innovations
150
100
50
0
-50
-100
5 10 15 20 25
HOR HOV HC
KOR KOV KC
SOR SOV SC
Response of SOV to Cholesky
One S.D. Innovations
.015
.010
.005
.000
-.005
-.010
-.015
5 10 15 20 25
HOR HOV HC
KOR KOV KC
SOR SOV SC
Response of SC to Cholesky
One S.D. Innovations
.015
.010
.005
.000
-.005
-.010
-.015
5 10 15 20 25
HOR HOV HC
KOR KOV KC
SOR SOV SC

Fig 4. Accumulated Responses for the Endogenous variables – HOR, HOV, HC, KOR, KOV, KC, SOR, SOV & SC

Fig 4 consists of a series of graphs that depict the corresponding accumulated responses and that they are observed to asymptote to some non-zero constant. A period of 28 quarters (i.e. 7 years) is specified to mirror a typical medium term real estate market cycle. Source: Authors and EViews6, 2011.

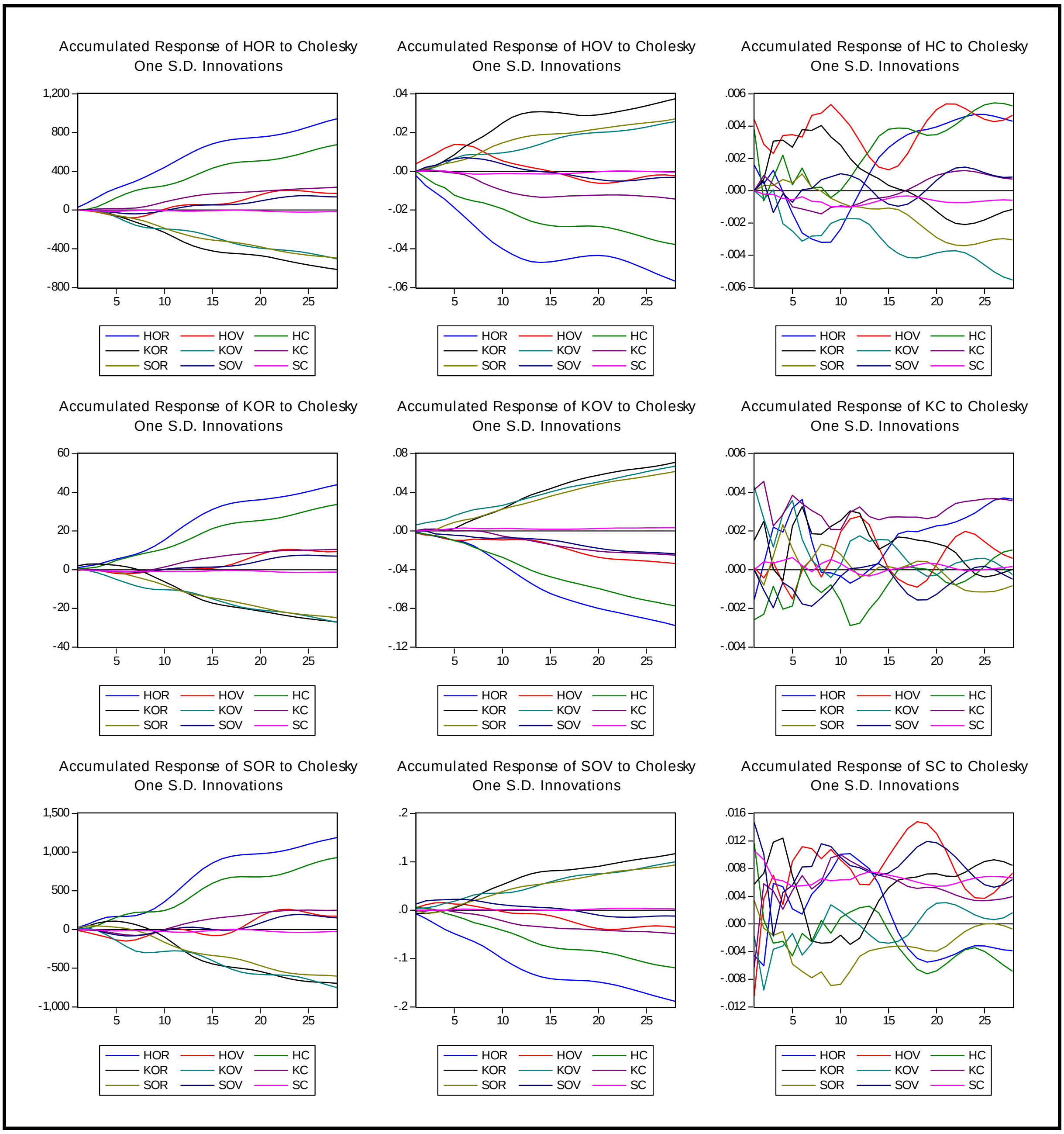


Fig 5. Impulse Response Functions for the Endogenous variables – HOCV HOY HC KOCV KOY KC SOCV SOY SC

Fig 5 consists of a series of graphs that depict the impulse response functions that help to simulate the behaviour of the real estate cyclical market dynamics, via tracing the effect of a one-time shock to one of the innovations on the current and future values of the endogenous variables. The associated dynamic lag structure of the estimated and stationary VAR is also depicted. 28 quarters (i.e. 7 years) is specified to mirror a typical medium term real estate market cycle. Source: Authors and EViews6, 2011.

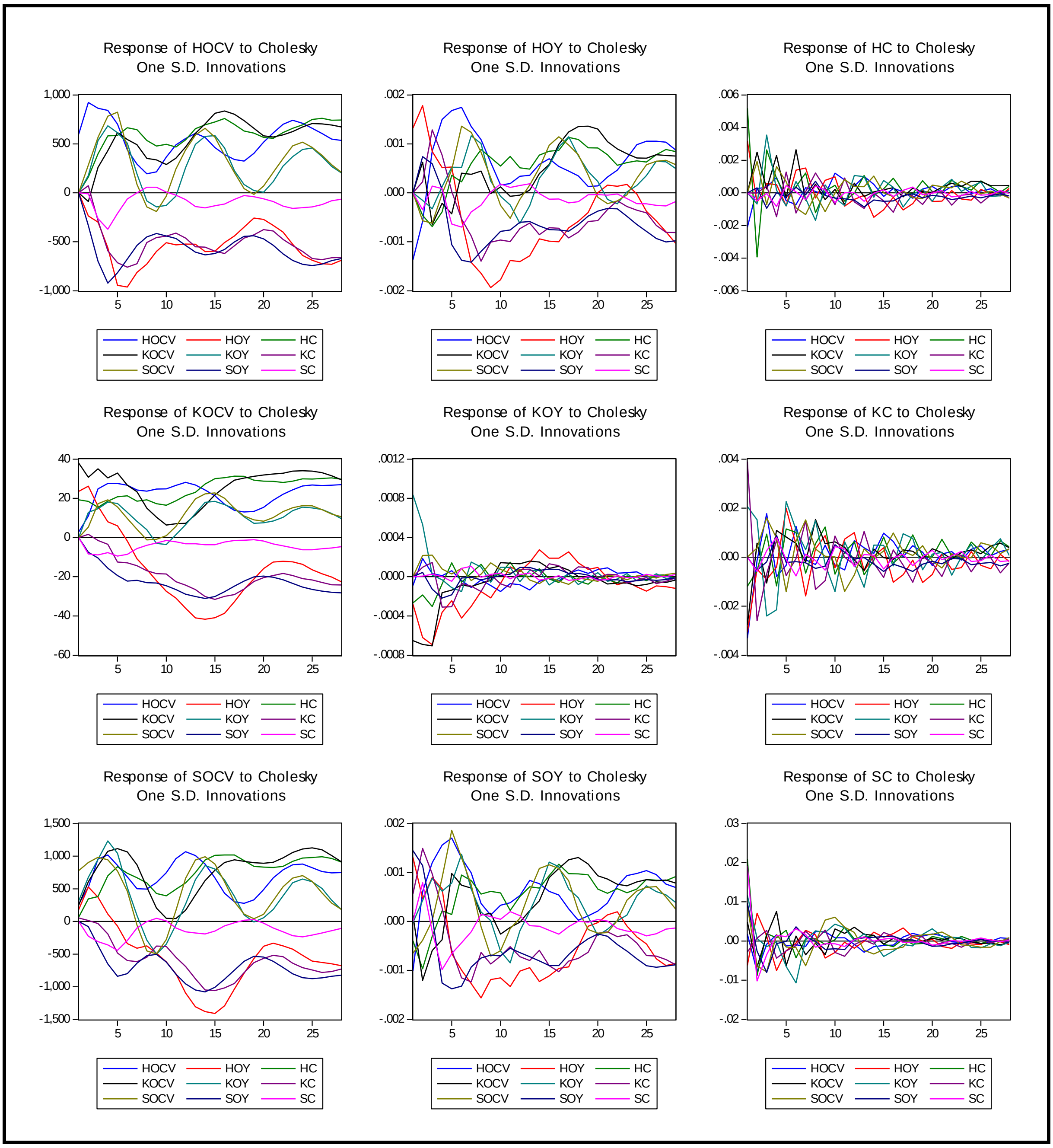
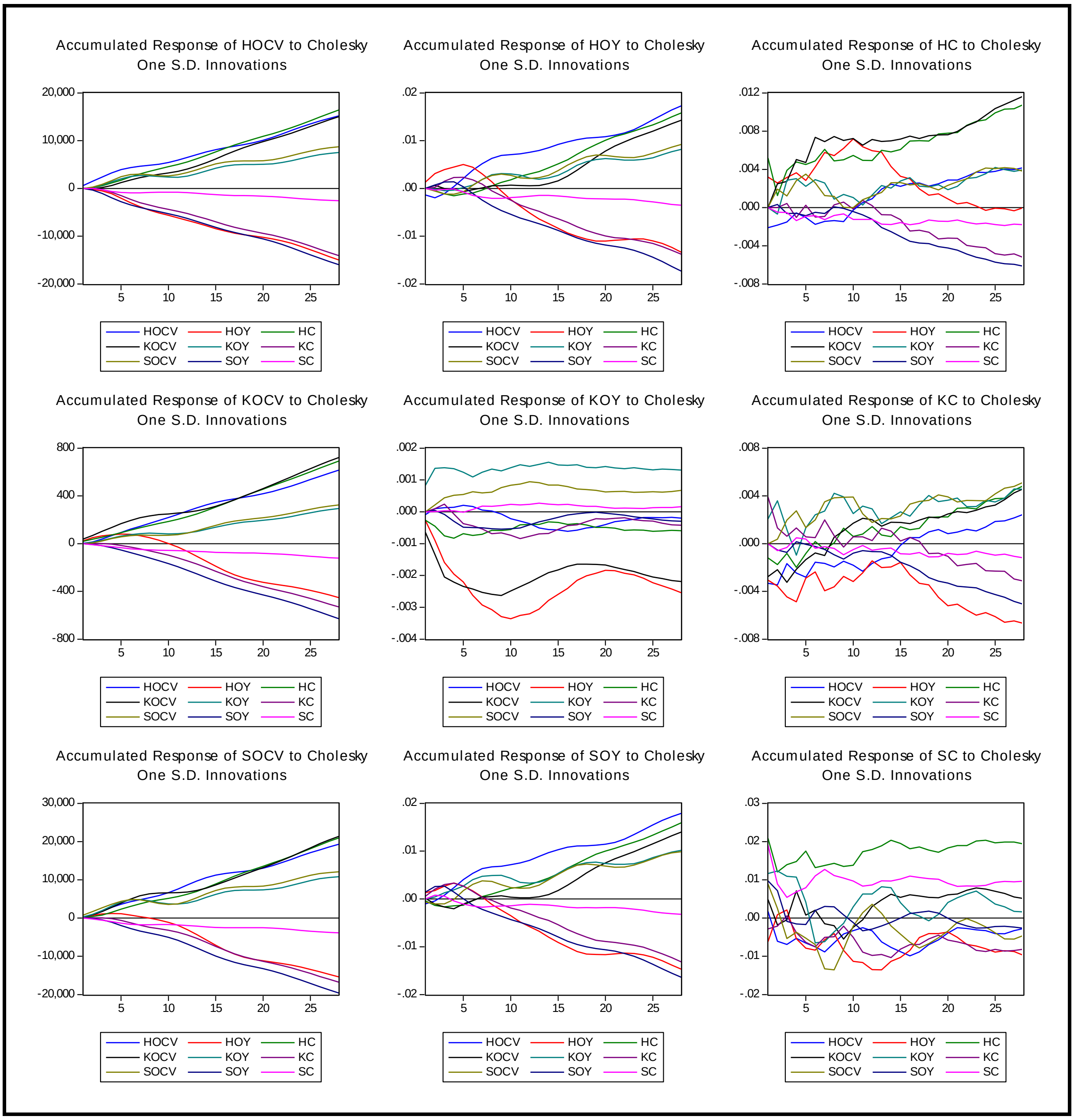


Fig 6. Accumulated Responses for the Endogenous variables – HOCV HOY HC KOCV KOY KC SOCV SOY SC

Fig 6 consists of a series of graphs that depict the corresponding accumulated responses asymptote to some non-zero constant. A period of 28 quarters (i.e. 7 years) is specified to mirror a typical medium term real estate market cycle. Source: Authors and EViews6, 2011.



Conclusion

The VAR model offers a complete dynamic system of solely real estate variables to provide international real estate investors and policy makers with the following meaningful findings to help them in their decision-making:

- The real estate market cycle is different from and partially independent of the underlying business cycle for the domestic economy. This concurs with extant literature that real estate cycles can be intrinsic.
- The real estate market cycle is more exaggerated in the construction and development industry than rents and vacancy.
- The vacancy cycle slightly leads the rental cycle.
- New construction completions tend to peak when vacancy peaks.

The evidence shows that office rents for Singapore and Hong Kong are more volatile than those for Kuala Lumpur. Thus, the Singapore and Hong Kong office sectors are more prone to cyclical fluctuations. Furthermore, the results reveal that rents and vacancies are negatively correlated as expected, and statistically significant for certain lagged relationships with other variables and with rents themselves. Similar results pertain to the relationships between capital values and initial yields.

On the whole, the VAR model estimation offers an insightful set of practical and empirical models that provide a comprehensive theoretical basis for analysing the prime office markets of Kuala Lumpur, Singapore and Hong Kong. Moreover, the price discovery process highlights the market fundamentals, their explanatory factors in the short- and long-run, and the cyclical behaviour of the predominantly inefficient prime office markets specifically and the real estate markets of Asia generally if the sampled markets are deemed to be a good proxy for the entire market.

The results are robust as evidenced by test statistics including the coefficient of determination and the Akaike and Schwarz information criteria, the diagnostic graph of the inverse roots of the characteristic polynomial, and the impulse response function. This implies that the VAR model for the study provides a reliable platform for explicit and rigorous quantitative forecasts of say rents and CVs when the rest of the variables in the model are forecasted beforehand.

Table 2. Summary Statistics of Key Real Estate Variables for the VAR Model Estimation

We present the summary and descriptive statistics of the rents, net new completions, stock levels, vacancies, capital values and initial yields for the prime office and luxury residential sectors of Kuala Lumpur City Centre, Singapore Raffles Place CBD and Hong Kong Central business district, from the JLL REIS-Asia data, 4Q 1987 to Q2 2009. Source: Authors, 2011; Eviews Version 6.

	SOR	SOC	SOS	SOV	SOCV	SOY	KOR	KOCV	KOY
Mean	483.7352	10748.49	674100.7	0.078060	11252.19	0.045088	138.9318	1830.860	0.077350
Median	399.6963	0.000000	697630.5	0.063496	9232.876	0.044010	120.5873	1618.184	0.076892
Maximum	1473.336	127806.0	825138.7	0.165529	22935.57	0.069200	253.4545	3040.105	0.093725
Minimum	148.4993	0.000000	367755.0	0.008000	6002.175	0.029405	52.26478	1491.287	0.071992
Std. Dev.	272.1470	24854.46	121932.5	0.050939	4757.649	0.009434	43.73890	421.9039	0.004236
Skewness	1.832045	3.368352	-0.951237	0.361265	0.879847	0.243490	1.107640	1.551710	1.787166
Kurtosis	6.487304	14.99049	3.524076	1.731007	2.573284	2.247743	4.161915	4.327303	6.927652
Sum	42084.96	709400.5	44490643	4.917752	877671.2	3.516847	8335.906	102528.1	4.331600
Sum Sq. Dev.	6369505.	4.02E+10	9.66E+11	0.160875	1.74E+09	0.006852	112872.4	9790160.	0.000987
Observations	87	66	66	63	78	78	60	56	56

	KOC	KOS	KOV	HOR	HOCV	HOY	HOC	HOV	HOS
Mean	30907.49	1667537.	0.121558	581.5039	11574.93	0.051759	45681.62	0.070226	6429262.
Median	0.000000	1812330.	0.146910	558.1757	10786.49	0.049513	31682.01	0.070568	6904925.
Maximum	272465.6	2005517.	0.195542	1084.130	21883.16	0.080701	182597.4	0.119658	7824678.
Minimum	0.000000	892844.4	0.012604	227.0808	4155.395	0.031928	0.000000	0.015846	2703953.
Std. Dev.	62717.49	338752.6	0.052674	213.9129	4577.392	0.011981	53202.87	0.021990	1354704.
Skewness	2.558442	-1.364732	-0.736622	0.367773	0.522335	0.796739	1.183221	0.166636	-1.481476
Kurtosis	9.026955	3.363921	2.242063	2.461450	2.207954	2.883205	3.484131	2.985233	4.140586
Sum	1823542.	1.00E+08	7.171944	50590.84	1007019.	4.503018	1553175.	3.370832	3.09E+08
Sum Sq. Dev.	2.28E+11	6.77E+12	0.160925	3935249.	1.80E+09	0.012344	9.34E+10	0.022728	8.63E+13
Observations	59	60	59	87	87	87	34	48	48

Table 3. VAR Model Estimation Results for Office Rent, Vacancy & Completions – Hong Kong, Kuala Lumpur & Singapore

We report the results of the office rental VAR model estimation for Singapore, Kuala Lumpur and Hong Kong, in particular the SOR model, the KOR model and the HOR model, for which the estimated coefficients and t-statistics for the right-hand-side (endogenous) variables are presented in the models' respective columns. Data is obtained from JLL REIS-Asia from 4Q 1987 to Q2 2009. *Denotes statistical significance at the 0.10 level. Source: Authors, 2011; Eviews Version 6.

Vector Auto Regression Estimates

T-statistics in [ ].

	HOR	HOV	HC	**KOR**	KOV	KC	**SOR**	SOV	SC
HOR(-1)	1.086461	3.49E-05	8.93E-05	0.018244	-9.66E-05	3.69E-05	0.279337	0.000158	0.000420
	[**2.68367***]	[0.54860]	[1.04399]	[0.53103]	[-0.98878]	[0.38011]	[0.42328]	[0.60717]	[1.13454]
HOR(-2)	-0.631991	-2.30E-05	-0.000159	-0.041282	-1.14E-06	-4.51E-05	-1.460888	-0.000426	-0.000466
	[-1.26877]	[-0.29402]	[-1.50788]	[-0.97660]	[-0.00948]	[-0.37678]	[-1.79916]	[-1.33236]	[-1.02282]
HOV(-1)	-6594.158	1.848930	0.839809	94.07641	-0.357029	-0.180882	-3540.691	2.346442	3.647772
	[-2.63752*]	[4.70151]	[1.58924]	[0.44340]	[-0.59196]	[-0.30135]	[-0.86877]	[1.46054]	[1.59459]
HOV(-2)	476.3782	-0.303761	-0.308349	-372.5593	0.145889	0.398724	-4459.251	-2.379209	-1.652561
	[0.26063]	[-1.05653]	[-0.79815]	**[-2.40182***]	[0.33086]	[0.90862]	[-1.49662]	[-2.02567]	[-0.98812]
HC(-1)	3056.528	-1.137139	-1.278563	-42.67409	-0.052589	0.115275	247.9885	-1.473029	-1.667905
	[1.61359]	[-3.81645]	[-3.19345]	[-0.26546]	[-0.11508]	[0.25348]	[0.08031]	[-1.21016]	[-0.96233]
HC(-2)	1151.118	-0.395397	-0.426222	78.42298	0.087909	0.065627	1207.948	0.583357	0.765647
	[0.94015]	[-2.05301]	[-1.64697]	[0.75474]	[0.29762]	[0.22326]	[0.60521]	[0.74144]	[0.68342]
KOR(-1)	-0.563267	-0.000119	0.000341	0.630002	0.000341	0.000347	6.506194	0.002360	0.000492
	[-0.18414]	[-0.24693]	[0.52706]	**[2.42685***]	[0.46180]	[0.47248]	[1.30476]	[1.20046]	[0.17583]
KOR(-2)	1.600454	0.000733	0.000974	-0.132173	-0.002102	-0.001232	9.522401	0.000773	0.004067
	[0.49814]	[1.45103]	[1.43408]	[-0.48477]	[-2.71254]	[-1.59672]	[1.81819]	[0.37452]	[1.38335]
KOV(-1)	99.32107	-0.332901	-0.321801	-44.27742	0.086548	-0.156729	-238.7485	0.225260	-2.601560
	[0.09435]	[-2.01052]	[-1.44635]	[-0.49565]	[0.34082]	[-0.62016]	[-0.13913]	[0.33302]	[-2.70105]
KOV(-2)	-2922.295	0.548059	0.198450	-220.1668	0.421121	0.196992	-3621.655	0.245106	2.851031

	[-2.53560*]	[3.02319]	[0.81467]	**[-2.25105*]**	[1.51467]	[0.71195]	[-1.92772]	[0.33096]	[2.70361]
KC(-1)	496.1865	0.381534	0.255147	-21.50725	0.491053	0.045081	570.8429	0.051508	2.430348
	[0.40423]	[1.97604]	[0.98344]	[-0.20646]	[1.65831]	[0.15297]	[0.28528]	[0.06530]	[2.16389]
KC(-2)	2260.182	-0.365256	-0.064196	34.50991	0.026635	-0.481973	-1268.886	0.004291	-0.590538
	[1.46823]	[-1.50844]	[-0.19730]	[0.26416]	[0.07172]	[-1.30411]	[-0.50565]	[0.00434]	[-0.41926]
SOR(-1)	-0.085014	5.42E-05	1.56E-05	-0.005266	-1.45E-05	-3.75E-05	0.720075	-0.000196	-0.000138
	[-0.41006]	[1.66354]	[0.35541]	[-0.29931]	[-0.29037]	[-0.75324]	**[2.13068*]**	[-1.47043]	[-0.72558]
SOR(-2)	0.031744	-4.24E-05	-1.44E-05	0.003919	8.27E-05	7.50E-05	-0.171373	0.000202	-5.99E-05
	[0.15631]	[-1.32595]	[-0.33614]	[0.22739]	[1.68833]	[1.53927]	[-0.51767]	[1.54455]	[-0.32245]
SOV(-1)	308.9608	0.138366	0.068756	20.75160	-0.044879	-0.126588	213.2674	0.460794	-0.213021
	[0.74401]	[2.11829]	[0.78335]	[0.58885]	[-0.44800]	[-1.26972]	[0.31505]	[1.72683]	[-0.56064]
SOV(-2)	398.7078	-0.168833	-0.234683	-41.00281	-0.077784	0.008172	-731.1830	-0.305018	-0.859720
	[0.71522]	[-1.92541]	[-1.99177]	[-0.86671]	[-0.57840]	[0.06106]	[-0.80462]	[-0.85149]	[-1.68549]
SC(-1)	-234.5558	0.020519	-0.019952	-24.89777	0.041309	0.038987	-0.890549	0.023348	-0.124476
	[-0.82794]	[0.46046]	[-0.33321]	[-1.03559]	[0.60443]	[0.57321]	[-0.00193]	[0.12825]	[-0.48020]
SC(-2)	-77.69783	-0.039219	-0.015534	-6.708485	-0.008062	0.029875	-169.1962	-0.024159	-0.256539
	[-0.35371]	[-1.13505]	[-0.33457]	[-0.35986]	[-0.15214]	[0.56648]	[-0.47250]	[-0.17115]	[-1.27636]
C	926.2575	-0.147609	-0.120899	134.9592	0.325427	0.087284	-11.09307	-0.239021	-0.522269
	[1.65002]	[-1.67167]	[-1.01895]	**[2.83293*]**	[2.40307]	[0.64764]	[-0.01212]	[-0.66261]	[-1.01680]
R-squared	**0.995436**	0.976793	0.714641	**0.986867**	0.979449	0.632436	**0.994139**	0.955316	0.682759
Adj. R-squared	**0.989117**	0.944660	0.319529	**0.968682**	0.950994	0.123501	**0.986023**	0.893447	0.243502
F-statistic	**157.5206**	30.39873	1.808706	**54.26914**	34.42118	1.242665	**122.4989**	15.44079	1.554349
Log likelihood	**-138.2231**	142.0131	132.5590	**-59.28845**	128.3283	128.4820	**-153.8600**	96.97725	85.66825
Akaike AIC	**9.826441**	-7.688318	-7.097439	**4.893028**	-6.833018	-6.842626	**10.80375**	-4.873578	-4.166766
Schwarz SC	**10.69672**	-6.818037	-6.227158	**5.763309**	-5.962737	-5.972345	**11.67403**	-4.003297	-3.296485
Mean dependent	**559.4197**	0.071111	0.006690	**128.1072**	0.131260	0.003512	**568.3424**	0.085167	0.010458
S.D. dependent	**273.4676**	0.019076	0.007310	**13.68088**	0.031089	0.007316	**393.3741**	0.056161	0.030012

<u>Table 4. VAR Model Estimation Results For Office CV, Initial Yield & Completions – Hong Kong, Kuala Lumpur & Singapore</u>

We report the results of the office capital value VAR model estimation for Singapore, Kuala Lumpur and Hong Kong, in particular the SOCV model, the KOCV model and the HOCV model, for which the estimated coefficients and t-statistics for the right-hand-side (endogenous) variables are presented in the models' respective columns. Data is obtained from JLL REIS-Asia from 4Q 1987 to Q2 2009. *Denotes statistical significance at the 0.10 level. Source: Authors, 2011; Eviews Version 6.

Vector Auto Regression Estimates

T-statistics in [ ].

	HOCV	HOY	HC	**KOCV**	KOY	KC	**SOCV**	SOY	SC
HOCV(-1)	1.567692	5.25E-07	-4.61E-06	0.013550	-7.82E-08	-7.86E-06	-0.109189	6.93E-06	-7.23E-06
	[3.44238*]	[0.36305]	[-0.94159]	[0.36557]	[-0.09082]	[-1.47823]	[-0.15327]	[3.79786]	[-0.27645]
HOCV(-2)	-0.582477	1.14E-07	2.29E-06	-0.006569	6.33E-07	9.27E-06	0.190317	-7.46E-06	9.25E-06
	[-1.14035]	[0.07019]	[0.41632]	[-0.15800]	[0.65541]	[1.55314]	[0.23819]	[-3.64293]	[0.31516]
HOY(-1)	64249.10	0.345664	-0.257084	-1417.884	-0.272710	-1.550813	-245269.0	1.599156	-0.453840
	[0.49701]	[0.84174]	[-0.18500]	[-0.13476]	[-1.11595]	[-1.02685]	[-1.21290]	[3.08713]	[-0.06110]
HOY(-2)	24571.78	0.055610	-0.325411	3993.116	0.248615	0.976996	193155.1	-0.840012	3.317578
	[0.25421]	[0.18110]	[-0.31317]	[0.50756]	[1.36058]	[0.86515]	[1.27744]	[-2.16871]	[0.59729]
HC(-1)	21470.06	-0.029940	-0.819280	1819.494	0.029530	-0.078612	61552.52	-0.182533	0.901261
	[0.83533]	[-0.36670]	[-2.96517]	[0.86977]	[0.60776]	[-0.26179]	[1.53093]	[-1.77228]	[0.61023]
HC(-2)	37.78525	-0.004288	-0.317481	-1024.317	0.010356	0.082298	-27770.53	-0.034913	1.665199
	[0.00157]	[-0.05612]	[-1.22788]	[-0.52325]	[0.22776]	[0.29287]	[-0.73810]	[-0.36224]	[1.20483]
KOCV(-1)	1.303262	1.67E-05	1.62E-05	1.120228	-1.08E-05	2.87E-05	16.31839	-2.21E-05	2.25E-05
	[0.28265]	[1.14000]	[0.32772]	[**2.98506*]**	[-1.23879]	[0.53201]	[**2.26245***]	[-1.19354]	[0.08480]
KOCV(-2)	1.636635	-1.80E-05	5.98E-05	-0.223546	-2.63E-06	-5.87E-05	1.632292	2.78E-06	0.000432
	[0.30320]	[-1.05100]	[1.03087]	[-0.50883]	[-0.25736]	[-0.93011]	[0.19331]	[0.12870]	[1.39211]
KOY(-1)	25120.78	0.199952	-1.317103	17048.60	0.479747	3.647500	546361.3	-0.703957	9.633797
	[0.13526]	[0.33891]	[-0.65969]	[1.12784]	[1.36643]	[1.68102]	[1.88059]	[-0.94589]	[0.90270]
KOY(-2)	204448.4	-0.699451	2.950096	-12647.86	-0.352956	-2.909041	7015.963	-0.452531	6.617422

	[1.19887]	[-1.29113]	[1.60922]	[-0.91124]	[-1.09485]	[-1.46010]	[0.02630]	[-0.66222]	[0.67529]
KC(-1)	48722.15	-0.046561	-0.118128	280.0132	0.017075	-0.672234	-26363.86	0.346566	-0.453174
	[1.49940]	[-0.45106]	[-0.33817]	[0.10588]	[0.27798]	[-1.77075]	[-0.51866]	[2.66159]	[-0.24270]
KC(-2)	9985.405	0.011416	0.207864	-559.4800	0.048803	-0.315445	-27104.88	0.011161	0.415745
	[0.36804]	[0.13245]	[0.71269]	[-0.25336]	[0.95153]	[-0.99517]	[-0.63864]	[0.10266]	[0.26667]
SOCV(-1)	0.178084	6.30E-09	3.09E-06	0.009884	2.97E-07	6.92E-07	1.315008	-5.40E-07	-5.66E-07
	[0.99429]	[0.01108]	[1.60551]	[0.67801]	[0.87616]	[0.33086]	[**4.69352***]	[-0.75244]	[-0.05495]
SOCV(-2)	-0.198226	-4.48E-07	-1.63E-06	-0.014689	-3.09E-07	1.44E-06	-0.872826	7.81E-07	-1.44E-05
	[-1.18277]	[-0.84189]	[-0.90676]	[-1.07683]	[-0.97642]	[0.73572]	**[-3.32927***]	[1.16250]	[-1.50013]
SOY(-1)	-228037.3	0.632370	0.386456	-2225.889	0.027546	-0.164885	25437.83	0.510703	1.804825
	[-4.56664*]	[3.98647]	[0.71992]	[-0.54767]	[0.29181]	[-0.28263]	[0.32565]	[2.55226]	[0.62898]
SOY(-2)	42679.66	0.007061	-1.385546	2932.388	-0.009884	-1.033154	-47862.69	0.487470	-6.247507
	[0.42312]	[0.02204]	[-1.27776]	[0.35718]	[-0.05183]	[-0.87670]	[-0.30333]	[1.20601]	[-1.07785]
SC(-1)	-496.0296	-0.018204	-0.025605	-439.7358	0.000363	-0.030664	-11913.91	0.041368	-0.533844
	[-0.09790]	[-1.13108]	[-0.47013]	[-1.06639]	[0.03795]	[-0.51804]	[-1.50325]	[2.03761]	[-1.83368]
SC(-2)	2060.452	-0.016915	-0.018725	30.66328	-0.004731	-0.030974	-4736.956	0.012628	-0.546727
	[0.38633]	[-0.99837]	[-0.32660]	[0.07064]	[-0.46928]	[-0.49709]	[-0.56777]	[0.59087]	[-1.78392]
C	-16926.23	0.032583	-0.147748	-341.2245	0.082292	0.051477	-63616.96	0.087658	-1.760267
	[-0.78100]	[0.47327]	[-0.63417]	[-0.19345]	[2.00861]	[0.20331]	[-1.87650]	[1.00937]	[-1.41347]
R-squared	**0.992326**	0.971591	0.675247	**0.972476**	0.801275	0.617068	**0.989682**	0.951585	0.449533
Adj. R-squared	**0.981699**	0.932255	0.225589	**0.934366**	0.526116	0.086853	**0.975396**	0.884548	-0.312652
F-statistic	**93.38489**	24.69983	1.501691	**25.51750**	2.912050	1.163808	**69.27418**	14.19499	0.589795
Log likelihood	**-235.6094**	169.5002	130.4899	**-155.3374**	186.1096	127.8266	**-249.9272**	162.0684	76.85057
Akaike AIC	**15.91309**	-9.406260	-6.968121	**10.89609**	-10.44435	-6.801665	**16.80795**	-8.941776	-3.615661
Schwarz SC	**16.78337**	-8.535980	-6.097840	**11.76637**	-9.574069	-5.931385	**17.67823**	-8.071495	-2.745380
Mean dependent	**11849.48**	0.045509	0.006690	**1690.728**	0.075830	0.003512	**10597.81**	0.050669	0.010458
S.D. dependent	**4423.373**	0.007303	0.007310	**190.1051**	0.001643	0.007316	**5967.571**	0.007057	0.030012

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