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FORECASTING REAL ESTATE BUSINESS: EMPIRICAL EVIDENCE FROM THE CANADIAN MARKET

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ABSTRACT

In this paper, we compare the out-of-sample forecasting ability of three ARIMA family models: ARIMA, ARIMAX, and ARIMAX-GARCH. The models are tested to forecast turning points and trends in the Canadian real estate index using monthly data from April 2002 to March 2011. The results indicate that the ARIMAX model, which includes exogenous macroeconomic variables such as the gross domestic product, the consumer price index, the difference in long-term and short-term interest rates, and the exchange rate of the Canadian dollar against the US dollar and their lags, provides the best out-of-sample forecasts. Overall, the models are suitable only for short-term forecasts.

JEL: R3, G01, O51, C53

KEYWORDS: Real Estate, Financial Crisis, Canada, ARIMAX, GARCH

INTRODUCTION

Since the 2008 financial crisis, the world markets have gone through much uncertainty, and even after four years of crisis, the markets are unstable. The crisis led many economists to probe the nature and causes: low interest rates, high interest rates, mortgage-backed securities, asset-backed securities, credit default swaps, bad regulations, cheating, etc. However, the real estate market played a central role, bringing real estate issues before policymakers. The real estate industry is unique in terms of its contribution to a country's gross domestic product (GDP) and the overall impact on economy. At the same time, the real estate market is inefficient and illiquid, and faces regular intervention by governments across the world. Hence, the movement of the real estate business becomes a key ingredient in planning for the layperson, investors, and policymakers.

Although much research is available for the US market, research on the Canadian real estate market is unavailable. Though the Canadian market is very similar to the US market in most cases, the Canadian real estate market has several different features. The Canadian real estate market was not hurt by the financial crisis compared to the US real estate market, which is still struggling to recover. In contrast, the Canadian real estate market has increased since the beginning of 2009. In terms of broader differences, the average Canadian saw his or her income grow, and the Canadian banking structure imposes uniform and stable interest rates. These factors suggest that other factors played a role in the real estate market. This study tests a simple and widely available model to assist the common forecaster. In particular, the study uses the time series auto regressive integrated moving average (ARIMA), and then uses the auto regressive integrated moving average with exogenous variables (ARIMAX) and the auto regressive integrated moving average with exogenous variables including generalized auto regressive conditional heteroskedastic (ARIMAX-GARCH) models to test their forecasting capability.

To understand the nature of the Canadian real estate market, this study uses a times series model with a macroeconomic variable in line with other studies such as those Brooks and Tsolocas (1999), De Wit and Van Dijk (2003), and Karakozova (2004), who found the effect of the macroeconomic variable on real estate. This paper contributes significantly to the existing real estate literature by adding knowledge of

Canadian real estate and its connection with macroeconomic variables and presenting a simple tool for forecasters.

Researchers have applied various models to explain the real estate market, from simple linear regression to advanced models such as the Vector Error Correction model (VECM), the Kalman filter, and so on. However, in the end simple models were found efficient compared to more complex models (Wilson, Ellis, Okunew and Higgins, 2000, Crawford and Fratantoni, 2003, Stevenson and Young, 2007). Thus, this paper focuses on the performance of univariate models. Moreover, the purpose of this study is to provide a simple tool to forecasters.

This study finds that it is very difficult to do precise long-term forecasting for the Canadian real estate index using the ARIMA family models, but these models worked very well in short-term forecasting. Specifically, out of the three models tested, the ARIMA, ARIMAX and ARIMAX-GARCH models, the ARIMAX model works best in all circumstances by giving minimum mean absolute percentage error. Other models work best in one circumstance but fail drastically in other circumstances. The performance of the ARIMAX model also demonstrates that macroeconomic variables have high information content in terms of future development in the real estate market.

The remainder of the paper is organized as follows: In the second section, we present our literature review, in the third section we present our data and methodology, in the fourth section we present our results and discussion, and in the fifth section we present our concluding comments.

LITERATURE REVIEW

In the context of this study, the literature related to real estate forecasting involving univariate models is reviewed.

Mei and Liu (1994) used rolling regressions for out-of-sample excess return forecasts for 10 years. These authors used the predictions of the models estimated for alternative real estate stock return series to construct active and passive buy and hold portfolios. Their analysis showed that active portfolios with a long and short trading strategy would have returned US\$238.20 for homebuilder stocks over and above a passive strategy.

Tse (1997) employed ARIMA models in forecasting real-estate prices in Hong Kong. The price index used in this study was simply compiled by calculating a weighted average of the index for a property class or grade. To avoid the effect of government intervention, the study uses only Hong Kong office and industrial properties in its calculations. Quarterly data for the period 1980 Q1 to 1995 Q2 is used. The study finds that for office and industrial property, the ARIMA (2,1,1) model is appropriate for forecasting. This model was able to predict trends and turning points in the data.

Brooks and Tsolacos (2000) investigated UK retail rents using LaSalle Investment Management series and CB Hiller Parker series. These authors used four models, an auto regressive (AR) model, a long-term-mean model, a random-walk model, and a Vector Autoregressive (VAR) model. They find the AR(2) model fits best in estimation and when an ex-post forecast is produced up to eight quarters ahead; the AR(2) model outperforms all other models.

Wilson *et al.* (2000) studied the securitized real estate indices of the US, the UK, and Australia. These authors applied an exponential smoothing model, an ARIMA model, and spectral techniques for forecasting. They find that the exponential smoothing model works better than other models when a stable trend is present. Both the ARIMA and spectral regression modeling processes are capable of forecasting turning points only when data has historical causal factors that are potentially repeatable.

Fullerton, Laaksonen, and West (2000, 2001) examine housing supply in Florida using single-family and multi-family data, respectively. These papers compared the forecast accuracy of structural equation models, ARIMA, and random walk models. In both studies, the random walk model outperforms other models.

Clapp and Giaccotto (2002) use an autoregressive process to model the city-wide house price index of Dade County, Florida. They proposed a battery of tests to compare prediction errors for one-quarter ahead forecasts for individual properties. They compared their forecasts with two forecasting models, hedonic and repeat sales. Overall, they found that the hedonic model is more efficient than the repeat sales model.

Stevenson and McGarth (2003) study the London office market by employing ordinary least square (OLS), auto regressive integrated moving average (ARIMA), and Bayesian Vector Autoregressive (BVAR) models, and a simultaneous equation model. They used CB Hillier Parker London Office index data over the period 1977–1996. Their emphasis was to compare the model for their long-term forecast. Hence, they generated three-year forecasts from their models for comparison. They found that BVAR provides the best forecasts, while the ARIMA model generated the worst forecasts. The ARIMA model fails to capture a large upswing after mid-1997. The authors argue that the main reason behind the failure of the ARIMA model is that the final model selected in the study is a pure AR(1) model with no moving average (MA) terms.

Crawford and Fratantoni (2003) use ARIMA, GARCH, and regime switching univariate models to forecast the real estate market in various parts of the US. They used state-level repeat transactions data for California, Florida, Massachusetts, Ohio, and Texas. Annualized growth rates at a quarterly frequency are computed from each of these indices from 1979:1 to 2001:4. The study found that ARIMA models are generally more suitable for out-of-sample forecasting and point forecasts.

Studying the Helsinki office market, Karakozova (2004) finds that the ARIMAX model forecasts better than the regression and error correction models. This study compared out-of-sample forecasts from 2002 to 2005. In the case of the ARIMAX model, the author finds that past values of capital growth, growth in service sector employment, and growth in the gross domestic product are relevant in explaining the variation in office market returns in the Helsinki area.

Guirguis, Giannikos and Anderson (2005) studied the US housing market using quarterly data from 1975:01 to 1998:02 by using real house prices and various other macroeconomic indicators. The key attraction of this paper is that it used six different estimation techniques, the vector error correction model (VECM), the auto regressive (AR) model, the generalized auto regressive conditional heteroskedastic (GARCH) model, the Kalman filter with a random walk, the Kalman filter with an AR model, and exponential smoothing, in which estimated parameters are allowed to vary over time. The authors claimed that the Kalman filter with the AR model and the GARCH model provides the best out-of-sample forecasts.

Stevenson and Young (2007) applied the OLS, ARIMA, and VAR models to forecasting housing supply in the Irish market, using quarterly data from 1978 through 2003. They found that the ARIMA model has better forecasting ability over others for the period 1998–2001, because the Irish market had a sustained housing boom beginning in the mid-1990s that ignored the fundamentals. In the absence of fundamentals, ARIMA models perform well in predicting trends.

Gupta and Das (2010) used a Bayesian approach in predicting downturns in the US housing market in the period 2007:Q1–2008:Q1. Their result shows that the BVAR model, in any form, spatial and non-spatial

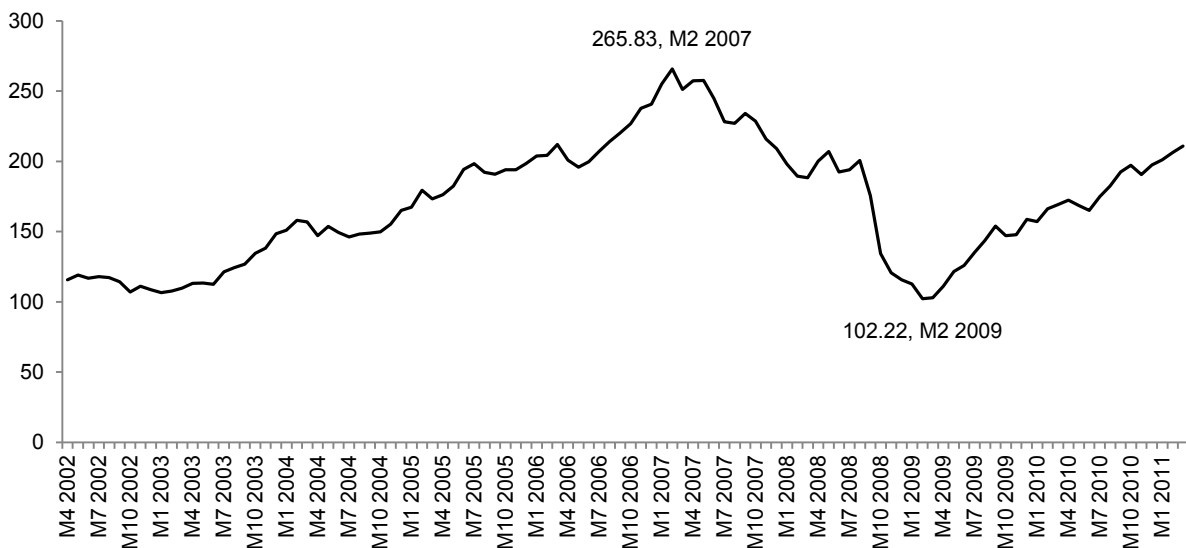
(univariate and multivariate), is the best-performing model as well as doing a fair job in predicting the downturn against unrestricted the classical VAR model.

DATA AND METHODOLOGY

This study uses monthly data from the S&P/TSX Capped Real Estate Index as a proxy for the real estate market in Canada (REI) and macroeconomic variables such as the GDP, inflation, long-term and short-term Treasury bond rates, and the exchange rate of the Canadian dollar against the US dollar. The real estate index was obtained from the Yahoo Canada website, and the macroeconomic variables were obtained from the Statistics Canada website. Due to the availability of data, this study restricts the sample of study from April 2002 to March 2011.

Figure 1 shows that the Canadian real estate sector grew rapidly until February 2007, with the index going as high as 265.83. In April 2002, the index was only 115.73; this is almost 130% growth. After the market crash in February 2007, the real estate market kept sliding downward until February 2009 when the market turned up again.

Figure 1: S&P/TSX Capped Real Estate Index



This figure shows S&P/TSX Capped Real Estate Index (REI) from April 2002 to March 2011.

The choice of the macroeconomic variable in this study is guided by previous studies in a related area. The GDP is used as a determinant based on the Chen, Roll, and Ross (1986) and Karolyi and Sanders (1998) studies that find stock prices and industrial production have explanatory power for each other. Gardiner and Henneberry (1988, 1991) used the GDP in their rent forecasting models. Higher inflation leads to decreased demand for housing according to Feldstein (1992) and Kearl (1979). However, Quan and Titman (1999) argue that inflation may increase demand for housing because housing is seen as a hedge against the inflation. The consumer price index (CPI) is used as the variable for inflation.

The financial literature suggests that the difference between long-term and short-term interest rates has predictive power about the state of economy (Fama and French, 1992, Stock and Watson, 1989). The higher the difference, the higher the premium for holding assets, which leads to increased demand for real assets. The difference in the long-term government bond (10 years) and the short-term interest rate

(three-month T-bill) is termed SPREAD. Ajayi and Mougoue (1996) and Granger, Huang and Yang (2000) find that the exchange rate and stock prices influence each other. Thus, this study uses the CAD/US exchange rate as another determinant in the model.

To understand the nature of the Canadian real estate market and its connection with major macroeconomic variable and provide valuable forecasts, this study follows Brooks and Tsolacos (1999), De Wit and Van Dijk (2003), Karakozova (2004), Crawford and Fratantoni (2003), Stevenson and Young (2007) and employs the auto regressive integrated moving average (ARIMA), the auto regressive integrated moving average with exogenous variables (ARIMAX), and the auto regressive integrated moving average with exogenous variables including generalized auto regressive conditional heteroskedastic (ARIMAX-GARCH) models. The ARIMA models have constant mean and constant variance while the ARIMAX model includes exogenous variables to explain the data-generating process. The ARIMAX-GARCH model has all the features of the ARIMAX model plus time-varying variance.

A general ARIMA (p,d,q) model can be represented as:

$$Z_t = \varphi_0 + \sum_{i=1}^p \varphi_i Z_{t-i} + \sum_{i=1}^q \beta_i \varepsilon_{t-i} \tag{1}$$

Where Z_t is a variable of interest, p denotes the order of auto regression, q denotes the order of moving average, and d denotes the order of integration. Where ε_t follows $[\sim N(0, h_t)]$.

A general ARIMAX(p,d,q) model can be represented

$$Z_t = \varphi_0 + \sum_{i=1}^p \varphi_i Z_{t-i} + \sum_{i=1}^k \gamma_i X_{t-i} + \sum_{i=1}^q \beta_i \varepsilon_{t-i} \tag{2}$$

Where Z_t is a variable of interest, p denotes the order of auto regression, q denotes the order of moving average, d denotes the order of integration, and X_t is a vector of exogenous variables with k lags. Where ε_t follows $[\sim N(0, h_t)]$.

Bollerslev (1986) developed the generalized auto regressive conditional heteroskedastic – GARCH (p,q) model that allows the conditional variance to be modeled as an ARMA process. Thus, in our paper we extend our ARIMAX model from equation (2) to model its conditional variance as the GARCH(p,q) process. Thus, our model (ARIMAX-GARCH) can be re-written as:

$$Z_t = \varphi_0 + \sum_{i=1}^p \varphi_i Z_{t-i} + \sum_{i=1}^k \gamma_i X_{t-i} + \sum_{i=1}^q \beta_i \varepsilon_{t-i} \text{ where error process be } \varepsilon_t = v_t \sqrt{h_t}$$

$$\text{Where } v_t = \text{white-noise process such that } \sigma_v^2 = 1 \text{ and } h_t = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^p \gamma_i h_{t-i} \tag{3}$$

where ε_t is shock $[\sim N(0, h_t)]$, α s are the ARCH coefficients with q lags, and γ s are the GARCH coefficients with p lags. A non-negativity constraint is imposed on α s and γ s during estimation.

The estimation process of all three models requires that the series used in the model are stationary. Hence, the log level series is tested for stationarity; if required, the log difference of series is used to make the

process stationary. The Dickey fuller test (Dickey and Fuller, 1979) and the augmented Dickey fuller (ADF) test are used to check for the stationary process. The Dickey fuller test can be represented as

$$\Delta Z_t = a_0 + \psi Z_t + \varepsilon_t, \text{ and the ADF test can be represented as } \Delta Z_t = a_0 + \psi Z_t + \sum_{i=1}^p \alpha_i \Delta y_{t-i} + \varepsilon_t. \text{ The}$$

ADF test helps in determining the unit root process beyond AR(1). After each series is made stationary, an ARIMA model is built based on Box-Jenkins (1976) three-step process of identification, estimation and diagnostic checking. First, the autocorrelation function (ACF) and the partial autocorrelation function (PACF) are examined to decide the order of the AR and MA process. Further, based on minimization of Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC), the AR and MA terms are decided in the model. These criteria may give different results; in such cases, the model with the smallest standard error and the Ljung-Box Q (Ljung and Box, 1978) value is estimated. After the model is estimated, its residuals are examined again to test for leftover auto correlation using the ACF and the PACF.

The ARIMAX model is built on the ARIMA model. After the order of the AR and MA terms is chosen, exogenous variables are introduced in the model. The AR and MA terms chosen for the ARIMA model from the previous exercise may not be suitable with the introduction of (X) exogenous variables. Hence, various combinations of AR and MA terms are tested with the lags of the exogenous variable, and the one with the smallest standard error and Ljung-Box Q statistics is chosen for the ARIMAX estimation.

The GARCH process is fitted using equation (3) on the errors generated by the ARIMAX model from the previous exercise that created the ARIMAX-GARCH process. To keep the model parsimonious, only GARCH(1,1) is estimated in this study.

Since the basic aim of this study is to provide a model that is simple to estimate and efficient in forecasting, more emphasis is on forecasting of these models in different circumstances, and much of the paper is devoted to the forecasting abilities of the model. As suggested by Crawford and Fratantoni (2003), models can fit well compared to others but can be still poor forecasters.

To test the forecast accuracy of the models, we estimated them for a certain period and then subsequently made them forecast for a certain period. While deciding about the estimation period and the forecasting period, the models were forced to test key features about the index, such as in-sample forecast performance, out-of-sample forecast performance, downward trend in the series, upward trend in the series, downward turning point in the forecasting period, and upward turning point in the forecasting period.

For each set of estimation and forecasting periods, two kinds of forecasts were generated: dynamic and static forecasts. Dynamic forecasting feeds forward forecasts of the early periods to forecast the next period. A static forecast computes the forecast as a series of one-step-ahead forecasts using only actual values for lagged dependent variable terms. Forecasts from different models are compared based on three forecast error statistics, Root Mean Squared Error, Mean Absolute Error, and Mean Absolute Percentage

Error. These can be represented as Root Mean Squared Error: $\sqrt{\sum_{t=T+1}^{T+h} (\hat{Z}_t - Z_t)^2 / h}$, Mean Absolute Error: $\sum_{t=T+1}^{T+h} |\hat{Z}_t - Z_t| / h$, and Mean Absolute Percentage Error: $100 \sum_{t=T+1}^{T+h} \left| \frac{\hat{Z}_t - Z_t}{Z_t} \right| / h$ where the forecast

sample is $j = T+1, T+2, \dots, T+h$, and Z_t and \hat{Z}_t denote the actual and forecasted value in period t , respectively.

RESULTS

As described in the Methodology section, the process starts with testing for unit root process in each series used, the Canadian real estate index (REI), the gross domestic product (GDP), the consumer price index (CPI), the difference in the long-term and short-term interest rates (SPREAD), and the exchange rate of the Canadian dollar against the US dollar (CAD/US). After log transformation, each variable is tested for stationarity using the DF and ADF tests. All are non-stationary. In the next step, the log difference of each variable is tested for stationarity, and the results indicate that all the variables become stationary after the first difference. Thus, the order of integration becomes one ($d=1$) for all the models used in this study. As a result, the log difference of the Canadian real estate index (RREI), the log difference of the gross domestic product (RGDP), the log difference of the consumer price index (RCPI), the log difference of the difference in the long-term and short-term interest rates (RSPREAD), and the log difference of the exchange rate of the Canadian dollar against the US dollar are used in all the models (RCAD/US).

The summary statistics of the full sample are reported in Table 1. It shows that over the entire sample the Canadian real estate index had an average return of approximately 0.6% with a standard deviation of 5%. The exchange rate of the CAD/US saw an average growth rate of -0.5%, which is due to the appreciation of the Canadian dollar against the US dollar. The average difference between long-term government and short-term bonds was negative. In addition, for the entire sample low inflation and low GDP growth are observed. Following Box-Jenkins (1976), ACF and PACF diagrams are used to decide the order of the AR and MA; the AIC picks the ARIMA(1,1,1) model, and the SBC picks the ARIMA(5,1,1) model. After these models were estimated using eq. (1), standard errors and Ljung-Box Q statistics were found to be smallest for the ARIMA (5,1,1) model. After the described diagnostic check for the model was conducted, the ARIMA (5,1,1) model was chosen for forecasting.

Table 1: Summary Statistics

	RREI	RCAD/US	RCPI	RSPREAD	RGDP
Mean	0.006	-0.005	0.002	-0.208	0.002
Std. Dev.	0.050	0.022	0.002	1.035	0.004
Observations	107	107	107	107	107

This table shows the summary statistics of the variables in the sample used for the study from April 2002 to March 2011. RREI is the log difference of the S&P/TSX Capped Real Estate Index. RCAD/US is the log difference of the exchange rate of the Canadian dollar against the US dollar. RCPI is the log difference of the consumer price index. RSPREAD is the log difference of the difference in long-term (10 years) and short-term interest rate (3 month) government bonds. RGDP is the log difference of the gross domestic product. Monthly data is used for all variables.

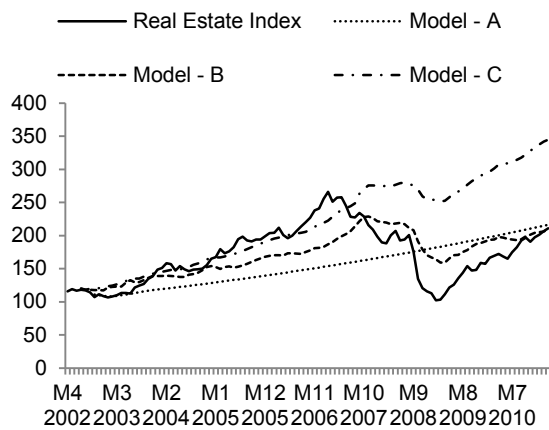
However, based on the smallest standard errors, AIC, and SBC criteria, the ARIMAX model, which was found suitable, was with AR(1) and MA(1) with RREI as the dependent variable and RGDP, RCPI, RSPREAD, RCAD/US, RGDP(-1), RCPI(-1), RSPREAD(-1), and RCAD/US (-1) as the exogenous variables, where (-1) stands for the lag of a variable. Equation (2) is used to estimate this for various time periods and forecasting. Further, the residuals from this model are fitted into the GARCH (1,1) process as described in eq. (3), which will be the ARIMAX-GARCH model for this study.

As suggested by Crawford and Fratantoni (2003), models can fit well over other but can be still poor forecasters. The forecasting results are presented in Figure 2 and Table 2, where * denotes the best model among that category. The first set of results is based on the estimation of models for the period M4 2002 to M3 2011, and forecasting is done for period M4 2002 to M3 2011. It is in-sample forecasting for the whole data set. In the next set, the models are estimated from M4 2002 to M3 2007 with the forecasting period from M3 2007 to M8 2007. It has a downward trend beginning from M2 2007. The third set of the result estimates the model from M4 2002 to M7 2007, which covers four extra months from the

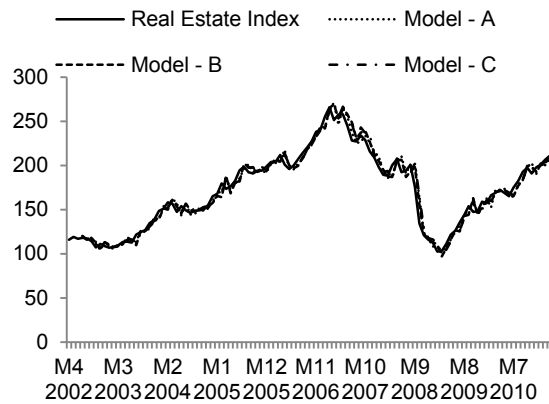
downward turning point of M2 2007 to give more information for data learning to the models used for forecasting from M7 2007 to M12 2007. The fourth set of estimation is done on the period M4 2002 to M1 2007, which is just before the downward turning point of M2 2007, and the forecast is produced for M1 2007 to M1 2008, which covers the turning point. The fifth set of results is from the estimation period of M4 2002 to M12 2008, which is just before the upward turning point of M2 2009 in the index, and the forecast is produced for the period of M12 2008 to M8 2009, which has an upward turning point and upward rally then onwards. The sixth set has an estimation period from M4 2002 to M10 2009, which has eight more observations from the upward turning point of M2 2009. The final set of the results has M4 2002 to M6 2010 as the estimation period, which covers one upward trend, one downward trend and two turning points in the series.

Overall, the results indicate that none of the models have good dynamic forecasts; they missed trends as well as turning points. However, the static forecasts have significantly better forecasts with very low MAPE. Thus, for practical purposes it is not wise to rely on dynamic forecasts. Another trend in the results indicates that including macroeconomic factors definitely improves the performance of the forecasts, except for the results for Set II. In all other cases, ARIMAX(1,1,1) or ARIMAX-GARCH(1,1) significantly improves the performance of forecasts over the ARIMA(5,1,1) model.

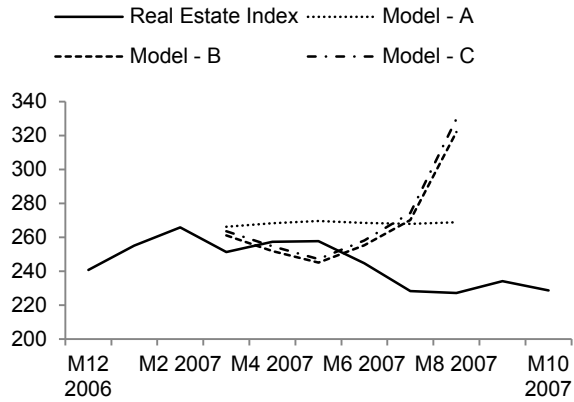
Figure 2: Dynamic and Static Forecasts



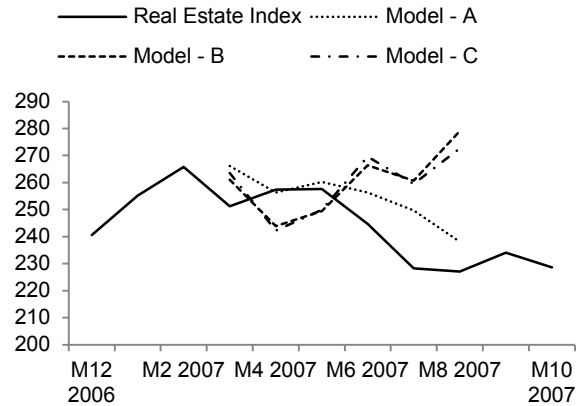
Set I - Model Estimation M4 2002 - M3 2011,
Dynamic Forecast M4 2002 - M3 2011



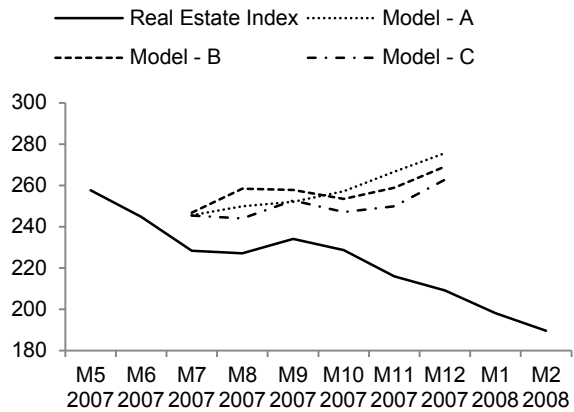
Set I - Model Estimation M4 2002 - M3 2011,
Static Forecast M4 2002 - M3 2011



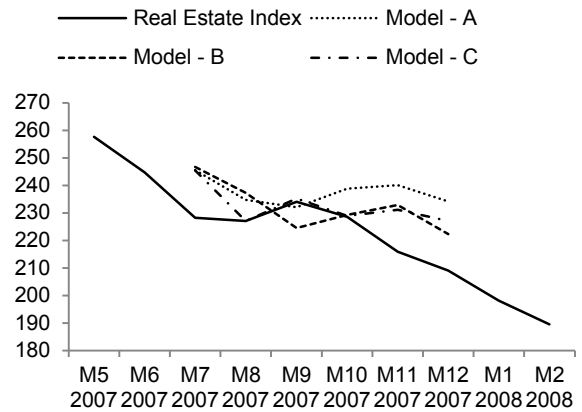
Set II - Model Estimation M4 2002 - M3 2007,
Dynamic Forecast M3 2007 - M8 2007



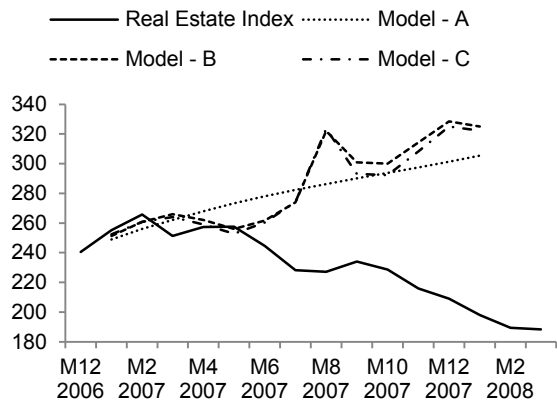
Set II - Model Estimation M4 2002 - M3 2007,
Static Forecast M3 2007 - M8 2007



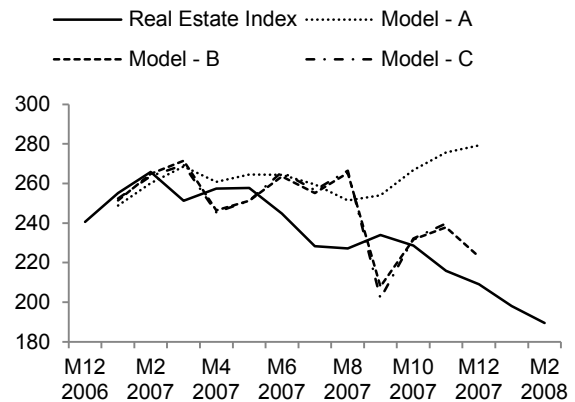
Set III - Model Estimation M4 2002 - M7 2007,
Dynamic Forecast M7 2007 - M12 2007



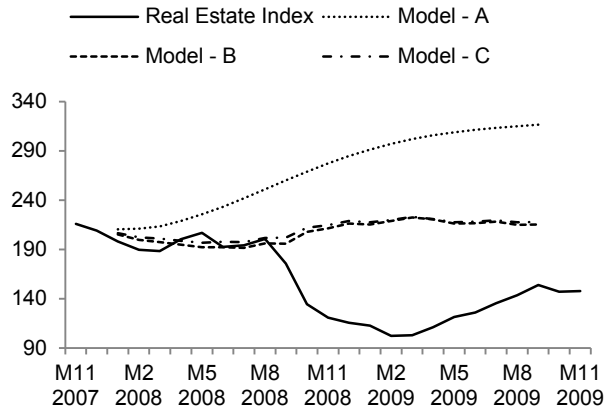
Set III - Model Estimation M4 2002 - M7 2007,
Static Forecast M7 2007 - M12 2007



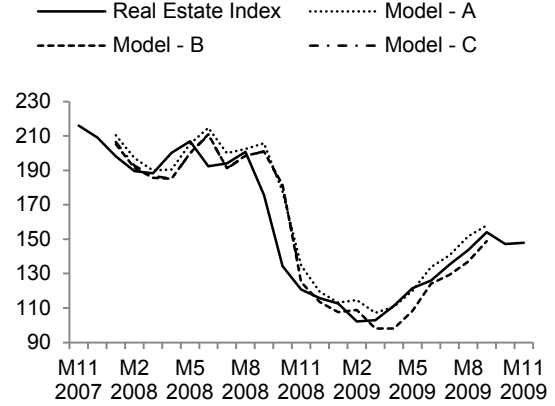
Set IV - Model Estimation M4 2002 - M1 2007,
Dynamic Forecast M1 2007 - M1 2008



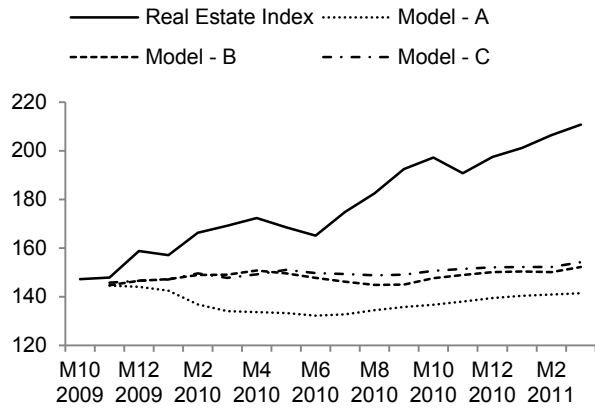
Set IV - Model Estimation M4 2002 - M1 2007,
Static Forecast M1 2007 - M1 2008



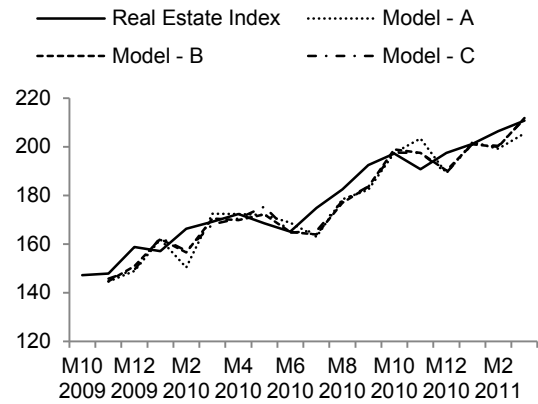
Set V - Model Estimation M4 2002 - M12 2008,
Dynamic Forecast M12 2008 - M8 2009



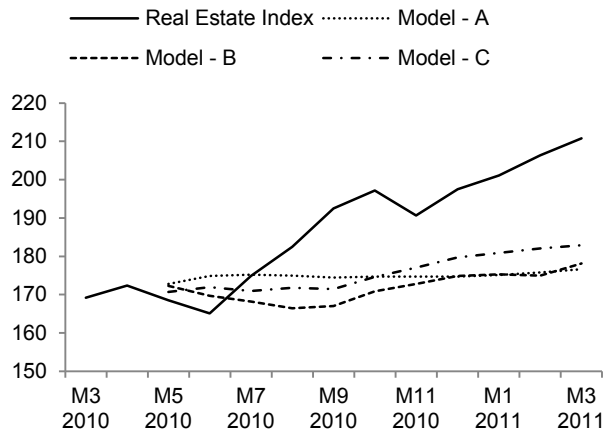
Set V - Model Estimation M4 2002 - M12 2008,
Static Forecast M12 2008 - M8 2009



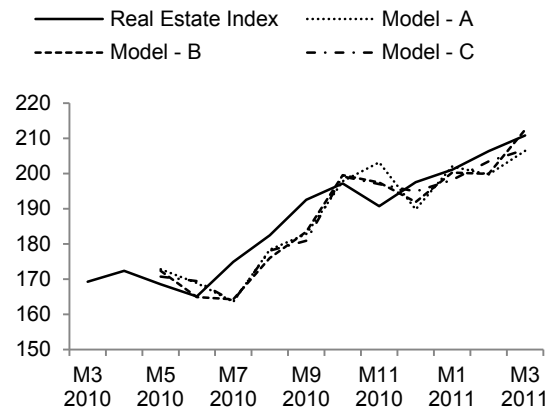
Set VI - Model Estimation M4 2002 - M10 2009,
Dynamic Forecast M10 2009 - M3 2011



Set VI - Model Estimation M4 2002 - M10 2009,
Static Forecast M10 2009 - M3 2011



Set VII - Model Estimation M4 2002 - M6 2010,
Dynamic Forecast M6 2010 - M3 2011



Set VII - Model Estimation M4 2002 - M6 2010,
Static Forecast M6 2010 - M3 2011

These figures are graphical representation of three alternative techniques: Model A: The ARIMA (5,1,1), Model B: The ARIMAX (1,1,1), and Model C: The ARIMAX (1,1,1)-GARCH (1,1) model.

Sets III, VI, and VII are the trend results; i.e., in actual data, the forecast period for Set III is downward trending, and Sets VI and VII are upward trending. In addition, in these cases, the turning point is introduced in the model’s estimation period. An interesting observation for all these cases is that macroeconomic factors as well as conditional volatility play a role. ARIMAX-GARCH (1, 1) performs the best in the three cases on a statistical basis, but the ARIMAX forecasts are also very close.

Sets IV and V test the model for forecasting a turning point without including the turning point date in estimation period. Set IV is for downward crash, and Set V is for an upward rally. Interestingly, the ARIMAX model predicted a downward turning point very well after M2 2007. However, the simple ARIMA model performs better than the ARIMAX model for predicating an upward turning point in set V on a statistical basis, although the difference is less than a percent.

Table 2: Comparison of Forecasting Accuracy of Models

Set	Model Estimation	Forecast Period	Model	Dynamic			Static		
				RMSE	MAE	MAPE	RMSE	MAE	MAPE
I	M4 2002 – M3 2011	M4 2002 – M3 2011	A	49.352	41.601	23.663	7.777	5.819	3.397
			B	31.468*	25.428*	15.192*	7.485*	5.684*	3.355*
			C	77.948	54.526	34.663	7.841	5.764	3.403
II	M4 2002 -M3 2007	M3 2007- M8 2007	A	26.931*	23.796*	10.034*	12.572*	10.443*	4.392*
			B	43.083	29.192	12.556	27.583	22.930	9.713
			C	46.738	31.273	13.480	26.171	22.809	9.616
III	M4 2002-M7 2007	M7 2007 – M12 2007	A	38.662	33.991	15.523	16.716	14.390	6.571
			B	12.783*	9.627	4.465	9.910	7.815	3.596
			C	13.031	8.747*	4.090*	9.823*	7.045*	3.285*
IV	M4 2002 -M1 2007	M1 2007- M1 2008	A	44.912*	36.581*	15.837*	26.667	21.155	9.168
			B	68.648	51.564	23.612	18.646*	15.150*	6.548*
			C	66.09	49.240	22.576	21.190	17.243	7.357
V	M4 2002 -M12 2008	M12 2008- M8 2009	A	136.341	115.675	91.305	14.115	9.435*	6.334*
			B	71.638*	56.524*	46.424*	14.041*	9.486	6.503
			C	73.101	57.994	47.527	17.913	12.475	7.661
VI	M4 2002 -M10 2009	M10 2009-M3 2011	A	46.194	42.235	22.656	7.633	6.170	3.469
			B	36.152	31.716	16.825	5.895*	4.853	2.738
			C	34.356*	30.152*	15.994*	5.926	4.767*	2.716*
VII	M4 2002 -M6 2010	M6 2010- M3 2011	A	20.321	17.424	8.844	7.060	5.970	3.178
			B	26.822	21.726	11.481	6.618	5.340	3.128
			C	17.586*	15.522*	7.906*	5.909*	4.930*	2.640*

This table compares the forecasting accuracy for the three alternative techniques: Model A: The ARIMA (5,1,1), Model B: The ARIMAX (1,1,1), and Model C: The ARIMAX (1,1,1)-GARCH (1,1) model. The models are compared based on the root mean squared error (RMSE), the mean absolute error (MAE), and the mean absolute percent error (MAPE), which can be represented as follows: Root Mean Squared Error:

$$\sqrt{\sum_{i=T+1}^{T+h} (Z_t - \hat{Z}_t)^2 / h}, \text{ Mean Absolute Error: } \sum_{i=T+1}^{T+h} |Z_t - \hat{Z}_t| / h, \text{ and Mean Absolute Percentage Error: } 100 \sum_{i=T+1}^{T+h} \frac{|Z_t - \hat{Z}_t|}{Z_t} / h$$

$T+2, \dots, T+h$, and Z_t and \hat{Z}_t denote the actual and forecasted value in period t , respectively. * denotes the best model in a set.

Overall, the results suggest that whenever the ARIMA model outperforms the ARIMAX model or the ARIMAX-GARCH model outperforms ARIMAX model, the ARIMAX model is very close to the best model in that set. At the same time, the ARIMA and ARIMAX-GARCH forecasts always remain far apart. This suggests the strength of the ARIMAX model in forecasting and ease of modeling compared to other complex models. In two extremes of models with ARIMA on one side and ARIMAX-GARCH on one side, the inclination of the results from the ARIMAX model should be seen as the correct trend investors can use as a guide. If one has to pick one model for one-step forecasting in all circumstances,

then ARIMAX models are the best. Similar to Karakozova (2004), our results also emphasize the importance of macroeconomic variables in ARIMAX models.

CONCLUDING COMMENTS

The main purpose of this paper is to provide a simple model that helps in forecasting turning points and trends in the Canadian real estate sector. Thus, a very comprehensive time series from the S&P/TSX Capped Real Estate Index from April 2002 to March 2011 is used for this study. This time series shows an upward rally from April 2002 to February 2007, a downward turning point in February 2007, a downward rally from February 2007 to February 2009, an upward turning point in February 2009, and an upward rally from February 2009 onwards. The real estate market, which is known to follow trends and changes due to economic impacts, is perfect for a study using ARIMA-family models. Thus, the forecasting ability of three models is compared in this paper: ARIMA, ARIMAX and ARIMAX-GARCH. The ARIMA model has constant mean and constant variance while the ARIMAX model includes exogenous variables to explain the data-generating process. The ARIMAX-GARCH model has all the features of the ARIMAX model, plus time-varying variance.

This study confirms the results of Tse (1997), Karakozova (2004), and Stevenson and Young (2007), that ARIMA-family models are suitable for short-term forecasting. Hence, one-step ahead forecasts are trustworthy for practical purposes. The results indicate that the ARIMAX model did a good job of predicting trends and turning points in static forecasts. In the best performance for one-step ahead forecasts, the ARIMAX model produced a mean absolute percentage error of 3.12%, and in the worst performance, the model produced a mean absolute percentage error of only 9.713%. These results further emphasize the importance of macroeconomic variables and their lags in the forecasting process.

This study has at least two forecasting limitations. First, none of the models can foresee systematic shocks. Thus, future forecasting always has some degree of riskiness. Secondly, it is difficult to get true future macro-economic variables ahead of time to perform future forecasting. Hence, it is difficult to do any long-term forecasting in the true sense when the economic environment is unstable.

This paper provides a simple tool for forecasting, but there are many complicated forecasting models available. Hence, this study can be extended in various forms, like using additional exogenous variables as explanatory variables, using multivariate forms of models, incorporating long memory in the models, and use of time varying coefficients for the model, among others. However, the ultimate choice of the investor or policy maker should depend on forecasting properties of the model.

REFERENCES

Ajayi, R.A. and M. Mougoue (1996) "On the Dynamic Relation between Stock Prices and Exchange Rates," *Journal of Financial Research*, vol. 19, p. 193-207.

Bollerslev, T. (1986) "Generalized Autoregressive Conditional Heteroscedasticity," *Journal of Econometrics*, vol. 31, p. 307-327.

Box, G. and G. Jenkins (1976) "Time Series Analysis, Forecasting, and Control," San Francisco: Holden Day.

Brooks, C. and S. Tsolacos (1999) "The Impact of Economic and Financial Factors on UK Property Performance," *Journal of Property Research*, vol. 16, p. 139-152.

Brooks, C. and S. Tsolacos (2000) "Forecasting Models of Retail Rents," *Environment and Planning A*, vol. 32 (10) p. 1825-1839.

Clapp, J. and C. Giaccotto (2002) "Evaluating House Price Forecasts," *Journal of Real Estate Research*, vol. 24, p. 1-26.

Chen, N.-F., R. Roll and S. Ross (1986) "Economic Forces and the Stock Market," *Journal of Business*, vol. 59, p. 383-403.

Crawford, G.W. and M.C. Fratantoni (2003) "Assessing the Forecasting Performance of Regime-Switching, ARIMA and GARCH Models of House Prices," *Real Estate Economics*, vol. 31, p. 223-244.

De Wit, I. and R. Van Dijk (2003) "The Global Determinants of Direct Office Real Estate Returns," *Journal of Real Estate Finance & Economics*, vol. 26(1) p. 27.

Dickey, D.A. and W.A. Fuller (1979) "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," *Journal of the American Statistical Association*, vol. 76 (366) p. 427-431.

Fama, E.F. and K.R. French (1992) "The Cross-section of Expected Stock Returns," *Journal of Finance*, vol. 47, p. 427-465.

Feldstein, M.S. (1992) Comment on James M. Poterba's paper, Tax reform and the housing market in the late 1980s: who knew what, and when did they know it?, in L. Browne and E. S. Rosegren (eds.), Real Estate and Credit Crunch, *Federal Reserve Bank of Boston Conference Series*, vol. 36, p. 252-257.

Fulleron, T. M., M. M. Laaksonen and C. T. West (2000) "Regional single-family housing start forecast Accuracy," *Journal of Housing Research*, vol. 11, p. 109-120.

Fulleron, T. M., M. M. Laaksonen and C. T. West (2001) "Regional multi-family housing start forecast Accuracy," *International Journal of Forecasting*, vol. 17, p. 171-180.

Gardiner, C. and J. Henneberry (1988) "The Development of a Simple Regional Model of Office Rent Prediction," *Journal of Property Valuation and Investment*, vol. 7, p. 36-52.

Gardiner, C. and J. Henneberry (1991) "Predicting Regional Office Rents Using Habit-Persistence Theories," *Journal of Property Valuation and Investment*, vol. 9, p. 215-226.

Granger, C.W.J., B. Huang and C.W. Yang (2000) "A Bivariate Causality between Stock Prices and Exchange Rates: Evidence from Recent Asian Flu," *The Quarterly Review of Economics and Finance*, vol. 40, p. 337-354.

Guirguis, H. S., C. I. Giannikos and R. I. Anderson (2005) "The US Housing Market: Asset Pricing Forecasts Using Time Varying Coefficients," *Journal of Real Estate Finance and Economics*, vol. 30(3), p. 33-53.

Gupta, R. and S. Das (2010) "Predicting Downturn in the US Housing Market: A Bayesian Approach," *Journal of Real Estate Finance and Economics*, vol. 41(3), p. 294-319.

Karakozova, O. (2004) "Modelling and Forecasting Office Returns in the Helsinki Area," *Journal of Property Research*, vol. 21(1), p. 51-73.

Karolyi, G.A. and A.B. Sanders (1998) "The Variation of Economic Risk Premiums in Real Estate Returns," *Journal of Real Estate Finance and Economics*, vol. 17, p. 245-262.

Kearl, J.H. (1979) "Inflation, Mortgages, and Housing," *Journal of Political Economy*, vol. 87, p. 1-29.
Ljung, G. and G. Box (1978) "On a Measure of Lack of Fit in Time Series Models," *Biometrika*, vol. 65, p. 297-303.

Mei, J. and C.H. Liu (1994) "The predictability of real estate returns and market timing", *Journal of Real Estate Finance and Economics*, vol. 8, p. 115-135.

Quan, D.C. and S. Titman (1999) "Do Real Estate Prices and Stock Prices Move Together? An International Analysis," *Real Estate Economics*, vol. 27, p. 183-207.

Stevenson, S. and O. McGrath (2003) "A comparison of alternative rental forecasting models: empirical tests on the London office market," *Journal of Property Research*, vol. 20, p. 235-260.

Stevenson, S. and J. Young (2007) "Forecasting Housing Supply: Empirical Evidence from the Irish Market," *European Journal of Housing Policy*, vol. 7, p. 1-17.

Stock, J.H. and M.W. Watson (1989) "New Indexes of Coincident and Leading Indicators," in Olivier Blanchard and Stanley Fischer (eds.), *NBER Macroeconomics Annual*, Cambridge, MA: The MIT Press.

Tse, R.Y.C. (1997) "An Application of the ARIMA Model to Real-estate Prices in Hong Kong," *Journal of Property Finance*, vol. 8(2), p. 155-163.

Wilson, P.J., C. Ellis, J. Okunew and D.M. Higgins (2000) "Comparing Univariate Forecasting Techniques in Property Markets," *Journal of Real Estate Portfolio Management*, vol. 6(3), p. 283-306.

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DETERMINANTS OF THE HOME PRICE- INCOME RELATIONSHIP: 1990-2011

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ABSTRACT

Many studies have attributed the housing bubble or misalignment of home price and income to inefficient markets, irrational behavior, excessive leverage, financial innovations, macroeconomic imbalances, the Fed’s easy money policy, and repeal of the Glass-Steagal Act. However, no study has actually looked at data for the past two decades to determine whether these factors do explain the movement in the home price relative to income in the United States. This study uses reduced form models to find the determinants of the income/home price ratio using data over the period 1990 to 2011. We find empirical support that lagged values of household debt and foreign indirect investment are significant predictors of movements in the income/home price ratio. Our results confirm that although the conventional mortgage rate has a stronger negative association with the income/home price ratio, the federal funds rate is a significant determinant as well. This supports the view that keeping the federal funds rate target too low for too long could prolong a misalignment between disposable income and home price. This study also identifies the inception of a housing bubble on a national scale by using the 20-year trend in a home affordability index as a benchmark.

JEL: E50, G18

KEYWORDS: housing bubble, debt, macroeconomic imbalance, monetary policy, financial deregulation

INTRODUCTION

Following a slight decline during the recession of the early 1990s, the average price of homes in the United States remained fairly stable until June 1997, then began its steep climb until its peak in the first quarter of 2006. The Case-Shiller Home Price index almost tripled from 79.91 in June 1997 to 226.38 in March 2006. The National Association of Realtors (NAR) home affordability index, which relates the median price of single-family homes to the median family income, fell below trend beginning in the first quarter of 2004, and reversed its decline when the bubble burst in the second quarter of 2006.

The inventory of foreclosed homes increased first in the states of California, Nevada, Arizona and Florida, but by Spring of 2008 housing prices fell nationwide, and the U.S. economy went into a recession more severe than any other cyclical downturn since the Great Depression. The fiscal stimulus and the loans to, and equity infusions into, large financial institutions necessitated by the financial crisis amounted to about \$1.5 trillion. While real GDP has consistently increased since the third quarter of 2009, the housing and job markets have not fully recovered. By now there is a general understanding that the bursting of the housing bubble triggered the financial meltdown of the Fall 2008. Many studies have attributed the housing bubble or misalignment of home price and income to inefficient markets, irrational behavior, excessive leverage, financial innovations (e.g. subprime mortgage-backed security, credit default swap), macroeconomic imbalances, and enactment of the Gramm-Leach-Bliley Act, which repealed the Glass-Steagal Act in November 1999. Moreover, debates continue about whether and how housing bubbles can be identified, whether central banks should prevent asset bubbles from forming, and the role played by the Fed’s easy money policy in causing asset bubbles. However, no study has actually

looked at data for the past two decades to determine whether these factors do explain the movement in the average home price relative to the average disposable income in the United States.

In this paper, we will review past studies pertaining to the existence and identification of a housing bubble, views on what brings this about, and the appropriate role for monetary policy. Then we will (a) propose a simple indicator of when a housing bubble has begun to form, and (b) attempt to determine if changes in the federal funds rate, household leverage, foreign capital inflows, and financial deregulation can explain movements in the median household income relative to the median price of single family homes. The remainder of this paper is organized as follows: (a) review of literature; (b) discussion of the data and regression models estimated to test for determinants of the income/home price ratio; (c) analysis of findings; and (d) conclusion and policy implications.

LITERATURE REVIEW

In March 2012, Federal Reserve Board Chairman Ben Bernanke gave a lecture on “The Fed and the Financial Crisis” in which, looking back, he noted that the decline in house prices and the associated mortgage losses were key triggers of the crisis, but that the effects of those triggers were amplified by the following vulnerabilities in the financial system: (a) borrowers and lenders took on too much debt or leverage; (b) banks and other financial institutions failed to adequately monitor and manage their risk exposures to subprime mortgages; (c) financial institutions relied excessively on short-term funding, such as commercial paper; (d) the increased use of exotic financial instruments concentrated risk; (e) gaps in the regulatory structure left important firms without strong supervision; and (f) failures of regulation and supervision, including consumer protection, and insufficient attention paid to the stability of the financial system as a whole (Bernanke 2012). Although not separating triggers from amplifiers, studies made by other government agencies such as the President’s Working Group (PWG 2008), the Securities and Exchange Commission (Schapiro 2010), and the Government Accountability Office (GAO 2009), as well as by economists and the financial media mirror this list (see Holstein 2008).

One thing that is missing in the above list is the role of macroeconomic imbalances. In their book, “This Time Is different,” Princeton economists Carmen Reinhart and Kenneth Rogoff (2009) contended that the Subprime Crisis was preceded by many alarming macroeconomic imbalances that unfortunately, were not perceived by the Fed nor the International Monetary Fund (IMF) as emerging threats to financial stability in the U.S. and globally. As late as 2006, the previous Fed Chairman, Alan Greenspan, viewed the current account deficit (then over 6.5% of GDP) as a reflection of the broader trend of global financial market deepening but not a primary risk factor, while then Fed governor Ben Bernanke viewed it as the product of a global savings glut (Reinhart and Rogoff 2009). These same authors also mentioned that even the IMF concluded in April 2007 that risks to the global economy had become extremely low, basing this assessment on reduced spreads in all sorts of risky assets due to foreign capital inflows.

These views were echoed by some in academia and the private sector who argued that the gaping current account deficit was just a natural consequence of emerging countries’ export-led growth and their need to invest some of the resulting sovereign wealth into safe U.S. assets (Dooley et al. 2004) or into the extraordinarily liquid U.S. financial and housing markets (Cooper 2005). Greenspan also viewed the higher prices for risky mortgage-backed securities as justified by increased liquidity in home finance made possible by securitization (Reinhart and Rogoff 2009). Kaminsky and Reinhart (1999) identified large current account deficits relative to GDP, a surge in capital inflows either due to financial liberalization or financial innovation, sustained debt buildups (private or public sector or both), along with markedly mispriced asset prices as common predictors of financial crises in both developed and emerging market economies since the 13th century. Early warnings that when housing booms are accompanied by a sharp increase in debt, the risk of a banking crisis is significantly elevated were sounded by Bordo and Jeanne (2002) and a study by the Bank for International Settlements (2005).

Investment banks loaded up on debt to increase returns on equity when asset prices were rising. Obstfeld and Rogoff (2001) warned that eventually, the U.S. borrowing binge would have to unwind precipitously and result in sharp asset price declines that could severely stress the complex global derivatives system. Likewise, Roubini and Setser (2004) projected that the U.S. debt would reach 10% of GDP before a dramatic collapse of the economy. When confronted with the possibility of a housing bubble, Greenspan minimized its implication on the broader economy by arguing that these were ‘froths’ limited to a few markets (PBS 2009). His view may have been based on an internal study conducted by economists at the Federal Reserve Bank of New York to determine if there was a “bubble” in home prices as of the second quarter of 2005. In their study, McCarthy and Peach (2005) found that, if one accounts for quality improvements (such as size, amenities and improvements) and low interest rates due to low inflation, aggregate home prices are “relatively high but not yet out of line”.

They acknowledged the possibility of “froth” in certain markets as of 2005, but attributed this to inelastic supply of land, which has caused home prices in these markets to be more volatile. The higher volatility, notwithstanding, they concluded that judging from previous large home value declines in these areas, a sizable negative effect on the aggregate economy was unlikely. Thus, they went against concerns expressed by many analysts that there has been a large deviation of home prices from the growth trend, and a precipitous correction, whether from the bursting of a bubble or from rising interest rates, will erase a significant portion of household wealth (Baker 2002; Shiller 2005).

The financial crisis raised a red flag for theoretical economists and policymakers. How did many rational financial market participants not perceive the housing bubble as it was happening and price in the risk appropriately in bonds backed by subprime mortgage loans? Regulation of the U.S. securities industry has leaned more towards ensuring disclosure of information so that investors can effectively exercise market discipline should they perceive mispricing: selling securities that are overpriced and buying securities that are underpriced. This is predicated on the efficient markets hypothesis (EMH), which implies that prices are always and everywhere correct because actors are all rational and able to process information instantaneously (Fama 1970). Although proponents of EMH maintain that asset bubbles cannot exist, evidence such as the run-up in the value of the dollar in the mid-1980s, the stock market crash in 1987, compression of spread due to convergence of trades in the run-up to the failure of Long-term Capital Management in 1998, the dotcom bubble of the late 1990s, and the recent housing and credit bubbles, make the existence of bubbles hard to deny. Krugman (2009) attributed the failure of academic financial economists, and those employed by banks and Wall Street firms to predict the subprime mortgage crisis of 2008 on the reliance of their models on the EMH.

He lamented that neoclassical theorists willingly looked past the limitations of human rationality in their use of mathematical models to explain economic phenomena. However, there have been economists and mathematicians who have cast doubt on how accurately the EMH captures the realities of financial markets. In his empirical studies of stock price series, Mandelbrot and Hudson (2004) argued that the randomness permitted by EMH is ‘mildly random’ but real markets are ‘wildly random’ in that future market price movements have a higher probability of repeating recent price movements. What they called a clustering effect causes large price movements to occur in short periods of time. Moreover, the EMH implies that a bubble would not occur because market participants would short the asset. The current President of the New York Fed, William Dudley, argues that this may not hold in practice because of constraints on the ability to short the asset, such as (a) the market is not sufficiently developed; (b) compensation schemes reward short-term performance and skew incentives toward trading with the market; and (c) in the case of real estate investments, high transaction costs and illiquidity (Dudley 2010). The applicability of one particular assumption of the EMH to arbitrage was questioned by Shleifer and Vishny (1997) who argued that arbitrageurs are a relatively small number of individuals compared to the large number of traders required to make the EMH valid.

The literature on herding and information cascades adds more to our understanding of the irrationality of market actors. Golec (1997) showed that, in the short run, savvy investors trade based on information implied by the behavior of a “herd” of traders instead of their own evaluation of the fundamentals of the investment. Calvo and Mendoza (1997) explained herding behavior through the increased cost of verifying information in globalized markets. Bikhchandani et al. (1992) proposed that as investors in securities continue to make purchases at rising prices, more and more people will conclude that these investors’ information about the market outweigh their own. More recently, behavioral economics has advanced into the mainstream. New theories in behavioral economics and behavioral finance show that individuals do not always behave as expected. They improperly discount the future, they fail to understand the difference between averages and aggregates, they make decisions that lead to lower payoffs, and they overvalue fairness (Avery and Zemsky 1998). In the real world settings of behavioral experiments, the actors who are part of the macroeconomists’ models do not play the roles necessary for those models to work (Villatoro 2009, Zhou and Lai 2009).

Interestingly, even the most adroit financial minds fall into this trap. Fedenia and Hirschey (2009) found a paradox: class A preferred stock of Chipotle sells at a significant and persistent premium to class B preferred stock even if the latter has superior voting rights. They concluded that even the savviest stock investors can find themselves acting irrationally and cause the pricing of assets to be incorrect for a long period of time. In relation to overvaluation in the housing market, in particular, Shiller (2005) shares the view that lack of information and uncertainty about risk because rational investors to rely on the judgment of other market participants. Imperfect information or lack of transparency did play a big role in the subprime crisis. The structuring of mortgage-backed securities (MBS) and other collateralized debt obligations (CDOs) became so opaque, and the valuation of these products became too complex for many investors to exercise due diligence, and for directors and stockholders of financial institutions to exercise market discipline. Investors relied on credit rating agencies in assessing the investment risk of the MBS they were buying. According to a government report (PWG 2008), credit rating companies: (a) gave certain mortgage-related securities higher ratings than they should have -- and were too slow in issuing downgrades once the credit markets slumped, (b) did not adequately differentiate the risk of MBS from a corporate bond of similar rating, (c) engaged conflict of interest when investment banks hired them as consultants in structuring the MBS that they subsequently rated, and (d) did not make their track record and the methodologies they used in arriving at credit ratings publicly available.

Moreover, banks and securities firms experienced difficulties in assessing counterparty risk, aggregating exposures across business lines, valuing instruments when markets became illiquid, pricing contingent liquidity facilities, and managing liquidity risk (PWG 2008). These weaknesses were particularly evident with respect to holding asset-backed commercial paper (ABCP) to fund off-balance sheet structured investment vehicles (SIV), and with syndicating leveraged loans. We now turn to the subject of whether monetary policy has a role to play in the formation of asset bubbles, and therefore, in preempting such formation. Many people have proposed that the housing bubble was caused by the Fed keeping interest rates too low for too long even after the recession of 2001 ended (Rajan 2009). In an interview, Greenspan explained that the Fed kept interest rates low because of the jobless recovery that followed the 2001 recession (PBS 2009). Some have speculated that the Fed needed to accommodate the rising federal government borrowing to finance the war on terrorism. Cooper (2005) drew an analogy with the Fed’s monetizing of the debt incurred during the Vietnam War. Bernanke (2012) argued against the view that easy money policy caused the housing bubble. He noted that changes in mortgage rates during the boom years seemed far too small to account for the magnitude of house price increases. He cited Dokko et al. (2011) who provide contrary evidence from the United Kingdom where there was a housing boom during the 2000s despite tighter monetary policy than the U.S. He also argued that house prices began to pick up in the late 1990s before monetary policy began easing and continued to rise sharply even after interest rates started to rise from their mid-2003 lows.

There is also disagreement on whether central banks should use monetary policy to prevent asset bubbles or should only clean up after asset bubbles burst, by providing the needed liquidity to the financial system. Morris (2008) faulted the Fed's "resolute insistence on focusing only on consumer price inflation, while ignoring signs of inflation in the prices of assets, especially houses and bonds of all kinds". The Fed under the leaderships of Alan Greenspan and Ben Bernanke has taken the view that central banks cannot identify or prevent an asset bubble from forming, but can only clean up after it burst. Bernanke (2010) maintains that it is the job of regulatory policy, not monetary policy, to deal with housing price bubbles fueled by weak lending standards. However, William Dudley, the current President of the New York Fed, argued that this view must be critically reevaluated and stressed the importance of an earlier response because the cost of waiting to clean up asset bubbles after they burst can be very high as the most recent financial crisis demonstrated (Dudley 2010). He proposed that central banks and other financial regulators should develop additional policy instruments, such as establishing system-wide leverage limits or collateral and collateral haircut requirements. In the next section, we will propose a measure and process for identifying the inception of a housing bubble and discuss the methodology and data sources used to find the determinants of the variance in an index that tracks the median home price relative to the median household income.

DATA AND METHODOLOGY

This study has two objectives: (1) propose a measure and process for identifying the inception of a housing bubble, and (2) attempt to determine if the variance in an index tracking the income/home price relationship for the years leading to the peak of the housing bubble can be explained by the variance in the federal funds rate, household leverage, foreign capital inflows, and financial deregulation. Moody's Analytics uses a structural model to forecast the long-run equilibrium home price by metropolitan area, then uses this value to determine which areas have overvaluation or undervaluation (Chen et al. 2012). Back testing this model, Moody's Analytics found overvaluation of at least 10% in 165 of 384 metro areas. Identifying a housing bubble on a national scale, however, is not an easy task.

First, one must decide which of alternative home price indices to use. Then one must recognize that a rapid rise in home prices by itself is not an indication of a bubble. Whether it is in the stock or housing market, a bubble is said to exist if, as Stiglitz (1990) put it "the reason the price is high today is *only* because investors believe that the selling price will be high tomorrow---when 'fundamental' factors do not seem to justify such a price." Economists have therefore evaluated home prices relative to a measure of its fundamental value, such as the implicit rent of owner-occupied homes or household income.

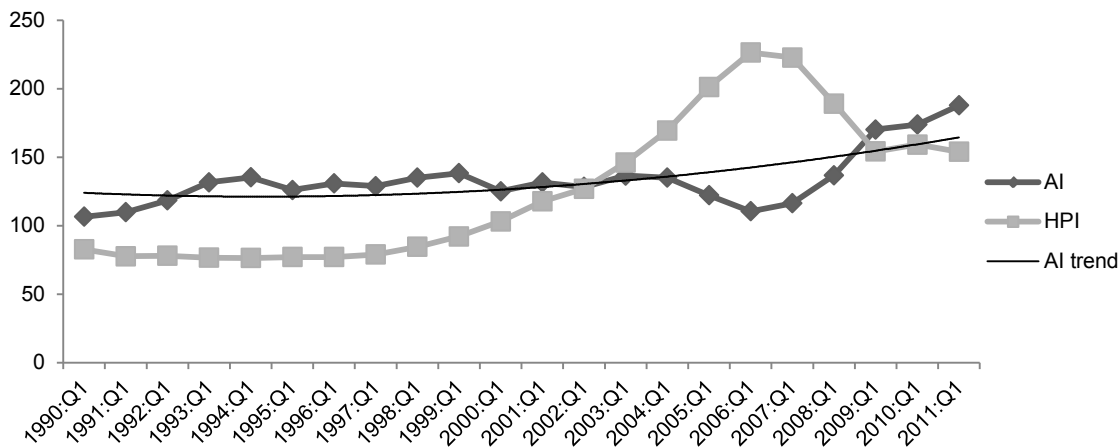
To chart the movement of the average price of homes, McCarthy and Peach (2005) argues that the Census Bureau's home price index is better than the repeat sales index of the Office of Federal Housing Enterprise Oversight (OFHEO), because the former adjusts for changes in quality measured by home size and amenities. By adjusting for quality changes, along with changes in interest rates, they found a flattening of the curves depicting the growth of home price relative to rent and to income during the housing boom. One problem with the McCarthy and Peach analysis is that they interpreted the concentration of rising price-income ratios at higher-end homes as evidence of a shift in consumer preference causing households to allocate more income toward the purchase of larger homes with greater amenities. We now know, of course, that lower underwriting standards and the use of home equity loan contracts on top of creative adjustable rate mortgages enabled many subprime borrowers to buy more house than they could afford under a conventional mortgage. Thus, their approach masked the effects of factors that may enable many homebuyers to afford larger homes. This approach also masked macroeconomic imbalances that may have kept interest rates low during that period. As a result, they failed to identify the housing bubble as late as mid-2005.

With the benefit of hindsight, we propose using the National Association of Realtors’ affordability index (AI), which measures the household income needed to qualify for a conventional mortgage on a median-priced single family home. This mortgage involves a 20% down payment, and a 25% qualifying ratio, that is, a monthly loan amortization below 25% of income using the effective rate on conventional mortgage loans from the Federal Housing Finance Board. An AI value of 100 means that a household earning the median income in the country has exactly the amount of income needed to qualify for a conventional mortgage on a median-priced single family home. An AI value above 100, say 125, means that households earning the median income have 25% more income than is needed to qualify for such a mortgage. Thus, for a given conventional mortgage rate, an increase in the median home price would pull AI down or make homes less affordable. We propose that a housing bubble may be identified through the following process:

- 1) determine the trend line, using a polynomial equation, for AI values in the most recent 20 years;
- 2) identify the month when the AI index falls below trend; this marks the probable start of a housing bubble that could be confirmed when AI remains below trend for at least three months.

As Figure 1 shows, the affordability index (AI) fell below trend beginning in the first quarter of 2004 as the increase in the average price of homes in the 10 largest metropolitan began to accelerate. Note that in the 1990-2011 period, the Case-Shiller composite index (HPI) of the average home price in the largest 10 metropolitan areas rose above trend sooner than when the AI fell below trend. This is possible because the AI is a nationwide index or includes parts of the country where home price appreciation is lower. Also, the median family income nationwide could still be rising faster than the nationwide median price of homes.

Figure 1: The Case-Shiller Home Price Index and NAR’s Affordability Index: 1990-2011



This figure shows that the affordability index (AI) fell below its trend line beginning in the first quarter of 2004 as the increase in the home price index began to accelerate. The bursting of the housing bubble in the first quarter of 2006 caused the affordability index to reverse its downtrend.

We estimated six reduced form regression models to find the determinants of movements in the median home price index (HPI), and another six reduced form regression models to find the determinants of movements in the Affordability Index, hereafter referred to as the income/home price ratio (IHPR). The explanatory variables in Equations 1~3 and 7~11 consist of a combination of one of two alternative interest rate variables and one of two alternative household indebtedness ratios that is not highly correlated with it. The alternative interest rate variables are the federal funds rate (FFR), which represents the lender’s cost of funds, and the 30-year conventional mortgage rate (CMR), which represents the

homebuyer’s cost of borrowing. We used the annual average of the interbank lending rate or effective federal funds rate (FFR) instead of the federal funds rate target, which would have discrete values. The explanatory variables in Equations 4~6 and 12 consist of variables of interest that are highly correlated with either the FFR or CMR. As a proxy for these two variables, we used the difference or SPREAD (CMR – FFR).

$$\begin{aligned}
 \text{HPI} &= \beta_0 + \beta_1 \text{FFR} + \beta_2 \text{lagged ADSR} + \varepsilon && \text{Eq. 1} \\
 \text{HPI} &= \beta_0 + \beta_1 \text{FFR} + \beta_2 \text{lagged HDSR} + \varepsilon && \text{Eq. 2} \\
 \text{HPI} &= \beta_0 + \beta_1 \text{CMR} + \beta_2 \text{lagged ADSR} + \varepsilon && \text{Eq. 3} \\
 \text{HPI} &= \beta_0 + \beta_1 \text{SPREAD} + \beta_2 \text{lagged FIIR} + \varepsilon && \text{Eq. 4} \\
 \text{HPI} &= \beta_0 + \beta_1 \text{SPREAD} + \beta_2 \text{lagged CADR} + \varepsilon && \text{Eq. 5} \\
 \text{HPI} &= \beta_0 + \beta_1 \text{SPREAD} + \beta_2 \text{GLBA} + \varepsilon && \text{Eq. 6} \\
 \text{IHPR} &= \beta_0 + \beta_1 \text{FFR} + \beta_2 \text{lagged ADSR} + \varepsilon && \text{Eq. 7} \\
 \text{IHPR} &= \beta_0 + \beta_1 \text{FFR} + \beta_2 \text{lagged HDSR} + \varepsilon && \text{Eq. 8} \\
 \text{IHPR} &= \beta_0 + \beta_1 \text{FFR} + \beta_2 \text{lagged FIIR} + \varepsilon && \text{Eq. 9} \\
 \text{IHPR} &= \beta_0 + \beta_1 \text{FFR} + \beta_2 \text{lagged CADR} + \varepsilon && \text{Eq. 10} \\
 \text{IHPR} &= \beta_0 + \beta_1 \text{CMR} + \beta_2 \text{lagged ADSR} + \varepsilon && \text{Eq. 11} \\
 \text{IHPR} &= \beta_0 + \beta_1 \text{SPREAD} + \beta_2 \text{GLBA} + \varepsilon && \text{Eq. 12}
 \end{aligned}$$

Table 1 summarizes the description of variables and sources of data. Many of the explanatory variables are highly correlated with each other (see Table 2). Using a cut-off of 0.50 for the correlation coefficient of explanatory variables, we could, in effect, only use two regressors at a time. Whenever the effective

Table 1: Description of Variables and Data Sources

Variable	Description/Unit of Measure	Period	Number of Observations	Source
IHPR	Income/home price ratio measured by the Affordability Index (100: a household earning the national median income has exactly the median income needed to qualify for a conventional loan for the median-priced single-family home)	First quarter 1990 ~First quarter 2011	22	National Association of Realtors
HPI	Home Price Index for the 10 largest metropolitan areas in the U.S. (January 2000 = 100).	March 1990 ~ March 2011	22	Case-Shiller Composite-10 Index
FFR	Effective Federal funds rate (quarterly average in %)	First quarter 1990 ~First quarter 2011	22	Federal Reserve Flow of Funds
CMR	Conventional mortgage rate (quarterly average in %)	First quarter 1990 ~First quarter 2011	22	Federal Reserve Flow of Funds
Spread	Difference between CMR and FFR (%)	First quarter 1990 ~First quarter 2011	22	Federal Reserve Flow of Funds
lagged ADSR	Ratio of all household debt to disposable income (lagged 3 months; in %)	Dec. 31, 1989 ~Dec. 31, 2010	22	Federal Reserve Flow of Funds
lagged HDSR	Ratio of household mortgage and consumer debt payments to disposable income (lagged 3 months; in %)	Dec. 31, 1989 ~Dec. 31, 2010	22	Federal Reserve Flow of Funds
lagged CADR	Ratio of the absolute value of the U.S. current account deficit to gross private domestic investments (lagged 3 months; in %)	Dec. 31, 1989 ~Dec. 31, 2010	22	Bureau of Economic Analysis International Accounts
lagged FIIR	Ratio of foreign indirect investment to GDP (lagged 3 months; in %)	Dec. 31, 1989 ~Dec. 31, 2010	22	Bureau of Economic Analysis International Accounts
GLBA	Dummy variable for the implementation of the Gramm-Leach-Bliley Act enacted in November 1999	1: if first quarter of 2000 or later; 0 otherwise	22	U. S. Senate Public Law 106-102

This table describes the dependent and independent variables used in our regression model, their units of measure, time period covered, number of observations, and sources of data.

Table 2: Correlation Matrix of Variables

Variables	IHPR	HPI	FFR	CMR	SPREAD	lagged HDSR	lagged ADSR	lagged CADR	lagged FIIR	GLBA
IHPR	1.00									
HPI	0.14	1.00								
FFR	-0.68	-0.51	1.00							
CMR	-0.65	-0.74	0.86	1.00						
SPREAD	0.49	0.09	-0.82	-0.42	1.00					
lagged HDSR	-0.07	0.87	-0.24	-0.50	-0.13	1.00				
lagged ADSR	-0.05	0.88	-0.23	-0.45	-0.10	0.95	1.00			
lagged CADR	0.16	0.93	-0.46	-0.71	0.04	0.93	0.86	1.00		
lagged FIIR	-0.18	0.70	-0.12	-0.43	-0.26	0.65	0.60	0.66	1.00	
GLBA	0.34	0.83	-0.57	-0.73	0.20	0.78	0.67	0.91	0.51	1.00

This table shows the correlation coefficients of pairs of variable used in the regression models. The explanatory variables included in each regression equation have correlation coefficients below 0.50.

federal funds rate is highly correlated with a control variable of interest, we used the conventional mortgage rate (CMR) or the interest rate spread (CMR - FFR) as alternative explanatory variables. To control for household leverage, we used two alternative measures: (a) household debt service ratio (HDSR), which is the ratio of estimated required payments on outstanding mortgage and consumer debt to disposable personal income, and (b) all debt service ratio (ADSR), which adds to mortgage and consumer debt payments, the rental payments on tenant-occupied property, homeowner's insurance, property tax payments, and automobile lease payments. Values for these two ratios are available on an annual, end-of year basis, so these are in effect lagged by one quarter relative to the home price index, income/home price ratio, and interest rate variables, which are for the first quarter of the following year. To control for macroeconomic imbalances, we used two alternative variables: (1) CADR: the ratio of the current account deficit (converted to absolute value) relative to gross private investments; and (2) FIIR: the ratio of the inflow of foreign indirect investments relative to GDP. Values for these variables are also available on an annual, end-of year basis, and hence, lagged by one quarter. To control for the effect of financial deregulation, particularly the implementation of the Gramm-Leach Bliley Act (GLBA) starting in the year 2000, we use a dummy variable (1990Q1~1999Q1=0; 2000Q1~2011Q1 = 1).

Table 3: Means and Values of Variables for Selected Years

Statistics	HPI	FFR (%)	CMR (%)	lagged ADSR (%)	lagged HDSR (%)	lagged FIIR (%)	lagged CADR (%)
Mean: 1990-1999	80.15	5.57	8.41	14.82	11.56	3.61	6.00
Mean: 2000-2006	164.66	2.92	6.52	16.20	13.25	7.95	24.46
First quarter 2006	226.38	3.22	5.86	17.10	13.72	8.99	29.46
First quarter 2011	153.92	0.18	4.69	14.80	11.51	6.95	18.65

The mean values of the home price index, and the debt, foreign indirect investment, and current account deficit ratios were higher in the 2000-2006 period than in the 1990's. Also shown are the high values of these variables at the peak of the housing bubble (first quarter of 2006), and the most recent values after the bubble burst (first quarter 2011). Note that the federal funds rate and conventional mortgage rate were, on average, lower in the 2000-2006 period than in the 1990s. The lower rates in the first quarter of 2011 compared to the first quarter of 2006 reflect the effect of expansionary monetary policy.

Table 3 presents means of the dependent and independent variables for the periods 1990~1999 and 2000~2006, as well as values for selected years. The mean values of the home price index, and the debt, foreign indirect investment, and current account deficit ratios were higher in the 2000-2006 period than in the 1990's. The values of these variables were above the mean at the peak of the housing bubble (first quarter of 2006), and fell after the bubble burst. The federal funds rate and conventional mortgage rate were, on average, lower in the 2000-2006 period than in the 1990s. The lower rates in the first quarter of

2011 compared to the first quarter of 2006 reflect the effect of expansionary monetary policy prompted by the Great Recession, which began in December 2007. We will now discuss the rationale for our choice of explanatory variables.

Federal Funds Rate: Traditional theory traces the transmission mechanism of monetary policy, particularly changes in the federal funds target, through its effect on long-term interest rates. As Blinder (1998) puts it: "...central banks generally control only the overnight interest rate, an interest rate that is relevant to virtually no economically interesting transactions. Monetary policy has important macroeconomic effects only to the extent that it moves financial market prices that really matter – like long-term interest rates, stock market values, and exchange rates." This is consistent with what Bernanke (2004) called the "expectations channel," i.e. the central bank influences mortgage rates and other interest rates that affect consumption and investing by charting a path for future short rates and communicating this path clearly to the market. However, in the aftermath of the financial crisis, Adrian and Shin (2009) argue that short-term rates are important in their own right because continued low short rates imply a steep yield curve for some time, which increases the risk-taking capacity of banks that participate in capital markets. In their so-called risk-taking channel of monetary policy, Borio and Zhu (2008) explained that because banks borrow short and lend long, a wider term spread increases bank profitability, and hence, their ability to raise funds in equity markets.

The boost in bank capital then increases the capacity of the bank to bear the risk of expanding its balance sheet, including the extension of new loans, which eventually increases real output. Moreover, as the recent financial crisis revealed, shadow banks and broker-dealers financed their purchase of long-term assets, including subprime mortgage securities, with short-term funding sources such as asset-backed commercial paper and repurchase agreements (repos). Through arbitrage in the money market, the Fed Funds target set by the Federal Open Market Committee determines other relevant short term interest rates, such as repo rates and interbank lending rates (what we refer to as effective federal funds rate (FFR)). For an off-balance sheet conduit or structured investment vehicle (SIV) that finances holdings of mortgage-backed securities by issuing commercial paper, a difference of a quarter or half percent in the federal funds rate makes all the difference between a profitable, and a loss-making, venture. Indeed, Adrian and Smith (2009) found that the growth in the balance sheets of shadow banks and security broker-dealers explain shifts in future real activity better than bank's balance sheets, mainly because they mark most items in their balance sheets to market.

Conventional Mortgage Rate and Spread: To deal with multicollinearity issues, we used the 30-year conventional mortgage rate (CMR) or its spread from the federal funds rate (FFR) as an alternative measure of borrowing cost, in some of our regressions. The 30-year CMR was on a downtrend since 1990 along with the yields on the one-year and 10-year Treasuries. The federal funds rate moved closely with the one-year Treasury yield, which was the typical benchmark for ARM loans.

Current Account Deficit and Foreign Indirect Investments : Beginning in 1999, the ratio of the absolute value of the current account deficit relative to gross private domestic investments and the inflow of foreign indirect investments relative to GDP both increased above the typical values in the 1990s. At about that time, the median home price in the 10 largest metropolitan areas started its steep climb (see Figure 2). Huge capital inflows from abroad resulted from trade surpluses of Japan, Germany, and emerging economies with the U.S. The portion of the national debt owed to external creditors grew along with the housing boom. Reinhart and Rogoff (2009) proposed that foreign capital inflows fueled asset price inflation and lowered the interest rate spread that ultimately masked risks for both regulators and rating agencies. Between 2004 and 2006, the U.S. soaked up more than two of every dollar of savings from China, Japan, Germany, Saudi Arabia, and Russia, net of their own investments. Clearly, the growing current account deficit of the U.S. was unsustainable.

Figure 2: The Home Price Index and Foreign Capital Inflows

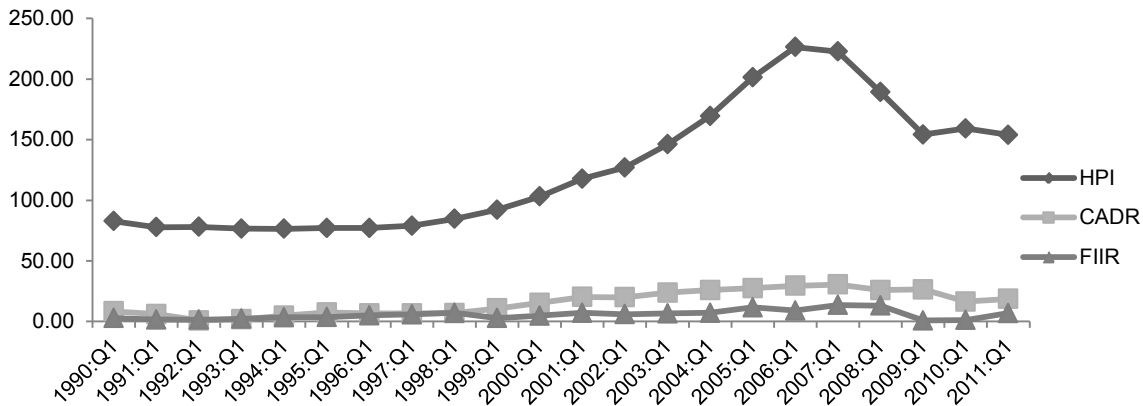


Figure 2 shows that the median price of single family homes in the 10 largest U.S. cities (HPI), the current account deficit ratio (CADR) and the foreign indirect investment ratio (FIIR) were fairly constant for most of the 1990s. The increase in the median home price accelerated since 2000 just as the CADR and FIIR rose above their typical values during the 1990s.

Household Leverage : During the housing boom, household debt grew dramatically as lax underwriting standards of mortgage brokers and fiancé companies enabled subprime borrowers to qualify for adjustable rate mortgage loans with low teaser rates, no proofs of income, or down payments financed by a home equity loan. Rising home equities enabled the purchase of larger homes, and boosted consumer confidence to take on more credit card debt, auto leases, and other consumer debt. Viewed against the growing current account deficit, the booming housing and stock markets may be considered evidence of borrowed prosperity. In this study, we use the household leverage ratios, not as a measure of household debt per se, but as a proxy for lax underwriting standards and financial innovations that enabled banks and broker-dealers to channel funds from the money and capital markets to homebuyers.

Among the financial innovations that enabled the increase in household leverage are complex derivatives, such as collateralized debt obligations backed by subprime mortgage loans, and credit default swaps, which were traded over the counter instead of a central clearinghouse or exchange. As Table 4 shows, the trading volume of over-the counter (OTC) derivatives (measured by notional value) is highly correlated with both household leverage ratios (lagged HDSR and lagged ADSR), the home price index (HPI) in the largest 10 metropolitan areas, and the income/home price ratio (IHPR). We were not able to control for the separate effect of OTC in our regressions because data is only available from 1998 to 2010. Overall, the volume of derivatives traded over the counter outpaced that of exchange-traded derivatives in 2006 and 2007, increasing six-fold from 2002 to a peak of \$818.3 trillion in 2007 (FSOC 2011). It declined during the crisis, but remains above exchange-traded derivatives.

The financial crisis revealed that all these OTC derivatives needed was a slight deterioration in the value of underlying subprime mortgage loans for losses to escalate rapidly. Securitization of subprime mortgage loans rose dramatically during the housing boom. Subprime mortgage loans were first securitized as private-label MBS by investment banks, and later by government sponsored enterprises (GSEs) like Fannie Mae and Freddie Mac. Issuance of private-label MBS outgrew issuance by GSEs from 2004 to 2006 (FSOC 2011). According to data cited in Goodman et al. (2008), subprime MBS accounted for only 32.7% of the \$2.1 trillion market for mortgage-backed securities in 2006, yet the collapse of this market brought down hedge funds and large financial institutions in North America and Europe. What made subprime MBS a very attractive investment globally were the insurance provided by credit default swaps and their AAA credit ratings. The issuer of a credit default swap guaranteed a continuation of income payments in the event that subprime borrowers defaulted on their payments. The notional value of credit

default swaps rose significantly from \$6.4 trillion in 2007 to \$58.2 trillion in 2007, but has declined by about half since then (FSOC 2011).

Table 4: Correlation of Trading Volume of Over-the-Counter Derivatives with Key Variables

Data for 1998 Q1-2006 Q1	Correlation Coefficient
OTC and lagged HDSR (mortgage and consumer debt to income ratio)	0.88
OTC and lagged ADSR (all household debt to income ratio)	0.96
OTC and HPI (Case-Shiller Composite-10 Home Price Index)	0.99
OTC and IHPR (income/home price ratio)	- 0.75

This table shows that the trading volume of over-the counter (OTC) derivatives is highly correlated with both household debt ratios (HDSR and ADSR), the home price index (HPI), and the income/home price ratio (IHPR).

Financial Deregulation : Banks lobbied for many years for the repeal of the Glass-Steagal Act, which was passed after the Great Depression to separate the business of banking from that of investment banking. Banks argued that they could not compete with large foreign banks, which could engage in securities underwriting, insurance, and in the case of Japan and Germany, also could own equity interest in nonfinancial corporations under so-called “universal banking” system. The Gramm-Leach- Bliley Act (GLBA) in 1999 allowed the creation of financial holding companies under which umbrella, a bank could engage in securities underwriting, insurance and real estate operations. GLBA led to consolidation in the financial industry and large, complex financial institutions emerged without one regulator. Moreover, regulation by function under GLBA led financial institutions to shop for the least restrictive regulators. For example, during the housing boom, banks affiliated with mortgage brokers and finance companies, whose lending practices were not subject to oversight by Federal bank regulators.

These affiliates increased the volume of subprime mortgage loans that banks then securitized. A second example is AIG, the largest insurance company in the world, marketed the credit default swap as a derivative, even though by being obligated to pay investors in mortgage –backed securities (MBS) in the event of default by homeowners, it was really an insurance product. The reason for this is that lax reporting and capital adequacy requirements for derivative products was predicated on the fact that, on average, investors in complex derivatives, including those traded over-the-counter (OTC), were more financially sophisticated or could afford to pay for information or expert advice. Insurance or deposit products, on the other hand, were heavily regulated. A third example is the request made by the five biggest U.S. investment banks in 2004 for exemption from the SEC’s net capital rule, which limited their debt –to-equity ratio to 8:1. An investigation by the Government Accountability Office (GAO 2009) found that the SEC Commissioners yielded to this request, giving the Federal Reserve Board of Governors oversight of their capital adequacy based on consolidated assets of the holding company they were affiliated with. The GAO study reported that this resulted in these investment banks’ debt to equity ratios to quadruple, averaging about 35:1 by 2008, without any federal regulator being alarmed. The GAO investigation also revealed that the SEC relied on the risk-management models of the holding company without doing its own independent review.

RESULTS AND DISCUSSION

Ordinary least squares estimates of equations 1~12 were obtained. We will first report the regression results on the determinants of home price movements. As discussed in the previous section, we could only enter two variables (with correlation coefficients below 0.50) in each regression to avoid multicollinearity issues. For example, the effective federal funds rate (FFR) or the conventional mortgage rate (CMR) paired with one measure of household leverage (lagged HDSR or lagged ADSR). Also, where FFR is highly correlated with the other variables of interest, we substituted it with the conventional mortgage rate (CMR) or its spread. The results summarized in Table 5, columns 2~3 show that the federal

funds rate is a statistically significant determinant of the average price of homes in the 10 largest urban areas. The same is true of the conventional mortgage rate (column 3) and the spread between CMR and FFR (columns 4~5). The signs of the coefficients are as expected, that is, as the FFR (a bank's cost of obtaining short-term funds), or CMR (a homebuyer's financing cost) fell, the average home price rose.

Table 5: Regression Results using the Home Price Index (HPI) as Dependent Variable

Regression Equation →	1	2	3	4	5	6
FFR	-7.13***	-6.99***				
CMR			-14.85***			
SPREAD				-11.15*	2.02	-3.14
lagged ADSR	40.11***		34.16***			
lagged HDSR		42.00***				
lagged FIIR				10.74***		
lagged CADR					4.92***	
GLBA						85.68***
Constant	-469.1***	-364.7	-298.3	30.41	43.60***	89.06***
F-value	67.32	56.05	110.2	12.50	65.85	21.72
Adjusted R ²	0.86	0.84	0.91	0.52	0.86	0.66

This table shows the coefficient estimates for Equations 1–6, along with the goodness-of-fit statistics. The federal funds rate (FFR), conventional mortgage rate (CMR), lagged ratios of household debt (ADSR and HDSR), foreign indirect investments (FIIR), and current account deficit (CADR), as well as implementation of the Gramm-Leach-Bliley Act (GLBA) are all significant determinants of the median home price.

Both ratios of household debt relative to disposable income (lagged HDSR and lagged ADSR) are significant positive predictors of home price movement in the next quarter. As expected, the narrower ratio of homeownership and consumer debt to disposable income (lagged HDSR) has a larger coefficient value than the ratio that includes car loan payments. The positive signs of the coefficients for both household debt ratios mean that as household indebtedness increased at year-end, the average home price in the 10 largest urban areas rose one quarter later. Theory would suggest that the more indebted the household is, the less likely it will add to its debt by borrowing to buy a bigger or better house.

Thus, everything else constant, this would have a dampening effect on demand, hence, the equilibrium price of homes. The positive sign may, as we proposed earlier, capture the reinforcing effect of the use of over-the-counter derivatives by banks and broker dealers, and lax underwriting standards, which enabled many subprime homebuyers to qualify for mortgage and home equity loans. We also find the enactment of the Gramm-Leach Bliley Act (GLBA) beginning in 2000, and the one-quarter lagged values of the ratio of foreign indirect investment to GDP (lagged FIIR) and the ratio of the absolute value of the current account deficit to gross private domestic investments (CADR), are all significant positive predictors of the movement in home price. Next, we look at the regression results using the income/home price ratio (IHPR) as dependent variable. The lagged value of indirect foreign investments relative to GDP (lagged FIIR) is a significant negative predictor of the income/home price relationship (Table 6, column 4), controlling for the effective federal funds rate. This suggests that the higher the inflow of indirect investments from abroad, the higher is the demand for and price of homes relative to income. The lagged ratio of all household debt to income (ADSR) is a significant negative determinant of the income/home price relationship, controlling for the conventional mortgage rate (column 6).

The negative sign of the coefficient for lagged ADSR means that as household indebtedness increased at year-end, the income/home price ratio fell a quarter later. This means that the median home price increased by more than the median income, making homes less affordable. Again, as explained in the previous paragraph, this suggests that high levels of indebtedness did not have a dampening effect on home price during the period 1990-2011. Instead, the lagged ADSR variable may be reflecting the effect of financial innovations and lax underwriting that enabled highly indebted and/or subprime borrowers to obtain mortgage loans to buy homes. The positive and statistically significant sign of the coefficient for the interest rate spread (column 7) suggests that as CMR rose relative to the FFR, demand for homes fell,

and everything else held constant, home prices fell relative to income, making homes more affordable. Although we find the enactment of GLBA since 2000 and the lagged current account deficit ratio (CADR) are statistically significant predictors of home price movement in the 10 largest urban areas, we do not find empirical evidence that these are significantly associated with the income/home price relationship (columns 5 and 7).

Table 6: Regression Results Using the Income/Home Price Ratio (IHPR) as Dependent Variable

Regression Equation →	7	8	9	10	11	12
FFR	-6.22***	-6.29***	-6.09***	-6.58***		
CMR					-11.53***	
SPREAD						6.68**
lagged ADSR	-4.29				-8.55**	
lagged HDSR		-5.02				
lagged FIIR			-1.47*			
Lagged CADR				-0.41		
GLBA						9.94
Constant	225.80***	221.40***	166.78***	166.82***	349.92***	107.14***
F-value	10.01	10.39	11.14	9.43	13.07	4.08
Adjusted R ²	0.46	0.47	0.49	0.45	0.53	0.23

This table shows the coefficient estimates for Equations 7~12, along with the goodness-of-fit statistics. The federal funds rate(FFR), conventional mortgage rate(CMR), lagged ratios of foreign indirect investment (FIIR) and household debt (ADSR and HDSR) are all significant negative determinants of the home price-income ratio, but the absolute current account deficit ratio(CADR), and implementation of the Gramm-Leach-Bliley Act (GLBA) are not.

The interest rate variables (FFR and CMR) are both significant negative determinants of the income/home price relationship (columns 2~6). This means that the lower is FFR (cost of obtaining short-term funds for banks), or CMR (financing cost for homebuyers), the higher is income relative to home price or the more affordable homes are. The coefficient estimates confirm that although the conventional mortgage rate (CMR) has an expected stronger negative association with home price as well as with the income/home price index, the federal funds rate is, in its own right, a significant determinant of both. This lends credence to those who argue that there is a risk-taking transmission channel of monetary policy. For a given CMR, the lower the federal funds rate is, the higher is the profitability of extending new mortgage loans. This increased profit expectation increases the ability of banks to raise capital. Given its regulatory capital requirement, more capital enables banks to acquire higher risk investments or extend higher risk loans. The federal funds rate also determines other short-term rates like the commercial paper and repo rates. There is a high negative correlation (-0.67) between the effective federal funds rate and the trading volume of over-the-counter derivatives during the period 1998 to 2006. The financial crisis of 2008 revealed that banks and broker-dealers financed their acquisitions of mortgage-backed securities with short-term funding, such as by issuing asset-backed commercial paper. Thus, it may indeed be possible that by keeping the federal funds rate target too low for too long, the Fed could inadvertently prolong the existence of a housing bubble (i.e. misalignment of home price and income), by increasing the risk-taking capacity of financial institutions.

CONCLUDING COMMENTS

In this study, we proposed that the 20-year trend in the National Association of Realtor’s home affordability index (AI) provides a simple benchmark for identifying the inception of a housing bubble on a national scale. This index tracks the movement of median household disposable income to the median price of single-family homes. We suggest that when the monthly affordability index value falls below trend for at least three months, a housing bubble probably exists. Using this benchmark during the housing boom that ended in the first quarter of 2006, we dated the start of the housing bubble to about the first quarter of 2004. This study also estimated reduced form models to determine if movements in home price and the income/home price ratio are associated with movements in the effective federal funds rate (or alternatively, the conventional mortgage rate or the spread between this and the effective federal funds

rate). We controlled for changes in household leverage enabled by financial innovation and lax underwriting standards, as well as foreign capital inflows, and deregulation. Our results confirm that although the conventional 30-year mortgage rate, as expected, has a stronger negative association with home price and with the income/home price relationship, the federal funds rate is a significant determinant as well. This supports the view that keeping the federal funds rate target too low for too long could prolong a misalignment between disposable income and home price by increasing the risk-taking capacity of financial institutions. For policy purposes, this implies that gradually increasing the federal funds target as soon as concern about a housing bubble arises can be an effective tool for preventing its persistence or worsening. This study found empirical evidence that one-quarter lagged increases in foreign indirect investments relative to GDP as well as the level of household indebtedness are significantly associated with an increase in home price and a decline in the income/home price relationship. Although the implementation of the Gramm-Leach Bliley Act and the one-quarter lagged value of the current account deficit were significant predictors of changes in home price, these could not significantly explain changes in the income/home price relationship. This result, however does not preclude the possibility that the SEC's relaxation of the leverage limit on the five largest investment banks from 2004 to 2008 played a role. Future research could include a dummy variable for this period.

REFERENCES

Adrian, Tobias and Hyun S. Shin (2010). *Financial Intermediaries and Monetary Economics*. (Staff Report No. 398). New York: Federal Reserve Bank of New York.

Avery, Christopher and Peter Zemsky (1998). Multidimensional Uncertainty and Herd Behavior in Financial Markets. *American Economic Review*, 88(4), 724-48.

Baker, Dean (2002, August). *The Run-Up in Home Prices: Is It Real or Is It Another Bubble?* (CEPR Report). Retrieved July 15, 2011 from the Center for Economic and Policy Research Web site: www.cepr.net/documents/publications/housing_2002_08.pdf.

Bank for International Settlements (2005). *Annual Report*. Basel, Switzerland: Bank for International Settlements.

Bernanke, Ben (2004, December) "The Logic of Monetary Policy," Remarks before the National Economists Club, Washington, D.C. Retrieved March 4, 2012 from www.federalreserve.gov/boarddocs/speeches/2004/20041202/default.htm

Bernanke, Ben (2010, January 3) "Monetary Policy and the Housing Bubble," Speech delivered at the Annual Meeting of the American Economic Association, Atlanta, GA.

Bernanke, Ben (2012, March). "The Federal Reserve and the Financial Crisis," Lecture delivered at George Washington University. Washington, D.C. Retrieved March 20, 2012 from the Federal Reserve Board's Web site: www.federalreserve.gov/newsevents/lectures/about.htm

Bikhchandani, Sushil, D. Hirshleifer, and I. Welch (1992). A Theory of Fads, Fashion, Custom, and Cultural Change in Informational Cascades. *Journal of Political Economy*, 100(5), 992-1026.

Blinder, Alan (1998). *Central Banking in Theory and Practice*. Cambridge, MA. MIT Press.

Bordo, Michael and Olivier Jeanne (2002). *Boom-Busts in Asset Prices, Economic Instability, and Monetary Policy* (NBER Working Paper No. 8966). Cambridge, MA: National Bureau of Economic Research.

Borio, Claudio and Haibin Zhu (2008). *Capital Regulation, Risk-taking and Monetary Policy: A Missing Link in the Transmission Mechanism?* (Working Paper No. 268). Basel, Switzerland: Bank for International Settlements.

Calvo, Guillermo and E. Mendoza (1997). *Rational Herd Behavior and the Globalization of Securities Markets*. (Institute for Empirical Macroeconomics Discussion Paper No. 120). Minneapolis: Federal Reserve Bank.

Chen, Celia, A. Burgos, S. Mehra, and M. Zoller (2011, January). *Case-Shiller Home Price Index Forecast Methodology*. Retrieved June 16, 2011, from the Moody's Analytics Web site: www.economy.com/home/products/samples/case-shiller-methodology.pdf

Cooper, Richard (2005). *Living with Global Imbalances: a Contrarian View*. (Policy Brief). Washington, D.C. Institute for International Economics.

Dokko, Jane et al. (2011) "Monetary Policy and the Housing Bubble," *Economic Policy*. 26(1), 237–87.

Dooley, Michael, F. Folkerts-Landau, and P. Garber (2004). *The U.S. Current Account Deficit and Economic Development: Collateral for a Total Return Swap*. (NBER Working Paper No. 10727). Retrieved November 22, 2011, from the National Bureau of Economics Research Web site: www.nber.org/papers/w10727.pdf

Dudley, William (2010, April 7). *Asset Bubbles and the Implications for Central Bank Policy*. Remarks at the Economic Club of New York, New York City.

Fama, Eugene (1970, May) "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance*. 25(2), 383-417.

Fedenia, Mark and Mark Hirschey (2009) "The Chipotle Paradox," *Journal of Applied Finance*. 19(1):144-159.

Financial Stability Oversight Council (FSOC 2011). *Annual Report*, Charts 4.1.18, 4.1.19, and 5.2.52. Washington D.C.: U.S. Treasury.

Goodman, Laurie, S. Li, D. Lucas, T. Zimmerman, and Frank Fabozzi (2008). *Subprime Mortgage Credit Derivatives*. NJ: John Wiley & Sons.

Golec, Joseph (1997) "Herding on Noise: The Case of Johnson Redbook's Weekly Retail Sales Data," *Journal of Financial and Quantitative Analysis*. 32(3), 367-81.

Kaminsky, Graciela and Carmen Reinhart (1999). "The Twin Crises: The Causes of Banking and Balance of Payments Problems," *American Economic Review*. 89(3):473-500.

Krugman, Paul (2009) "How Did Economists Get It so Wrong?" *New York Times*, September 6, 2009.

Mandelbrot, Benoit and Richard Hudson (2004). *The (Mis)behavior of Markets: A Fractal View of Risk, Ruin and Reward*. New York: Basic Books.

McCarthy, Jonathan and Richard Peach (2005). "Is There a "Bubble" in the Housing Market Now?". Paper prepared for the Eurobank EFG Conference on Real Estate, Macroeconomic and Monetary Studies Function, Federal Reserve Bank of New York.

Morris, C.R. (2008). *The Two Trillion Dollar Meltdown: Easy Money, High Rollers, and the Great Credit Crash*. NY: Public Affairs.

Public Broadcasting Service (2009). *Frontline: Inside the Meltdown*. Retrieved December 17, 2011, from the PBS Web site: www.pbs.org/wgbh/pages/frontline/meltdown/

Rajan, Raghuram (2009) "The Credit Crisis and Cycle-Proof Regulation," *Federal Reserve Bank of St. Louis Review*. 91(5):397-402

Reinhart, Carmen and Kenneth Rogoff (2009). *This Time is Different. Eight Centuries of Folly*. NJ: Princeton University Press.

Roubini, Nouriel and Brad Setser (2004, November). *The United States as a Debtor Nation: The Sustainability of the U.S. External Imbalances*. (Working Paper). NY: New York University.

Schapiro, Mary (2010, January 14). *SEC Chairman's Testimony Concerning the State of the Financial Crisis Before the Financial Crisis Inquiry Commission*. Washington, DC: Securities and Exchange Commission.

Shiller, Robert (2005). *Irrational Exuberance*. 2nd ed. NY: Broadway Books.

Shleifer, Andrei and Vishny, Robert (1997) "The Limits of Arbitrage," *Journal of Finance*, 52(1), 35-55.

Stiglitz, Joseph (1990) "Symposium on Bubbles," *Journal of Economic Perspectives*, 4(2), 13-18.

U.S. Government Accountability Office (2009). *Financial Crisis Highlights Need to Improve Oversight of Leverage at Financial Institutions and Across System*. (GAO Report 09-739). Washington, DC.

U.S. President's Working Group (2008). *Policy Statement on Financial Market Developments*. <http://media.hoover.org/sites/default/files/documents/PWGPolyStateMktTurmoilFinal03122008--FINAL.pdf>

U.S. Senate Banking Committee (2009, July). *Gramm-Leach-Bliley Act*. (PL 106-102). Washington, DC.

Villatoro, Felix (2009, November). The Delegated Portfolio Management Problem: Reputation and Herding. *Journal of Banking and Finance*, 33(11), 2062-69.

Zhou, Rhea and R. Lai (2009). Herding and Information Based Trading. *Journal of Empirical Finance*, 16(3), 388-93.

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BANK RECAPITALIZATION AND MARKET CONCENTRATION IN GHANA'S BANKING INDUSTRY: A HERFINDAHL-HIRSCHMAN INDEX ANALYSIS

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ABSTRACT

Using Concentration Ratio and Herfindahl-Hirschman Index techniques, the paper investigates the concentration levels of the banking industry in Ghana and forecasts the future concentration levels of the industry should consolidations triggered by the new bank recapitalization policy occur in the industry. The study finds that the HHI indices provide evidence for the contention that for the past eight years the banking industry in Ghana has been highly competitive with no signs of concentration. Evidence also exists to underpin the conclusion that any consolidation of four banks or less stimulated by the new bank recapitalization policy will not upset the existing market concentration. However, consolidation of five or more banks will culminate in high concentration which will be inimical to the interest of customers. The paper, therefore, recommends that, all things being equal, policy makers should permit consolidation of four or less banks if that is the only way the banks will meet the new bank recapitalization requirement.

JEL: D40, D41, E02, G21

KEYWORDS: Banking, Market Concentration, Herfindahl-Hirschman Index, Ghana

INTRODUCTION

Driven, ostensibly, by the desire to promote prudent management of banks in Ghana, the Bank of Ghana introduced a bank recapitalization policy in 2007. In this policy, universal banks operating in Ghana were required to recapitalize from GH¢ 7 million to GH¢ 60 million (approximately US\$ 60 million at the time) by the end of 2012. Two roadmaps were set for the implementation of this new policy. All majority locally-owned banks were given up to December, 31, 2010 to achieve minimum capitalization of GH¢ 25 million, and December, 31, 2012 to recapitalize fully. Foreign banks that predated the policy were given up to 31st December, 2009 to recapitalize whilst banks that were licensed after the announcement of the policy had to start with the new capitalization. All foreign banks that existed before the policy have since met their obligations at the completion point in 2009. However, indications are that their indigenous counterparts are still struggling to meet the target. What seems plausible to conjecture is that some of these may have to consolidate to keep themselves in the industry. This conjecture is premised on the precedents obtainable from similar exercises that took place in other jurisdictions.

After the Asian crises, Malaysia undertook recapitalization in its banking sector whereby about 80 banks shrunk to about 12 within two years. South African experience is also available for reference. A similar policy stimulated bank consolidations in South Africa in 2003 which led to a reduction in the number of banks in South Africa (Akomea, 2009). Nigerian experience obviously lends more credence to prediction of bank consolidations in Ghana. In the Nigerian situation, out of 89 banks that were in existence before the recapitalization exercise in 2004, 14 lost their licenses and the rest consolidated through mergers and acquisitions into 25 banks by the end of 2005 (Ezeoha, 2011).

Bank consolidations bring in their wake some structural changes with concomitant advantages and disadvantages. Between 1975 and 1997, the U.S banking industry experienced significant structural changes as a result of intense process of consolidation (mergers). The number of commercial banks decreased about 35% from 14,318 to 9,215 (Cetorelli, 2000). Consolidation leads to larger banks and that could change the relationship between banks and their retail customers (Akomea, 2009). Evidence from the United States suggests that larger banks charge higher fees and pay less interest on deposits. They also make fewer loans available to small businesses than the smaller banks they take over from (Dymski, 1999). Studies on bank consolidation and consequences abound in many countries. In Nigeria, for instance, many studies have been undertaken on bank consolidation and consequences (Somoye, 2008; Ezeoha, 2011). However, in Ghana whereas many studies have been undertaken on banking in Ghana (Aboagye-Debrah, 2007; Abor, and Biekpe, 2007; Aryeetey, 1996; Gockel, 1998; Hinson *et al.*, 2009; Korsah *et al.*, 2001; Adusei, 2011; Adusei, 2012) to the best knowledge of the authors, none of these copious studies addresses the competitive environment of banks and the possible effect of bank consolidations on the competitive environment of banks in Ghana. Filling this knowledge gap constitutes the focus of this study. The paper seeks to answer two questions: (1) Is the banking industry in Ghana competitive? (2) Should bank consolidations occur as a result of the new bank recapitalization policy to what extent will they impact the competitive environment of Ghana's banking industry?

An important question of measuring competition is the definition of the relevant market of competitors (Lijesen, *et al*, 2002). For instance, banks, non-bank financial institutions, rural banks, pension funds and insurance firms belong to the large sector called financial institutions; yet, it will be an exercise in futility to measure the competition among them. The economic concept of a market is stated in terms of the behavior of buyers and sellers. Two products belong to the same market if a small change in price (or product) causes a significant diversion in a relatively short time of the buyers' purchases or the sellers' production from one product to another" (Kaysen and Turner, 1959). In order to measure competition, this paper narrows its reference of banks to mean universal banks in Ghana.

The rest of the paper is structured as follows. The next section reviews the relevant literature on bank consolidation, concentration and market power. This is followed by the historical background of banking in Ghana. The third section presents data and methodology of the study. The results section follows. The final section presents the concluding comments of the study highlighting on implications of the findings for banks, shareholders, investors, and consumers as well as the limitations of the study.

LITERATURE REVIEW

Industry Competition

Firms buy resources necessary to implement their strategies (Hirshleifer, 1980; Porter, 1980). Mergers and acquisitions provide an opportunity to trade otherwise non-marketable resources and to buy or sell resources in bundles. Through this vehicle, one can for example buy an image or a set of technological capabilities and contacts in a given set of market (Wernerfelt, 1997). Horizontal merger among a subset of firms in the same market may reduce competition by reducing the number of firms and increasing concentration. One possible advantage of bank mergers is the exploitation of potential economies of scale or scope. For instance a bank interested in pursuing low cost will acquire another bank with a higher market share; likewise a bank pursuing differentiation will acquire a bank with sound reputation or one that has differentiated products. There are varieties of stakeholders in merging companies who have interests in the success of mergers. Shareholders and managers are two most important stakeholders but others include; employees, consumers, local communities and the economy at large (Sudarsanam, 2004). The possible improvements in efficiency may translate into welfare gains for the economy to the extent that customers pay lower prices for bank's services or are able to obtain higher quality services or services that could not have been offered before. If the merged firm can lower costs by re-allocating

production, the incentive to merge is reinforced. The concern is that such a change in structure increases market power and adversely affects market performance (Levin, 1990).

Market power is commonly defined as the ability to profitably charge prices above the competitive level for a significant period of time. This economic definition is equivalent to the European concept of significant market power (SMP), which a firm is deemed to possess “if, either individually or jointly with others, it enjoys a position equivalent to dominance, that is to say a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers (Hausman and Sidak, 2007). In higher number of cases, mergers are triggered by market forces and strategic initiatives.

In a regulatory regime, banks that do not meet the minimum recapitalization are considered as failing banks (Shih, 2003). Whereas studies on the outcomes of market-induced consolidation are very common for both developed and developing economies, regulation-induced mergers are still very scanty (Ezeoha, 2011). In the instance situation of the Ghana’s banking industry, banks may not be willing to merge with others, they have no strategic factor demands, they want to remain small and serve their niche markets; but regulators insists they grow or face uncertain future (Akomea, 2009). In reviewing the Nigerian consolidation failures, Ezeoha (2011), laments that a high degree of process interference normally results from the fusion of very dichotomous entities. It is therefore possible that reform-induced consolidation might be incapable of resolving the prevalence of bank distress and failure in developing economies.

Market Concentration Indices

Market concentration refers to the number of firms that account for the total production within a given industry; sometimes referred to as industrial concentration (Tirole, 1988). The idea is to identify how many firms account for the majority of the product that is produced within a given market, and whether there is room for new firms to compete within that market. Market concentration measures are also referred to as competition measures. A basic feature associated with the definition of concentration indices is that they incorporate two relevant aspects of industry structure, namely, size inequalities and the number of firms. Essentially, a finding of collective dominance must be based on a number of criteria, such as the existence of a mature market, stagnant or moderate growth on the demand side, low elasticity of demand, homogeneous products, similar cost structures, similar market shares, lack of technological innovation, mature technology, absence of excess capacity, high barriers to entry, lack of countervailing buying power, lack of potential competition, various kinds of informal or other links between the undertakings concerned, and retaliatory mechanisms (Hausman and Sidak, 2007).

Industrial concentration is necessary for investors, consumers and regulators. To the investor, the level of concentration means quite a lot since it determines the entry barrier, turbulence, or price mechanism of the market. In simplistic approach, industrial concentration can be achieved by practically counting competitors in the industry. However the drawback of this approach is that it does not take into account the individual strengths of the firms (Lijesen, *et al*, 2002). Concentration indices are traditional instruments within the industrial organization literature employed to provide a synthetic measure of market structure, as well as to evaluate the existing degree of competition in particular industries (Tirole, 1988). Three major measures that are internationally recognized in measuring absolute industrial concentration indices are the Herfindahl-Hirschman Index, Concentration Ratio, and the Hannah-Kay Index. However, ever since the U.S. Department of Justice adopted the Herfindahl-Hirschman Index as part of its merger guidelines, the use of Hannah-Kay has been rare. Also in few situations, some researchers have used Lerner Index (for market power), Gini coefficient, alongside Lorenz curve to measure market concentration (Korsah *et al*, 2001). This study, however, limits itself to concentration ratio and Herfindahl-Hirschman Index.

One of the early indicators taking market concentration into account is the Concentration Ratio which is defined as the sum of market shares of the largest markets in the industry (Lijesen, *et al*, 2002). With that broad definition come CR₄, CR₈, and CR₁₀ etc of which CR₄ is widely in use. Concentration ratio is mathematically stated as:

$$CR_m = \sum_{i=1}^m S_i \quad (1)$$

In simplistic terms, $CR_m = S_1 + S_2 + \dots + s_m$ where S_i is the market share and m defines the i^{th} firm. Total concentration is usually set at 100%. This measure has been in use for major industrial policies until 1982. In general, if the CR₄ measure is less than 50 (indicating that the four largest firms own less than 50% of the market), then the industry is considered to be very competitive, with a number of other firms competing, but none owning a very large chunk of the market. On the other extreme, if the CR₁ measure is 90, then one firm controls about 90% of the market and that is effectively, a monopoly. The main problem with this indicator is the arbitrary character of its cut-off point (Lijesen, *et al*, 2002). Whereas in some industries the players are so many that the largest four may not make any relevant impact unless you take largest six or eight, in other industries the largest two firms may be more relevant than four or more. Other shortfalls occur in situations where the other market shares beyond the largest four may be too significant to be left out in decision making.

Herfindahl-Hirschman Index (HHI)

The Herfindahl-Hirschman Index (HHI) has gained prominence in the industrial organization discipline ever since it was adopted by the U.S. Department of Justice in 1982 as the primary market concentration guide (Levin, 1990). The index was developed independently by A. O. Hirschman (in 1945) and O. C. Herfindahl (in 1950). The HHI which sums the squared market shares of firms in the relevant market is based on the Cournot model (Lijesen, *et al*, 2002). The HHI takes into account the relative size and distribution of the firms in a market and approaches zero when a market consists of a large number of firms of relatively equal size. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. The major advantage of HHI over the Concentration Ratio is the inclusion of all actors in the market for analysis. The study will use the formula for HHI, denoted by the equation:

$$HHI = \sum_{i=1}^n (MS_i)^2 \quad (2)$$

where MS_i represents the market share of firm i and there are n firms in the market.

The U.S. Department of Justice: In the U.S., the Department of Justice (DoJ) officially adopted this measure of concentration in 1982. This practise has since been followed by several regulatory bodies such as Federal Trade Commission (FTC), Federal Reserve Board (banking), federal Energy Regulatory Commission (electricity), and the Department of Transport (aviation) (Lijesen, *et al*, 2002). In 1992, guidelines as applied to banking specified that if a bank merger would result (1) in a post-merger HHI in a market of less than 1800, or (2) in a change in HHI of less than 200, it is likely that the market structure would not reach a concentration level. However, any index beyond 1800 will be questioned (White, 1987). In 2010, new guidelines with increased thresholds have been published by the DoJ and FTC in respect of banking. In the new threshold, The U.S. DoJ considers a market with an index of less than 1,500 to be a relatively unconcentrated market or a competitive marketplace, and will not challenge any merger that will eventually fall within that range. A market with HHI between 1,500 and 2,500 is seen to be moderately concentrated whilst a market with HHI which is greater than 2500 is seen to be a concentrated market. However, if the market already has an index between 1500 and 2500, the change in post-merger HHI should not exceed 100 and 200 respectively. Antitrust actions are likely to be brought against firms that perpetuate such mergers. In such situations, DoJ authorities sometimes require that

firms to divest some of their assets to rivals through auction or tackle the merger on regional basis in order to allow the residual firm to have a lower index. The U.S. DoJ closely evaluates the competitive impact of each merger within the moderately concentrated and highly concentrated markets and will challenge those they see as anti-competitive. The fundamental objective is to avoid or reduce the creation of market powers.

BANKING IN GHANA

Ghana, as an independent country in 1957 inherited two imperial banks and a local bank, namely; Bank of British West Africa (1896), (now Standard Chartered Bank), Colonial Bank (1917) (now Barclays Bank), and the Bank of Gold Coast (1953) which also doubled as the Central Bank. The latter was primarily established to serve as a commercial bank for indigenous traders and farmers. At independence, the Bank of Gold Coast was split into two: Bank of Ghana and Ghana Commercial Bank. Reflections on Ghana's banking sector in this paper will be organized into three broad eras, Pre-FINSAP Era (1957-1987), Financial Sector Adjustment Programme (FINSAP) Era (1985-1999), and Post-FINSAP Era (2000-date)

Pre Financial Sector Adjustment Programme (FINSAP)

Ghana's economic development after attaining independence followed the centrally planned approach (Mensah, 1997) Government's industrialization efforts came with the import substitution policy that led to the establishment of many state-owned enterprises (SOEs) between 1957 and 1965. The Ghana Industrial Holding Corporation (GIHOC) was a dominant brand in government economic activities. Production orientation was the order of the day. In order to support the numerous developments that sprang up after independence, specialized banks were established with specific mandates. The objectives of these banks were tailored to meet the financial needs of specific sectors of the economy (Aryeetey, 1996). For instance, to strengthen industrialization, agriculture, commerce, and construction, banks such as National Investment Bank, Agricultural Development Bank, Merchant Bank and Bank for Housing and Construction (liquidated in 2000), respectively, were created in 1960s and 1970s. In 1972, the state also acquired (40%) shares in the expatriate banks: Barclays and Standard Banks. Prior to 1988, each of the 10 banks operating in Ghana had some level of state shareholding, mainly wholly-owned: except the expatriate banks where the state had minority shareholding. Aryeetey (1996) describes the situation 'as absence of a relatively high level of competition'. During the period, the banks remained conservative and innovations were non-existent as a result of lack of due diligence in loan approvals, unbridled political interference, corruption, and weak legal and regulatory framework, the banks piled up huge debts with their balance sheets showing high levels of non-performing assets (Aboagye-Debrah, 2007). Bank opening hours to the public was a maximum of 6 hours a day and average waiting time for banking service was about 45 minutes (Akomea, 2009). By mid 1980s, as part of the Economic Recovery Programme, the IMF recommended that the financial sector in Ghana be revamped. Financial Sector Adjustment Programme became the antidote prescribed.

Financial Sector Adjustment Programme (FINSAP)

The banking industry has undergone much transformation since the Financial Sector Reforms in the late 1980s. The banking system before the reforms was characterized by state-owned banks that had been set up with narrow objectives: development, investment and commercial. The reform package initially focused on issues of credit allocation, the efficiency of banking operations, the Bank of Ghana's supervision of the commercial banks and the development of capital markets (Aryeetey, 1996). As a result of the defined compartmentalization of bank markets, competition was not existent; each bank had to focus on the reason why it was set up and could not take advantage of other opportunities in the marketplace since they were monopolistic in nature. Three major factors impacted the state of banking. First, as part of the FINSAP, the Central Bank through various enactments strengthened its supervisory

and regulatory responsibilities. What was important was the realization that the Central Bank applied the regulations objectively on both state-owned and private banks. Second, the deregulation of the sector saw the licensing of local and foreign banks (private sector participation) that brought about new life into banking in Ghana. Third, the liberalization of the economy and growth of FDIs as a result of political stability saw major private sector participation in the economy leading to vibrant banking activities of all types.

Post-FINSAP

By the year 2000, Ghana had only 17 banks and the banking environment was somewhat relaxed for the larger banks whilst the smaller banks licensed in the 1990s gradually captured progressive market shares though insignificantly. In February 2003, the Central Bank formally introduced the Universal Banking Business License (UBBL) which brought more competition within the industry. Under the universal banking license, existing banks were to have minimum net worth of ₵70 billion (GH₵ 7 million). Banks were required to hold 9% of the cedi and forex deposit base with Bank of Ghana on daily basis as primary reserves and 35% (later reduced to 51%) of their deposit base in cedi denominated assets as secondary reserves. In 2005, the Banking Act, 2004 (Act 673) was promulgated and brought with it major managerial and accountability clauses in line with the Basel Accords. Also in 2005, Zenith Bank and Standard Trust Bank (now United Bank for Africa), both Nigerian Banks were granted universal licenses by Bank of Ghana. Again in August, 2005, the Central bank abolished the secondary reserves requirement of banks. In 2006, three more Banks (two Nigerian and one Ghanaian) were licensed by the Central Bank, namely; Guaranty Trust Bank, Intercontinental Bank, and Fidelity Bank; a total of five new banks in two years. Major gains for customers included the move towards technology in the mid-1990s. For instance, the use of computers in banking was pioneered by the expatriate banks. ATM services started slowly and later became the order of the day.

Bank working hours were extended as a result of competition. Loan approval waiting time was reduced to a record time of 48 hours from average of four months. By 2006, the risk of transferring bulk money to the banks had become a major issue with banks acquiring or engaging the services of bullion vans for that sole purpose. The problem was however solved with the successful denomination of the local currency the “Cedi” to “Ghana Cedi” in July 2007. Four other banks have been licensed since 2006; Sahel-Sahara Bank, and Bank of Baroda, both in 2008; Access Bank (2009) and Energy Bank (2011). Table 1 traces the evolution of banking activities in Ghana since 1896. The table also gives a summary of existing and defunct banks in the history of banking in Ghana.

DATA AND METHODOLOGY

The paper uses secondary data sources from the Ghana Banking Survey Reports covering 2003-2010. The annual surveys are conducted by PricewaterhouseCoopers in collaboration with Ghana Association of Bankers. According to the Consultants who undertook the survey, they analyzed the annual reports and audited financial statements of the banks in calculating the respective market shares. Therefore, to the extent of the correctness of these audited accounts and no claim to the contrary as the unreliability of the published report, the statistics can be deemed credible. The market shares of banks in this paper are based on share of industry deposits and share of industry net advances. These are common parameters used by many financial marketing studies. The survey covered 25 out of the 26 banks that existed at the time of the survey. However, NIB did not take part in recent years making it possible for some market shares to be adjusted by few decimal points. The study therefore approximates its accuracy to be about 98%.

Table 1: Evolution of Banks in Ghana

	Bank	Acronym	Year	Origin	Historical Remarks
1	Standard Chartered Bank	SCB	1896	U.K.	<i>British Bank of West Africa, Later Standard Bank, in 1972, Government acquired 40% shares till 2003.</i>
	Barclays Bank	BBG	1917	U.K.	
2					<i>Colonial Bank, in 1972, Government acquired 40% shares till 2003</i>
3	Ghana Commercial Bank	GCB	1953	Ghana	<i>Bank of Gold Coast, (Commercial and Central Bank functions until 1957</i>
4	National Investment Bank	NIB	1963	Ghana	
5	Agricultural Development Bank	ADB	1965	Ghana	
6	Merchant Bank	MBG	1972	Ghana	
7	Bank for Housing and Construction**	BHC	1972	Ghana	<i>Officially liquidated in 2000</i>
8	National Savings and Credit Bank**	NSCB	1977	Ghana	<i>Originally Post Office Savings Bank, Absorbed by SSB in 1994</i>
9	SG-SSB Bank	SSB	1977	France	<i>Originally Social Security Bank, acquired by SG from France in 1995.</i>
10	Co-operative Bank**	CO-OP	1977	Ghana	<i>Officially liquidated in 2000</i>
11	ECOBANK	EBG	1990	Togo	<i>Transnational Bank with shareholding across West Africa. Major shareholders in Nigeria.</i>
12	CALBANK	CAL	1990	Ghana	<i>Originally Continental Acceptances</i>
13	Bank for Credit and Commerce**	BCCI	1991	Pakistan	<i>Officially liquidated in 2000</i>
14	Prudential Bank	PBL	1996	Ghana	
15	UT Bank	UTB	1995	Ghana	<i>Metropolitan and Allied Bank and later acquired by BPI Malaysia.</i>
16	First Atlantic Merchant Bank	FAMB	1995	Ghana	
17	The Trust Bank	TTB	1994	Ghana	<i>Meridian BIAO</i>
18	Amalgamated Bank	ABL	1996	Mali	
19	International Commercial Bank	ICB	1996	Malaysi a	
20	Unibank	UGL	1997	Ghana	
21	Stanbic Bank	SBG	1999	S. Africa	<i>An investment wing of Standard Bank in South Africa, the original parent bank of Standard Chartered Bank.</i>
22	HFC Bank	HFC	2003	Ghana	<i>Offshoot of Home Finance Company, (Mortgage Financing) established in 1994</i>
23	United Bank for Africa	UBA	2005	Nigeria	<i>Entered Ghana as Standard Trust Bank, later parent bank was acquired. Introduced the first cashless account.</i>
24	Zenith Bank	ZBL	2005	Nigeria	
25	Guaranty Trust Bank	GTB	2006	Nigeria	
26	Intercontinental Bank	IBG	2006	Nigeria	
27	Fidelity Bank	FBL	2006	Ghana	<i>Offshoot of the Fidelity Group, (Investment and Securities) established in 1998.</i>
28	Bank of Baroda	BBL	2008	India	
29	Sahel Sahara Bank	BSIC	2008	Libya	
30	Access Bank	ABG	2009	Nigeria	
31	Energy Bank	EBL	2011	Nigeria	

** No longer operational (see historical remarks) This table chronicles when each of the universal banks entered the market as well as each bank's country-of-origin. There is a remarks column for important landmarks along the developmental path of some banks.

In order to establish the current competition in the banking industry, the 2010 market shares (latest available) serve as inputs to calculate the market concentration of universal banks in Ghana. The HHI is calculated of each year is calculated according to the number of banks. Since Ghana has no specific guidelines and regulations regarding mergers and acquisitions, conclusions in this paper are drawn using international acceptable standards (the 1992 guidelines established by the United States DoJ). The HHI is calculated from 2003 to 2010. It would have been ideal to calculate a ten- year period but the reliable data obtained from the survey started in 2003. In order to forecast the concentration levels in the industry after possible mergers, various scenarios of consolidations have been created.

RESULTS

Even though the Security Exchange Commission (SEC) has the mandate of regulating mergers and acquisitions in public listed companies in Ghana, not much legal framework has been developed to guide businesses in terms of consolidations matters outside the domain of SEC. Securities Industry Law, 1993, (P.N.D.C. Law 333) and Security Exchange Act, 2000, (Act 590), do not provide enough guidelines in mergers and acquisitions in Ghana. Past consolidation of Guinness Ghana Limited and Ghana Breweries Company which culminated in a duopoly, points to the fact that every consolidation is acceptable in Ghana. It is commonplace knowledge that market economies frown on monopolies and blatant oligopolies in certain sectors of the economy. However, the legal system in Ghana seems ambivalent on these. Table 2 depicts raw percentage market shares of industry deposits and net advances from 2003 to 2010 (Ghana Banking Survey, 2011); the basis for calculation of the HH indices.

Table 2: Share of Industry Deposits and Net Advances of Universal Banks (2003 -2010)

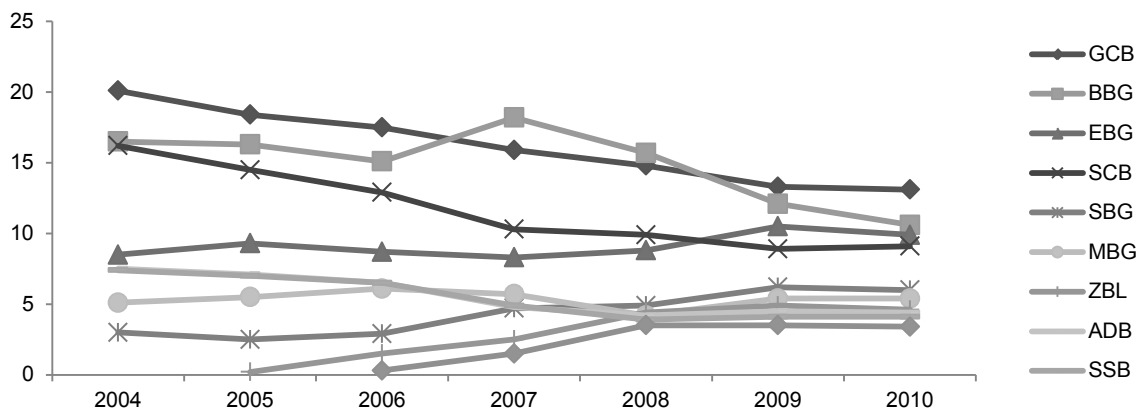
	BAN K	2010		2009		2008		2007		2006		2005		2004		2003	
		D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L
1	GCB	13.1	15.0					15.									19.
2	BBG			13.3	21.7	14.8	20.1	9	19.1	17.5	15.9	18.4	2	20.1	18.6	4	19.7
3	EBG	10.6	6.5					18.					17.				17.
4	SCB			12.1	8.8	15.7	13.3	2	16.5	15.1	15.8	16.3	3	16.5	18.3	7	18.0
5	SBG	9.9	7.4	10.5	7.7	8.8	7.3	8.3	7.4	8.7	7.0	9.3	7.3	8.5	6.1	7.7	7.0
6	MBG	9.1	7.0					10.					13.				17.
7	ZBL			8.9	7.0	9.9	8.5	3	7.4	12.9	10.4	14.5	7	16.2	14.5	6	15.9
8	ADB	6.0	5.1	6.2	4.5	4.9	4.5	4.7	5.0	2.9	3.1	2.5	1.6	3.0	2.3	1.8	1.2
9	SSB	5.4	3.4	5.4	5.8	4.2	5.7	5.7	7.6	6.1	9.5	5.5	7.2	5.1	5.7	4.9	4.1
10	IBG	4.6	4.0	4.9	3.2	4.4	2.5	2.5	1.7	1.5	0.6	0.2	0.2	0	0	0	0
11	ABL	4.4	8.6	4.5	6.4	4.2	6.8	4.8	5.7	6.5	6.6	7.1	8.0	7.5	7.5	9.2	9.7
12	FBL	4.1	4.5	4.1	5.1	3.9	5.3	4.9	5.5	6.5	6.2	7.0	7.8	7.4	6.6	7.7	8.4
13	CBL	3.4	4.1	3.5	3.6	3.5	3.2	1.5	0.9	0.3	0.3	0	0	0	0	0	0
14	PBL	3.1	2.8	3.2	2.8	3.4	2.2	2.2	1.9	1.5	0.8	1.1	0.7	1.2	0.7	0.9	0.5
15	FAM	4.5	3.2	3.1	3.0	2.1	1.6	2.3	0.9	1.8	0.1	0	0	0	0	0	0
16	TTB	2.4	3.8	2.9	3.7	2.3	3.5	2.2	2.9	2.4	3.7	2.4	2.5	2.6	2.7	2.3	2.5
17	UBA	2.8	3.4	2.7	3.2	2.6	2.9	3.2	3.0	2.9	3.9	2.8	3.0	2.4	2.6	1.9	1.5
18	GTB	1.2	1.5	2.7	1.5	4.4	3.2	1.8	1.8	1.6	2.4	1.7	2.5	1.2	1.9	1.3	1.8
19	HFC	2.3	3.9	2.4	3.0	2.3	3.0	2.7	2.9	2.6	3.0	2.9	2.8	3.1	2.0	2.7	2.0
20	ICB	2.6	1.3	2.1	0.8	2.5	0.7	0	0	0.1	0.1	0	0	0	0	0	0
21	UTB	2.7	3.3	2.0	1.9	1.2	1.2	1.0	1.0	0.7	0.7	0.6	0.6	0.5	0.4	0.5	0.3
22	ABG	2.4	2.1	1.9	1.8	2.1	0.8	0.6	0.3	0.3	0	0	0	0	0	0	0
23	BSIC	1.5	2.7	1.5	2.7	1.4	2.6	1.5	2.6	1.5	2.9	1.1	1.9	0.8	2.0	0.6	2.4
24	BBL	0.9	0.7	0.9	0.6	1.0	0.6	1.1	0.6	1.4	0.7	1.4	0.6	1.2	0.7	1.0	0.4
25	NIB	1.5	4.7	0.9	0.8	0.3	0.5	0.3	0.3	0.5	0.3	0.5	0.4	0.6	0.4	0.7	0.4
26	Total %	100	100	100			100%	100	100	100	100	100	100	100	100	100	100

D: Deposits, L: Net Advances (Loans) Source: Ghana Banking Survey, 2004-2011 This table displays the raw percentage market shares of existing universal banks in Ghana in terms of deposits and net advances from 2003-2010. The data have been compiled from year by year releases of the Ghana Banking Survey.

From Table 2, the share of industry deposits reveals that the smaller banks are capturing market share from the market leaders. For instance, in 2007 and 2008, BBG, the then market leader had market share of 18.2% and 15.7% respectively but in 2009, it placed second to GCB with a market share of 12.1% and further decline to 10.6% in 2010; signifying significant reduction in four years. GCB, between 2003 and 2010 consistently lost an average of 1.5 points of its market share for deposits annually. Much as it is normal in industrial organizations for market shares to shrink as more firms enter the industry, with the resources at the disposal of GCB, BBG and SCB, the worst expected of these banks was status quo. The

fact that the leading banks are losing market shares consistently suggest that competition in the banking environment can be aggressive in the near future. Some existing smaller banks are also losing grounds and in some instances others have managed undulating performances. At the time top banks have been losing market shares, new entrants like ZBL, SBG, IBG, FBL, GTB and UBA have been making inroads to gain higher market shares. ZBL, however, is more aggressive in its pursuit than the other Nigerian cohorts. Ghana's banking environment has changed drastically such that the current situation runs contrary to the findings of Korsah *et al.* (2001) who observe that the market shares of the rest of the banks have moved within a rather narrow band implying that they have not made significant inroads by way of wresting market share from the Top 4 banks or 'growing' their own markets. Figure 1 depicts the trend-lines of the top ten banks and their respective market shares (deposits) since 2003.

Figure 1: Trends of Deposits Market Share of Top 10 Banks 2003-2010



This figure shows the trend of market shares of industry deposit of the top 10 banks from 2003-2010. The tapering end depicts the competition in the industry in recent years.

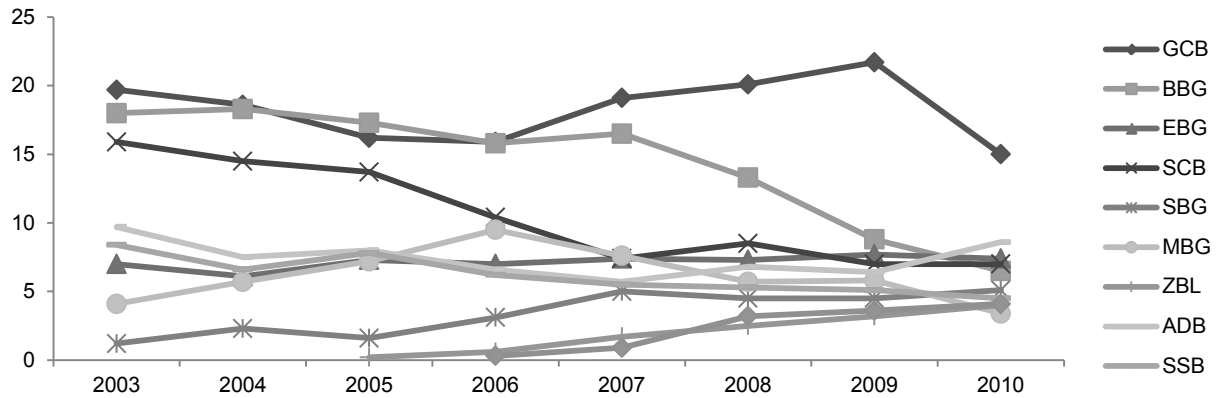
From Figure 1, it is evident that in 2003, the three leading banks had a commanding lead in terms of market share of industry deposits when each bank held more than 15 percent market share. As the years go by and competition intensifies, EBG, SBG, ZBL and other are making significant inroads such that the highest market share (deposits) in 2009 was 13.3%. The figure above shows at a glance, the spread at 2003 which strikes a chord with Korsah *et al's* (2001) conclusion of a wide gap of market share between leading banks and others; and the convergence at 2009. The findings also supports the assertion of Aboagye-Debrah (2007) that the reduction in market concentration for the six large banks from 86% to 71% from 2000 and 2005 was marginal and the industry could do with further competition. However the story differs in the net advances criterion. GCB managed to maintain its lead and increased its market share in the midst of the global financial crisis. Other leading banks have not been able to catch up.

where MS_i represents the market share of firm i and there are n firms in the market. Hence, the summation of squares of (bank 1) + (bank 2) + (bank 3).....(bank 25). We proceed by calculating market shares from 2003 to 2010. In practice, market shares in banking are calculated based on three major criteria: industry deposits, industry net advances, and industry total assets. However, this study limits itself to deposits and net advances since they are seen as more market-driven activities than assets which are mainly strategic in nature.

The HHI indices reported in Table 3 below support the assertion that for the past eight years the entire banking industry in Ghana has been highly competitive market with no signs of concentration. However, currently, the net advances market is more competitive than deposit market, recording 644.3 and 675 points respectively. Also observable from Table 3 is that using the U.S. 1992 guidelines it is abundantly

clear that Ghana’s banking environment has consistently reduced its HHI since 2003, suggesting that no bank commands market power.

Figure 2: Trends of Net Advances Market Share of Top 10 Banks 2003-2010



This figure shows the industry market share in net advances for the period under review. It shows clearly the commanding lead of Ghana Commercial Bank in net advances.

The calculation of Herfindahl-Hirschman Index is easily done when all market shares are known; the formula is:

$$HHI = \sum_{i=1}^n (MS_i)^2 \tag{3}$$

Table 3: HHI (Deposits) and (Net Advances) 2003-2010

Year	No. of Banks	HHI (Deposits)	HHI (Net Advances)	Commencement of Operations
2010	25	675.0	644.3	
2009	25	718.2	868.5	ABG
2008	23	814.9	907.2	BSIC, BBL
2007	23	928.3	962.6	
2006	23	964.9	931.7	GTB, FBL, IBG
2005	20	1088.9	1048.8	UBA, ZBL
2004	18	1188.9	1141.9	
2003	17	1255.1	1236.6	HFC

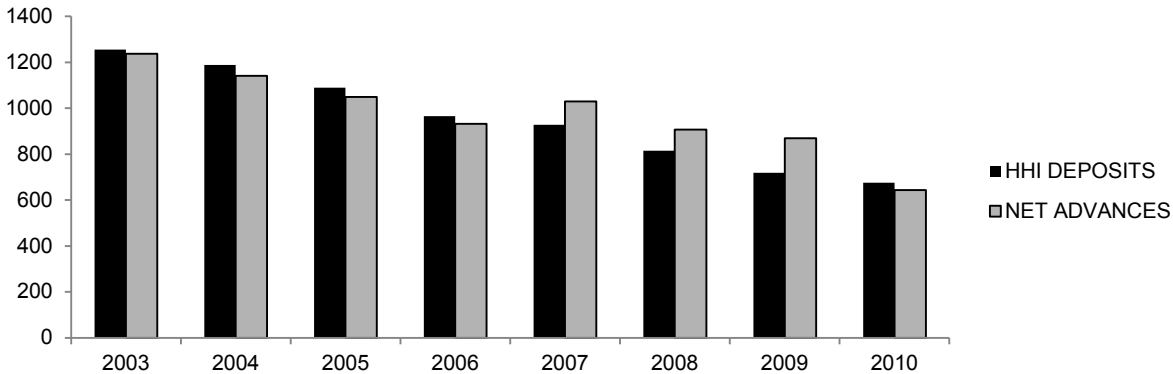
This table shows HHI in terms of deposits and net advances for the years under review. It depicts the number of banks that were surveyed in a particular year and new banks that joined the industry in the course of the period. The summary points clearly to the fact that the HHI decreases as more banks enter the industry.

The comparison between the figures for deposit and that of net advances suggest that there is a dominant market leader in net advances; accounting for the higher HHI from 2007. In most cases, the behaviour of the industrial player with commanding market share dictates the pattern of HHI. For instance, before 2006 with the exception of BBG, all market leaders had higher market shares in deposits than net advances; which gives credence to the maxim that “one cannot give what one doesn’t have”. However, with the abolition of the secondary reserve in 2005, it was possible for banks to be aggressive in lending; hence, from 2007 when BBG was looking inwards to correct the over-exposure of the previous years, GCB took a commanding lead with its might and captured net advances market shares; a position it still maintains. This could be attributed to the scramble for market shares around 2007 as a result the entry of about five banks on the market.

The Nigerian banks were very aggressive in the pursuit of market shares. Their marketing innovations brought down the regime of high initial deposits and minimum balances. For instance, before 2005, some

banks demanded the equivalent of \$75 for customers to open accounts. Other local banks had similar arrangements even though thresholds were comparatively lower. In 2006, UBA (then STB) introduced the cashless account which was unknown in Ghana’s banking sector. Customers could, therefore, open empty accounts and build up later. Other Nigerian banks followed, eventually. The existing banks had to yield to pressure, accepting initial deposits as low as GH¢ 5 (\$5) in 2007. Figure 3 is a bar graph that shows the comparison between HHI in deposits and net advances. Carbo *et al*, (2003) posit that a competitive financial sector confers benefits on users of financial services.

Figure 3: HHI (Deposits) and Net Advances (2003-2010)



This figure compares the HHI for both Industry deposits and advances which are the main measures of market shares in banking. The trend shows competitiveness in deposit mobilization from 2007 to 2009.

Forecast of Future Concentration Levels in Event of Consolidations

Two objectives are in the contemplation of this study: (1) to ascertain the concentration level of the banking industry in Ghana and (2) to forecast the future concentration levels should consolidations take place before the deadline for recapitalization at the end of 2012. The analyses done so far have focused on objective (1). We now turn our attention to objective (2). Using 2010 share of industry deposits, we would like to forecast concentration levels in event of (1) two-bank merger and (2) concentration levels in event of mega-mergers involving more than two Top Ten banks. Table 4 shows HHI (deposits) for 45 scenarios of two-bank mergers. The table depicts permutation of the likelihood of any two of the Top Ten banks merging. Two-bank merger between any other banks outside these scenarios will have no significant consequences on the Herfindahl index of the industry.

Table 4: Scenarios of Consolidation within Top 10 Banks (Post Merger HHI)

BANKS	GCB	BBG	EBG	SCB	SGL	MBG	ZBL	ADB	SSB
BBG	952.76								
EBG	934.42	884.92							
SCB	913.46	867.96	855.22						
SBG	832.24	802.24	793.84	784.24					
MBG	816.52	789.52	781.96	773.32	739.84				
ZBL	795.56	772.56	766.12	758.76	730.24	724.72			
ADB	790.32	768.32	762.16	755.12	727.84	722.56	715.52		
SSB	782.46	761.96	756.22	749.66	724.24	719.32	712.76	711.12	
IBG	764.12	747.12	742.36	736.92	715.84	711.76	706.32	704.96	702.92

This table shows the scenarios of consolidations within top 10 banks. That is, post merger HHI It points to the situation that will exist should any two of the top 10 banks merge.

It is obvious that GCB-BBG merger will trigger the highest HHI of 952.76 since the two banks have the highest market share. However, this will have inconsequential effect on the exiting market concentration. Evidently, all the permutations will keep the concentration below 1000, suggesting that even if there

should be a two-bank merger in Ghana’s banking industry this will not alter the existing market concentration structure.

Consolidation in its proper sense has no limits as to the number of banks that can come together. Playing the devil’s advocacy, mega-merger combinations have been put together to ascertain the possible outcomes in the unlikely event of mega-mergers taking place. In doing so, the concentration ratio and the HHI have been ascertained simultaneously. Hence, CR₃, CR₄, CR₅, and CR₆ have been calculated. Table 5 presents the outcome of the mega-mergers.

Table 5: Mega-Mergers and Consolidations

Level of Concentration:	CR ₃	CR ₄	CR ₅	CR ₆
	-	-	-	GCB
	-	-	GCB	BBG
	-	GCB	BBG	EBG
	GCB	BBG	SCB	SCB
	BBG	EBG	EBG	SBG
	EBG	SCB	SBG	MBG
Concentration Ratio	33.6	42.7	48.7	54.1
New Herfindahl Index	1422.02	2033.54	2545.94	3071.9

This table displays the concentration ratio and new Herfindahl Index in case of mega-mergers and consolidations arising out of the unlikely event of more than two banks merging.

Table 5 shows that the consolidation of four or less banks in the banking industry in Ghana will not create concentration upset. However, consolidation of five or more banks is likely to bring about high concentration in the banking industry which is likely to injure the interest of customers.

CONCLUDING COMMENTS

The paper seeks to answer two questions: (1) Is the banking industry in Ghana competitive? (2) Should bank consolidations occur as a result of the new bank recapitalization policy to what extent will they impact the competitive environment of Ghana’s banking industry? The paper uses secondary data sources from the Ghana Banking Survey Reports covering 2003-2010 conducted by PricewaterhouseCoopers in collaboration with Ghana Association of Bankers. The analysis shows that for the past eight years the banking industry in Ghana been highly competitive with no signs of concentration. The analysis also shows that any consolidation of four banks or less stimulated by the new bank recapitalization policy will not upset the existing market concentration. However, consolidation of five or more banks will culminate in high concentration which will be inimical to the interest of customers.

The conclusion drawn out of the study is that the Bank of Ghana and other regulators can safely approve mergers in the industry should they arise. However, they need to prevent consolidation of five or more banks in the top ten positions in the industry. Our findings have some implications for local banks, strategic investors, shareholders and consumers of banking services. Whereas equity capitalization window is available to the local banks, waiting too close to the deadline before listing on the Ghana Stock Exchange might create complications for them. Those local banks that may be contemplating of seeking refuge in equity recapitalization should, thus, fast track the process. Strategic investors may also invest in some banks and share control. However, in the absence of such moves, mergers and take-overs become the obvious choice.

There is the need to remind shareholders of solvent banks to move before all the good deals get finished. Mergers do not occur overnight and negotiations are not always smooth, the earlier banks start talking, the better for both acquirer and the target. The competitiveness of the banking industry in Ghana has been of immense benefit to bank consumers in the country. In their anxiety to claim higher market shares, some

banks more than ever, have been closer to their customers. Customer value in banking has increased to unprecedented levels since 2006. Major value propositions to consumers include customized banking, new product development, expedite loans processing, extended banking hours including weekend banking in selected banks, access to bank management, relationship marketing, improve banking environment, provision of electronic products, improved customer service among others. Consumers are, therefore, not willing to go back to the monopolistic era of banking, hence, the concern about consolidation outcomes. The competitive nature of the banking industry in Ghana implies that efficiency resulting in low bank charges is predictable. It is trite that when markets are operationally efficient the direct beneficiaries are the customers. This presupposes that bank customers in Ghana should expect low prices for the services rendered by banks in Ghana even in the face of bank consolidations.

Limitations of the Study

One obvious weakness of this paper is that it has relied on the data from survey reports gathered by PricewaterhouseCoopers. Thus, the validity of our conclusions is limited to the extent to which these data are credible. We would, therefore, recommend a follow-up study using a new dataset. Besides, our study has focused on the competitiveness of the universal banking industry. Rural and community banks have been omitted. It will, therefore, be advisable for future researchers to consider using our methodology to study these institutions.

REFERENCES

- Aboagye-Debrah, K., (2007), Competition, growth and performance in the banking industry in Ghana, PhD Thesis, St Clement University.
- Abor, J. and Biekpe, N. (2007), Small business reliance on bank financing in Ghana, *Emerging Markets Finance and Trade*, 43(4), 93-102.
- Adusei, M. (2012) Determinants of Bank Board Structure in Ghana, *The International Journal of Business and Finance Research*, 6(1), 15-23
- Adusei, M. (2011) Board Structure and Bank Performance in Ghana, *Journal of Money, Investment and Banking*, 19, 72-84
- Akomea, S.Y., (2009), Consequences of host country threshold regimes on small businesses, Conference Proceedings, 10th International Academy of African Business and Development Annual Conference, Makerere University, Uganda, 267-272.
- Aryeetey, E. (1996), The formal financial sector in Ghana after the reforms, Overseas Development Institute Working Paper Series, No. 86, Chameleon Press Ltd, London
- Barney, J.B. (1992) Strategic Factor Markets: Expectations, luck and business strategy in Foss, N.J. (1998), Resources, firms, and strategies: a reader in the resource-based perspective, by Oxford University Press.
- Carbo, V.S., Humphrey, D.B. and Rodriguez F.F., (2003) Deregulation, bank competition and regional growth, *Regional Studies*, 37(3), 227–237.
- Cetorelli, N. (2000), Competitive analysis in banking: appraisal of the methodologies, Federal Reserve of Chicago, *Economic Perspectives*, 1, 2-15.

Cetorelli, N. & Peretto, P. F., (2000), Oligopoly Banking and Capital Accumulation," Working Papers 00-19, Duke University, Department of Economics.

Ezeoha, A.E., (2011), Banking consolidation, credit crisis and asset quality in a fragile banking system: Some evidence from Nigerian data, *Journal of Financial Regulation and Compliance*, 19(1), 33-44

Ghana Banking Survey, (2010) Risk Management in well capitalized banks, PricewaterhouseCoopers and Ghana Association of Bankers, 2010.

Gockel, A. F. (1998), in *Banking in Africa: the impact of financial sector reforms since independence*, by Brownbridge M. and Harvey C., James Currey Publishers, Oxford, London.

Hausman J. and Sidak J.G., (2007), Evaluating market power using competitive benchmark prices rather than the Hirschman-Herfindahl Index, *Antitrust Law Journal*, 74(2), 387-407.

Hinson R, Owusu Frimpong, and Dassah, J. (2009) Key motivations for bank patronage in Ghana", *International Journal of Bank Marketing*, 27(5), 381-399

Kaysen, C. and Turner D.F. (1959) *Antitrust Policy*. Cambridge, Mass.: Harvard University Press.

Korsah, K.B, Nyarko, E.K, and Tagoe, N.A, (2001), Impact of financial sector liberalization on competition and efficiency in the Ghanaian banking industry, International Labour Organization Research Paper 01.

Lijesin, M. G. Nijkamp, P. and Rietveld P. (2002), Measuring competition in civil aviation, *Journal of Air Transport Management*, 8, 189-197.

Levin, D. (1990) Horizontal Mergers: The 50 Percent Benchmark, *The American Economic Review*, 80(5), 1238-1245

Mensah, (1997), Financial Markets and Institutions: Ghana's Experience", paper presented at the International Programme on Capital Markets and Portfolio Management, Indian Institute of Management, 8(20), 1-22.

Shih, M.S.H. (2003), An investigation into the use of mergers as a solution for the Asian banking sector crisis, *The Quarterly Review of Economics and Finance*, 43, 31-49.

Somoye, R.O.C. (2008), The performances of commercial banks in post-consolidation period in Nigeria: an empirical review", *European Journal of Economics, Finance and Administrative Sciences*, 14, 62-73.

Tirole, J. (1988), *The Theory of Industrial Organization*. The MIT Press, Cambridge, Massachusetts

White, L. J. (1987), Antitrust and merger policy: review and critique *Journal of Economic Perspectives*, Fall, 1987, 1, 13-22.

Wernerfelt, B. (1984), A resource- based view of the firm, *Strategic Management Journal*, 5(2), 171-180

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EFFECTS OF INSIDER SHAREHOLDING ON CORPORATE GOVERNANCE IN EMERGING MARKETS: EVIDENCE FROM TAIWAN

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ABSTRACT

Ownership structure is one of the key determinants constituting internal corporate governance, which is especially crucial in emerging markets. This study explores the effects of insider shareholding, an obvious characteristic of ownership structure, on corporate governance. The empirical results demonstrate partial support for the convergence-of-interests argument. This means that a higher insider shareholding structure tends to benefit corporate governance. However, the results also show possible moderating effects from different industrial settings; further studies are needed to deepen the understanding of these effects. Policy implications are provided for legislation and investing in emerging markets.

JEL: G32; G34; G38

KEYWORDS: corporate governance, ownership structure, insider shareholding, agency theory

INTRODUCTION

In recent years, emerging markets have drawn considerable attention for their growth potential. Correspondingly, corporate governance in emerging markets has become a focus of discussion (Kearney, 2012; Claessens & Yurtoglu, 2012). Emerging markets provide different research settings for academic-oriented researchers to re-examine theories and hypotheses derived from developed markets. Meanwhile, demands from the practical application front are also strong. Knowledge on emerging markets is crucial for extending business into these regions and for improving the institutional environment in these regions.

A complete system of corporate governance includes external mechanisms originating from the market and internal mechanisms within corporate organizations. However, emerging markets typically suffer from a lower level of legal protection for shareholders (Lins, 2003), a lack of influential institutional investors and an inactive takeover market (Tsai et al., 2006). Under these conditions, corporate governance systems in emerging markets tend to have a greater reliance on internal mechanisms rather than external ones (Sheu & Yang, 2005).

Taiwan's minimum shareholding requirement for insiders (directors and supervisors) is exactly such a case. According to the Security Exchange Act in Taiwan, the entire body of insiders in a public company must possess at least a certain number of shares of this company, which is presented in Table 1. This legal requirement attempts to strengthen internal corporate governance by regulating ownership structure (Hung & Chen, 2009). Although a similar regulation does not exist in any major country, ownership structure has long been considered a key determinant constituting internal corporate governance (Berle & Means, 1932; Jensen & Meckling, 1976; Fama & Jensen, 1983; Demsetz & Lehn, 1985; Shleifer & Vishny, 1997; Demsetz & Villalonga, 2001; Sanchez-Ballesta & Garcia-Meca, 2007). Insider shareholding is an obvious characteristic of ownership structure (Garcia-Meca & Sanchez-Ballesta, 2011; Gugler et al., 2008). Does a higher insider shareholding really benefit corporate governance? This study examines the effects of insider shareholding on corporate governance. Policy implications are provided based on the empirical results.

The remainder of this paper is organized as follows. The next section reviews the related literature and develops the scope of this research. We then describe our data and methodology and discuss the empirical results. The final section concludes.

Table 1: Taiwan's Minimum Shareholding Requirements for Insiders

Company Paid-in Capital	Entire body of Directors	Entire body of Supervisors
Less than NT\$ 0.3 billion	15.00%	1.50%
NT\$ 0.3 billion - NT\$ 1 billion	10.00%	1.00%
NT\$ 1 billion - NT\$ 2 billions	7.50%	0.75%
NT\$ 2 billion and above	5.00%	0.50%

This table shows minimum shareholdings required by Taiwan's Security Exchange Act. According Article 26 of the Act, public companies must file the total combined number of shares held by their directors and supervisors every month. When this number falls below the legally mandated minimum shares, authorities levy a fine and dictate a deadline by which the minimum number must be met.

LITERATURE REVIEW

In their influential 1932 masterpiece, *The Modern Corporation and Private Property*, Berle and Means first discussed the separation of ownership and control (Berle & Means, 1932). Since that time, numerous theoretical and empirical studies have explored the consequences of ownership structure (e.g. Cullinan et al., 2012; Taboada, 2011; Delios et al., 2008; Patro, 2008; McConnell et al., 2008; O'Regan et al., 2005; Donnelly & Kelly, 2005). As an obvious characteristic of ownership structure, insider shareholding has been repeatedly investigated. Nevertheless, no commonly accepted theory regarding the effects of insider shareholding has been reached.

According to classic agency theory, increased insider ownership naturally helps align insider-owner's interests with those of outside shareholders. Thus, a higher insider shareholding could improve firm performance (Fama & Jensen, 1983; Jensen and Meckling, 1976). This is the convergence-of-interests argument. Many reasons have been provided to explain the positive insider shareholding-performance relationship, e.g. signaling effects (Leland & Pyle, 1977), decreased agency costs of free cash flow (Jensen, 1986), and mitigated problem of managerial myopia (Palia & Lichtenberg, 1999).

Alternatively, the entrenchment argument asserts that insiders tend to secure their positions, build up a business empire, and resist supervision (Jensen & Ruback, 1983). When insiders possess a higher number of shares, which increases their discretion and strengthens their positions, they tend to inflate their own power and damage internal supervisory rules to pursue their own interests (Morck et al., 1988; Gugler et al., 2008), hence assailing corporate governance.

Recently, a stream of articles has suggested that there is a non-linear relationship between insider shareholding and firm performance in an attempt to synthesize the two rival arguments. However, the empirical results are even more diversified because of the inherent complexity of non-linear model. For example, Morck et al. (1988) presented a N-shaped curve with two turning points to portray the relationship; Hermalin and Weisbach (1991) depicted the relationship as a M-shaped curve with 3 turning points; Cui and Mak (2002) found a W-shaped curve with 3 turning points; Davies et al. (2005) specified a fifth-degree function with two maximum turning points and two minimum turning points; Selarka (2005) found a U-shaped curve with one turning point; Hung and Chen (2009) obtained a V-shaped curve.

It's worthy to note here, that most of the above cited studies actually examined firm performance (e.g. return of asset, earnings per share, productivity, and market value-Tubin's q) rather than quality of corporate governance. However, firm performance doesn't necessarily synchronize with quality of

corporate governance. Although it's understandable that performance is an innate concern of business or management-related studies and is a research variable more clearly defined and easy to measure. The original concern regarding ownership structure (or insider shareholding) is corporate governance.

Very limited studies explored non-performance effects of ownership structure. Garcia-Meca and Sanchez-Ballesta (2011) investigated the influence of ownership structure on analysts' forecast accuracy for Spanish firms. Because analysts' forecast accuracy is deeply associated with the quality of financial reports, and the quality of financial information is largely determined by quality of corporate governance (Ackert & Athanassakos, 2003), the dependent variable of this study is considered more related to corporate governance. Cullinan et al. (2012) investigated the relationship of ownership structure and accounting conservatism in China. Accounting conservatism itself is actually a governance mechanism serve to lessen information asymmetry to result in better protection of outside shareholders (Lara et al., 2009; LaFond & Roychowdhury, 2008).

Contrary to arguments derived from agency theory, some scholars have asserted that external supervisory mechanisms based on market economic rationality (e.g. potential merge-and-acquisition threats and competitive pressures) and appropriate internal supervision or motivation measures (e.g. internal audits and employee profit-sharing schemes) are sufficient to induce insiders to fulfill their management responsibilities (Demsetz & Lehn, 1985; Demsetz & Villalonga, 2001). Stewardship theory has also provided a new notion from the organizational behavior perspective. This theory posits that numerous non-financial incentives (e.g. the pursuit of career achievements, social reputation, and self-fulfillment) influence manager behavior and that managers are not necessarily agents in sole pursuit of self-interest (Muth & Donaldson, 1998).

In summary, existing research articles indicate that insider ownership has complex consequences. To explore its effects on corporate governance, a more realistic strategy is to differentiate industry settings. This study adopts such an approach.

DATA AND METHODOLOGY

Data and Sample

The data used in this study were drawn from the Taiwan Economic Journal (TEJ) database. Annual data were collected from January 1, 2004 to December 31, 2007 to avoid the effects of legal regulation revision. To ensure completeness of annual data, sample companies were restricted to those listed before January 1, 2004 and continuously listed through December 31, 2007. Sample companies were listed on the Taiwan Stock Exchange Corporation (TSEC) or were traded through the Over-the-Counter Securities Exchange (OTC). Companies listed on TSEC are typically larger in scale, whereas companies traded through OTC are smaller and typically in their early development stage. To compare between the technological industry and the traditional industry, companies in the electronics and biotech segments were labeled "technological," and companies in the textile, steel, construction, food, chemical, and machinery industries were labeled "traditional." The number of effective observations totals 1,156. The breakdown of effective observations are 320 in TSEC-technological, 536 in TSEC-traditional, 168 in OTC-technological, and 132 in OTC-traditional.

Variable Definition and Measurement

Insider shareholding is the independent variable of this study by nature. We defined insider shareholding as the aggregate ownership of directors and supervisors. This definition is consistent with and comparable to those of existing studies. However, thanks to Taiwan's minimum shareholding requirement for insiders, this study designed two additional measures to provide a richer observation on insider shareholding. The

three measures of insider shareholding used in this study were insider shareholding ratio (ISR), insider shareholding deviation (ISD), and frequency of insufficient shareholding (FIS). ISR is the aggregate shareholding of directors and supervisors over the weighted average outstanding common stock in a given year. This is a fundamental and commonly used measure of insider ownership. ISD refers to the difference between ISR and the legally required minimum shareholding ratio in a given year. ISD is a positive number when the aggregate insider shareholding is higher than the legal requirement. Conversely, a negative ISD shows that the aggregate insider shareholding falls below the legal requirement. FIS is the number of months filed as insufficient shareholding in a given year. According to Taiwan's Security Exchange Act, public companies must file their aggregate insider shareholding every month. Companies are fined if their aggregate insider shareholdings are lower than the minimum legal requirements. Thus, the value of this indicator ranges from 0 to 12, which is the number of times in a given year that a company is fined for insufficient aggregate insider shareholding.

Revision of financial information (RFI) and crisis occurrence (CRI) were adopted as proxies of level of corporate governance, which is the dependent variable of this study. RFI is defined as the number of times a company revises its financial predictions and corrects its financial statements in a given year. CRI is a dummy variable. When a company runs into crisis in a given year, CRI is dummy coded as 1, and 0 if no crisis occurs in that year. The TEJ database labels a company as falling into a crisis in one of the following situations: default, bankruptcy, request for a bailout, suspension of operations caused by financial shortcomings, stock market delisting, temporary suspension of trade in the stock market, negative net worth, or financial misappropriation. Because both RFI and CRI are negative indicators, higher values mean that corporate governance is worse.

To identify the specific effect of insider shareholding, two covariates were used to control statistically for confounding influences on corporate governance. Leverage (LEV) denotes the ratio of total debts to total assets, which was included to account for the possibility that creditors are able to lessen managerial agency problems (McConnell & Servaes, 1995; Harvey et al., 2004). Duality (DUA) denotes a situation in which the board chair concurrently holds the position of general manager or CEO. Duality was dummy coded 1 if duality existed in a given year; otherwise, it was coded 0.

Empirical Models

The data used in this study included cross-sectional and time series longitudinal data of the years observed. A panel data model was adopted to obtain parameter estimates efficiently. The empirical model was adopted to examine the relationship between insider shareholding and the RFI (a proxy of level of corporate governance) as follows:

$$RFI_{it} = \alpha_{it} + \beta_1(ISR_{it}) + \beta_2(ISD_{it}) + \beta_3(FIS_{it}) + \beta_4(DUA_{it}) + \beta_5(LEV_{it}) + \varepsilon_{it} \quad (1)$$

Here, RFI_{it} is the regression dependent variable of company i ($i = 1 \dots n$) at year t ($t = 1 \dots n$); β_1 through β_5 are the parameters to be estimated; and ε_{it} is the random error.

Because CRI is a dummy variable, when used as the regression dependent variable, a logit method was adopted to establish the regression model, and White adjustment (heterogeneous variance adjusted standard error) was adopted to express the estimated results and reduce the regression formula variance heterogeneity problem. The empirical model is:

$$CRI_i = \alpha_i + \beta_1(ISR_i) + \beta_2(ISD_i) + \beta_3(FIS_i) + \beta_4(DUA_i) + \beta_5(LEV_i) + \varepsilon_i \quad (2)$$

EMPIRICAL RESULTS AND DISCUSSION

Descriptive Statistics

Table 2 presents the descriptive statistics. It reveals that insider shareholding structures are different among industrial settings. Companies in traditional industries tend to have higher ISR, higher ISD, and lower FIS, which implies a high and stable insider shareholding. As presents in the table, the *mean* of ISR and ISD for TSEC-technological companies is 0.1563 and 0.1361, respectively. Both are lower than the figures for TSEC-traditional companies (0.1922 and 0.1815, respectively). Likewise, the *mean* of ISR and ISD for OTC-technological companies is 0.2169 and 0.1939, respectively; both are lower than the figures for OTC-traditional companies (0.2479 and 0.1997, respectively). In addition, the technological industry has higher FIS. This echoes that Taiwan’s public companies in traditional industry typically develop from family-controlled businesses, and insider-owners of such companies tend to have higher shareholding even after the IPO process.

Different insider shareholding structures can also be found in TSEC companies and OTC companies. OTC companies have a higher ISR (0.2169 for OTC-technological, 0.1563 for TSEC-technological; 0.2479 for OTC-traditional, 0.1992 for TSEC-traditional) and a higher ISD (0.1939 for OTC-technological, 0.1361 for TSEC-technological; 0.1997 for OTC-traditional, 0.1815 for TSEC-traditional). Meanwhile, OTC companies also have a higher FIS (0.6667 for OTC-technological, 0.2406 for TSEC-technological; 0.3712 for OTC-traditional, 0.1063 for TSEC-traditional). The statistics show that insider-owners of OTC companies (typically smaller and/or younger) tend to possess higher shareholding and adjust their shareholding more frequently, which implies a high and unstable insider shareholding.

Table 2: Summary of Descriptive Statistics

	TSEC Companies				OTC Companies			
	Mean		Standard Deviation		Mean		Standard Deviation	
	Technological	Traditional	Technological	Traditional	Technological	Traditional	Technological	Traditional
ISR	0.1563	0.1922	0.0872	0.1485	0.2169	0.2479	0.1430	0.1742
ISD	0.1361	0.1815	0.1426	0.2222	0.1939	0.1997	0.2704	0.2161
FIS	0.2406	0.1063	1.0835	0.7195	0.6667	0.3712	1.6764	0.9839
DUA	0.3719	0.2519	0.4841	0.4345	0.4583	0.2727	0.4998	0.4471
LEV	0.3793	0.4023	0.1484	0.2305	0.4153	0.3963	0.1842	0.2568
CRI	0.0750	0.0448	0.2638	0.2070	0.1488	0.0985	0.3570	0.2991
RFI	0.1281	0.1381	0.5703	0.6172	0.0655	0.1515	0.3308	0.5859

This table shows the descriptive statistics. It reveals that insider shareholding structures are different among industrial settings. Companies in traditional industries tend to have higher ISR, higher ISD, and lower FIS, which implies a high and stable insider shareholding (comparing with technological industries). OTC companies tend to have higher ISR and ISD, accompanied with higher FIS, which implies a high and unstable insider shareholding (comparing with TSEC companies).

Table 3 presents correlation matrix of independent variables. It can be observed that all the 4 correlation coefficients of ISR and ISD are much higher than others and with statistical significance, which implies a severe collinearity might exist in the regression model. To avoid the collinearity problem, this study adopts variance inflation factor (VIF) to detect the potential problem. According to Hair et al. (2006), the acceptable VIF value should be lower than 10. As Table 4 presents, the all-variable-included mode (Mode 1) tends to have a high VIF value on ISR and ISD. However, when the regression models only include ISR or ISD (Mode 2 and Mode 3), most of VIF value on all variables are lower than 2. Thus, the following empirical analysis only adopts Mode 2 and Mode 3 to run regression models.

Table 3: Correlation Matrix

TSEC Companies							
	ISR	ISD	FIS	DUA	LEV	CRI	RFI
ISR		0.9002***	-0.0720*	0.0557	0.1947***	0.0002	0.0332
ISD	0.8763***		-0.0748*	0.0486	0.0994**	-0.0095	-0.0154
FIS	-0.1926***	-0.1629***		0.0158	0.1349***	0.3194***	0.0216
DUA	-0.0501	-0.1177**	0.0141		-0.0091	0.0406	0.0165
LEV	0.0779	0.0820	0.0342	-0.0368		0.3659***	0.1002**
CRI	-0.0781	-0.1312**	0.0902	0.0755	0.2049***		0.1417***
RFI	-0.0204	-0.0648	0.0058	0.1108**	-0.0075	0.1651***	
OTC Companies							
	ISR	ISD	FIS	DUA	LEV	CRI	RFI
ISR		0.8869***	-0.0428	0.1584*	0.5825***	0.1144	0.0180
ISD	0.9015***		-0.0041	0.1605*	0.5019***	0.1993**	0.0177
FIS	-0.1267	-0.1479*		0.0284	0.1803**	0.4196***	0.0606
DUA	0.0105	0.0267	0.0905		0.1546*	-0.0882	0.0742
LEV	-0.0943	-0.1619**	0.0623	-0.0971		0.3032***	0.1516*
CRI	-0.2596***	-0.2107***	0.1134	0.1189	0.2593***		0.0013
RFI	-0.1261*	-0.0882	0.1260*	-0.0377	0.0423	0.6691	

This table shows the correlation matrixes for TSEC and OTC companies respectively. The lower-left corner indicates technology industries, and the upper-right corner indicates traditional industries. *, **, and *** indicate significance at the 10%, 5%, and 1% levels respectively.

Table 4: Variance Inflation Factor (VIF) Analysis

	TSEC Companies						OTC Companies					
	Technological Industry			Traditional Industry			Technological Industry			Traditional Industry		
	Mode 1	Mode 2	Mode 3	Mode 1	Mode 2	Mode 3	Mode 1	Mode 2	Mode 3	Mode 1	Mode 2	Mode 3
ISR	7.345	1.141	-	7.830	1.367	-	10.619	1.559	-	14.289	4.552	-
ISD	11.518	-	1.361	8.404	-	1.229	5.469	-	1.070	7.815	-	6.063
FIS	1.008	1.008	1.009	1.003	1.003	1.003	1.079	1.082	1.078	1.031	1.025	1.025
DUA	1.107	1.020	1.063	1.013	1.012	1.013	1.068	1.066	1.068	1.065	1.057	1.063
LEV	1.036	1.037	1.033	1.222	1.179	1.113	1.121	1.045	1.044	2.941	2.489	1.626

This table adopts VIF to detect the potential collinearity problem. The all-variable-included mode (Mode 1) is excluded from regression analysis because of its high VIF value on ISR and ISD.

Empirical Results

This study uses RFI and CRI as proxies for level of corporate governance. In Empirical Model (1), RFI is the dependent variable to perform a fixed effect panel data regression. In Empirical Model (2), CRI is the dependent variable to perform a logit mode regression. The empirical results are presented in Table 5, which shows partial support for the convergence-of-interests argument.

Empirical Model (1) shows the following results. For TSEC-technological companies, both ISR and ISD have a negative coefficient with statistical significance ($p=0.0225$ and $p=0.0261$, respectively). The same results can be found in OTC-traditional companies where both ISR and ISD are significantly negative ($p=0.0068$ and $p=0.0695$, respectively). This phenomenon implies that a higher level of corporate governance (lower RFI) comes with a higher insider shareholding structure; this supports the convergence-of-interests argument. However, the same results cannot be found in TSEC-traditional companies and OTC-technological companies. For TSEC-traditional companies, ISR has a significantly positive coefficient. However, its p -value is only 0.0779, which is not a strong anomaly. Firm scale has opposite moderating effects for companies in technological industry and traditional industry. As OTC companies are typically smaller in scale comparing with TSEC companies. It can be observed that the insider shareholding-corporate governance relationship is not significant for OTC-technological companies but significant for TSEC-technological companies. Conversely, the relationship is significant for OTC-traditional companies but insignificant for TSEC-traditional companies.

The results of Empirical Model (2) demonstrate a more consistent relationship between insider shareholding and the level of corporate governance. However, statistical significance can only be observed in technological industries. For TSEC-technological companies, the p -value for ISR and ISD is 0.0837 and 0.0047, respectively. For OTC-technological companies, the p -value for ISR and ISD is 0.0385 and 0.0677, respectively. For both TSEC- and OTC-traditional companies, p -values are insignificant.

Other than ISR and ISD, the empirical results on FIS are notable. In both Empirical Models (1) and (2), FIS is consistently significant in traditional industries, which tend to have higher insider shareholding. In Empirical Model (1), FIS p -values are 0.0404 (Mode 2) and 0.0417 (Mode 3) in TSEC-traditional companies, and 0.0177 (Mode 2) and 0.0685 (Mode 3) in OTC-traditional companies. Similar results can be found in Empirical Model (2). For TSEC-traditional companies, the FIS p -values are 0.0176 (Mode 2) and 0.0175 (Mode 3); for OTC-traditional companies the FIS p -values are 0.0003 (Mode 2) and 0.0001 (Mode 3). However, FIS does not relate to the level of corporate governance in technological industries, irrespective of whether it is TSEC or OTC, even though technological industries tend to have lower insider shareholding.

Taiwan's minimum shareholding requirement, which establishes a bottom line for insider shareholding and requires all public companies to file their insider shareholding figures every month, actually creates a signal to the stock market. However, the empirical results on FIS do not support the idea that insufficient shareholding has a consistent effect in different industrial settings. Two implications can be drawn from this part of empirical result. First, the critical volume for insider shareholding might vary among industrial settings. If so, the minimum insider shareholding requirement could raise dispute for its fairness. Second, for investors in the Taiwan stock market, the mandatorily revealed information about insider shareholding is more meaningful for traditional industries, which tend to have a higher insider shareholding structure.

Table 5: Effects of Insider Shareholding on Corporate Governance

	TSEC Companies				OTC Companies			
	Technological Industry		Traditional Industry		Technological Industry		Traditional Industry	
	Mode 2	Mode 3	Mode 2	Mode 3	Mode 2	Mode 3	Mode 2	Mode 3
Empirical Model (1): $RFI_{it} = \alpha_{it} + \beta_1(ISR_{it}) + \beta_2(ISD_{it}) + \beta_3(FIS_{it}) + \beta_4(DUA_{it}) + \beta_5(LEV_{it}) + \varepsilon_{it}$								
ISR	-0.0081 (0.0225)**		0.0023 (0.0779)*		0.0004 (0.2273)		-0.5058 (0.0068)***	
ISD		-0.0033 (0.0261)**		0.0001 (0.2358)		0.0022 (0.1262)		-0.1190 (0.0695)*
FIS	0.0003 (0.5041)	0.0003 (0.5082)	0.0002 (0.0404)**	0.0000 (0.0417)**	0.0000 (0.4028)	0.0001 (0.2152)	0.0066 (0.0177)**	0.0042 (0.0685)*
DUA	0.0037 (0.1139)	0.0037 (0.1257)	-0.0003 (0.1699)	-0.0001 (0.2529)	-0.0000 (0.5017)	-0.0000 (0.9645)	0.0021 (0.4378)	0.0018 (0.4186)
LEV	-0.0125 (0.0094)***	-0.0112 (0.0102)**	0.0000 (0.1664)	0.0000 (0.4794)	0.0009 (0.2248)	0.0010 (0.1637)	0.3714 (0.0132)**	0.1940 (0.0302)**
Adj. R²	0.3293	0.3241	0.3368	0.3384	0.1029	0.1016	0.1686	0.1418
F value	2.8867***	2.8433***	2.9828***	2.9978***	1.4259*	1.4200*	1.7377**	1.6014**
D-W value	2.5122	2.5163	2.8034	2.8114	2.6730	2.6660	2.9185	2.9015
Empirical Model (2): $CRI_i = \alpha_i + \beta_1(ISR_i) + \beta_2(ISD_i) + \beta_3(FIS_i) + \beta_4(DUA_i) + \beta_5(LEV_i) + \varepsilon_i$								
ISR	-4.5165 (0.0837)*		-1.5196 (0.5454)		-11.8032 (0.0385)**		-0.4409 (0.7224)	
ISD		-6.9662 (0.0047)***		-0.8376 (0.5617)		-10.4813 (0.0677)*		0.5959 (0.3949)
FIS	0.1372 (0.2122)	0.0993 (0.3648)	0.8303 (0.0176)**	0.8153 (0.0175)**	0.0871 (0.5149)	0.0561 (0.6533)	0.4232 (0.0003)***	0.4457 (0.0001)***
DUA	0.6060 (0.1641)	0.4905 (0.2721)	1.0843 (0.0853)*	1.0687 (0.0836)*	0.9001 (0.0656)*	0.7475 (0.1245)	-0.3190 (0.4252)	-0.3271 (0.4093)
LEV	5.6492 (0.0013)***	5.7488 (0.0012)***	12.5025 (0.0000)***	12.4751 (0.0000)***	4.6785 (0.0023)***	4.1598 (0.0049)***	1.8494 (0.0449)**	1.3262 (0.1372)
McF R²	0.1141	0.1461	0.4900	0.4893	0.2322	0.2151	0.2672	0.2723
LR value	19.4586***	24.9114***	96.0496***	95.9033***	32.8189***	30.4003***	22.6947***	23.1311***

This table shows regression results based on Empirical Model (1) and (2). The number before the () is the coefficient; the number within the () is the p-value. *, **, and *** denote the 10%, 5%, and 1% significant level respectively. The overall empirical results are in favor of the convergence-of-interests argument. In the results of Empirical Model (1), both ISR and ISD have a negative coefficient with statistical significance for TSEC-technological companies and OTC-traditional companies, implies that a higher level of corporate governance (a lower RFI) comes with a higher insider shareholding structure. The results of Empirical Model (2) demonstrate a more consistent relationship between insider shareholding and the level of corporate governance. However, statistical significance can only be observed in technological industries. In both Empirical Models (1) and (2), FIS is significant in traditional industries but not significant in technological industries. That means the insufficient insider shareholding doesn't have a consistent effect in different industrial settings.

CONCLUDING COMMENTS

This study examines the effects of insider shareholding on corporate governance. Existing theories provide two rival arguments regarding consequences of insider shareholding. The convergent-of-interests argument predicts a positive effect resulting from increased insider shareholding, while the entrenchment argument predicts a negative effect. What the effects most previous empirical researches investigated is on firm performance, e.g. return of assets, market value of the firm (usually measured by Tobin's q), productivity, and earnings per share. This study refocuses research concern on the quality of corporate governance, which is the original concern of the discussion of ownership structure.

Taking advantage of Taiwan's minimum insider shareholding requirement, this study designs two additional measures, ISD and FIS, along with the commonly used ISR to provide a richer observation on insider shareholding. RFI and CRI were adopted as proxies of level of corporate governance. The empirical results are in favor of the convergence-of-interests argument. Meanwhile, the inconsistency implies that industrial setting (firm scale and technological characteristic) might have moderating effects on the relationship of insider shareholding and corporate governance. Further studies are needed to deepen the understanding of these effects.

Though the positive convergence-of-interests effect is supported, it remains a technical difficulty to find appropriate minimum requirements for insider shareholding. Because the moderating effects of industrial setting are not very clear and the ever-changing business environment makes these effects even more complex and dynamic, the mandatory minimum insider shareholding inevitably raises dispute for its fairness. Nevertheless, it helps align the interests between insider-owners and outside shareholders, and ultimately, protects minority stock investors. For emerging economies who attempt to improve their overall corporate governance in a relative short-term, the legislative policy turns out to be a result of pro-and-con.

Corporate governance is a multi-dimension construct. In this study, RFI and CRI, the adopted proxies of level of corporate governance, each can only catch a part of reality. Given its importance for academic research and policy design, a more comprehensive and precise measurement is urgently needed for the future studies.

REFERENCE

- Ackert, L. and Athanassakos, G. (2003) A simultaneous equations analysis of analysts' forecast bias, analyst following and institutional ownership. *Journal of Business, Finance and Accounting*, 30(7), 1017-1041.
- Berle, A.A. and Means, G.C. (1932) *The Modern Corporation and Private Property*. New York: MacMillan Publishing Co.
- Claessens, S. and Yurtoglu, B.B. (2012) Corporate governance in emerging markets: A survey. *Emerging Markets Review*, doi: 10.1016/j.ememar.2012.03.002.
- Cullinan, C.P., Wang, F., Wang, P. and Zhang, J. (2012) Ownership structure and accounting conservatism in China. *Journal of International Accounting, Auditing and Taxation*, 21, 1-16.
- Cui, H. and Mak, Y.T. (2002) The relationship between managerial ownership and firm performance in high R&D firms. *Journal of Corporate Finance*, 8, 313-336.
- Davies, J.R., Hillier, D. and McColgan, P. (2005) Ownership structure, managerial behavior, and corporate value. *Journal of Corporate Finance*, 11, 645-660.

Delios, A., Zhou, N. and Xu, W.W. (2008) Ownership structure and the diversification and performance of publicly-listed companies in China. *Business Horizons*, 51, 473-483.

Demsetz, H. and Lehn, K. (1985) The structure of corporate ownership: Causes and consequences. *Journal of Political Economy*, 93(6), 1155-1177.

Demsetz, H. and Villalonga, B. (2001) Ownership structure and corporate performance. *Journal of Corporate Finance*, 7, 209-233.

Donnelly, R. and Kelly, P. (2005) Ownership and board structures in Irish plcs. *European Management Journal*, 23(6), 730-740.

Fama, E.F. and Jensen, M.C. (1983) Separation of ownership and control. *Journal of Law and Economics*, 26, 301-325.

Garcia-Meca, E. and Sanchez-Ballesta, J.P. (2011) Ownership structure and forecast accuracy in Spain. *Journal of International Accounting Auditing and Taxation*, 20, 73-82.

Gugler, K., Mueller, D.C. and Yurtoglu, B.B. (2008) Insider ownership, ownership concentration and investment performance: An international comparison. *Journal of Corporate Finance*, 14, 688-705.

Hair, J.F. Jr., Black, W.C., Babin, B.J., Anderson, R.E. and Thatam, R.L. (2006) *Multivariate Data Analysis*. New Jersey: Prentice-Hall.

Harvey, C.R., Lins, K.V. and Roper, A.H. (2004) The effect of capital structure when expected agency costs are extreme. *Journal of Financial Economics*, 74, 3-30.

Hermalin, B.E. and Weisbach, M.S. (1991) The effects of board composition and direct incentives on firm performance. *Financial Management*, 20, 101-112.

Hung, J.H. and Chen, H.J. (2009) Minimum shareholding requirements for insiders: Evidence from Taiwanese SMEs. *Corporate Governance*, 17(1), 35-46.

Jensen, M.C. (1986) Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review*, 76, 323-329.

Jensen, M.C. and Ruback, R.S. (1983) The market for corporate control: The scientific evidence. *Journal of Finance Economics*, 5(11), 5-50.

Jensen, M.C. and Meckling, W.H. (1976) Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Finance Economics*, 3(4), 305-360.

Kearney, C. (2012) Emerging market research: Trends, issues and future directions. *Emerging Markets Review*, 13, 159-183.

LaFond, R. and Roychowdhury, S. (2008) Managerial ownership and accounting conservatism. *Journal of Accounting Research*, 46, 101-135.

Lara, J.M.G., Osma, B.G. and Penalva, F. (2009) Accounting conservatism and corporate governance. *Review of Accounting Studies*, 14, 161-201.

- Leland, H.E. and Pyle, D.H. (1977) Information asymmetries, financial structure, and financial intermediation. *Journal of Finance*, 32(2), 371-384.
- Lins, K.V. (2003) Equity ownership and firm value in emerging markets. *Journal of Financial and Quantitative Analysis*, 38(1), 159–84.
- McConnell, J.J. and Servaes, H. (1995) Equity ownership and the two faces of debt. *Journal of Financial Economics*, 39, 131-157.
- McConnell, J.J. Servaes, H. and Lins, K.V. (2008) Changes in insider ownership and changes in the market value of the firm. *Journal of Corporate Finance*, 14, 92-106.
- Morck, R., Shleifer, A. and Vishny, R.W. (1988) Management ownership and market valuation: An empirical analysis. *Journal of Financial Economics*, 20, 293-315.
- Muth, M. and Donaldson L. (1998) Stewardship theory and board structure: A contingency approach. *Corporate Governance: An International Review*, 6(1), 5-28.
- Palia, D. and Lichtenberg, F. (1999) Managerial ownership and firm performance: A re-examination using productivity measurement. *Journal of Corporate Finance*, 5, 323-339.
- Patro, S. (2008) The evolution of ownership structure of corporate spin-offs. *Journal of Corporate Finance*, 14, 596-613.
- O'Regan, N., Sims, M. and Ghobadian, A. (2005) High performance: Ownership and decision-making in SMEs. *Management Decision*, 43(3), 382-396.
- Sanchez-Ballesta, J.P. and Garcia-Meca, E. (2007) A meta-analytic vision of the effect of ownership structure on firm performance. *Corporate Governance: An International Review*, 15(5), 879-893.
- Selarka, E. (2005) Ownership concentration and firm value. *Emerging Markets Finance and Trade*, 41(6), 83–108.
- Sheu, H.J. and Yang C.Y. (2005) Insider ownership structure and firm performance: A productivity perspective study in Taiwan's electronics industry. *Corporate Governance*, 13(2), 326-337.
- Shleifer, A. and Vishny, R.W. (1997) A survey of corporate governance. *Journal of Finance*, 52, 737-783.
- Taboada, A.G. (2011) The impact of changes in bank ownership structure on the allocation of capital: International evidence. *Journal of Banking & Finance*, 35, 2528-2543.
- Tsai, W.H., Hung, J.H., Kuo, Y.C. and Kuo, L. (2006) CEO tenure in Taiwanese family and non-family firms: An agency theory perspective. *Family Business Review*, 19(1), 11–28.

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THE EFFECT OF INNOVATION CAPABILITIES AND EXPERIENCE ON CROSS-BORDER ACQUISITION PERFORMANCE

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ABSTRACT

Due to the integration of the European market, the globalization process, and the rising importance of technological innovation, there has been a surge in cross-border acquisition strategy for European firms. Innovative technology and experience are the main drivers behind firms' acquisition imperatives to realize sound performance. Based on the resource-based view and organizational learning perspective, our empirical research focuses on the effects of European firms' innovative capabilities and experience on their acquisition performance when targeting United States firms. The results indicate that both innovative capabilities and experience have a positive effect on acquisition performance. This suggests that in order to have successful acquisition performance, European firms need to reinforce their innovative capabilities and commit to accumulating experience in articulating cross-border acquisition strategy. In addition, we discuss the interaction effect that relatedness has on the acquisition performance of European firms. Our findings indicate that related acquisitions associated with redundant or similar innovative capabilities and acquisition experience hinder acquisition performance. We posit that relatedness has a negative moderating effect on acquisition performance.

JEL: M16

KEYWORDS: Resource-based view, organizational learning, cross-border acquisition, innovation capability, acquisition experience, relatedness.

INTRODUCTION

Merger and acquisition (M&A) has long been a key strategy for firms wishing to initiate strategic growth and expansion (Shimizu, Hitt, Vaidyanath, and Pisano, 2004). Acquisitions represent a significant strategic choice, with increased global activity over the last decade (Boeh, 2011). As the globalization of business radically increases, it is evident that firms encounter opportunities for growth through cross-border acquisitions (CBAs). The increasing globalization of business has heightened both the opportunities and the pressures for firms to engage in CBAs (Hitt, Ireland, and Lee, 2000). The recent decade has proven that the already unprecedented number of CBAs is continually increasing (UNCTAD, 2011). Typical phenomena observed with the current acquisitions streams include more global attributes, with the value of CBAs growing more significant (Bertrand and Zuniga, 2006). However, numerous studies suggest that the intended CBAs are not highly successful.

Various motives induce firms to pursue CBAs. Many acquirers pursue CBAs to enhance their capability to gain resources and knowledge (Bartlett and Ghoshal, 1988; Luo, 2000). Specifically, studies indicate that there is a high correlation between research and development (R&D) expenditures and M&A activity, with firms utilizing acquisition strategy to obtain technology (Blonigen, 1997; Blonigen and Taylor, 2000; Kogut and Chang, 1991). This suggests that a technology and innovation seeking motive can be considered as an important driver of CBA. Previous studies have examined technological and innovative asset seeking intent in the context of European acquisitions, and observations of European M&A indicate growth in CBA activities (Sleuwaegen and Valentini, 2006). Scholars have posited that the integration of

Europe, the introduction of the euro, the globalization process, and technological innovation are causal factors behind the increasing number of acquisitions in Europe (Petroulas, 2007; Sleuwaegen and Valentini, 2006). The integration of European markets has further contributed to the surge in CBAs as firms search beyond national borders for promising acquisition partners (Frey and Hussinger, 2011).

Innovation and technological motives have been found to be strong in the case of European CBAs. Narula (1999) asserts that the main imperative of the single European market initiative was to narrow the technological and economic gap between the European Union (EU) and the United States (US). Crescenzi, Rodríguez-Pose, and Storper (2007) also state that the significant gap in innovative capacity between the EU and the US provides the impetus for European firms to implement vigorous innovation seeking CBA strategies. Frey and Hussinger (2006) also note that enhanced technological competencies are the main drivers behind European CBA attempts. As CBA activities demonstrate firms' strategic intent to vigorously search for technological innovation (Cefis and Marsili, 2006), the relationship between innovation capability and CBA performance has received escalating attention in the academic literature (Bertrand and Zuniga, 2006; Sleuwaegen and Valentini, 2006; Veugelers, 2006).

Strategic management and international business researches has generated important findings relevant to the effects of acquisition experience on the performance of CBAs. CBAs are complex events which diverge in various dimensions (Zollo and Singh, 2004). European firms' CBA strategies confront uncertainty and unfamiliar preferences that lead to the probability of acquisition failures (Barkema, Bell, and Pennings, 1996). In order to solve such failures, companies must prioritize the development of knowledge and the routines necessary for learning (Nelson and Winter, 1982; Nadolska and Barkema, 2007). Padmanabhan and Cho (1999) stressed that experienced acquirers may have developed the skills and capabilities to effectively manage CBAs. Accordingly, acquisition experience can indeed have an effect on performance (Haleblian and Finkelstein, 1999; Hayward, 2002). Lubatkin (1983) also suggested that a firm with prior acquisition experience may be more adroit regarding the management of the indispensable structural changes and therefore avoid administrative problems. It is therefore plausible that European firms with acquisition experience will likely have better performance in CBAs.

Our research questions focus on analyzing the effects of the innovative capabilities and experience of European firms targeting US on the acquisition performance. Intense global competition and technological advances have pressured European firms to adjust their economic organization and redefine their core competencies to construct technological assets (Bertrand and Zuniga, 2006). Through the combination of innovation capability and accumulated experience, European firms began utilizing CBAs as a strategic method to acquire new knowledge and innovative capabilities to enhance firm performance (Uhlenbruck, Hitt, and Semadeni, 2006; Vermeulen and Barkema, 2001).

We present our research in the following sequence. In the first section, we discuss the theoretical background and our hypotheses about the effect of innovation capability and acquisition experience, as well as the moderating effect of relatedness, on acquisition performance. In the second section, we discuss methodology and describe our variables and their measurements. In the third section, we present the results of our analysis including descriptive statistics and the hierarchical regression analysis. In the last section, we provide conclusions along with additional discussions.

LITERATURE REVIEW AND HYPOTHESES

Innovation Capabilities and CBA Performance

A substantial body of literatures asserts that firms are seeking to learn from knowledge sources beyond the boundaries of their own firms (Cassiman and Veugelers, 2002; Veugelers and Cassiman, 1999). Firms have their own knowledge bases (Levinthal and March, 1993; March 1991) which can be expanded

through knowledge enhancing investments and acquiring new knowledge (Cohen and Levinthal, 1989; Huber, 1991). Strategically, acquisitions expand and promote exploration which in turn helps firms overcome the inertia and rigidity that results from exploiting only the firm's existing knowledge base (Vermeulen and Barkema, 2001). Accordingly, CBAs are a fundamental management strategy for gaining competitive advantage (Driffield and Love, 2005) by providing access to foreign technological capabilities and knowledge (Neary, 2007; Kuemmerle, 1999). Innovation capabilities and knowledge bases acquired through CBAs permit innovation combinations that potentially increase the chances that a firm will develop innovation driven performance (Nelson and Winter, 1978; Zahra, 1996). Previous research indicates that a firm's absorptive capacity is developed over time through firms' own innovation capabilities and acquiring other firms' R&D capabilities enhances absorptive capacity and thus performance (Cohen and Levinthal, 1990; Tsai, 2001). In this vein, the acquiring firm's existing innovative capability is necessary for learning and applying the acquired new knowledge (Bierly and Chakrabarti, 1996; Cohen and Levinthal, 1990, Dutta and Kumar, 2009). Innovation intensive firms demonstrate a propensity to engage in acquisitions for more innovation for sound performance implications (Dutta and Kumar, 2009). Following this reasoning, we claim that the innovation capabilities of European firms have a positive impact on the performance.

Hypothesis 1: The higher the innovation capabilities of European firms, higher the CBA performance.

Acquisition Experience and CBA performance

The significance of experience and learning in acquisitions has been explored in the literatures on organization learning (Cyert and March, 1963; Levitt and March, 1988; March, 1991; Nelson and Winter, 1982). Firms acquire experience through being exposed to past events, activities, and capabilities (Zahra and George, 2002). Acquiring firms gain experience from prior engagement in acquisitions. Based on organization learning theory, researchers assert that prior experience develops the absorptive capacity of a firm by providing a repertoire of past investments and routines that assists the firm in recognizing and selecting targets and successfully implementing the integration process (Barkema and Vermeulen, 1998; Cohen and Levinthal, 1990; Nelson and Winter, 1982). Nadolska and Barkema (2007) suggest that acquisition experience is crucial in the success and survival of CBAs. Padmanabhan and Cho (1999) posit that experienced acquirers develop the skills to effectively manage CBAs. Similarly, other researchers have found a positive relationship between acquisition experience and CBA performance (Bruton, Oviatt, and White, 1994; Fowler and Schmidt, 1989; Hitt, Keats, and DeMarie, 1998). Therefore, it is expected that acquisition experience and the routines created through strategic acquisition activity will enhance the performance of the acquiring firm.

Hypothesis 2: The higher the acquisition experiences of European firms, higher the CBA performance.

Moderating Effect of Relatedness on CBA Performance

Relatedness refers to the extent of similarity in strategy, resources, and knowledge a target firm has compared to an acquirer (Jemison and Sitkin, 1986). The arguments against relatedness contend that in related acquisitions firms become limited to targets that are similar in resources and R&D patterns (Harrison, Hitt, Hoskisson, and Ireland, 1991; Wolpert, 2002; Higgins and Rodriguez, 2006). This reasoning points to a resource redundant propensities between the combined firms (Zollo and Singh, 2004). Duplication of existing resources (King, Slotegraaf, and Kesner, 2008) has an adverse effect on acquisition performance. Relatedness between firms will weaken the innovative capabilities of an acquired firm to provide novel and innovative resources (King *et al.*, 2008) and new knowledge (Ahuja and Katila, 2001; Cloudt, Hagedoorn, and Kranenburg, 2006) concerning other markets and industries. Basically, relatedness leads to over commitment to preexisting resources resulting in inflexibility, lowered adaptability, and poor responsiveness to changes, and consequently to negative performance (Hill and

Hoskisson, 1987).

Furthermore, Anand, Capron, and Mitchell (2005) suggest that access to heterogeneous resources and environments is important for CBA performance. It is imperative for acquiring firms to enhance capabilities by acquiring access to diverse resources and environments. Sorenson and Sorenson (2001) assert that distinctiveness between firms is an important attribute for the creation of complementary knowledge and the development of new products. It is of significance that a certain degree of differentiation in technological capabilities is required for better innovative capability and consequently enhanced acquisition performance (Ghoshal, 1987; Hitt, Hoskisson, Johnson, and Moesel, 1996). Unrelated acquisitions provide acquiring firms with a broader pool of intellectual capital providing more chances for synergies and better acquisition performance (Brage and Eckerstrom, 2008). Consistently, manifold scholars have found that relatedness does not play a significant role in better acquisition performance in the case of the European firm studies (Gregoriou and Renneboog, 2007; Yen and Andre, 2006). Related acquisitions are likely to be diminutive when firms in the same industry possess highly comparable intangible assets. Therefore, we reason that the moderating effect of relatedness impedes the CBA performance of European firms.

Hypothesis 3a: Relatedness negatively moderates the positive relationship between innovation capabilities and CBA performance.

Organizational learning theory suggests that when executing complex organizational tasks such as acquisitions, experience diversity (Hayward, 2002; Huber, 1991; Zahra and George, 2002) is crucial for performance. Diverse experiences provide rich data about the causes of acquisition success or failure (Cheng and Van de Ven, 1996; McGrath, 2001) and provide better solutions when problems related to acquisitions emerge. Beckman and Haunschild (2002) posit that CBA implementation is a very complex business process which requires heterogeneous experience, and they found that more effective learning between firms occurs when acquiring firms interact with firms that have experience in implementing diverse types of acquisitions. At the same time, however, related targets tend to provide firms with redundant or similar experience, and thus do not provide the diverse skills and knowledge required for better acquisition performance (Levinthal and March, 1993; Hayward, 2002). Firms tend to make inferences from a narrow range of acquisitions (Levinthal and March, 1993) causing them to erroneously generalize previous acquisition experience. Acquisitions with related firms hamper the exploration of novel markets and capabilities, rendering firms vulnerable to competitors whose acquisitions coevolve with markets and change from new and diverse experience (Leonard-Barton, 1992; Penrose, 1959). Therefore, we posit that relatedness of acquisition experience will have a negative moderating effect on acquisition performance.

Hypothesis 3b: Relatedness negatively moderates the positive relationship between acquisition experience and CBA performance.

Therefore, the following regression equation was estimated to identify the determinants of CBA performance:

$$\begin{aligned} \text{ROA} = & \alpha + \beta_1(\text{innovation capability}) + \beta_2(\text{acquisition experience}) + \beta_3(\text{relatedness}) \\ & + \beta_4(\text{innovation capability} \times \text{relatedness}) \\ & + \beta_5(\text{acquisition experience} \times \text{relatedness}) + \varepsilon. \end{aligned} \quad (1)$$

METHODOLOGY

Sample and Data

Cross-border acquisitions of US firms conducted by firms from the EU 27 were collected through the Thomson SDC database for the period of 1993 to 2007. Both the acquirer and target firms selected for our data are in the public domain. Our sample consists of 220 cross-border acquisition transactions of 146 acquiring firms from 12 European countries. While most other research mainly focuses on either the United Kingdom or one specific European country, our data cover acquisition transactions from a number of European countries. We maintain that the collected empirical data will contribute to current research on CBAs.

Dependent Variables

Cross-border acquisition performance was measured through the return on assets (ROA) of acquirer firms. Bromiley (1986) states that measures of ROA are suitable for research because firms rely on accounting performance measures when formulating and initiating strategic action such as acquisitions. Taking into consideration the long-term effects of knowledge transfer and integration of innovation post-acquisition, consistent with research of Singh and Zollo (1998) and Zollo and Singh (2004), our research renders the acquiring firm's profitability empirically as post three years ROA. Zollo and Singh (2004) have used ROA to assess the effects of acquisition experience and Miller (2006) utilized ROA as a dependent variable to test for the effects of relatedness on acquisition performance. The ROA data were collected from the COMPUSTAT database.

Independent Variables

We measured innovation capability based on R&D intensity. Research contends that R&D intensity has a high level of effect on innovation (Hagedoorn and Duysters, 2002). Previous research has demonstrated R&D intensity as a measure of innovative capability (Bierly and Chakrabarti, 1996; Cohen and Levinthal, 1990; Dutta and Kumar 2009; Tsai, 2001). We posit that R&D intensity is an appropriate proxy to measure innovative capability. In our research, R&D intensity was defined as R&D expenditures divided by total sales. R&D intensity for the European acquiring firms for the three years prior to acquisitions was collected from the COMPUSTAT database. As for acquisition experience, consistent with prior research, it was measured by the number of acquisitions conducted by focal firms (Halebrian and Finkelstein, 1999; Hayward, 2002; Hitt *et al.*, 1998; Nadolska and Barkema, 2007; Vermeulen and Barkema, 2001; Zollo and Singh, 2004). We assessed the number of recent acquisitions undertaken by the acquirer firm in the three years prior to transaction year. The data on acquisition experience were collected from the Thomson SDC database.

Moderating Variable

Business relatedness refers to similarities in markets and industries in acquisition transactions (Homberg, Rost, and Osterloh, 2009). The statistical data for this variable were input utilizing the SIC codes that reflect the primary line of business for the acquirer and target firms (Halebrian and Finkelstein, 1999; Homberg *et al.*, 2009). Utilizing the four-digit SIC code obtained through the Thomson SDC database, we classified the acquisition as related if the four digits were identical and unrelated acquisitions if the digits differed. If the acquirer and target firms were in the same industry sector, we coded the acquisition transaction as "one," meaning "related." If they were not, we coded the transaction as "zero" meaning "unrelated."

Control Variables

Several factors were controlled for analyzing CBA performance. Firm size was measured by the total assets of acquirer and target firms. This variable was controlled because larger firms tend to have higher ROA or R&D intensity due to their size (Hayward, 2002; Nadolska and Barkema, 2007). We also operationalized the R&D intensity as innovation capacity; however Lev (2001) measured innovation capability by intangible assets as a proxy, while other researchers measured innovation capacity by expenditures on intangible assets (Arundel, Lorenz, Lundvall, and Valeyre, 2007). Due to this conflicting view, we controlled for the intangible assets of acquirer and target firms as they can pose an influence when measuring innovation capacity by R&D intensity. The R&D intensity of US target firms was controlled in order to assess the effects of the innovation capacity of European acquiring firms on CBA performance. Makri, Hitt, and Lane (2010) stated that innovation capabilities are particularly crucial in the high-tech environment. Therefore, we assumed that the effects of knowledge integration on post-acquisition performance in high-tech industries and controlled the acquirer and target firms in the high-tech industry as a dummy variable. The information was collected from the Thomson SDC database and we gave firms in high-tech industries a score of “one,” and those in non-high-tech industries a “zero.”

Analysis

A hierarchical regression analysis was used to examine our hypotheses (Cohen, Cohen, West, and Aiken, 2003). The control variables were entered first, followed by the independent variables (innovative capabilities and acquisition experience) in Step 2. Relatedness was entered in the third step and, finally, in Step 4 the interaction term was included in order to discern the moderating effect of related-unrelated acquisitions. As our hypotheses assume interaction terms based on relatedness between the acquiring and target firms, a regression analysis is appropriate when analyzing these effects (Aiken and West, 1991; Jaccard, Turrisi, and Choi, 1990). The hierarchical regression analysis has been utilized before in other research, such as that conducted by Sarala and Vaara (2010) and Casal and Fontela (2007) to analyze the impact of independent and control variables in CBAs, and distinguish between direct and interaction effects.

RESULTS

Table 1 presents the descriptive statistics of the empirical analysis. Table 2 reports the results of the hierarchical regression analysis to test the hypotheses. Multicollinearity was checked for the variance inflation factor (VIF) (Aiken and West, 1991), which evaluates the extent to which the relationships among the independent variables inflate the standard error. We found that they were all lower than 10 (Neter, Kutner, and Wasserman, 1990), which indicates that there is no problem in implementing the regression analysis. In Step 1, where the effect of control variables was tested, we found that except for cases in which the acquirer was in a high-tech industry, all other control variables were insignificant, suggesting that an acquirer’s acquisition performance is independent of variables such as the assets of the participating firms or innovative capability of the target. Step 2 presents support for Hypothesis 1 and indicates that an acquiring firm’s innovative capability is positively related to the acquisition performance ($\beta=0.164$; $p<0.01$), thus we posit a firm’s innovative capabilities are of crucial importance for successful acquisition performance. Step 2 also examines Hypothesis 2 and reports evidence that an acquiring firm’s acquisition experience has a positive and significant effect on performance ($\beta= 0.190$; $p<0.01$). To verify Hypothesis 3a and 3b, about the moderating effect of relatedness on acquisition performance, an interaction term was added in Step 4. Step 4 represents the full estimation of our research and, as shown in the table, innovative capability and acquisition experience of the acquiring firm continue to be significant in the proposed directions. The results from Step 4 support that moderating effect of relatedness through a regression analysis of the interaction between independent and moderating variables to the dependent variables (Baron and Kenny, 1986). Moderating effects prevail if the increment of F (ΔF)

and the interaction term are significant, which is consistent with other CBA research (Casal and Fontela, 2007).

Table 1: Descriptive Statistics and Correlation Matrix

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
ACQ High Tech	0.47	0.40	1										
TAR High Tech	0.55	0.49	0.627**	1									
ACQ Asset	23711.	4196.	0.010	-0.011	1								
TAR Asset	1460.	337.44	-0.154*	-0.173*	0.275**	1							
ACQ Int Asset	3386.	496.50	-0.009	-0.094	0.515**	-0.018	1						
TAR Int Asset	111.97	19.76	-0.057	-0.151*	0.133*	0.524**	0.020	1					
TAR Intensity	0.04	0.00	0.191**	0.167*	-0.072	-0.048	-0.071	-0.066	1				
ACQ Intensity	1.16	0.43	0.609**	0.509**	-0.037	-0.060	-0.149*	-0.033	0.136*	1			
ACQ EXP	1.30	0.12	0.232**	0.199**	0.020	-0.083	0.001	-0.108	0.260**	0.306**	1		
Related	0.26	0.03	0.001	-0.148*	0.016	0.159*	-0.012	0.181**	-0.040	0.108	-0.074	1	
ACQ ROA	0.02	0.00	0.224**	0.134*	-0.143*	-0.062	-0.115	-0.041	0.272**	0.095	0.253**	-0.043	1

This table represents the mean and standard deviation and correlations of the independent and dependent variables

Table 2: Results of Hierarchical Regression Analysis

Variable entered	Step 1		Step 2		Step 3		Step 4		VIF
	β	T	β	T	β	T	β	T	
(Constant)		2.967**		2.082*		2.273*		1.092	
ACQ High-Tech	0.234	2.717**	0.125	1.340	0.129	1.375	0.106	1.175	2.127
TAR High-Tech	-0.026	-0.300	-0.069	-0.800	-0.085	-0.966	-0.062	-0.731	1.901
ACQ Asset	-0.118	-1.430	-0.130	-1.624	-0.131	-1.637	-0.172	-2.225*	1.581
TAR Asset	0.013	0.152	0.009	0.107	0.014	0.169	-0.001	-0.019	1.582
ACQ Intangible	-0.051	-0.641	-0.029	-0.366	-0.028	-0.359	-0.002	-0.029	1.491
TAR Intangible	-0.019	-0.237	-0.005	-0.064	0.002	0.020	0.009	0.127	1.446
TAR intensity	0.042	0.616	-0.001	-0.012	-0.001	-0.020	-0.002	-0.029	1.111
ACQ R&D intensity (A1)			0.164	1.906*	0.179	2.044*	0.322	3.349***	2.443
ACQ M&A EXP(A2)			0.190	2.718**	0.184	2.627**	0.269	3.593***	1.480
Related-unrelated (B)					-0.062	-0.919	0.181	2.142*	1.882
A1*B							-0.241	-2.415**	2.619
A2*B							-0.237	-2.766**	1.941
F	2.473		3.580		3.304		4.722		
R ²	0.076		0.133		0.136		0.215		
ΔR ²	0.076		0.058		0.003		0.078		
ΔF	2.473**		6.964***		0.844		10.336***		

*This table shows the hierarchical regression analysis of our research. ***, **, and * indicate the significance at the 1, 5 and 10 percent levels and can be shown as * p< .10, ** p<0.05, *** p<0.01. The total number of the sample was 220 and the Durbin-Watson was 1.424*

In Step 4 we can see that compared to Step 3 the increment of F (ΔF) was 10.336 and significant (p<0.01). We find support for Hypothesis 3a, as the interaction between the degree of innovative capability and relatedness exists, and its impact on CBA performance is statistically and negatively significant (β=-0.241; p<0.05). We contend that relatedness has a negative moderating effect on the relationship between innovative capabilities and an acquirer's performance. As depicted in Figure 1, in unrelated acquisitions when the acquirer's innovative capabilities (R&D intensity) increased, acquisition performance (ROA) increased as well. In related acquisitions, even if the acquirer's innovative capabilities increased there was no change in acquisition performance. The results prove that relatedness can function as a moderating variable in terms of an acquirer's innovative capabilities and performance.

Accordingly the empirical evidence shows that the interaction term of an acquirer's acquisition experience and the acquirer's ROA is also negatively significant (β=-0.237; p<0.05). This supports Hypothesis 3b, that relatedness will have a negative moderating effect on the relationship between an acquirer's acquisition experience and performance. As shown in Figure 2, as an acquirer's experience in related acquisitions increases the acquirer's performance decreases, whereas in unrelated acquisitions, an acquirer's performance increases substantially as experience increases. Therefore this proves that relatedness can be a moderating variable in the relationship between an acquiring firm's experience and performance.

Figure 1: Moderating Effect of Relatedness between R&D Intensity and ROA

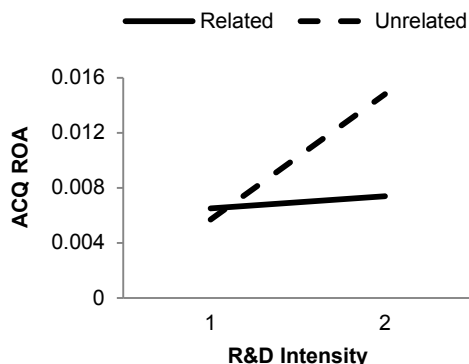


Figure 1 shows the interaction effects of relatedness and R&D intensity on acquisition performance. In unrelated acquisitions, acquisition performance substantially increases along with the acquirer's innovative capabilities compared to related acquisitions.

Figure 2: Moderating Effect of Acquisition Experience between Acquisition and ROA

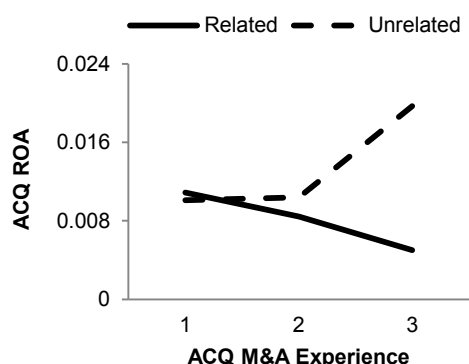


Figure 2 shows the interaction effects of relatedness and acquisition experience on acquisition performance. In related acquisition the acquirer's performance is decreased according to experience whereas in unrelated acquisitions, an acquirer's performance substantially increased as experience increases.

CONCLUSION

The objective of this research paper is to analyze the determinants of European firms' CBAs targeting US firms and the performance of those CBAs, scrutinizing particularly on the moderating effect of relatedness. Our empirical findings indicate that European firms' acquisition strategies reveal a technology and innovation asset seeking motive for targeting firms in a developed economy, and also show that acquisition experience positively affects acquisition performance. We also investigate the moderating effect of relatedness to articulate the significance of considering relatedness as a factor when considering CBA strategy in both developed economy domains, using data collected from the Thomson SDC database and COMPUSTAT. We conducted a hierarchical regression analysis to show that European acquiring firms with higher innovative capabilities and prior acquisition experience demonstrate improved acquisition performance. We delve deeper to ascertain whether relatedness between firms plays a moderating role in CBA performance. The results indicate that relatedness has a negative and significant interaction effect on acquisition performance.

Our research contributes to the current literature as it provides a European acquisition lens of study that

complements previous literatures on acquisition research that tended to focus on the US or the UK. Furthermore, while most studies focus on emerging economies conducting CBA strategy toward developed countries with a logic similar to that described here, our study is unique in analyzing CBAs between two developed economies, European Union and the US. Our research suggests that both innovative capability and acquisition experience have a positive effect on the acquisition performance of firms and that these qualities are important preconditions for acquiring firms to initiate successful innovation-seeking CBAs. To the best of our knowledge, we provide insights into how European CBA relatedness with the US firms can have negative effects on acquisition performance. This suggests that European firms should be cautious when deciding whether they should engage in related acquisitions, though considerations of innovation capabilities and prior experience seem to be positively certain. Furthermore, although our study focuses on CBAs between developed economies we believe that it provides important implications for CBAs in general and that it gives valuable insights to those many firms from developing and emerging economies that are actively engaging in CBAs.

Limitations and Future Research

Although the insights revealed by this study complement existing literatures, our research possesses limitations associated with generalization. The research setting of European acquiring firms and US targets may provide meaningful context to investigate determinants of CBAs in both domains of developed economy, however due to sample restrictions our analysis is unable to satisfy the logic of generalization as our data include US acquisitions by European firms only. This limitation enables better control and thus better analysis of our hypotheses, but the generalization of our results to CBAs conducted by firms from different countries remains an empirical question for further research. Furthermore, the findings of our study indicate that innovation capability, prior experience, and relatedness are important determinants when it comes to acquisition performance in the case of developed economies. Therefore it would be interesting to research if these findings apply to other cases such as between developing economies or between other developed economies. Other limitations might be the lack of control variables and our focus on mainly internal factors affecting CBA performance, while external factors such as economic conditions could affect CBA performance as well. Future research would benefit by providing more control variables and measures and taking into consideration external forces. In addition, although our research provides implications for the innovation seeking intent of European firms, we do not directly prove that European firms are innovation motivated when entering the US, as our data consist mainly of available secondary data and we believe that more explicit and diverse configurations of operationalization of variables are necessary to derive rigorous research. It is imperative for future research to expand our study in terms of methodological complementation and by further testing the various motivations behind CBAs.

REFERENCES

- Ahuja, Gautam and Riitta Katila (2001) "Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study," *Strategic Management Journal*, vol. 22, p. 197–220
- Aiken, Leona S. and Stephen G. West (1991) *Multiple regression: Testing and interpreting interactions*, New York: Sage
- Anand, Jaideep, Laurence Capron, and Will Mitchell (2005) "Using acquisitions to access multinational diversity: thinking beyond the domestic versus cross-border M&A comparison," *Industrial and Corporate Change*, vol. 14(2), p. 191-224

- Arundel, Anthony, Edward Lorenz, Bengt-Ake Lundvall, and Antoine Valeyre (2007) "How Europe's economies learn: a comparison of work organization and innovation mode for the EU-15," *Industrial and Corporate Change*, vol. 16(6), p. 1175-1210
- Barkema, Harry G. and Freek Vermeulen(1998) "International expansion through start-up or acquisition: A learning perspective," *Academy of Management Journal*, vol. 41(1), p. 7-26
- Barkema, Harry G., John H. J. Bell, and Johannes M. Pennings (1996) "Foreign entry, cultural barriers, and learning," *Strategic Management Journal*, vol. 17, p. 151-166
- Baron, Reuben M. and David A. Kenny (1986) "The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations," *Journal of Personality and Social Psychology*, vol. 51(6), p. 1173-1182
- Bartlett, Christopher A. and Surnantra Ghoshal (1988), "Organizing for worldwide effectiveness: the transnational solution", *California Management Review*, Autumn, p. 54-74
- Beckman, Christine M. and Pamela R. Haunschild (2002) "Network learning: The effect of partners' heterogeneity of experience on corporate acquisitions," *Administrative Science Quarterly*, vol. 47(1), p. 92-124
- Bertrand, Oliver and Pluvia Zuniga (2006) "R&D and M&A: are cross-border M&A different? An investigation on OECD countries," *International Journal of Industrial Organization*, vol. 24, p. 401-423
- Bierly, Paul and Amaresh Chakrabarti (1996) "Generic knowledge strategies in the U.S. pharmaceutical industry," *Strategic Management Journal*, vol. 17(winter special issue), p. 123-135
- Blonigen, Bruce A. (1997) "Firm-Specific Assets and the Link between Exchange Rates and Foreign Direct Investment," *American Economic Review*, vol. 87(3), p. 447-465
- Blonigen, Bruce A. and Christopher T. Taylor (2000) "R&D Intensity and Acquisitions in High-Technology Industries: Evidence from the US Electronic and Electrical Equipment Industries," *Journal of Industrial Economics*, vol. 48(1), p. 47-70
- Boeh, Kevin K. (2011) "Contracting costs and information asymmetry reduction in cross-border M&A," *Journal of Management Studies*, vol. 48(3), p. 568-590
- Brage, Viktor and Gustaf Eckerstrom (2008) "Measuring Value creating in M&As - A comparison between related and unrelated firms," Master thesis in Industrial and financial management, School of business and Economics and Law (Goteborg University)
- Bromiley, Philip (1986) "Corporate planning and capital investment," *Journal of Economic Behavior and Organization*, vol. 7, p.147-170
- Bruton, Garry D., Benjamin M. Oviatt, and Margaret A. White (1994) "Performance of acquisitions of distressed firms," *Academy of Management Journal*, vol. 37(4), p. 972-989
- Casal, Carmen C. and Edelmira N. Fontela (2007) "Transfer of socially complex knowledge in mergers and acquisitions," *Journal of Knowledge Management*, vol. 11(4), p. 58-71

- Cassiman, Bruno and Reinhilde Veugelers (2002) "R&D cooperation and spillovers: Some empirical evidence from Belgium," *American Economic Review*, vol. 92(4), p. 1169-1184
- Cefis, Elena and Orietta Marsili (2006) "Survivor: The role of innovation in firms' survival," *Research Policy*, vol. 35(5), p. 626-641
- Cheng, Yu-Ting and Andrew H. Van de Ven (1996) "Learning the innovation journey: Order out of chaos?" *Organization Science*, vol. 7(6), p. 593-614
- Cloodt, Myriam, John Hagedoorn, and Hans Van Kranenburg (2006) "Mergers and acquisitions: Their effect on the innovative performance of companies in high-tech industries," *Research Policy*, vol. 35(5), p. 642-654
- Cohen, Jacob, Patricia Cohen, Stephen G. West, and Leona S. Aiken (2003) *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.), Lawrence Erlbaum Associates, Inc.
- Cohen, Wesley M. and Daniel A. Levinthal (1989) "Innovation and learning: The two faces of R&D," *The Economic Journal*, vol. 99, p. 569-596
- Cohen, Wesley M. and Daniel A. Levinthal (1990) "Absorptive capacity: A new perspective on learning and innovation," *Administrative Science Quarterly*, vol. 35(1), p. 128-152
- Crescenzi, Riccardo, Andrés Rodríguez-Pose, and Michael Storper (2007) "The geographical processes behind innovation: A Europe-United States comparative analysis," Working Papers 2007-13, Instituto Madrileño de Estudios Avanzados (IMDEA) Ciencias Sociales.
- Cyert, Ricard M. and James G. March (1963) *A behavioral Theory of the Firm*, Englewood Cliffs, NJ: Prentice Hall
- Driffield, Nigel and James H. Love (2005) "Who gains from whom? Spillovers, competition and technology sourcing in the foreign-owned sector of UK manufacturing," *Scottish Journal of Political Economy*, vol. 52(5), p. 663-686
- Dutta, Shantanu and Vinod Kumar (2009) "Mergers and Acquisitions (M&AS) by R&D Intensive Firms," *Journal of Risk and Financial Management*, vol. 2, 1-37
- Fowler, Karen L. and Dennis R. Schmidt (1989) "Determinants of tender offer post-acquisition financial performance," *Strategic Management Journal*, vol. 10(4), p. 339-350
- Frey, Rainer and Katrin Hussinger (2006) "The Role of Technology in M&As: A Firm Level Comparison of Cross-Border and Domestic Deals," ZEW Discussion Paper No. 06-069, Mannheim
- Frey, Rainer and Katrin Hussinger (2011) "European Market Integration through Technology-Driven M&As," *Applied Economics*, vol. 43(17), p. 2143-2153
- Ghoshal, Sumantra (1987) "Global Strategy: An Organizing Framework", *Strategic Management Journal*, vol. 8(5), p. 425-440
- Gregoriou, Greg N. and Luc Renneboog (2007) "Understanding mergers and acquisitions: activity since

1990,” *International Mergers and Acquisitions Activity Since 1990*, Elsevier, Burlington, San Diego, London

Hagedoorn, John and Geert Duysters (2002) “External sources of innovative capabilities: The preferences for strategic alliances or mergers and acquisitions,” *Journal of Management Studies*, vol. 39(2), p. 167-188

Haleblian, Jerayr and Sydney Finkelstein (1999) “The influence of organizational acquisition experience on acquisition performance: A behavioral learning perspective,” *Administrative Science Quarterly*, vol. 44(1), p. 29-56

Harrison, Jeffrey S., Michael A. Hitt, Robert E. Hoskisson and R. Duane Ireland (1991) “Synergies and post-acquisition performance: Differences versus similarities in resource allocations,” *Journal of Management*, vol. 17, p. 173–190

Hayward, Mathew L. A. (2002) “When do firms learn from their acquisition experience? Evidence from 1990 to 1995,” *Strategic Management Journal*, vol. 23(1), p. 21-39

Higgins, Matthew J. and Daniel Rodriguez (2006) “The outsourcing of R&D through acquisitions in the pharmaceutical industry,” *Journal of Financial Economics*, vol. 80(2), p. 351-383

Hill, Charles W. L. and Robert E. Hoskisson (1987) “Strategy and structure in the multiproduct firm,” *Academy of Management Review*, vol. 12, p. 331-341

Hitt, Michael A., Robert E. Hoskisson, Richard A. Johnson, and Douglas D. Moesel (1996) “The market for corporate control and firm innovation,” *Academy of Management Journal*, vol. 39, p. 1084–1119

Hitt, Michael A., Duane R. Ireland, and Ho-uk Lee (2000) “Technological learning, knowledge management, firm growth and performance: An introductory essay,” *Journal of Engineering and Technology Management*, vol. 17, p. 231-246

Hitt, Michael A., Barbara W. Keats, and Samuel M. DeMarie (1998) “Navigating in the new competitive landscape: Building strategic flexibility and competitive advantage in the 21st century,” *Academy of Management Executive*, vol. 12(4), p. 22-42

Homberg, Fabian, Katja Rost, and Margit Osterloh (2009) “Do synergies exist in related acquisitions? A meta-analysis of acquisition studies,” *Review of Managerial Science*, vol. 3, p. 75–116

Huber, George P. (1991) “Organizational learning: The contributing processes and the literatures,” *Organization Science*, vol. 2(1), p. 88-115

Jaccard, James, Robert Turrisi, and Wan K. Choi (1990) *Interaction Effects in Multiple Regression*, Sage: Newbury Park, CA

Jemison, David B. and Sim B. Sitkin (1986) “Corporate acquisitions: A process perspective,” *Academy of Management Review*, vol. 11(1), p. 145-163

King, David R., Rebecca J. Slotegraaf, and Idalene Kesner (2008) “Performance Implications of firm Resource Interactions in the Acquisition of R&D intensive firms,” *Journal of Organization Science*, Vol. 19 (2), p. 327-340

- Kogut, Bruce and Sea Jin Chang (1991) “Technological capabilities and Japanese Foreign direct investment in the United States,” *Review of Economics and Statistics*, vol. 73(3), p. 401-413
- Kuemmerle, Walter (1999) “The drivers of foreign direct investment into research and development: An empirical investigation,” *Journal of International Business Studies*, vol. 30(1), p. 1-24
- Leonard-Barton, Dorothy (1992) “Core capabilities and core rigidities: A paradox in managing new product development,” *Strategic Management Journal*, vol.13, p. 111–125
- Lev, Baruch (2001) *Intangibles: Management, Measurement, and Reporting*, Washington, DC.
- Levinthal, Daniel A. and James G. March (1993) “The myopia of learning,” *Strategic Management Journal*, vol. 14, p. 95–112
- Levitt, Barbara and James G. March (1988) “Organizational learning,” *Annual Review of Sociology*, vol. 14, p. 319–340.
- Lubatkin, Michael (1983) “Mergers and the performance of the acquiring firm,” *Academy of Management Review*, vol. 8(2), p. 218-225
- Luo, Yadong (2000) “Dynamic capabilities in international expansion,” *Journal of World Business*, vol. 35(4), p. 355-378
- Makri, Marianna, Michael A Hitt, and Peter J. Lane (2010) “Complementary technologies, knowledge relatedness and invention outcomes in high technology mergers and acquisitions,” *Strategic Management Journal*, vol. 31, p. 602-628
- March, James G. (1991) “Exploration and exploitation in organizational learning,” *Organization Science*, vol. 2(1), p. 71-87
- McGrath, Rita G. (2001) “Exploratory Learning, Innovative Capacity and Managerial Oversight,” *Academy of Management Journal*, vol. 44(1), p. 118-131
- Miller, Douglas J. (2006) “Technological diversity, related diversification, and firm performance,” *Strategic Management Journal*, vol. 27(7), p. 601–619
- Nadolska, Anna and Harry G. Barkema (2007) “Learning to internationalize: the pace and success of foreign acquisitions,” *Journal of International Business Studies*, vol. 38, p. 1170-1186
- Narula, R. (1999) “Explaining Strategic R&D Alliances by European Firms,” *Journal of Common Market Studies*, vol. 37(4), p. 711-723
- Neary, J.Peter (2007) “Cross-border mergers as instruments of comparative advantages,” *Review of Economic Studies*, vol. 74(4), p. 1229-1257
- Nelson, Richard R. and Sidney G. Winter (1978) “Forces generating and limiting concentration under Schumpeterian competition,” *Bell Journal of Economics*, vol. 9(2), p. 524-548
- Nelson, Richard R. and Sidney G. Winter (1982) *An evolutionary theory of economic change*, Cambridge, Massachusetts: Belknap Press of Harvard University Press.

Neter, John, Michael H. Kutner, and William Wasserman (1990) *Applied Linear Statistical Models: Regression, Analysis of Variance and Experimental Designs*, Richard D. Irwin, Homewood, IL.

Padmanabhan, Prasad and Kang Rae Cho (1999) "Decision specific experience in foreign ownership and establishment strategies: Evidence from Japanese firms," *Journal of International Business Studies*, vol. 30(1), p. 25-43

Penrose, Edith (1959) *The theory of the growth of the firm*, Oxford: Oxford University Press

Petroulas, Pavlos (2007) "The effect of the euro on foreign direct investment," *European Economic Review*, vol. 51(6), p. 1468-1491

Sarala, Riikka M. and Eero Vaara (2010) "Cultural differences, cultural convergence and crossvergence as explanations of knowledge transfer in international acquisitions," *Journal of International Business Studies*, vol. 41(8), p. 1365-1390

Shimizu, Katsuhiko, Michael A. Hitt, Deepa Vaidyanath, and Vincenzo Pisano (2004) "Theoretical foundations of cross-border mergers and acquisitions: A review of current research and recommendations for the future," *Journal of International Management*, vol. 10(3), p. 307-353

Singh, Harbir and Maurizio Zollo (1998) "The impact of Knowledge codification, experience trajectories and integration strategies on the performance of corporate acquisitions," The Wharton School Working Paper No. 98-24

Sleuwaegen, Leo and Giovanni Valentini (2006) "Trends in merger and acquisitions," in: *Merger and Acquisitions – The Innovation Impact*, B. Cassiman and M.G. Colombo (Eds.), p. 30-60

Sorenson, Olav, Jesper B. Sørensen (2001) "Finding the right mix: Franchising, organizational learning, and chain performance," *Strategic Management Journal*, vol. 22 (6-7), p. 713-724

Tsai, Wenpin (2001) "Knowledge transfer in intra organizational networks: Effects of network position and absorptive capacity on business unit innovation and performance," *Academy of Management Journal*, vol. 44(5), p. 996-1004

Uhlenbruck, Klaus, Michael A. Hitt, and Matthew Semadeni (2006) "Market value effects of acquisitions involving Internet firms: A resource-based analysis," *Strategic Management Journal*, vol. 27(10), p. 4-26

United Nations Conference on Trade and Development (2011) "Global and Regional FDI Trends in 2010", *Global investment trends monitor*, No.5

Vermeulen, Freek and Harry Barkema (2001) "Learning through acquisitions," *Academy of Management Journal*, vol. 44(3), p. 457-476

Veugelers, Reinhilde (2006) "Literature review on M&A and R&D," in: *Merger and Acquisitions – The Innovation Impact*, B. Cassiman and M.G. Colombo (Eds.), pp. 79-118

Veugelers, Reinhilde and Bruno Cassiman (1999) "Make and buy in innovation strategies: evidence from Belgian manufacturing firms," *Research Policy*, vol. 28(1), p. 63-80

Wolpert, John D. (2002) "Breaking out of the innovation box," *Harvard Business Review*, vol. 80(8), p. 76-83

Yen, Tze-Yu and Paul Andre (2007) “Ownership structure and operating performance of acquiring firms: The case of English-origin countries,” *Journal of Economics and Business*, vol. 59(5), p. 380-405

Zahra, Shaker A. (1996) “Technology strategy and financial performance: Examining the moderating role of the firm's competitive environment,” *Journal of Business Venturing*, vol. 11(3), p. 189-219

Zahra, Shaker A. and Gerard George (2002) “Absorptive capacity: A review, reconceptualization, and extension,” *Academy of Management Review*, vol. 27(2), p. 185-203

Zollo, Maurizio and Harbir Singh (2004) “Deliberate learning in corporate acquisitions: Post-acquisition strategies and integration capability in U.S. bank mergers,” *Strategic Management Journal*, vol. 25, p. 1233–1256

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LUMP-SUM QUOTA BONUSES AND OTHER VERTICAL RESTRAINTS WITH COURNOT RETAILERS

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ABSTRACT

Lump-sum quota bonuses are a specific type of quota bonus that provides a lump-sum transfer from a manufacturer to a retailer when the retailer's sales exceed a pre-determined quota. This paper explores whether lump-sum quota bonuses and two other vertical restraints, two-part tariffs and resale price maintenance, can resolve the double marginalization problem when the market size is uncertain. It emerges that only lump-sum quota bonuses can always resolve the double marginalization problem in our two-state case.

JEL: L42, L13, D89

KEYWORDS: Vertical Restraints, Lump-Sum Quota Bonuses, Cournot Competition, Uncertain Market Size

INTRODUCTION

Perhaps because of a lack of knowledge of the market, manufacturers may not effectively promote their own product, as occurred when Google failed to effectively market the Nexus One. As an alternative to self-promotion, many manufactures sell products through more than one retailer. For example, publishers sell books through bookstores, of which the leaders in the United States include Borders, Barnes and Noble, Amazon.com, and the Follett Corporation (Datamonitor, 2010). The vertical relationships between manufacturers and retailers have been addressed in the literature. Rey and Vergé (2008) provide a good overview of relevant academic studies and legal matters.

This paper addresses a special case in which few retailers control retail markets. In addition to the book market mentioned, the cable television in the U.S. is another example. In each area, there exist only few cable systems operators to carry programming. In this special case, the double marginalization problem (DMP) raises. Market power of retailers induces a pricing inefficiency in vertically related markets, and hence, profits of manufacturers and of channels are eroded. Sprengler (1950) firstly addresses the DMP. Waterman and Weiss (1996) verify the DMP in the U.S. cable television market. Manufacturers often use vertical restraints, which is the restraints imposed by manufacturers on retailers, to regulate retailers' behavior and resolve the DMP. Without market uncertainty, several vertical restraints can resolve the DMP. However, it may not be true when market size is uncertain.

Two-parts tariffs (TTs) and resale price maintenance (RPM) are often discussed in the literature. In addition to the above vertical restraints, this paper address lump-sum quota bonuses (LSBQs), which is only mentioned in very few papers. LSQB, which are similar but not exactly identical to other vertical restraints, are a specific type of quota bonuses, which involve making a lump-sum transfer from a manufacturer to a retailer when the retailer's sales exceed a predetermined quota. For example, car manufacturers often offer some "volume bonus incentives" to dealers. In this paper, we show that only LSBQs can resolve the DMP when market size is uncertain. Hence, we spend more paragraphs in discussing LSBQs than other vertical restraints.

We discuss related literature in the following section. The model and the impacts of LSQB on retailers' best response functions are presented in the section after the next section. If a manufacturer simply maximizes its profits, none of vertical restraints discussed in this paper can be counted upon to always resolve the DMP. However, when a manufacturer maximizes channel profits, LSQB is superior to TTs and RPM. These discussions can be found in the following sections. The final section provides

concluding comments. Proofs of all propositions or lemmas can be found in the appendix.

LITERATURE REVIEW

Several aspects of vertical relations have been addressed in the literature. Mathewson and Winter (1985) study vertical relations from the principal-agent perspective. Mathewson and Winter (1984) posit that vertical restraints can be used to ease externalities among retailers. In Mathewson and Winter (1984), these externalities are due to advertising by retailers. Klein and Murphy (1988) focus on exclusive territory, a specific form of vertical restraint. They claim that vertical restraints can influence retailer behaviors indirectly by lowering their short-term gains. In contrast, this paper examines whether LSQBs and other vertical restraints can resolve the double marginalization problem given an uncertain market size.

Although LSQBs and slotting allowances are both forms of payments from manufacturers to retailers, they differ in two ways. First, with LSQBs, retailers receive payments from manufacturers only when the amount that they sell exceeds a certain threshold, which creates the quantity-fixing effect. In contrast, retailers can usually have slotting allowances as long as they sell the manufacturer's product. Shaffer (1991) and Kuksov and Pazzal (2007) adopt this setup in their models. Secondly, LSQBs are generally offered when manufacturers are relatively dominant, whereas slotting allowances are more prevalent when retailers are relatively dominant. LSQBs are also very similar to the all-units discounts discussed in Kolay et al. (2004). Unlike with all-units discounts, however, the wholesale price is not altered when the sales exceed the quota.

In practice, quota bonuses are frequently used to stimulate sales either by subordinate sales-persons or by contracted retailers. The role of quota bonuses in motivating salesperson effort has been analyzed in the literature (Raju and Srinivasan, 1996; Oyer, 2000), but no study has addressed the role of quota bonuses in the context of vertical relations or considered the issue of the DMP in particular. The DMP, which is addressed in this paper, often occurs in a decentralized supply chain. When selling products through retailers, manufacturers suffer from the imperfect competition that occurs among retailers. To maximize their profits, retailers raise retail prices. Hence, both the quantity sold and the manufacturer's profits decrease. The same problem also occurs with intermediate goods. To solve this channel coordination problem, a manufacturer can apply vertical restraints to retailers, including TTs, RPM, and exclusive territory agreements (Rey and Tirole, 1986). Note that we exclude exclusive territories from the discussion in this paper because we introduce imperfect quantity competition among multiple potential retailers into the model. Like Rey and Tirole (1986); Gal-Or (1991); Kolay et al. (2004), we compare different vertical constraints in a context in which the manufacturer faces uncertain demand. We simply assume that manufacturers and retailers have common *ex ante* knowledge of the probability distribution of an unknown market size. Furthermore, due to contract costs, manufacturers and retailers neither renegotiate retail contracts nor redesign the vertical restraints when retailers know the actual market size. It emerges that if the manufacturer maximizes the channel profits, only LSQBs can ensure monopoly profits for the whole channel in our two-state case. When the aim is to resolve the DMP, the LSQB scheme is indeed superior to the other two vertical restraints in the case of an uncertain market size.

The Model

There exists one monopoly manufacturer, which produces one product and sells the product via potential retailers. This paper addresses the issue of the distribution of profits within the channel. Hence, we exclude the case in which multiple manufacturers compete with homogeneous or heterogeneous products though the case is more general and may generate different interests. Further, there are two potential Cournot retailers. That is, the two potential retailers in the retail market simultaneously choose quantity to compete with each other. The theorem of independent Nash equilibria in Bergstrom and Varian (1985), of which Cournot competition is a typical example, is still valid here. The assumption of two potential retailers can simplify the analysis without loss of generality. In our model, the manufacturer has a better position in the distribution of channel profits because of the status of monopoly. If the number of potential retailers is reduced to one, the retailer will become a monopsony. The negotiation power of the retailer must be considered then. The manufacturer's production cost is zero, and retailers sell the product at no distribution

cost. This paper does not address the issue of asymmetric information of retailers' distribution cost. The inverse market demand is $\alpha - Q$, where $\alpha > 0$, and Q is the quantity supplied by retailers in the market. Unlike in O'Brien and Shaffer (1992), we do not introduce retailers' heterogeneity in the model. Hence, no retailers are discriminated; all are offered the same retail contract once the latter is designed. If the manufacturer is allowed to offer some retailers preferential treatment, it is easy for the manufacturer to manipulate the equilibrium in stage of the retailers' competition, and it becomes difficult to investigate the influence of different vertical restraints. Further, the DMP emphasized in this paper is caused by the imperfect competition among retailers. Preferential treatment to specific retailers can enhance the retailers' market power. Hence, the DMP cannot be mitigated by preferential treatment.

Here is the timing of our model. First, the manufacturer designs the retail contract, including the wholesale price and vertical constraints. The retail contract can be considered the take-it-or-leave-it offer from the manufacturers to the potential retailers. Both potential retailers must agree to the retail contract and accept all vertical constraints in the equilibrium. Finally, the two potential retailers decide the amount of products purchased from the manufacturers according to the terms in the retail contract. If any potential retailer decides to purchase nothing from the manufacturer, the potential retailer will be considered to quit the retail market. Two potential retailers r_1, r_2 are Cournot duopoly in the retail market, competing with quantities $q_i, i = 1, 2$, where q_i is the amount purchased from the manufacturer and sold by r_i . Hence, the market quantity $Q = q_1 + q_2$ and the market price $P = \alpha - Q$, given $Q < \alpha$.

However, the market size in the retail market can be affected by many factors, such as the business cycle, and fluctuates all the time. It is assumed that market size α is unknown to both the manufacturer and the potential retailers until the moment when potential retailers decide the amount of purchased. All the manufacturer and potential retailers know is the probability distribution of α . α may be α_H or α_L , $\alpha_H > \alpha_L$ when the retail contract is designed and agreed. The probability that $\alpha = \alpha_H$ is p , $p \in (0,1)$. In this one-period model, it is also assumed that the retail contract cannot be renegotiated due to contract costs or negotiation costs. Hence, the information of the actual market size does not affect the design of the retail contract.

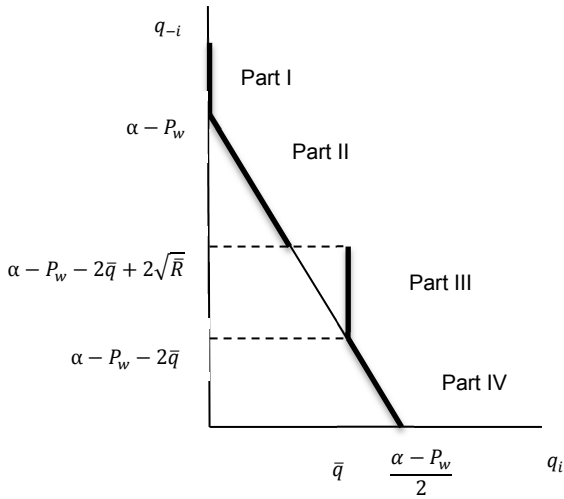
We investigate a specific form of LSQBs in this paper and identify how LSQBs introduce more competition into the retail market. Consider the following LSQB scheme. Once any retailer's sales equal or exceed a given sales threshold \bar{q} , the retailer can obtain a lump-sum bonus \bar{R} . Under LSQBs, the manufacturer needs to decide the amount of \bar{q} and \bar{R} in addition to P_w . Unlike the all-units discounts in Kolay et al. (2004), the LSQB scheme in this paper does not allow the wholesale price to vary, even if sales exceed \bar{q} .

If the manufacturer can only set the wholesale price P_w , which is also the marginal cost each retailer faces, r_i 's best response, given α , is

$$q_i = \frac{\alpha - q_{-i} - P_w}{2}, \tag{1}$$

where q_{-i} is the amount sold by the retailer other than r_i . Under LSQBs, the best response function in Equation (1) will no longer hold at all times. A jump will occur in the best response function because the reward to retailers is discontinuous due to LSQBs, and because retailers are encouraged to sharply increase their sales when sales are close enough to the threshold \bar{q} .

Figure 1: r_i 's Generic Response Function under LSQBs



A jump will occur in the best response function because the reward to retailers is discontinuous due to LSQBs.

Lemma 1 Under LSQBs, r_i 's best response function jumps as $q_{-i} = \alpha - P_w - 2\bar{q} + 2\sqrt{\bar{q}}$. After the jump, r_i continues to choose $q_i = \bar{q}$ as q_{-i} decreases. q_i does not change until $q_{-i} < \alpha - P_w - 2\bar{q}$.

Lemma 1 shows that how the discontinuous reward scheme of LSQBs creates a jump in r_i 's best response function. Except for the jump r_i 's best response function is the same as indicated by Equation (1). The generic best response function r_i is depicted in Figure 1 based on the formula.

$$q_i = \begin{cases} 0 & q_{-i} \geq \alpha - P_w & \text{Part I} \\ \frac{\alpha - q_{-i} - P_w}{2} & \alpha - P_w > q_{-i} \geq \alpha - P_w - 2\bar{q} + 2\sqrt{\bar{R}} & \text{Part II} \\ \bar{q} & \alpha - P_w - 2\bar{q} + 2\sqrt{\bar{R}} > q_{-i} \geq \alpha - P_w - 2\bar{q} & \text{Part III} \\ \frac{\alpha - q_{-i} - P_w}{2} & \alpha - P_w - 2\bar{q} > q_{-i} \geq 0 & \text{Part IV} \end{cases} \quad (2)$$

Note that when $\alpha - P_w - 2\bar{q} + 2\sqrt{\bar{R}} \geq \alpha - P_w$ or $\alpha - P_w - 2\bar{q} < 0$, Part II or Part IV of r_i 's best response function disappears, respectively.

The necessary conditions of the equilibrium in the retail market can be induced by the best response function. For example, if each retailer sells \bar{q} units in the retail market, Inequation (3) must be satisfied.

$$\alpha - P_w - 2\bar{q} \leq \bar{q} < \alpha - P_w - 2\bar{q} + 2\sqrt{\bar{R}}. \quad (3)$$

Inequation (3) ensures that one retailer’s best response function crosses the other’s at Part III. Similarly, if each retailer sells $q = \frac{\alpha - P_w}{3} < \bar{q}$ units in the retail market, Inequation (4) must be satisfied.

$$\alpha - P_w - 2\bar{q} + 2\sqrt{\bar{R}} \leq \frac{\alpha - P_w}{3} < \alpha - P_w. \tag{4}$$

And Inequation (4) ensures that one retailer’s best response function crosses the other’s at Part II. Note that, letting $q_i = q_{-i}$, the amount sold by each retailer can be easily solved from Equation (1).

The Self-Interested Manufacturer

We assume that the manufacturer simply maximizes its profits by using different types of vertical restraints in this section. Unfortunately, due to the nonlinearity of the reaction functions, the case of LSQBs becomes unnecessarily complicated. Again, the main purpose of our analysis is to prove that LSQBs can be superior to TT and RPM in resolving the DMP. Instead of solving all possible cases, we simply consider symmetric equilibrium in the retail market for simplicity. In some asymmetric cases, one potential retailer might quit the retail market. However, the result of our analysis will not be altered.

Two-Part Tariffs

Under TTs, the manufacturer needs to choose the wholesale price P_w and the franchise fee F in the retail contract. It is assumed that retailers realize the actual market size after agreeing to the retail market. Hence, retailers have to pay F before α is realized. Consequently, the manufacturer simply determined the wholesale price that will maximize the expected channel profits and capture all of the expected channel profits through the franchise fee. The manufacturer faces a dilemma. A high wholesale price can increase profits when the market is large but may cause the manufacturer to totally lose the market when the market is small. If the manufacturer charges retailers by the wholesale price according to the average monopoly price, the wholesale price will be too low (high) when the market size is large (small).

Proposition 1 Under TTs, the DMP cannot be resolved when the manufacturer maximizes its profits.

Indeed, the manufacturer who adopts TTs in the retail contract is already taking channel profits into account. The DMP still cannot always be completely resolved due to the lack of tools. Recall that P_w is the only manufacturer’s tool to affect a retailer’s marginal condition. Unfortunately, one tool cannot account for two states simultaneously.

Resale Price Maintenance

Under RPM, the manufacturer needs to set the market price ceiling \bar{P} along with P_w in the retail contract. The market price ceiling often implicitly appears in the format of the manufacturer’s suggested retail price (MSRP). Almost no retailers set a price strictly higher than MSRP. An appropriate \bar{P} should be binding in at least one state. Recall that without \bar{P} and given α , the market quantity and the market price are $\frac{2(\alpha - P_w)}{3}$ and $\frac{\alpha + 2P_w}{3}$ respectively. Hence, \bar{P} becomes binding only when

$$\bar{P} \leq \frac{\alpha + 2P_w}{3}, \text{ or } \alpha > 3\bar{P} - 2P_w. \tag{5}$$

Under RPM, although \bar{P} cannot directly alter the retailers’ marginal condition, it can still serve as a tool for regulating market price. Nevertheless, similar to the case under TTs, the manufacturer has insufficient tools to regulate the market prices in different states. Proposition 2 yields undesirable results.

Proposition 2 *Under RPM, the DMP cannot be resolved when the manufacturer maximizes its profits.*

Proof:

Please see Appendix.

Apparently the manufacturer can freely choose P_w and \bar{P} and can induce the market prices in both states to the monopoly level. One reasonable approach that may come to our mind immediately is to set $\bar{P} = \frac{\alpha_H}{2}$ and $P_w = \frac{\alpha_L}{4}$, in which market price may be directly regulated by \bar{P} when $\alpha = \alpha_H$ and the monopoly price can be induced by P_w when $\alpha = \alpha_L$. The DMP may be able to be resolved completely then. Unfortunately, this approach cannot be the manufacturer's strategy for maximizing its profits. Indeed, this strategy is not sustainable even when the manufacturer maximizes channel profits. Please see the related discussion in the next section. \bar{P} has influence only in the case of the large market size, under which the manufacturer's profits are $(\alpha_H - \bar{P}) \cdot P_w$. Clearly, given P_w , the manufacturer must choose \bar{P} as small as it can to enhance the profits. To prevent \bar{P} from being binding when $\alpha = \alpha_L$, the constraint $\bar{P} \geq \frac{\alpha_L + 2P_w}{3}$ must be satisfied, and the manufacturer must choose \bar{P} as $\frac{\alpha_L + 2P_w}{3}$, which is also the market price when $\alpha = \alpha_L$ (details can be found in the proof of Proposition 2).³ Clearly, RPM empowers the manufacturer to choose different market prices in different states, but the manufacturer will not do so.

Lump-Sum Quota Bonuses

We only consider the symmetric equilibrium in the retail market. Under an appropriate \bar{q} is binding in at least one state. Further, if \bar{q} is binding when $\alpha = \alpha_L$, it must be binding when $\alpha = \alpha_H$. Only two cases in the retail market should be taken into account: 1. \bar{q} is binding when $\alpha = \alpha_L$; 2. \bar{q} is binding only when $\alpha = \alpha_H$. However, the second case can be easily ruled out while considering whether the DMP can be resolved. In Case 2, if the DMP can be completely resolved, \bar{q} and P_w must be $\frac{\alpha_H}{4}$ and $\frac{\alpha_L}{4}$ respectively. Otherwise, the monopoly quantity and the monopoly price cannot be induced in both states. However, the solution $\bar{q} = \frac{\alpha_H}{4}$ and $P_w = \frac{\alpha_L}{4}$ cannot be sustained in Case 2. When $\alpha = \alpha_H$ and each retailer sells $\bar{q} = \frac{\alpha_H}{4}$ units in the retail market, Inequation (3) cannot be satisfied. More precisely, the left inequality of Inequation (3) is violated. Hence, only Case 1 will be considered, in which each retailer sells exactly \bar{q} units when $\alpha = \alpha_L$ and each retailer sells an amount higher than \bar{q} when $\alpha = \alpha_H$. It is also the case that can always resolve the DMP, as indicated in the next section.

In contrast to RPM, \bar{q} in LSBQs provides the manufacturer with more power to choose the market quantity. In addition, \bar{R} in LSBQs provide some flexibility to choose P_w . With the compensation of \bar{R} , retailers are willing to accept a higher wholesale price. It seems that LSBQs are more likely to resolve the DMP. However, the instinctive conflict of choices associated with \bar{q} and \bar{R} when LSQB are used yields the undesirable results of Proposition 3.

Proposition 3 Under LSBQs, the DMP cannot be resolved when the manufacturer maximizes its profits.

Similarly, to make market quantity reach monopoly levels in two states, one may use the following strategy: $\bar{q} = \frac{\alpha_L}{4}$ and $P_w = \frac{\alpha_H}{4}$. Again, this strategy cannot be the manufacturer's strategy for maximizing its profits. In this class of solutions, the manufacturer's expected profits are

$$2(1 - p)(\bar{q} \cdot P_w - \bar{R}) + 2p \left(\frac{\alpha_H - P_w}{3} \cdot P_w - \bar{R} \right).$$

Suppose that the manufacturer chooses $\bar{q} = \frac{\alpha_L}{4}$ and $P_w = \frac{\alpha_H}{4}$. When market size is small, a higher wholesale price may not reduce the quantity sold because the binding quota. The manufacturer can raise

P_w to increase its profits then. Because P_w is less than $\frac{\alpha_H}{2}$, the optimal level of P_w when market size is large. Because the manufacturer can increase its profits in both states by raising P_w , we can conclude now that $\bar{q} = \frac{\alpha_L}{4}$ and $P_w = \frac{\alpha_H}{4}$ cannot be the manufacturer's optimal strategy.

Resolving the Double Marginalization Problem

As we know, if the DMP can be ex post completely resolved, then both the market quantity and the market price must be $\frac{\alpha}{2}$ no matter whether the actual α is α_H or α_L . Hence, the whole channel, in each state, can earn monopoly profits $\frac{\alpha^2}{4}$ and the expected channel profits occur at the highest level

$$p \frac{\alpha_H^2}{4} + (1-p) \frac{\alpha_L^2}{4}.$$

Due to the incompatibility between the manufacturer's interests and the channel interests, the manufacturer cannot maximize its profits and the channel profits at the same time by using RPM or LSQBs in the retail contract. The manufacturer simultaneously maximizes its profits and the channel profits when it uses TTs in the retail contract. Due to the lack of tools available, the manufacturer can resolve the DMP in one state at most. If the manufacturer is instead allowed to use *ex ante* franchise fees to exploit retailers along with RPM or LSQBs in the retail contract, the manufacturer must be willing to maximize channel profits when designing its retail contracts. However, it emerges below that only LSQBs can always resolve the DMP. First, we consider RPM. Recall that the manufacturer does not have complete freedom to choose P_w and \bar{P} . In general, a lower wholesale price must be associated to a lower effective price ceiling, and *vice versa*. In this case, when P_w is as low as $\frac{\alpha_L}{4}$, the equilibrium market price when the market is large (which is also the lower bound of the effective price ceiling) is $\frac{2\alpha_H + \alpha_L}{6}$ less than the monopoly price $\frac{\alpha_H}{2}$. Hence, there is no way of resolving the DMP completely by using RPM in the retail contract.

Proposition 4: Under RPM, the DMP cannot be resolved when the manufacturer maximizes the channel profits.

We now turn to LSQBs. Ironically, the failure of RPM sheds light on when the DMP can be resolved. To ensure that the DMP is resolved in both states, the manufacturer must charge a high wholesale price which can cause retailers' losses from sales, especially when the market is small. However, as long as the retailers receive adequate compensation, including through the bonuses under the LSQB scheme, they can be convinced to accept a high wholesale price. As mentioned in the last section, the LSQB scheme does provide the manufacturer with option of charging a high wholesale price. Consider the special class analyzed in the last section.

Proposition 5 Under LSQBs, when the manufacturer maximizes channel profits, the retail contract with $\bar{q} = \frac{\alpha_L}{4}, P_w = \frac{\alpha_H}{4}$, and $\bar{R} \geq \frac{\alpha_H}{4}$ can always be used to resolve the DMP.

In the proof of Proposition 5, using first order conditions indicates that the retail contract that can maximize the expected channel profits is exactly the one in Proposition 5. The validness of the strategy is also checked in the following way. The manufacturer's goal is clear. \bar{q} and P_w must be $\frac{\alpha_L}{4}$ and $\frac{\alpha_H}{4}$ respectively. As long as we can show that there exists a \bar{R} that ensures that the retail contract is sustainable for the class of solutions considered, the proof is complete. In general, if we can find a set of \bar{q} , P_w and \bar{R} that can resolve the DMP for a class of solutions, then we can prove that the DMP can be resolved by using LSQBs. In this way, it is easy to show the importance of the flexibility provided by \bar{R} . Clearly, the superiority of LSQBs is resulted by more instruments to manipulate retailers' behavior than RPM and TTs.

CONCLUDING COMMENTS

In the modern economy, manufacturers are usually not directly involved in the retail business. Coordination failure among agents in the channel, referred as the double marginalization problem (DMP), results in lower channel profits. To coordinate agents in that channel, different types of vertical restraints are used. This paper focuses on the performance of vertical restraints when the market size is uncertain. Hence, we analyze lump-sum quota bonuses (LSQBs), two-part tariffs (TTs), and resale price maintenance (RPM) in this paper.

The quantity-fixing effect helps to distinguish LSQBs from other vertical restraints in cases in which the market size is uncertain. However, if the quantity-fixing effect is all the manufacturer needs, then why should the manufacturer bother to use LSQBs in the retail contract rather than using the following pricing scheme: the wholesale price for the amount less than $\bar{q} = \frac{\alpha}{4}$ is $P_w = \frac{\alpha}{2}$ and an extremely high price for the amount exceeding \bar{q} . The proposed scheme is highly similar to the tariff quota measure used in the agricultural trade. The LSQB scheme can actually make retailers willing to accept a wholesale price even higher than the market price because bonuses will be awarded. This strategy thus gives the manufacturer more flexibility to choose the wholesale prices, and this flexibility is important to resolving the DMP when the market size is uncertain.

With the quantity-fixing effect and the flexibility to choose wholesale prices, only LSQBs can always resolve the DMP in our two-state case. In contrast, TTs or RPM can only resolve the DMP in one of two possible states at most. Although the LSQBs may not always resolve the problem when there are more than two states, it still reasonable to believe that using LSQBs may create higher channel profits than do the other two vertical restraints due to the quantity-fixing effect and the flexibility to choose wholesale prices. Further, the vertical restraints with more instruments, such as the all-units discounts in Kolay et al. (2004), should be more powerful to resolve the DMP in the case of uncertain market demand.

We do not address welfare analysis in this paper because welfare implication is intuitive in our simple model. Once the DMP is resolved, the lower market price and the higher channel profits guarantee a higher social welfare. However, it is inappropriate to conclude that antitrust authority should not regulate the measure of LSBQs without deeper analysis. TTs and RPM only regulate the aggregate figures in the market, including market price and market quantity. Instead, through the setup of quota and bonus, under LSBQs, the manufacturer has stronger influence on individual retailer's behavior. For example, if the asymmetric equilibrium in the retail market is allowed, the manufacturer can expel one retailer by raising quota and bonus. Clearly, the manufacturer gains more market power under LSBQs. Hence, the impact of LSBQs on social welfare could be controversial. LSBQs can help abating the DMP in the short run, but an upstream firm with strong market power may jeopardize market competition in the long run.

APPENDIX

The Proof of Lemma 1

Assume that given P_w, \bar{q} and \bar{R} , the best response for r_i jumps to \bar{q} as $q_{-i} = x$ because of the extra bonuses \bar{R} . Because r_i 's best response function jumps as $q_{-i} = x$, r_i should enjoy the same profits regardless of whether q_i equals \bar{q} or $\frac{\alpha - x - P_w}{2}$. Hence, x can be solved from

$$(\alpha - (\bar{q} + x) - P_w)\bar{q} + \bar{R} = \left(\alpha - \left(\frac{\alpha - x - P_w}{2} + x \right) - P_w \right) \frac{\alpha - x - P_w}{2}. \quad (6)$$

Accordingly,

$$x = \alpha - P_w - 2\bar{q} \pm 2\sqrt{\bar{R}}, \tag{7}$$

When q_{-i} is equal to $\alpha - P_w - 2\bar{q} + 2\sqrt{\bar{R}}$, r_i may respond with a quantity of either $\bar{q} - \sqrt{\bar{R}}$ or \bar{q} . Although \bar{q} yields lower profits from sales, r_i can earn \bar{R} . In contrast, when q_{-i} is equal to $\alpha - P_w - 2\bar{q} - 2\sqrt{\bar{R}}$, r_i must respond with $\bar{q} + \sqrt{\bar{R}}$ rather than \bar{q} . Note that r_i can still earn \bar{R} by choosing $\bar{q} + \sqrt{\bar{R}}$. Hence, the jump in r_i 's best response function must occur at $x = \alpha - P_w - 2\bar{q} + 2\sqrt{\bar{R}}$.

When r_i follows the original best response (Equation (1)), r_i 's profits are

$$\pi_i^{BR} = \frac{(\alpha - P_w - q_{-i})^2}{4}. \tag{8}$$

When $q_i = \bar{q}$, r_i 's profits are

$$\pi_i^{\bar{q}} = [\alpha - (\bar{q} + q_{-i}) - P_w]\bar{q} + \bar{R}. \tag{9}$$

We differentiate π_i^{BR} and $\pi_i^{\bar{q}}$ with respect to q_{-i} ; this yields

$$\frac{\partial \pi_i^{BR}}{\partial q_{-i}} = -\frac{\alpha - P_w - q_{-i}}{2} < 0. \tag{10}$$

$$\frac{\partial \pi_i^{\bar{q}}}{\partial q_{-i}} = -\bar{q} < 0. \tag{11}$$

Comparing Equation (10) and Equation (11); we see that $\frac{\partial \pi_i^{\bar{q}}}{\partial q_{-i}} < \frac{\partial \pi_i^{BR}}{\partial q_{-i}}$ as $\bar{q} > \frac{\alpha - q_{-i} - P_w}{2}$. Recall that q_i equal to $\bar{q} - \sqrt{\bar{R}}$ or \bar{q} yields the same profit as $q_{-i} = \alpha - 2\bar{q} + 2\sqrt{\bar{R}}$. Furthermore, $\bar{q} - \sqrt{\bar{R}} < \bar{q}$. As q_{-i} decreases from $\alpha - 2\bar{q} + 2\sqrt{\bar{R}}$, π_i^{BR} is less than $\pi_i^{\bar{q}}$ until $\bar{q} < \frac{\alpha - q_{-i} - P_w}{2}$ or $q_{-i} < \alpha - P_w - 2\bar{q}$. Hence, we know that r_i chooses $q_i = \bar{q}$ when q_{-i} is between $\alpha - P_w - 2\bar{q}$ and $\alpha - P_w - 2\bar{q} + 2\sqrt{\bar{R}}$.

The Proof of Proposition 1

Note that the relative relationship among α_L, α_H , and P_w determines the way of calculating the expected channel profits. Because a P_w higher than α_H guarantees no profits, there are only two possible cases below.

Case 1: $P_w \leq \alpha_L \leq \alpha_H$

No matter what α is, each retailer sells $\frac{\alpha - P_w}{3}$ and the market price is $\frac{\alpha + 2P_w}{3}$. Accordingly, the expected channel profits are

$$E\left(\frac{\alpha + 2P_w}{3} \cdot \frac{2(\alpha - P_w)}{3}\right) = \frac{2}{9}[E(\alpha^2) + P_w E(\alpha) - 2P_w^2]. \tag{12}$$

Based on the first order condition, we have $P_w = \frac{E(\alpha)}{4}$, and the expected channel profits are $\frac{2}{9}[\alpha + \frac{1}{8}(E(\alpha))^2]$. Accordingly, the market price and the market quantity are $\frac{(2+p)\alpha_H+(1-p)\alpha_L}{6}$ and $\frac{(4-p)\alpha_H-(1-p)\alpha_L}{6}$ respectively when $\alpha = \alpha_H$, and the market price and the market quantity are $\frac{p\alpha_H+(3-p)\alpha_L}{6}$ and $\frac{(3+p)\alpha_L-p\alpha_H}{6}$ respectively when $\alpha = \alpha_L$. Note that the necessary condition for this solution is $P_w \leq \alpha_L$. That is, $\frac{\alpha_H \leq 3+p}{\alpha_L \leq p}$.

Case 2: $\alpha_L \leq P_w \leq \alpha_H$

Only if $\alpha = \alpha_H$, then each retailer sells $\frac{\alpha_H - P_w}{3}$, and then the market price is $\frac{\alpha_H + 2P_w}{3}$. Otherwise, the retailers sell nothing. Accordingly, the expected channel profits are

$$p \cdot \frac{\alpha_H + 2P_w}{3} \cdot \frac{\alpha_H - P_w}{3}.$$

Based on the first order condition, we have $P_w = \frac{\alpha_H}{4}$, and the expected channel profits are $p \cdot \frac{\alpha_H^2}{4}$. Accordingly, the market price and the market quantity are both at the monopoly levels when $\alpha = \alpha_H$, but there are no sales at all when $\alpha = \alpha_L$. Note that the necessary condition is simply $\alpha_L \leq P_w$ because the optimal $P_w, \frac{\alpha_H}{4}$, is surely less than α_H . That is, $\frac{\alpha_H \geq 4}{\alpha_L}$.

Depending on the value of α_L, α_H , and p , Case 1, Case 2, or both cases are sustainable. However, neither the monopoly quantity nor the monopoly price is induced in either state. Hence, the DMP cannot be resolved.

The Proof of Proposition 2

An appropriate \bar{P} should be binding in at least one state. Hence, there exist three types of possible solutions when the manufacturer adopts RPM in retail contracts.

- Case 1: $P_w \leq 3\bar{P} - 2P_w \leq \alpha_L \leq \alpha_H$
- Case 2: $P_w \leq \alpha_L \leq 3\bar{P} - 2P_w \leq \alpha_H$
- Case 3: $\alpha_L \leq P_w \leq 3\bar{P} - 2P_w \leq \alpha_H$

Because the complete resolution of the DMP requires two different market prices in two different states, \bar{P} cannot be binding all the time, and no markets can be entirely surrendered. Hence, we only consider Case 2 below.

Although the manufacturer and retailers sell goods in both states, \bar{P} is only binding when $\alpha = \alpha_H$. The manufacturer's expected profits are

$$(1 - p) \cdot \frac{2(\alpha_L - P_w)}{3} \cdot P_w + p \cdot (\alpha_H - \bar{P}) \cdot P_w. \tag{13}$$

If we differentiate Equation (13) with \bar{P} and P_w , we have

$$\bar{P}: -p \cdot P_w \leq 0, \tag{14}$$

$$P_w: \frac{2(1 - p)}{3}(\alpha_L - 2P_w) + p(\alpha_H - \bar{P}) = 0. \tag{15}$$

Similarly, based on Inequation (14), $\bar{P} = \frac{\alpha_L + 2P_w}{3}$. However, the internal solution suggested by Equation (15) is not necessarily sustainable. After we substitute \bar{P} , the internal solution becomes

$$P_w = \frac{2\alpha_L + 3p(\alpha_H - \alpha_L)}{4 - 2p}, \tag{16}$$

and the internal solution must satisfy the constraints below.

$$\frac{2\alpha_L + 3p(\alpha_H - \alpha_L)}{4 - 2p} \leq \alpha_L, \text{ or, } \frac{\alpha_H}{\alpha_L} \leq \frac{2 + p}{3p}. \tag{17}$$

If $\frac{\alpha_H}{\alpha_L} \leq \frac{2+p}{3p}$, then

$$P_w = \frac{2\alpha_L + 3p(\alpha_H - \alpha_L)}{4 - 2p}, \bar{P} = \frac{4(1 - p)\alpha_L + 3p\alpha_H}{3(2 - p)}. \tag{18}$$

Accordingly, the market price and the market quantity are $\frac{2\alpha_L + 3p(\alpha_H - \alpha_L)}{4 - 2p}$ and $\frac{4(1 - p)\alpha_L + 3p\alpha_H}{3(2 - p)}$ respectively

when $\alpha = \alpha_L$, and the market price and the market quantity are \bar{P} and $\alpha_H - \bar{P}$ respectively when $\alpha = \alpha_H$. Otherwise, $P_w = \bar{P} = \alpha_L$. In both states, the market price is always α_L , and the market quantity is $\alpha - \alpha_L$ when the market size is α .

The Proof of Proposition 3

In this class of solution, the manufacture earns

$$2(1 - p)(P_w \cdot \bar{q} - \bar{R}) + 2p \left(\frac{\alpha_H - P_w}{3} \cdot P_w - \bar{R} \right), \text{ and the first derivatives with respect to } \sqrt{\bar{R}}, \bar{q}, \text{ and } P_w$$

are

$$\sqrt{\bar{R}}: (-4(1 - p) - 4p)\sqrt{\bar{R}} \leq 0, \tag{19}$$

$$\bar{q}: 2(1 - p)P_w \geq 0, \tag{20}$$

$$P_w: 2(1-p)\bar{q} + \frac{2}{3}p(\alpha_H - 2P_w) = 0. \tag{21}$$

Given any P_w , the manufacturer should raise \bar{q} and lower \bar{R} as possible as it can though the exact choices are still regulated by the necessary conditions.

However, no matter whether the necessary conditions are satisfied or not, the DMP cannot be resolved while the manufacturer maximizes its own profits. The DMP can be resolved only when $\bar{q} = \frac{\alpha_L}{4}$ and $P_w = \frac{\alpha_H}{4}$. It is clear that the combination of \bar{q} and P_w cannot satisfy Equation (21).

The Proof of Proposition 4

As seen in the proof of Proposition 2, we only analyze the case in which \bar{P} is only binding when $\alpha = \alpha_H$. The expected channel profits are

$$(1-p) \cdot \frac{2(\alpha_L - P_w)}{3} \cdot \frac{\alpha_L + 2P_w}{3} + p \cdot (\alpha_H - \bar{P}) \cdot \bar{P},$$

The first order conditions are

$$\alpha_L - 4P_w = 0, \tag{22}$$

$$\alpha_H - 2\bar{P} = 0. \tag{23}$$

Accordingly, $P_w = \frac{\alpha_L}{4}$ and $\bar{P} = \frac{\alpha_H}{2}$. Unfortunately, this internal solution, which is the only candidate for resolving the DMP under RPM, does not satisfy the necessary condition in such a case. When $P_w = \frac{\alpha_L}{4}$, the equilibrium market price is $\frac{2\alpha_H + \alpha_L}{6} \leq \frac{\alpha_H}{2}$ when $\alpha = \alpha_H$. Indeed \bar{P} cannot be binding in either state.

The Proof of Proposition 5

Only one case should be taken into account, in which \bar{q} are binding in both states and each retailer sells exactly \bar{q} units when $\alpha = \alpha_L$ (please refer to the discussion in the main text). The expected channel profits are

$$(1-p) \cdot (\alpha_L - 2\bar{q}) \cdot 2\bar{q} + p \cdot \frac{2(\alpha_H - P_w)}{3} \cdot \frac{\alpha_H + 2P_w}{3}.$$

The first order conditions are

$$\alpha_L - 4\bar{q} = 0, \tag{24}$$

$$\alpha_H - 4P_w = 0. \tag{25}$$

Accordingly, $\bar{q} = \frac{\alpha_L}{4}, P_w = \frac{\alpha_H}{4}$, which can induce the monopoly quantity and the monopoly price in both states. We need to check whether the below necessary conditions are satisfied.

$$\alpha_L - P_w - 2\bar{q} \leq \bar{q} \leq \alpha_L - P_w - 2\bar{q} + 2\sqrt{\bar{R}}, \quad (26)$$

$$0 \leq \frac{\alpha_H - P_w}{3} \leq \alpha_H - P_w - 2\bar{q}. \quad (27)$$

As long as the manufacturer sets $\sqrt{\bar{R}} \geq \frac{\alpha_H}{8}$ the necessary conditions must be satisfied.

REFERENCES

Bergstrom, T. C. and Varian, H. R. (1985), When Are Nash Equilibria Independent of the Distribution of Agents' Characteristics? *The Review of Economic Studies*, 52(4), 715–718.

Datamonitor (2010, June), Books in the United States. *Industry Profile*.

Gal-Or, E. (1991), Vertical Restraints with Incomplete Information. *The Journal of Industrial Economics*, 39(5), 503–516.

Klein, B. and Murphy, K. M. (1988), Vertical Restraints as Contract Enforcement Mechanisms. *Journal of Law and Economics*, 31, 265–297.

Kolay, S., Shaffer, G., and Ordovery, J. A. (2004), All-Units Discounts in Retail Contracts. *Journal of Economics & Management Strategy*, 13(3), 429–459.

Kuksov, D. and Pazgal, A. (2007), The Effects of Costs and Competition on Slotting Allowances. *Marketing Science*, 26(2), 259–267.

Mathewson, G. F. and Winter, R. A. (1984), An Economic Theory of Vertical Restraints. *The Rand Journal of Economics*, 15(1), 27–38.

Mathewson, G. F. and Winter, R. A. (1985), The Economics of Franchise Contracts. *Journal of Law & Economics*, 28, 503–526.

O'Brien, D. P. and G. Shaffer (1992), Vertical Control with Bilateral Contracts. *Rand Journal of Economics*, 23(3), 299–308.

Oyer, P. (2000), A Theory of Sales Quota with Limited Liability and Rent Sharing. *Journal of Labor Economics*, 18(3), 405–426.

Raju, J. S. and Srinivasan, V. (1996), Quota-Based Compensation Plans for Multiterritory Heterogeneous Salesforces. *Management Science*, 42(1), 1454–1462.

Rey, P. and Tirole, J. (1986), The Logic of Vertical Restraints. *American Economic Review*, 76(5), 921–939.

Rey, P. and Vergé, T. (2008), *Handbook of Antitrust Economics*, Chapter The Economics of Vertical Restraints, pp. 353–390. The MIT Press.

Shaffer, G. (1991), Slotting Allowances and Resale Price Maintenance: A Comparison of Facilitating Practices. *Rand Journal of Economics*, 22(1), 120–135.

Sprengler, J. (1950), Vertical Integration and Antitrust Policy. *Journal of Political Economy*, 58(4), 347–352.

Waterman, D. and Weiss, A. A. (1996), The Effects of Vertical Integration between Cable Television Systems and Pay Cable Networks. *Journal of Econometrics*, 72(1-2), 357-395.

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SALES FORCE'S ATTITUDES TOWARD TECHNOLOGY: EVIDENCE FROM SPAIN

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ABSTRACT

Technology has changed company activity. It has equipped companies with elements which give them better and greater knowledge of their target audiences and clients. Within the commercial scope of organizations, it is important to understand which factors explain the use of technology. In this project, a study on vendors' attitude toward technology and on their use of technology is developed. We analyse different sales force opinions toward technology and develop a segmentation of vendors, characterizing each segment identified based on the variables used. The results show, technological use is related to the sales force job, the industry, the size of the organization, in relevance to the different vendors' segments.

JEL: M31

KEYWORDS: Sales Force, Attitudes Toward Technology, Market Segmentation

INTRODUCTION

Technology is an essential element for the development of organizations. Commercial and sales areas are no exception. Several studies have analyzed the development of different aspects of sales force automation. Sales force automation is a process wherein several organizations observe problems in adopting and implementing a strategy. The ratio of negative experiences in implementing technologies such as CRM or SFA (Sales Force Automation) is between 50% (Amerongen, 2006; Froom, 2000; Rigby, Reichheld and Schefter, 2002) and 75% (Kaido, 1999; Petersen, 1997).

It is important to understand which factors explain the use of technology. In this project, a study on vendors' attitude toward technology and their use of technology is developed. We analyzed different sales force opinions toward technology and develop a segmentation of vendors, characterizing each one of the segments identified based on the variables used.

The remainder of this paper is organized as follows. The next section examines the literature and develops the goal of this study. We then describe our data and methodology and discuss the results of our empirical tests. The final section includes conclusions.

LITERATURE REVIEW

Most companies implement sales technology in their sales forces with the aim of improving productivity, communication and customer relationships (e.g. Campbell, 1998; Goldenberg, 1996; Moncrief, Lamb & Mackay, 1991). In general, research on barriers to technology adoption is consistent with the general conclusion that organizational barriers are more important than technical barriers. Organizational barriers include issues such as fragmentation and poor relationships between functional departments, non-acceptance by the senior management of the strategic benefits of investment in technology and the absence of a clear strategy for implementation (Wright, Fletcher, Donaldson & Lee, 2008).

Schillewaert and others (Schillewaert, Ahearne, Frambach & Moenaert, 2005) note it is surprising that only a few marketing studies have dealt with adoption of sales technology within sales organizations.

Major studies have focused on consumer adoption (e.g. Steenkamp, ter Hofstede & Wedel, 1999), organizational adoption (e.g. Frambach, Barkema, Nooteboom & Wedel, 1998; Gatignon & Robertson, 1989) or salespeople's adoption of selling new products (Anderson & Robertson, 1995).

Parthasarathy and Sohi (1997) suggest that adopting automation systems goes through two stages. In the first stage, the organization takes the decision to adopt a technology, and then the vendors must choose whether or not to adopt that technology. This is a "dual adoption" (Buehrer, Senecal and Pullman, 2005). If adopting technology in the sales force is a dual adoption, for it to succeed, the second phase is critical.

In many companies, executives decide they must adopt technology and they make decisions on investments in technology for their organizations. Frequently, vendors do not understand the technology. They do not believe there is any real organizational support behind it and do not see any real benefits for them (Buehrer, Senecal and Pullman, 2005). Moreover, in many cases, once the technology is adopted, its implementation is not successful because the company management had not given adequate support (money and training) to technology or were not aware of the complexity of the system introduced.

Many academic studies have focused on technology adoption in the organization (e.g. Pullig, Maxham and Hair, 2002; Rivers and Dart, 1999), regardless of individual factors on the adoption of technology. Two exceptions are the work of Jones, Sundaram and Chin (2002) and Speier and Venkatesh (2002). There is also little development of the literature on the impact of information technology on individual performance (Avlonitis & Panagopoulos, 2005).

The literature indicates that a large part of the sales force do not adopt technologies, or adopts them using only a portion of their potential (Buehrer et al, 2005, p. 390). As indicated by Xu, Yurong, Yen, David C., Lin, Binshan and Chau (2002), employees' resistance is a main risk in implementing CRM technology. Several authors indicate the existence of factors which explain the underuse of technologies, such as (Jones, Sundaram, Chin, 2002): Natural inertia, Low perception of value (Cost vs. Benefit), Low support from the organization, Personal and demographic factors, and Low reward for change.

Many of these factors have not been empirically analyzed, and others were studied for some specific industry. Jones et al. studied the influence of individual variables on the intent-to-use for commission-based insurance agents. They found three variables explained intention to use the new technology: perceived usefulness of the new system, attitude toward the new system and the compatibility with the existing system. They also found that only salespeople's innovativeness influenced their extent of usage. Widmier, Jackson and McCabe (2002) found that technologies are heavily used for the contact management, generating proposals and scheduling. They also found that technologies were less used for automated sales plans, geographic route planning and qualifying the customer (Widmier et al., 2002).

The literature suggests the need to study the factors of the vendors' attitude toward technology in general, and evaluation of the benefits it provides. We believe that the role of vendor attitudes toward using technology, and the influence their work position, their industry or organization size has on vendors' opinions has not been sufficiently examined in the literature. We focus on evaluating vendors' attitudes regarding adopting technology in their activity, but our interest consists more specifically of determining if different vendor groups exist, characterised by showing similar attitudes toward technology.

Based on the previous evaluations, a segmentation technique was used which allows us to group vendors based on a series of items which indicate vendors' "attitude toward technology". Our hypothesis is based on the fact that vendors do not show homogeneous attitudes regarding using technology in their professional activity.

DATA AND METHODOLOGY

After revising the literature, several interviews were carried out with different vendors in order to adjust the items from the selected scales to the scope of commercial activity in Basque Country. Based on these interviews, the world café technique was applied to develop the questionnaire with the different items to be measured in the survey. Later, an empirical study was developed to collect the evaluations of vendors and sales managers. The field work for the empirical study was done between March and April of 2010. The sample type was a quota sample, wherein quotas were employed for vendor type and company activity variables.

The technique used was cluster analysis. This technique allows for making attitudinal segmentations. Cluster Analysis allows for determining how to group objects (brands, products, purchasers) into different segments within the population they form a part of.

After classifying the objects (vendors, in this case) into groups, we develop profiling for the different clusters or groups. We examine how different groups evaluate the items regarding attitude toward technology used to develop the groups. Later, we analyzed the profile of vendor groups or segments based on other classification variables used in the study, such as industry, company size, geographical scope of the company’s activity and sales position type from whence their activity is developed.

Table 1 shows the main results obtained, beginning with a descriptive analysis of the sample, and the main results from the issues referenced in each question on the questionnaire. The results show 54.5% of the sample is made up of vendors and 45.5% by sales force responsible for other vendors. The results further show 57.2% are men, and 42.8% are women. We see that 31.9% of the companies have less than 10 employees, 28.4% have between 11 and 49 employees, 20.7% of the companies have between 50 and 249 employees, and the leftover 19% have 250 employees or more.

The industries are distributed in an equal fashion, where a third of the companies are from the commercial sector, another third from industry and the remaining third from the services sector. 26% have their business scope in a local setting, 16.1% have a provincial scope, 14.7% regional, 24.5% have a nationwide scope, and 18.7% have an international scope. The majority of vendors, 82.3%, indicate that their organization uses new technologies.

Table 1: Descriptive Statistics of the Sample

		Percentage
Sales position	Vendors	54.5
	Sales force responsible for other vendors	45.5
Gender	Man	57.2
	Woman	42.8
Size of the company	Less than 10 employees	31.9
	between 11 and 49 employees	28.4
	between 50 and 249 employees	20.7
	250 employees or more	19

This table shows the percentages for the categories of the main variables used in the research

RESULTS

Respondents were asked about the use made of different technologies analyzed: mobile telephone, Black Berry, Smartphone, Pager, PDA or Electronic Agenda, computer, electronic pad, online communication platform, email, GPS, CRM, Databases, Social networks and others. For each technology, the use was differentiated between for the organization, the use for commercial information and control, the use for

vendor activity and the use for customer service. In Table 2, one can see, in general, a high usage of mature technologies such as the mobile phone, the computer, email, an average use of databases, and lesser use of more current technologies such as CRM, Web 2.0 or social networks.

Table 2: Usage Percentage of Different Technologies within the Scopes Analyzed

	In the Organization	For Commercial Information and Control	For Vendor Activity	For Customer Service	Media
Mobile phone	85.7	64.7	74.1	71	73.88
Black Berry	29.9	23.7	27.6	18.5	24.93
Smartphone	13.7	11.8	12.2	9.8	11.88
Pager	4.8	3.1	2.5	1.2	2.90
PDA (Electronic agenda)	23.6	14.1	17.4	8.5	15.90
Computer	91.5	83.6	79	74.1	82.05
Electronic pad	9.8	6.8	5.6	6	7.05
Online communication platforms (web 2.0)	33	23.6	23.9	28.6	27.28
Email	78.8	70.1	67.8	66	70.68
GPS	14.7	6.9	21.8	7.3	12.68
CRM	13.5	12.5	11.2	9.5	11.68
Databases	73	65.4	58.9	44.6	60.48
Social networks	19.1	10.8	12.9	19.9	15.68
Others. Indicate which one(s)	5	3.5	3.5	3.7	3.93

This table shows the utilization rates of different technologies. For each type of technology the use in various fields is shown: In the organization, for commercial information and control, for vendor activity and for customer service. In the last column the average values are included.

Table three shows that 56.7% of those surveyed consider technology to be used appropriately, as opposed to 16.9% that believe that technology is little or very little used in their company. In 61.9% of companies, technology is used very frequently or always. Only 26.2% of the vendors receive training with the new technologies in a habitual fashion, while 45.1% receive it on occasion.

Regarding whether the vendors are consulted for implementing new technologies within the commercial scope, 39.8% indicate that they are never consulted, 47.4% indicate that on occasion, and 12.8% indicate that they are always consulted for this type of decision. A third of those surveyed indicate that they participated in the implementation process for new technologies for sales force.

The vendors were asked about aspects regarding their attitudes concerning the use of technology and concerning the benefits of using said technology. The results are presented in Table 4. Vendors gave high scores to affirmations such as “technology is mandatory for any organization” (7.95 out of 10) and also that “technology improves the efficacy of my work, which translates to better results” (7.34 out of 10)

Included in affirmations with lower average scores is “it basically means more work for the vendor” (4.33 out of 10), “that technological difficulties are normal in my activity” (4.92 out of 10) and that “it is mainly applied at companies to control the vendor more” (4.95 out of 10). In general, we can see a favourable attitude toward technology from sales force who participated in the survey.

Regarding benefits, we highlight the high scores given by vendors to the majority of the aspects studied, particularly agreeing with the fact that technology means “agile and dynamic sales management” (7.72 out of 10), “having better and more updated information on clients” (7.64 out of 10) and “better-informed sales force” (7.61 out of 10).

Table 3: Participation and Training in New Technologies

Receives Training in New Technologies at Their Company or Organization			
		Frequency	Percentage
	Habitually	150	26.2
	On occasion	258	45.1
	I do not receive	164	28.7
Total	572	100.0	
Indicate If Vendors Are Consulted When Implementing a New Technology within the Commercial Scope			
		Frequency	Percentage
	Never	227	39.8
	Sometimes	270	47.4
	Always	73	12.8
Total	570	100.0	

This table shows the degree of participation of the vendors in the decisions about new technologies and information about their training. Frequencies and percentages are shown.

Analysis of Different Sales Force Typologies

In order to detect different vendor groups with similar characteristics, a cluster analysis was applied, using variables related to the attitude toward technology and to its benefits. The intent is that vendors in one same group be similar, and that they differ from vendors in other groups. As a grouping method, a hierarchal agglomeration procedure was used, as a linking method to the Ward method, and squared Euclidean as a distance measurement. After analyzing the results obtained and the different grouping possibilities, in 2, 3, or 4 clusters, the latter grouping was chosen, since the distances between the clusters show us an important leap in this grouping within the conglomeration record. The results obtained are also more consistent, which corroborates with the previous reasoning.

Table 4: Evaluations of Attitude and Benefits of Technology

Evaluations Concerning Attitude toward Technology Matters	Average	Stand. Dev.
I like to always use technology whenever I can, even if it is not necessary	6.613	2.186
I think technology is fun	6.490	2.200
Technological difficulties are normal with my activity	4.920	2.347
Technology improves the efficacy of my work, which translates to better results	7.341	1.903
I try to make it so the most modern technology is used at my organization	5.938	2.350
It worries me when the organization changes or implements a new technology	5.440	2.411
I consider that nowadays, technology is mandatory for any organization	7.955	1.817
I think that technology basically means more work for the vendor	4.335	2.341
Technology is mainly applied at companies to control the vendor more	4.959	2.233
I think it is good for a commercial manager to control their vendors' activity and to establish concrete guidelines	6.949	1.864
I consider that technology should be more developed within the commercial scope at my organization	6.216	1.870
Evaluations on Benefits of Technology Matters	Average	Stand. Dev.
Better-informed sales force	7.610	1.872
Satisfied clients	7.301	1.840
Agile and dynamic sales management	7.727	1.638
Real-time feedback to the marketing department	7.193	2.192
Savings on administrative expenses, on transportation and on fewer errors	7.438	1.775
Better vendor control and management	7.108	1.821
Greater vendor motivation	6.034	2.036
Having better and more updated information on clients	7.644	1.761
Greater comfort for the vendor	7.366	1.773

This table lists the mean scores given by respondents to issues related to attitude and benefits of technology. Mean values and standard deviations are shown.

The variables used were obtained by asking those surveyed to evaluate their level of agreement or disagreement with a series of affirmations and evaluations related to the attitude toward technology, as well as the benefits it provides. The evaluation scale used was from 1 to 10. The affirmations were as follows:

Attitude toward technology: 1- I like to always use technology whenever I can, even if it is not necessary 2- I think that technology is fun 3- Technological difficulties are normal with my activity 4- Technology improves the efficacy of my work, which translates to better results 5- I try to make it so the most modern technology is used at my organization 6- It worries me when the organization changes or implements a new technology 7- I consider that nowadays, technology is mandatory for any organization 8- I think that technology basically means more work for the vendor 9- Technology is mainly applied at companies to control the vendor more 10- I think it is good for a commercial manager to control their vendors' activity and to establish concrete guidelines 11- I consider that technology should be more developed within the commercial scope at my organization

Benefits of technology: 1) Better-informed sales force 2) Satisfied clients 3) Agile and dynamic sales management 4) Real-time feedback to the marketing department 5) Savings on administrative expenses, on transportation and on fewer errors 6) Better vendor control and management 7) Greater vendor motivation 8) Having better and more updated information on clients 9) Greater comfort for the vendor

Description of the Clusters

To describe the four clusters identified, we used Analysis of the Variance of a factor (ANOVA). This technique was used to determine which variables used to create the clusters show significant differences in the groups obtained. The technique indicates significant differences in all of the variables used, which means that all of them will be taken into account in interpreting the groups' profile.

The segments identified have the following characteristics: The first segment stands out from the rest as it is the segment with the highest average rating for variables related to pleasure and having fun with technology. In this sense, it is made up of those who most enjoy using technology and to whom it seems the most fun. It also has a high rating regarding the variable related to technology improving results. Additionally, it also gives high ratings regarding the fact that it is mandatory, and in the same fashion agrees with the sales manager controlling their vendors. It is characterized by the attitude that technology should be more developed in their company, and technology provides better vendor management and control. We call this segment "Technologists oriented toward control"

The second segment has more elevated ratings for two matters: technological difficulties are normal with my activity, and it worries me when my organization changes or implements a new technology. They rate technology as fun and enjoyable below the average, in addition to doing so with the majority of variables concerning the benefits of technology. This shows us a segment of vendors who are not familiarised with technology, and are not oriented toward its use. We call this segment "Those concerned by technology".

The third segment likes using technology, it seems fun to them (above average ratings for both variables), and is the most convinced group that it improves results, and it is the group to which it seems the most mandatory. Additionally, it is characterized by the attitude it does not mean more work, and does not see it as a tool for control, but rather as providing several benefits for sales and for the customer. This is the segment which provides the most elevated average ratings for the majority of benefits of technology proposed, excepting the benefit related to better management and control of vendors, where the first segment obtains better ratings. We call this third vendor type "Convinced by technology".

The fourth segment is made up of vendors who least like using technology, and to whom it seems the least fun. Additionally, it does not see difficulties when using it, nor is it worried when their organization changes the technology, but they are the ones who intend to use it the least, and do not believe that it improves results. This segment provides the lowest average ratings for practically all of the items analyzed, although it is in second place and slightly above average for the variable which refers to the company using technology mainly for control. We can call this segment “Sceptical with technology”.

Table 5 shows, the first segment, “Technologists oriented toward control” form 27.45% of vendors, the second, “Those concerned by technology”, the most numerous, at 37.61%, the third, “Convinced by technology” make up 29.23% of the total, and the fourth, “Sceptical with technology”, only make up 5.7% of the total.

Table 5. Number of Those Surveyed per Segment

Segment 1	154	27.45%
Segment 2	211	37.61%
Segment 3	164	29.23%
Segment 4	32	5.70%

The table shows the number and percentage of vendors that make up each of the segments identified

Later, we relate the segments with some of the classification variables included in the survey, such as: Vendor type (commercial manager, sales manager, delegation manager, team manager and vendor). Sex, Age, Size of the company (less than 10 employees, between 10 and 49, between 50 and 249, equal o more than 250), Activity sector (Industry, commerce and services) and Business scope (local, provincial, regional, national and international).

For this part, we used the Chi-square contrast, since these are relations between either nominal or ordinal variables, except for the case of age, where we again used the ANOVA technique. The results are presented in Table 6. Regarding classification variables, gender is a variable which does not show significant differences between segments. However, sales position type, age, size of the company, activity sector and business scope variables do relate with relevance to the different vendor segments.

Table 6: Contingency Table- Clusters and Sales position

			SALES POSITION			
			Sales managers	Intermediate sales positions	Vendors	Total
Technologists oriented toward control	Ward Method	Recount	25	32	87	144
		Expected frequency	31.0	34.4	78.6	144.0
Those concerned by technology	Ward Method	Recount	33	42	134	209
		Expected frequency	45.0	50.0	114.0	209.0
Convinced by technology	Ward Method	Recount	50	55	58	163
		Expected frequency	35.1	39.0	88.9	163.0
Sceptical with technology”.	Ward Method	Recount	10	2	20	32
		Expected frequency	6.9	7.6	17.5	32.0
Total	Ward Method	Recount	118	131	299	548
		Expected frequency	118.0	131.0	299.0	548.0

This table shows a contingency table which combines the identified segments and the variable "sales position". The respondents have been grouped in sales managers, intermediate sales positions and vendors. In each cell of the table the expected frequency is shown.

The Chi Square contingency table is presented in Table 7. The sales position variable, was re-encoded to analyse the differences between sales managers, vendors and intermediate sales positions, and to avoid problem caused to the Chi-square technique by the low expected frequency provided by some of the boxes on the contingency table. This variable shows us how “Technologists oriented toward control” and

“Concerned by technology” are largely vendors. On the other hand, for those “Convinced by technology”, the frequency observed is greater than expected for sales manager positions and intermediate positions.

In the age variable, significant differences are observed in averages with 95% confidence. As we can observe on the table, “Technologists oriented toward control” are a bit younger on average than the rest of segments (34.8 years), followed by those “Convinced by technology” (37.5 years). The third place age group is “Sceptical of technology” (37.8 years), and lastly, those “Concerned by technology” (38 years).

Table 7: Chi-square Tests

	Value	df	Asymptotic Sig. (Bilateral)
Pearson’s Chi-square	39.836 ^{a***}	6	.000***
Verisimilitude ratio	41.705	6	.000
Linear-by-linear association	13.672	1	.000
N of valid cases	548		

This table shows the Chi-square test. The Asymptotic significance shows that, with 99% of confidence, there is a relationship between the type of sales position and being of a particular segment. a. 0 boxes (.0%) have an expected frequency less than 5. The expected minimum frequency is 6.89.

The contingency table for cluster and size is presented in Table 8. Regarding the size of the company, we re-encoded the variable to simplify the analysis and avoid the existence of boxes with expected frequencies under 5, leaving two company groups, those with less than 50 employees (1) and those with 50 employees or more (2). For this variable, “Technologists oriented toward control” and those “Convinced by technology” are found, in a proportion greater than expected, in average and large companies, while those “Concerned by technology” and those “Sceptical of technology” are more concentrated in small companies. This indicates that there is a certain relationship between the size of the company and the vendor profile type regarding their attitude toward technology.

The activity sector is another one of the factors that explains significant differences between the groups. “Technologists oriented toward control” belong to all sectors in a similar proportion. However, those “Concerned by technology” belong in a greater proportion to the services sector, those “Convinced by technology” are largely from industrial companies and those “Sceptical of technology” are more concentrated in companies in the commercial sector. The Chi Square test results are presented in Table 9. Table 10 shows the Contingency table for clusters and activities. Table 11 shows additional Chi square test results.

Finally, insofar as the company’s business scope is concerned, “Technologists oriented toward control” combine different geographical scopes, those “Concerned by technology” largely belong to local-scope companies, those “Convinced by technology” are largely companies of an international scope, and those “Sceptical of technology” almost all work in companies of a local or provincial scope.

Summarizing the analysis made for the four segments, we note that: “Technologists oriented toward control” are mainly vendors, relatively younger in age, largely from average or large companies, and from all sectors and geographical scopes. -Those “Concerned by technology” are also mainly vendors without management responsibility, largely from the services sector and of local scope. Those “Convinced by technology” are more managers or sales managers, from average or large companies, largely from industrial companies and of an international scope. Those “Sceptical of technology” mainly work in small companies in the commercial sector, of mainly local scope.

Table 8: Contingency Table-Clusters and Size

		SIZE		
		1	2	Total
Technologists oriented toward control	Recount	89	65	154
	Expected frequency	93.6	60.4	154.0
Those concerned by technology	Recount	135	76	211
	Expected frequency	128.3	82.7	211.0
Ward Method	Convinced by technology	89	75	164
	Expected frequency	99.7	64.3	164.0
Sceptical with technology".	Recount	28	4	32
	Expected frequency	19.5	12.5	32.0
Total	Recount	341	220	561
	Expected frequency	341.0	220.0	561.0

This table shows a contingency table which combines the identified segments and the variable "Size of the company". The respondents have been grouped in those who work in companies with less than 50 employees (1) and those who work in companies with 50 employees or more (2). In each cell of the table the expected frequency is shown.

Table 9: Chi-square Tests

	Value	Gf	Asymptotic Sig. (Bilateral)
Pearson's Chi-square	13.986 ^{a***}	3	.003 ^{***}
Verisimilitude ratio	15.616	3	.001
Linear-by-linear association	1.166	1	.280
N of valid cases	561		

This table shows the Chi-square test. The Asymptotic significance shows that, with 99% of confidence, there is a relationship between the size of the company and being of a particular segment. a. 0 boxes (.0%) have an expected frequency less than 5. The expected minimum frequency is 12.55.

CONCLUDING COMMENTS

Our goal was to evaluate vendors' attitudes regarding adopting technology, but more specifically to determine if different vendor groups exist, characterised by showing similar attitudes toward technology. The adoption and implementation of technology by sales force is a process wherein several organizations have had problems. Failure percentages are elevated partially due to adaptation problems of the vendors themselves. If sales force adopting technology is a dual adoption, the sales force's attitudes toward technology becomes an important aspect for the final success of implementation of different types of technologies. The result may be not using it, or also under-using it.

The empirical study was developed to collect the assessments of sellers and sales managers on the use and attitude toward technology. The field work for the empirical study was conducted between March and April 2010. After initial data analysis, a cluster analysis was used to create groups of vendors based on their attitudes toward technology.

The empirical study shows us that the majority of vendors respond that they use technology in their professional life. Insofar as the type of technology they use is concerned, in general, we observe an elevated use of mature technologies such as the mobile telephone, the computer, email, an average use of databases, and a lesser use of more current technologies such as CRM, Web 2.0 or social networks. Regarding whether vendors are consulted or not for the implementation of new technologies within the commercial scope, one-third of those surveyed indicate that they had participated in the implementation process for new technologies for the sales force.

Table 10: Contingency Table: Clusters and Activity Sector

		ACTIVITY SECTOR				
		Commercial Sector	Industrial Sector	Services Sector	Total	
	Technologists oriented toward control	Recount	53	52	49	154
		Expected frequency	52.4	50.5	51.1	154.0
Ward Method	Those concerned by technology	Recount	72	63	76	211
		Expected frequency	71.8	69.2	70.0	211.0
	Convinced by technology	Recount	46	67	51	164
		Expected frequency	55.8	53.8	54.4	164.0
	Sceptical with technology".	Recount	20	2	10	32
		Expected frequency	10.9	10.5	10.6	32.0
Total		Recount	191	184	186	561
		Expected frequency	191.0	184.0	186.0	561.0

This table shows a contingency table which combines the identified segments and the variable "Activity Sector". The respondents have been grouped in those who work in Commercial Sector, in Industrial Sector and in Services Sector. In each cell of the table the expected frequency is shown.

Table 11: Chi-square Tests

	Value	Gf	Asymptotic Sig. (Bilateral)
Pearson's Chi-square	20,919 ^{a***}	6	,002***
Verisimilitude ratio	22,764	6	,001
Linear-by-linear association	,364	1	,546
N of valid cases	561		

a. 0 boxes (.0%) have an expected frequency less than 5. The expected minimum frequency is 10.50.

This table shows the Chi-square test. The Asymptotic significance shows that, with 99% of confidence, there is a relationship between the activity sector and being of a particular segment

Vendors give high ratings to affirmations such as “technology is mandatory for any organization” (7.95 out of 10) and also “technology improves the efficacy of my work, which translates to better results (7.34 out of 10), while they do not agree so much with “it basically means more work for the vendor” (4.33 out of 10) and with “it is mainly applied in companies to control the vendor more” (4.95 out of 10). Regarding benefits, we note high ratings given by vendors to the majority of the aspects studied.

We proposed the heterogeneity of vendor attitudes concerning the use of technology. We confirmed said hypothesis by describing four different segments. We have called the analyzed segments: “Technologists oriented toward control”, “Concerned by technology”, “Convinced by technology” and “Sceptical of technology” based on the ratings given to the variables used.

The “Technologists oriented toward control” are mainly vendors without management responsibility, of a relatively younger age, largely from average or grand companies, and from all sectors and geographical scopes. Those “Concerned by technology” are also mainly vendors, largely from the services sector and of a local scope. Those “Convinced by technology” are more managers or sales managers, from average or large companies, largely from industrial companies and of an international scope. Those “Sceptical of technology”, work mainly in small companies in the commerce sector of a mainly local scope.

REFERENCES

Amerongen, Thomas (2006) Hitting the Mark with CRM (Beating the Odds and Ensuring CRM Success...) Ideaca knowledge Services, http://www.ideaca.com/assets/resources/crm/hitting_the_mark_with_crm.pdf (March 12, 2006).

Anderson, E., & Robertson, T. S. (1995, April) "Inducing multiline salespeople to adopt house brands" *Journal of Marketing*, 59, 16–31.

Avlonitis, G. J., & Panagopoulos, N. G. (2005) "Antecedents and consequences of CRM technology acceptance in the sales force" *Industrial Marketing Management*, 34(4), 355–368.

Blodgett, Michael (1995) "Vendor tries to simplify sales force automation" *Computer World*, 32(1), 62.

Buehrer, R. E., Senecal, S., & Pullman, E. B. (2005) "Sales force technology usage: Reasons, barriers, and support" *Industrial Marketing Management*, 34(4), 389–398.

Campbell, Tim (1998) "Beating sales force technophobia" *Sales and Marketing Management*, 150(3), 68–73.

Frambach, RT, Barkema, HG, Nootboom, B. and Wedel, M. (1998) "Adoption of a service innovation in the business market: an empirical test of supply-side Variables", *Journal of Business Research*. 41, 161-174

Frook, John E. (2000) "Sales tools as friends, not foes" *B to B*, 85(3), 55.

Gatignon, H., & Robertson, T. S. (1989, January) "Technology diffusion: An empirical test of competitive effects" *Journal of Marketing*, 53, 35–49.

Goldenberg, B. (1996) "Re-engineering sales and marketing with advanced information delivery systems" *Sales and Marketing Management, Special Supplement*, S1–S31.

Jones, Eli, Sundaram, Suresh, & Chin, Wynne (2002) "Factors leading to sales force automation use: A longitudinal analysis" *Journal of Personal Selling & Sales Management*, 22(3), 145–156.

Kaydo, C. (1999, March) "Get plugged in: Friend or foe" *Sales and Marketing Management*, 43–45.

Moncrief, William C., Lamb, Charles W., & Mackay, Jane M. (1991) "Laptop computers in industrial sales" *Industrial Marketing Management*, 20, 279–285.

Parthasarathy, M., & Sohi, R. (1997) "Salesforce automation and the adoption of technology innovations by salespeople: Theory and implications" *Journal of Business and Industrial Marketing*, 12(3/4), 196–208.

Pullig C.; Maxham J.G.; Hair J.F. (2002) "Salesforce automation systems: an exploratory examination of organizational factors associated with effective implementation and sales force productivity" *Journal of Business Research*, Volume 55, Number 5, May, pp. 401-415(15).

Rigby, Darrell K., Reichheld, Frederick F., & Scheffer, P. (2002) "Avoid the four perils of CRM" *Harvard Business Review*, 80(2), 101–108.

Rivers, L.M. & Dark, J (1999) "The acquisition and use of sales force automation by mid-sized manufacturers" *The Journal of Personal Selling & Sales Management*, vol. 19, Spring, pp. 59-70

Schillewaert, N., Ahearne, M. J., Frambach, R. T., & Moenaert, R. K. (2000). *The acceptance of information technology in the sales force* (No. ISBM Report 15-2000): Institute for the Study of Business Markets, The Pennsylvania State University.

Speier, C., & Venkatesh, V. (2002) “The hidden minefields in the adoption of sales force automation technologies” *Journal of Marketing*, 66(July), 98–111.

Steenkamp, J. B. E. M., ter Hofstede, F., & Wedel, M. (1999) “A crossnational investigation into the individual and nationalcultural antecedents of consumer innovativeness” *Journal of Marketing*, 63(2), 55–69.

Widmier, S. M., Jackson, D. W., & McCabe, D. B. (2002) “Infusing technology into personal selling” *Journal of Personal Selling & Sales Management*, 23(3), 189–198

Wright, G. and Fletcher, K. and Donaldson, B. and Lee, J. H. (2008) “Sales force automation systems : an analysis of factors underpinning the sophistication of deployed systems in the UK financial services industry” *Industrial marketing management.*, 37 (8). pp. 992-1004.

Xu, Yurong, Yen, David C., Lin, Binshan, & Chau, David C. (2002) “Adopting customer relationship management technology” *Industrial Management and Data Systems*, 102(8), 442– 452.

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MODELING OF FINANCIAL CRISES: A CRITICAL ANALYSIS OF MODELS LEADING TO THE GLOBAL FINANCIAL CRISIS

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ABSTRACT

The causes of financial crises are multiple but the models of financial crises revolve around four generational models. In this paper, the authors analyzed these models and highlighted the fact that each model was adapted to specific situations to explain the financial crises faced rather than being visionary or systematic in approach. These models suggest crises may develop without significant change in economic fundamentals, since policies usually respond to changes in economy and agents consider these when forming expectations. Therefore, any set of indicators together may not provide an over-all picture but interactions among indicators should be pursued. Common sense and guesswork is used but is not sufficient for representing real behavior. Modeling suggests that stressed or fraudulent companies should be removed to avoid further crises. While the new models handle a wider range of nonlinear behavior, little new work is in fact evident. Apart from a patchwork-like approach of the past, financial or currency crises modeling has not been dealt with systematically. A new way thinking is not emerging suggesting a visionary and dynamic robust mathematical modeling approach is needed with attention to the many possible risks.

JEL: G01

KEYWORDS: Applied Mathematics, Generational Models, Financial Crisis Models, Macroeconomic Fundamentals, Financial Indicators

INTRODUCTION

A currency crisis is defined as a situation in which an attack on the currency leads to a sharp depreciation of the currency, a large decline in international reserves, or a combination of the two (Kaminsky, Linzondo and Reinhart, 1998). Many studies have focused on modeling financial crises and the development of early warning systems relying on different techniques (Lestano and Kuper, 2003; Kaminsky et al., 1998; Kaminsky and Reinhart, 1999; Frankel and Rose, 1996; Sachs, Tornell, and Velasco, 1996; Berg and Pattillo, 1999; Eichengreen, Rose, and Wyplosz, 1995). The models have been developed to understand and predict crises such as the recent global financial crisis. Some were tuned to even predict a particular point of time at which a crisis will occur. However, none of these models could predict or explain the current global financial crises. It seems that previous models were insufficient in structure to aid either in understanding or predicting the 2007 global crisis. Some authors state that current dominant theories and econometric models failed to predict the recent crisis (Bezemer, 2009).

The aim of this paper is to critically review models of the past, investigate approaches taken during their development and pointing out reasons why the models failed. Based on mathematical and critical reflective analysis of the literature, new ideas are explored and some insights provided based on history, for the development of new, visionary models. In the remainder of the paper, the authors present a brief literature review followed by a comprehensive analysis of the four generational models of currency and financial crises. This section also includes models related to signal processing and agent analysis. This is followed by a discussion section. The final section provides some concluding comments.

LITERATURE REVIEW

The increase in the number of crises and their impact of the economy has generated a large amount of research into their causes. At theoretical level, the literature distinguished between four main types (first, second, third and fourth generation) models. The following literature review examines each of these theories in turn.

First generation models (Salant and Henderson, 1978; Krugman, 1979) and its extension models (Flood and Garber 1984; Connolly and Taylor, 1984; Calvo, 1987; Edwards, 1989; Krugman and Rotemberg, 1992) represent the balance-of-payment crises. These models view crises as the unavoidable consequence of macroeconomic policies that vary with the maintenance of a pegged exchange rate. First generation crisis theories represent crises that are mainly due to weakness in economic fundamentals. In these models, there is the assumption that there are two types of exchange rate systems, namely, flexible and pegged exchange rates. Under the flexible system, changes in expectations are reflected in the short run by changes in the exchange rate. Pegged exchange rate regimes are directly reflected by changes in the government's reserves. In first generation crisis models the strength of a fixed exchange rate is established by external fundamentals unconnected to how economic agents behave (Salant and Henderson, 1978; Krugman, 1979; Flood and Garber 1984). Krugman (1979) explained how a standard crisis occurs and suggested that timing of the speculative attack is dependent on a critical official foreign reserve level. Esquivel and Larrain (1998) argued that the original source of problems in Krugman's (1979) model is the excessive creation of domestic credit to either finance deficits or provide assistance to a weak banking system. The first generation models of crises were ultimately driven by ongoing fiscal deficits. However, fiscal amounts were essentially in balance before the Mexican 1994 and the Asian 1997-1998 crashes, and hence the first generation models were inadequate.

Second generation models of financial crises such as Obstfeld (1994) were developed after the collapse of the European Exchange rate Mechanism (ERM) in 1992-1993 and described devaluation as a multiple equilibrium process. In second generation models, crises are attributed either to some deterioration of domestic conditions or to shifts in expectations. The monetary crisis starts either with the worsening of economic fundamentals, or a shift from the expectations to consider endogenous exchange rate policies with optimizing policy makers (Benside & Jeanne, 1997; De Kock & Grilli, 1993; Drazen & Masson, 1994; Obstfeld 1994, 1996, 1997; Ozken & Sunderland, 1995, 1998). These models introduce government decision making and show the possibility of multiple equilibriums (Obstfeld, 1994, 1996). Even if the fundamentals are not bad, currency crises can still occur so long as speculative attacks on currencies are able to drive market participants to believe that policy makers will devalue the currencies; leading to a so called self-fulfilling currency crises. Some research shows that prospective deficits account for currency crises (Burnside et al., 2001; Corsetti et al., 1999; Daniel, 2001; Dupor, 2000). Esquivel & Larrain (1998) identified two key characteristics of second generation models, namely: (i) the government is an active agent and maximizes an objective function and (ii) a circular process exists, leading to multiple equilibriums. The ERM crisis proved that some important fundamentals such as international reserves, domestic credit growth and fiscal deficit, and good economic policies were not enough to protect countries from speculative attacks.

During the mid-1990s, when the economic fundamentals of the affected countries were found to be rather sound, outbreak of the crises continued. A new third generation of theoretical models were then developed that included financial sector indicators derived from aggregate balance sheets of banks. After the failure of two generations of models, two approaches were featured: herd behavior and the moral hazard problem. Under the herd behavior, speculators follow behavior with the assumption that it reflects knowledge sets of others, and that multiple equilibriums are likely to occur (Froot et al., 1992; Krugman, 1997). According to moral hazard, implicit guarantees granted to the financial institutions that are

already ill-regulated and not monitored closely led to over expansion of supply of financial instruments, including derivatives (Mckinnon & Pill, 1996; Krugman, 1998; Kaminsky & Reinhart, 1999). Third generation models focused on contagion effects as a cause of currency crises. Gerlach and Smets (1996) and Kaminsky et al. (1998) presented models in which devaluation by one country led its trading partners to devalue in order to avoid a loss of competitiveness. Calvo & Reinhart (1996) and Eichengreen et al. (1996) discussed the channels for transmission of contagion effect. In the context of contagious currency crises, Masson (1999a, b) explained the distinction between joint exchange market crises as a consequence of a common macroeconomics shock to fundamentals spillovers of one country's crisis on other countries, and fundamentals triggering crises in those countries too. Chang & Velasco (1998) explained currency crises as the byproduct of a bank run. Krugman (1999) argued that two factors had been omitted from formal models: the role of companies' balance sheets in determining their ability to invest, and capital flows in affecting the real exchange rate. The empirical literature in these models uses the ratio of domestic debts dominated foreign currency and the real exchange rate as key factors in predicting crisis, specifically in emerging markets (Calvo et al., 2004, 2006a, 2006b, 2008).

Krugman (2001) conjectured fourth generation crisis modeling that may not be a currency crisis model. Rather it may be a more general financial crisis model in which other asset prices also play the major role. Fourth generation models extend the earlier literature by identifying features of the institutional environment that set the stage for the build-up of macroeconomic imbalances, which subsequently give rise to banking problems. The models also relate to some previous work in which political indicators play a significant role in crisis forecasting (Bussiere & Mulder, 2000). Breuer (2004) referred to a model in which crises are determined by institutional factors. Poor institutional factors appear to be the underlying cause for unsustainable policies, excessive borrowing and lending, hyperinflation, among others. It appears that institutional factors set the conditions for economic outcomes. In contrast, Ghosh (2002) understood the fourth generation as those models in which currency crises are created and accentuated by unexpected financial panic from different players in the market and governments. Bonin & Wachtel (2003) and De Nicolo, et al. (2003) showed that institutional infrastructure affects the level of financial development, depositor trust in the financial system, and the level of credit risk. In the fourth generation models (Agenor & Aizeman, 1999; Alesina et al., 2002; Das et al., 2004), explanatory variables include variables such as politics, trust, ethic, tensions, culture property rights, legal origin, types of governance and quality of financial policies. These variables are important given they have an impact on information and uncertainty, and can affect the efficiency of decision-making. These models highlight the roles of rule of law and contract enforcement, protection of shareholder and creditor rights, regulatory frameworks, and the socioeconomic environment (Buch & De Long, 2008; Das et al., 2004; Demirguc-Kunt & Detragiache, 1998, 2005; Eichengreen & Arteta, 2000; Hutchinson, 2002; Hutchinson & McDill, 1999). The advantage of fourth generational models is that they builds upon forward looking information, contained in market prices.

A number of empirical studies on early warning system (EWS) explained currency crises or twin crises (Berg & Patillo, 1999; Demirguc-Kunt & Detragiache, 1998; Eichengreen et al., 1996; Furnam & Stiglitz, 1998; Gavin & Hausman, 1996; Goldstin et al., 2000; Honohan, 1997; Kaminsky & Reinhart, 1999). There are two main approaches for constructing EWS models: the signals approach and the econometric approach. The signals approach is a non-parametric approach to determine the risk of financial crisis. Here a variable is considered to be issuing a warning signal if it goes beyond a certain threshold level in the "bad" signal. The signals approach was pioneered by Kaminsky & Reinhart (1999) while the econometric approach is a multivariate one that allows testing of statistical significance of explanatory variables. This approach estimates a probability relationship among discrete dependent variables. Eichengreen et al. (1996) exemplified the econometric method for prediction of currency crisis, in which exchange rates played a significant role in predicting the incidence of currency crises.

Agent-based models explain nonlinear behavior when compared to conventional equilibrium models (Krugman, 2001). This type of modeling is not well developed in economics, because of historical choices made to address the complexity of the economy and the importance of human reasoning and adaptability. The agent approach simulates complex and nonlinear behavior that are so far intractable in equilibrium models. The next section presents a mathematical review of four generation models of financial crisis, including signal based early warning systems and agent-based models that are considered as fourth generational models.

FOUR MODELS OF FINANCIAL CRISES

First Generation Models

Mathematical models to study financial crisis originated in the late 70's and the models are popularly known as first generation models. Kouri (1976) first developed monetary equilibrium and stationary state models by an analysis of the short run effects of stock shift, flow shift and central bank intervention in the foreign exchange market on the current account and exchange rate; and the long run effects of the same shifts on the current account and exchange rate. Stock shift refers to an increase in the expected rate of depreciation and flow shift refers to a tax financed increase in government expenditure. On momentary equilibrium in Equation (1), Kouri (1976) obtained the following equilibrium condition for the asset markets as

$$L\left(\eta, Y, \left(\frac{M}{P}\right) + F\right) = \frac{M}{P} \quad (1)$$

where η - expected rate of inflation, Y - domestic output, M – domestic money, F – foreign assets, P – domestic price level, and $L(.)$ – demand function; and the capital flow or current account Equation (2) given as

$$\dot{F} = B(Y, T, F, \eta, M) \quad (2)$$

based on the real trade balance Equation (3);

$$B = Y - C(Y - T, W) - G \quad (3)$$

where T – real taxation, C – private consumption (a function of $Y-T$ and W), W – financial wealth, and G – government expenditure. On the same equilibrium this model provides the realized change in the stock of foreign assets given by Equation (4):

$$\dot{F} = F_{\eta}\dot{\eta} + F_w\dot{W} = F_{\eta}\dot{\eta} + F_w X - F_w \left[\frac{M}{P} \right] \left[\frac{\dot{P}}{P} \right] \quad (4)$$

and the balance of payments Equation (5) given by

$$L_{\eta}\dot{\eta} + L_w\dot{W} = \frac{\dot{M}}{P} \quad (5)$$

where $F_{\eta}\dot{\eta}$ represents the stock shift induced by the change in the expected return on domestic assets; $F_W\dot{W}$ is the flow shift induced by the change in the expected new savings allocated to foreign assets; $X = Y - T - C$, $F_{\eta} = -L_{\eta}$ and $F_W = I - L_W$. On stationary state Kouri (1976) obtained Equation (6), the long run exchange rate path:

$$\ln P(t) = \ln M_0 + mt - \ln \bar{M}^* \tag{6}$$

where m – money stock, \bar{M}^* - real balance and M_0 – a constant.

Kouri (1976) suggested that this model could be extended for rigid wages and unemployment, for changes in relative prices, and for accumulation of real capital.

Salant and Henderson (1978) developed a model to explain the effects of anticipations of government gold policies on the path of gold prices and explained the inability of the standard theory that could be used to explain movements in the gold price. This model generates time paths for the price of gold in anticipation of an auction given by Equation (7):

$$P_t = \frac{\alpha f_{t+1} + (1 - \alpha)P_{t+1}}{1 + i} \tag{7}$$

where auction price was given by $\sum_{x=0}^{\infty} L[f_t(1+i)^x] = \bar{G} + S_t$. The private stock of gold was given by

$S_{t+1} = S_t - L(P_t)$, where f_t – auction price, i – rate of interest, \bar{G} - total stock sold in a single auction, $L(.)$ – demand function, and α - arbitrary constant. Equation (7) indicates that the price expected in period t to prevail one period in the future is equal to the price in period t . From this model the authors discussed a rational speculative attack and explained the market solution to how best to deplete existing reserves when supplies are additionally anticipated at an unknown time.

Following these two models, the classical balance-of-payments crises model was developed by Krugman (1979). It provided the portfolio equilibrium condition as (portfolio balance in Equation (8))

$$\frac{M}{P} = L(\eta) \cdot W \tag{8}$$

where the changes in reserve asset as $\Delta R = \frac{\Delta M}{P}$, where M – domestic money, P – domestic price level, η – expected rate of inflation, W – private wealth, $L(.)$ – demand function, R – reserve of foreign money. Krugman (1979) analyzed the model for flexible and fixed exchange rate in Equation (9). For floating exchange rate, the rate of change of real balance was examined using

$$\dot{m} = \left[g - \eta \left(\frac{m}{F} \right) \right] m \tag{9}$$

$m = \frac{M}{P}$, g is a constant, and the rate of accumulation of foreign money F was given by Equation (10):

$$\dot{F} = Y - G - C(Y - T, m + F) \tag{10}$$

where Y – domestic output, G – government expenditure, C – private consumption (a function of $Y - T$ and $m + F$), T – real taxation. For fixed exchange rate, the government budget constraint was derived in Equation (11):

$$\frac{\dot{M}}{P} + LB - (1 - L)(G - T) = G - T = \left[\frac{M}{P} \right] g \tag{11}$$

where B – trade balance. Due to nonlinearities, Krugman (1979) was unable to solve explicitly a solution for the time of collapse in a fixed exchange rate regime. Later work by Flood and Garber (1984) provided an example of how such a solution is derived in a linear model with or without arbitrary speculative behavior. Krugman (1979) showed how the crises were caused by weak economic fundamentals such as fiscal and monetary policies.

A number of studies extended Krugman’s basic model by exploring the nature of the collapse time of an exchange rate regime and collapse probabilities (Goldberg, 1991; Flood & Garber, 1984), external borrowing and capital controls (Bacchetta, 1990; Dellas & Stockman, 1988; Wyplosz, 1986), and imperfect asset substitutability and sticky prices. These studies provided a qualitative discussion of the causes and developments of the currency crises. Parametric and non-parametric tests were conducted to limit the number of indicators (Eichengreen et al., 1995; Frankel and Rose, 1996; Edwards, 1989; Edwards and Santaella, 1993). Some attempts were made to find variables that determine devaluation. These studies largely compared the pre-crisis behavior variables with non-crisis behavior variables.

Flood and Garber (1984) introduced uncertainty about the domestic policy process in which one-time events could lead authorities to substitute one policy for another, thereby introducing the possibility of self-fulfilling speculative attacks. The authors also adopted the Salant and Henderson (1978) model for collapsing exchange rate regimes. Flood and Garber (1984) constructed two linear examples to study the collapse of a fixed exchange rate regime. The first example was a continuous-time with perfect-foresight model. This model examined the timing of regime collapses either based entirely on market fundamentals; or based in part on arbitrary speculative behavior. This example was a simple realization of Krugman’s (1979) model in which a solution could be derived. The second example was a discrete-time model containing stochastic market fundamentals, which forces the regime collapse. Equations (12-16) show continuous-time model’s principal equations at time t :

(i). Money market equilibrium condition

$$\frac{M(t)}{P(t)} = a_0 - a_1 i(t), \quad a_1 > 0 \tag{12}$$

(i) Money supply equation

$$M(t) = R(t) + D(t) \tag{13}$$

(ii) Domestic credit equation

$$\dot{D}(t) = \mu, \quad \mu > 0 \tag{14}$$

(iii) Purchasing power parity equation

$$P(t) = P^*(t)e(t) \tag{15}$$

(iv) Uncovered interest parity equation

$$i(t) = i^*(t) + \left[\frac{\dot{e}(t)}{e(t)} \right] \tag{16}$$

where $M(t)$ – domestic money, $P(t)$ – domestic price level, $P^*(t)$ – foreign price level, $i(t)$ – domestic interest rate, $i^*(t)$ – foreign interest rate, $R(t)$ – government book value of foreign money holdings, $D(t)$ – domestic credit, $e(t)$ – spot exchange rate and μ – constant rate. The authors derived the time z of the regime collapse using Equation 17:

$$z = \frac{R(0)}{\mu} - \frac{\alpha}{\beta} - A \frac{\beta}{\alpha} \tag{17}$$

and floating exchange rate by Equation (18):

$$e(t) = A \exp\left[\frac{(t-z)\beta}{\alpha}\right] + \frac{\alpha\mu}{\beta^2} + \frac{M(t)}{\beta} \tag{18}$$

where $\alpha = a_1P^*$ and $\beta = a_0P^* - a_1P^*i^*$ (both are constants). Flood and Garber (1984) showed that the fixed exchange system is subject to exactly the same type of dynamic instability problem that may affect a floating system. The discrete-time model's principal equations are same as in continuous-time model except the Domestic credit equation and the uncovered interest parity Equations (19-20) respectively change to:

$$D(t) = D(t-1) + \mu + \varepsilon(t) \tag{19}$$

$$i(t) = i^*(t) + \frac{E[e(t+1)|I(t)] - e(t)}{e(t)} \tag{20}$$

and time t is an integer and $\varepsilon(t)$ represents a random disturbance with zero means, which obeys $\varepsilon(t) = -I/\lambda + \nu(t)$, where $\nu(t)$ is distributed exponentially with an unconditional probability density function. The authors obtained the expected exchange rate conditional on the information set $I(t)$ using Equations (21-22):

$$E[e(t+1)|I(t)] = \frac{\alpha\mu}{\beta^2} - \frac{D(t) + \mu}{\alpha} \quad \text{when } K(t) < 0 \tag{21}$$

$$E[e(t+1)|I(t)] = \frac{\pi(t)}{\beta\lambda} + \bar{e} \quad \text{when } K(t) \geq 0 \tag{22}$$

where $K(t) = \beta \bar{e} - \frac{\alpha\mu}{\beta} - D(t) - \mu + \frac{1}{\lambda}$, $\pi(t)$ – probability evaluated at time t that a collapse will occur at time $t + 1$ and \bar{e} – fixed exchange rate. This model produces the forward discount during the fixed-rate system. However, the result is not attributable to the possibility that unusual, large random disturbances may impinge on the system. In the analysis of the discrete-time uncertainty model the authors ignored the possibility that the country may devalue its currency when a crisis seems imminent.

Agenor et al. (1991) and Blackburn and Sola (1993) reviewed the first-generation models and argued that the main contribution is the identification of the tension between domestic fiscal policy and the fixed

exchange rate regime. In the first generation models the main indicators are fiscal deficit/GDP, real money balance, *MI* balance surplus. However, the models are lacking in two aspects. First, the models require agents to suddenly increase their estimates of the likelihood of devaluation; and second, they do not explain why the currency crises spread to other countries. Basically, within the framework, it is difficult to understand why the government on the one hand tries to keep the exchange rate fixed, while on the other hand, conduct a policy which the government knows may ultimately lead to a currency crisis. In general, unpredictable currency crises are not in accordance with the implication of a speculative attack with a probability one event in first generation models.

Second Generation Models

Second generation models appeared in the mid of 80's and were designed to capture the characteristics of the speculative attacks in currency crisis. Second generation models are also referred to as 'endogenous policy' models. Obstfeld (1986) developed a basic second generation model that suggested when and if an attack occurs, governments simply shift policy in an assumed but different direction (considered as one of the limitations of this model). This model included an expectation difference Equation (23) involving floating rate evolution given by:

$$-\beta E_t[\bar{S}_{t+1}] + (\alpha + \beta)\bar{S}_t = \bar{R} + D_t \quad (23)$$

and the saddle-path solution for floating rate \bar{S}_T at a time T given by Equation (24):

$$S_T = \alpha^{-1}(\bar{R} + \bar{D}) + [\alpha + \beta(1 - \rho)]^{-1}v_T \quad (24)$$

where \bar{R} - lower bound on central bank reserves, $E_t[\cdot]$ - an expectation conditional on time t , D_t - domestic credit such that $D_t = \bar{D} + v_T$, v_T - random disturbance with zero mean, α, β - constants. These models focus on the relationship between expectations and outcomes, in which expectations affect the policy decisions. Obstfeld (1986) also provided several examples of multiple equilibrium and self-fulfilling attacks on foreign exchange markets in the context of bank runs, bubbles and extrinsic uncertainty.

In fact, Obstfeld (1994) is an important representative of the second generation model. Obstfeld provides two self-fulfilling currency crisis models, in which the crisis and realignment of exchange rates result from interaction between rational private agents and a policymaker with precise objectives. The models are of single currency attack but consider endogenous exchange rate policies with optimizing policy makers. The policymaker may devalue the currency out of a desire to offset external shocks to the economy. The first and second generational models suggest the possibility of the existence of multiple equilibria since speculative anticipation depend on conjecture government responses; which in turn depend on how price changes, themselves powered by expectations, affect the government's economic and political positions. This implies that crises need not have occurred, but do occur because market participants expect them to occur. Obstfeld described a variety of circumstances in which an optimizing government wishing to peg the exchange rate will be forced to abandon that commitment by a self-fulfilling attack. In these models, the cost function of the government is determined and the variables are the tax rate and devaluation. The loss function (£) of the government is defined in Equation (25):

$$\pounds = \frac{1}{2}\tau^2 + \frac{\chi}{2}\delta^2 + cZ \quad (Z = 1 \text{ if } \delta \neq 0, Z = 0 \text{ otherwise}) \quad (25)$$

where τ is the tax rate, δ is the depreciation rate, χ is the weight placed on depreciation relative to other taxes, and c is the fixed cost. The author provided the role of foreign currency public debt in his model, but the impact of private foreign currency debt has not been analyzed. Obstfeld (1994) provided some examples of values of the variables in the model. For high interest rates, it is also possible to show that the model can have no solution; that is there is no equilibrium. Obstfeld (1994) focused on short-term government debt in generating self-fulfilling crisis without endogenizing the choice of maturity. The author provided the theoretical surveys of EMS crisis and of aspects of other crises. In first generation models the suddenness of currency crises did not mean that their timing was arbitrary, on the contrary, Obstfeld argued that the timing of crisis was indeed arbitrary.

Jeanne and Masson (2000) used Markov switching regime model to analyze the speculation against the French franc in 1987-1993 and argued that the devaluation expectations were influenced by sunspots. Jeanne and Masson developed currency crises models with a non-linear relationship between devaluation expectation and economic fundamentals that produce multiple equilibria. From the results, it is clear that performance of the model improves significantly once sunspots are introduced to influence devaluation expectations by means of a Markov process approach. Jeanne and Masson provided a mean shifted model to study how fundamentals such as the unemployment rate, trade balance and real effective exchange rate, affect the devaluation probability of the French franc conditional on switching between multiple equilibria. Under the fundamental-based equilibrium the devaluation probability at time t is defined in Equation (26):

$$\pi_t = \Pr ob[\phi_{t+1} < \phi^{*e} / \phi_t] = F(\phi_t, \phi^{*e}) \tag{26}$$

where ϕ_t is a variable reflecting the exogenous economic fundamentals at time t and ϕ^{*e} is the level of the fundamental under which speculators expect the policymaker to devalue. The authors defined the devaluation probability under the sunspot equilibrium jointly on the state and the fundamental variable, using Equation (27):

$$\pi_t = \sum_{\rho=1}^n \theta(\rho_t, \rho) F(\phi_t, \phi_{\rho}^*) \tag{27}$$

where $\theta(i, j)$ ($1 \leq i, j \leq n$) is the transition matrix and ρ_t is the state of the economy at time t . Under the Markov switching regime the devaluation probability is defined in Equation (28):

$$\pi_t = \gamma_{s_t} + \beta' x_t + \nu_t, \quad s_t = 1, 2, \dots, n \tag{28}$$

where γ_s is a constant that depends on the state, $\beta = (\beta_1, \dots, \beta_k)'$ is a vector of coefficients and ν_t is an independent and identically distributed shock.

Jeanne and Masson (2000) used interest rate differentials as a proxy for market expectations to study the speculative attack. The authors showed that the statistical significance of the coefficients on the macro fundamentals and time is much stronger when the relationship is allowed to include a different constant term in two regimes than in a single regime model. The two regime model successfully captures several periods of turmoil, while the single regime model yields a smooth, curved, downward trend in the interest differential. However, testing a single regime versus the alternative of two regimes is not that straightforward, since some of the parameters are not defined under the null hypothesis. Jeanne and

Masson showed that the Markov regime switching models do a better job in describing the speculative attack on the French franc than the simple linear models.

Tamgac (2011) analyzed the role of fundamentals and self-fulfilling expectations in the crisis episodes of Turkey in 1994 and 2000-2001. The author followed a similar approach to Jeanne and Masson (2000) and used a Markov regime switching framework to test the existence of self-fulfilling expectations. Tamgac (2011) estimated the pure fundamentals based model by Ordinary Least Squares (OLS) and then estimated the model for multiple equilibria via self-fulfilling expectations using a Markov switching model. Abiad (2003) provided a survey on the empirical crises literature that showed a Markov switching estimation procedure performs better than probit and signaling models as an early warning system for currency crisis. The devaluation probability at time t is given by Equation (29):

$$\pi_t = a_{s_t} + b_1x_{1,t} + b_2x_{2,t} + b_3x_{3,t} + \dots + \nu_t \tag{29}$$

where $x_{i,t}$ are the fundamental variables that affect the probability of a crisis at time t , b_i is the coefficient of explanatory variable i that will be estimated and ν_t is the normally distributed error term with variance σ_ν^2 . The value of the constant term a_{s_t} depends on the state s_t ; with $s_t = 0$ or 1 - two regimes in the economy. Regime “0” is the tranquil regime (low state or no crisis state), during which the probability of devaluation is low, whereas regime “1” is called taut regime (high state or crisis state) represents a time of high economic tensions and reflects periods during which the devaluation probability is considerably higher for the same level of fundamentals. The dependent variable provided an estimate of the devaluation probability π_t . The author used the Speculative Pressure Index (SPI) to proxy for the devaluation probability. The method is labeled an ad hoc method to measure exchange market pressure, and is based on the earlier work of Girton and Roper (1977) but first introduced by Eichengreen et al. (1994) for the identification of crises. The SPI is calculated as the weighted average of the monthly percentage changes in the real effective exchange rate (Δe) and international reserves (ΔR) and monthly change of the interest rate differential ($\Delta(i-i^*) = \Delta i$) as noted in Equation (30):

$$SPI = \left(\frac{1}{\sigma_e} \right) \left(\frac{\Delta e}{e_{t-1}} \right) - \left(\frac{1}{\sigma_R} \right) \left(\frac{\Delta R}{R_{t-1}} \right) + \left(\frac{1}{\sigma_i} \right) \Delta i \tag{30}$$

The weights are inversely related to the standard deviation of each of the three variable, σ_e , σ_R , σ_i - the standard deviations of the exchange rate, international reserves and the interest rate differential over the same period respectively. The author inferred the timing of the crisis from the spikes of the SPI and the crisis dummy is construed from the SPI based on a threshold level of mean plus two standard deviations.

Tamgac (2011) considered a set of crisis indicators that included general macroeconomic variables, indicators related with the real sector, the financial sector, government, and political and institutional variables, which might have influenced the Turkish crisis. Under OLS estimation the author estimated the devaluation probability without multiple equilibria. Here the variables except the current account to GDP ratio and export growth have the expected signs. The significant variables are: the deviation of real exchange rate from trend, annualized growth rate of M2 to reserves ratio, trade balance, growth rate of the ratio of bank deposits to M2 and ratio of short term debt to reserves. The OLS model was a poor performer as it gave a false crisis signal in 1990.

The CTP-Markov switching model estimation of probabilities correctly picked two crises in 1994 and 2000-2001. During both crises the economy had switched to a high devaluation expectations state. The switch of the economy to a high devaluation expectations state during both crises shows that the agents’

expectations for devaluation had significant contribution to the occurrence of the crisis. Hence self-fulfilling expectations played a role in the Turkish crisis.

In TVTP-Markov switching model estimation, the transition probabilities are defined as a function of the exogenous variables. This model also correctly picked the two crises in 1994 and 2000-2001 but it provided an incorrect crisis signal in 1998. It seemed that the CTP model did a better job in predicting the occurrence of crises. Both CTP and TVTP models show that besides the deteriorating fundamentals, agents' devaluations expectations played a part in the Turkish crises.

Flood and Marion (1998) and Rangvid (2001) reviewed the second-generation models and concluded that speculative attacks are unrelated to economic fundamentals. The second generation models suggest how a government should behave in periods leading to currency convulsion and some of the models explained the relationship between economic fundamentals and speculative attack period. These models explained self-fulfilling currency crises. The devaluation in one country affects the price level or the currency account by reduction of exports in a neighboring country. Since the crises are self-fulfilling, these expectations increase the likelihood of devaluation.

The second generation models focus on short run, multiple equilibriums, government policies, and largely depend on speculator expectations. In these models the main indicators were export, import, real exchange rate, terms of trade, production, real interest rate. However, these models did not survey the Asia currency crisis. The Asia crisis was neither a problem brought on by fiscal deficits (as in first generation models) nor as one brought on by macroeconomic temptation (as in second generation models); but as a problem brought on by financial excess and then financial collapse (Krugman 1998).

Third Generation Models

Third generation models appeared after the 1997 financial crisis of Asia. These models explained how banking financial system interact with currency crises and considered real effects of crises on the economy. The Asian crisis seems to have differed from the Latin American crisis of 1980. The currency crisis included failures of financial institution, bank runs, and bankruptcies of many firms with a result of severe real down turn (Krugman 1998).

Braggion, Christiano and Roldos (2005) focused on the response to an increase in interest rates before and at the moment of financial crisis and reductions in them after crisis. The authors characterized a financial crisis as a shock in which collateral constraints unexpectedly bind and were expected to remain in place permanently. They noted that collateral constraints were increased during the Asian financial crisis because collateral was widely used in emerging markets. The authors compared the dynamic behavior of the variables with data drawn from the Asian crisis economies. Braggion et al. developed a model that provided the response in terms of maximizing welfare; that is to raise interest rates and then reduce them sharply. Braggion et al. explained how frictions in the model contributed to the optimal monetary policy outcome by an example. In this dynamic, monetary model, the traded and non-traded intermediate goods were produced as given in Equation (31):

$$y^T = C^T + i^* r \quad \text{and} \quad y^N = C^N \tag{31}$$

where y^T , y^N - gross amount of traded goods and non-traded goods respectively, C - consumption, i^* - gross rate of interest in traded good terms, and r - amount borrowed from abroad. The authors maximize the profits based on Equation (32):

$$\dot{\phi} = p^N y^N + y^T - q(K - K_0) - \omega(1 + \tau)\ell - i^* r \quad (32)$$

were p – price of consumption good, q – price of capital, ω - wage rate, ℓ – labor, τ - tax on labor, K - actual capital used in production, K_0 - initial endowment of capital of the firm. The authors showed that financial frictions could actually reverse the sign of the effect of a monetary action. However, this model doesn't focus on the currency problem and does not possess multiple equilibriums. Moreover, the initial rise in interest rates is not a consequence of monetary policy actions but the outcome of the activation of credit constraints - the increase in the value of the capital stock in the traded and non-traded sectors.

Schneider and Tornell (2004) analyzed the impact of implicit guarantees on dynamics of financial crisis. The authors described how interactions of contract enforceability problems and systemic bailout guarantees generate financial fragility and boom-bust episodes. It was also noted that the balance of payment crises are preceded by lending booms and real appreciation; with self-fulfilling crises and balance sheet effects. The analysis was based on two assumptions: asymmetry in financing opportunities across tradable and non-tradable sectors and systemic bailout guarantees. The features of this model are: excessive risk taking and credit constraints arise simultaneously in equilibrium; both credit risk and real exchange rate risk arise endogenously. Schneider and Tornell analyzed distortions in an explicit microeconomic setting and showed that such interaction is non-trivial. However, there are no linkages between skewness and growth because only one crisis occurs in equilibrium and there is no welfare analysis.

In third generational models, policies are not pre-determined but respond to change in economy and economic agents take this relationship into account in forming their expectations. The models focus on financial excesses and how monetary policy can impact the currency crises. The model attempt to explain causes of crises spread across other countries. The main indicators in the third models include domestic credit/GDP, M2/international reserves, M2 multiplier, stock prices, bank deposits and, banking crises. Third generation models may be characterized as emphasizing the capital account, whereas the first two generation of models focus on the current account.

Fourth Generation Models

Krugman (2001) conjectured about a future fourth-generation crisis model which may not be a currency crisis model, but a more general crisis model in which asset prices other than the exchange rate play the major role. Breuer (2004) defined fourth-generation (institutional) models as a model that determines important economic outcomes such as ethic tension, politics (voting, checks, and, balances, etc.), civil order including rule of law, trust, culture, social norms, property rights, legal origin and types of governance, be it over the financial sector or the trade sector. In these models, economic and financial rules and regulations, shareholder rights, transparency and supervision over the financial system, and government distortions are emphasized. Breuer (2004) highlighted the parallels to be found in developing literatures on currency crises and banking crises. Breuer (2004) offered more questions related to institutions and financial system for further research and it seems that such models are still under investigation or development. Overall much less work is evident in the fourth generational models but some signal processing and agent based models are considered fourth generational and are reviewed.

Signal processing – Early warning systems- Kaminsky et al. (1998) reviewed the empirical literature examining methodologies and variables used to estimate the probability of a crisis. The authors suggested a specific early warning system for currency crises in the context of a signals approach. Kaminsky et al. highlighted variables that determine indicators useful in predicting crises. The authors reviewed a large variety of indicators and grouped them into six categories 1.) the external sector (capital account, external

debt profile and current account international variables); (2) the financial sector (financial liberalization and other financial variables); (3) the real sector (real GDP growth, the output gap, employment/unemployment, wages, and changes in stock prices); (4) the public finances (fiscal variables); (5) institutional and structural variables; and (6) political variables.

Fifteen indicators were chosen using theoretical considerations and availability of information on a monthly basis. Each of the indicators was compared one at a time with a crisis index. The indicators apparently behave differently close to the border of crises. Here the probability of a crisis is defined by higher indicator signals. Vulnerability to crisis is signaled when the indicator variable deviates from its usual behavior. The period of target is 24 months. The model estimated an optimal threshold value for each country and maximized the correct signals while minimizing the false signals.

Kaminsky and Reinhart (1999) used a non-parametric approach to find variables and compared the behavior of such variables in pre-existing crises. This model was examined to study the behavior of the variables around the time of balance-of-payment crises, banking crises, and twin crises. A single composite indicator is expressed as a weighted sum of the indicators, where the weights are defined by the inverse of its noise-to-signal ratio. In many emerging economies the indicator performed comfortably well in the case of some currency crises.

Kaminsky (2000) described a method for finding the degree of distress of the economy using the methodology of leading indicators. The author developed a warning system based on the empirical regularities from a sample of 20 countries; examining 76 currency crises and 26 banking crises. The information from each variable is combined, using each variables forecasting track record to produce a composite measure of the probability of a crisis. This model proposes four different composite leading indicators and evaluates them in terms of forecasting accuracy and calibration. The author constructed conditional probabilities for both currency and banking crises for each indicator of fragility; and constructed four sets of probability forecasts of banking and currency crises based on Equation (33):

$$\pi(\psi_{t,t+h} | I_i^k < I_t^k < I_j^k) = \frac{\text{months with } I_i^k < I_t^k < I_j^k \text{ and a crisis with } h \text{ months}}{\text{months with } I_i^k < I_t^k < I_j^k} \quad (33)$$

where π denotes probability, $\psi_{t,t+h}$ is the occurrence of a crisis in the interval $[t, t+h]$ and I_t^k are four different composite leading indicators with $k = 1, 2, 3, 4$.

Analysis of the model led to two main results: first, in the midst of multiple economic problems, no crisis occurred following a unique bad shock; and second, the best composite leading indicator is the one that accounts for the forecasting track record of the individual leading indicators.

Edison (2003) extended the early warning systems by adding more countries and indicator variables compared to those used by Kaminsky et al. (1998) and Kaminsky and Reinhart (1999). Edison (2003) approached the benchmark model on different indicators and evaluated the in-sample performance and out-of-sample probability indicators of a crisis. The author defined a crisis as an event where the exchange market pressure index rises above an extreme value as shown in Equation (34):

$$\text{Crisis} = 1 \text{ if } emp_t > 2.5 \sigma_{emp} + \mu_{emp}; = 0 \text{ otherwise} \quad (34)$$

where emp_t is the exchange market pressure index at time t , σ_{emp} and μ_{emp} are the sample standard deviation and sample mean of exchange market pressure respectively. Again, the probability of future

crisis is defined as in Equation (33). Edison attempted to take account of signals in overlapping crises windows.

Liu and Lindholm (2006) used a fuzzy (c-means based fuzzy clustering) method to find important economic indicators for the prediction of crisis at the time of crisis as well as pre and post crisis. This paper analyzes the Finnish currency crisis in 1992 using the fuzzy c-means method. In this clustering analysis a collection of variables were analyzed together, but how the variables interacted with each other was not explicitly shown. The important indicators of financial crisis identified are: (1) current account as a percentage of GDP; (2) increase in net foreign debt as a percentage of GDP; (3) foreign exchange reserves as percentage of imports; (4) deviation of the exchange rate from its PPP equilibrium level; and (5) growth rate decline i.e., GDP decline. Liu and Lindholm (2006) discussed the economic theoretical framework for the assessment of early warning signals of financial crises. The selection of early warning indicators was based on the portfolio balance model was first introduced by Kouri (1976).

Agent based models- Clearly, the financial markets are complex systems and involve human activities and behavior. Therefore, there is a need to understand the behavior of the whole economic system in a simplistic manner. One way to understand human behavior better is by using agent analysis. Agent-based modeling appears to be one of the better ways to explain the behavior of the economic systems, since it does not assume that the economy can achieve a settled equilibrium. Moreover, it uses a bottom-up approach that assigns behavioral rules to each agent.

Farmer and Foley (2009) made a strong case for the use of agent-based models in economics. The authors suggested that agent-based models are capable of generating complex dynamics even with simple behavioral rules. In fact, the use of rules can give rise to emergent properties that could not possibly be deduced by examining the rules themselves.

A recent example of an agent-based model that deals specifically with the financial crisis was suggested by Thurner, Farmer and Geanakoplos (2009). Thurner et al. investigated the effects of use of leverage and margin calls on the stability of the market. In this model, traders had a choice between owning a single asset such as stock or a commodity and owning cash. There were two types of traders, noise traders and funds. The noise traders buy and sell nearly at random, with a slight bias that made the price weakly mean-revert around a perceived fundamental value V . The funds traders use a strategy that exploits mispricing by taking a long position when the price is below V , but otherwise staying out of the market. In addition, there is a representative investor who either invests in a fund or holds cash. The funds in this model are value investors, who base their demand on a mispricing signal $m(t) = V - p(t)$, where $p(t)$ is the price of asset at a time t . Thurner et al. showed that when individual lenders seek to control risk through adjusting leverage, they may collectively amplify risk. The authors concluded that this mechanism comes into play with other risk control mechanisms, such as stop-loss orders and derivatives; whenever they generate buying or selling in the same direction as price movement.

Another example an of agent-based model was developed by Korobeinikov (2009) who considered an economy as a population of interacting economic agents of size N dividing the population into two subpopulations; namely the healthy subpopulation of size $x(t)$, and the activated or infected subpopulation of size $y(t)$. Here the activated or infected units could activate (infect) healthy units by failing to fulfill their financial obligations. The model described using Equations (35-36) explain the dynamics of the system:

$$\dot{x} = -\beta xy^\alpha \quad (35)$$

$$\dot{y} = \beta xy^\alpha - \frac{y}{\varphi} \quad (36)$$

where α - number of activated units contact with healthy units, β - positive activation rate coefficient and, φ - an average time duration in which an activated units was affecting the others and then the units removed from the population and didn't participate in further events. The behavior of this model is defined by the three parameters α , β and, φ ; where β and φ defined by $\xi = \beta\varphi$. The parameter α is viewed as a mean value for a large population and the activation rate coefficient β reflects efficiency of an economy. This model provides a general idea of what can be done to avoid a crisis and explains how one can reduce the length of infection time - η such that the crisis can slow down and reduce its consequence. This model clearly indicates how "dangerous" fraudulent companies could exist in reality, and indeed how important it is to detect and remove them in time.

DISCUSSION

Financial crises are usually described as failures of financial institutions or sharp falls in asset prices. Currency crises played a large role in recent economic turmoil and since the late 1970s have been a major subject of academic study. In this review financial crisis models are categorized as first, second, third and fourth-generation models. First-generation models of currency crises are based on macroeconomic fundamentals and speculations. They focus on long run, unique equilibrium, fiscal deficits and monetary policies. The models were developed in response to the sovereign debt crisis of Latin America in 1980s. The models explain currency crises by poor domestic macroeconomic conditions such as budget deficit, hyperinflation, and current account deficit (Agenor et al., 1991; Blackburn and Sola 1993). Also, they emphasize the relationship between speculation attack in foreign exchange market and macroeconomic variables. First-generation models begin with a fixed rate regime but external macroeconomic conditions can set the stage for a crisis as in Dooley (1997). These models showed how fundamentally inconsistent domestic policies lead an economy inevitably toward a currency crisis. The models did not focus on predicting whether or not the currency will collapse but rather on the timing of a speculative attack on the currency. From the literature of first generation models it is difficult to understand why governments keep exchange rates fixed and retain a policy the government knows will ultimately lead to a currency crisis.

Second-generation models of currency and banking crises introduce speculation based on self-fulfilling expectations that need not be tied to fundamentals. These models were developed in response to the European Exchange Rate Mechanism (ERM) crisis (1992-1993) and Mexican crisis (1994-1995). Second-generation models emphasize that speculative attacks can occur in the absence of poor macroeconomic fundamentals but also explain herding behavior, information cascades, and contagion (Calvo and Reinhart, 1996). The models focus on short run, multiple equilibriums, government policies and speculations expectations. Second generation models explain the relationship between economic fundamentals and a speculative attack period. These models view currency crisis not as a result of bad policy but a shift in expectation. The model is called self-fulfilling. Second-generation models showed how a spontaneous speculative attack on a currency can cause a crisis, even if fiscal and monetary policies are consistent. Essentially, the literature suggests that crises are not affected by the position of the fundamentals. Instead, they may simply occur as a consequence of pure speculation against the currency. However, these second models are not necessarily mutually exclusive with first-generation models. In fact, the second-generation models analyze the market decision-making behind the drain of international reserves initially modeled by the first-generation models. These models did not attempt to review the Asia currency crisis, which involved great financial excess and then a financial collapse.

The causes of speculative attacks on Asian currencies appeared to be different from those explained in the first and second-generation models. Therefore, economists came up with third-generation models to explain currency crisis. The Asian crisis (1997-1998) motivated the development of third-generation models. Third-generation models emphasized incentives and opportunities that invite lending and borrowing for overly risky or unproductive projects. Thus, they explicitly making a connection between banking and international currency markets. The models focused on the role of foreign currency denominated debt and its adverse balance sheet effects. The models explained the relationship between financial fragility and currency crisis. In third generation models, macroeconomic fundamentals were strong in the context of high annual growth rates, a low inflation rate and budget deficits, strong capital inflows and manageable current account deficits. Moral-hazard-driven investments leads to an excessive buildup of external debt and then to a collapse; (ii) bank-run; and also (iii) balance-sheet implications of currency depreciation.

Krugman (2001) proposed a fourth-generation crisis model, which was similar to the third-generation model, except that the new models considered asset prices other than the exchange rate. These are more general financial crisis models where other asset prices play the starring role. Breuer (2004) considered currency and banking crises, the author called fourth-generation models, as the role of institutional factors. For example, the fourth-generation models emphasized economic and financial rules and regulations, shareholder rights, transparency and supervision over the financial system, and government distortions. The models also included legal variables such as legal origin, shareholder protection property rights, and enforcement of contracts. Moreover, the models also considered political variables such as democracy and political instability and sociological variables such as corruption, trust, culture, and ethnicity. Yet very few models of this nature have been developed as yet and thus are not readily available for an in depth review. The signal processing and agent based approaches have been considered in this set but were reviewed separately within the section.

Agent-based simulations can handle a far wider range of nonlinear behavior than conventional equilibrium models. Farmer and Foley (2009) stated that this type of modeling was not well developed in economics, because of historical choices made to address the complexity of the economy rather than the importance of human reasoning and adaptability. Such models do not rely on the assumption that the economy will move towards a predetermined equilibrium state, as other models. The agent approach simulates complex and nonlinear behavior that is so far intractable in equilibrium models. A summary of all four generation models highlighting main variables, feature and issues is presented in Table 1.

Table 1: A summary of the four generational models with authors, variables, main features and issues

Generation Models	Pioneers	Main Variables	Important Features	Issues
First (1978)-defined as those in which speculation is determined solely by the fundamentals	Salant, S., Henderson, D., Kouri, P.J.K., Krugman, P.	Fiscal deficit/GDP, real money balance, M1 balance surplus, government consumption/GDP, credit growth, growth in M2 trade account balance, evolution of real exchange rate, capital account,	It focus on long run, unique equilibrium, fiscal deficits and monetary policies. Crises arise as a result of an inconsistency between an excessive public sector deficit that becomes monetized and the exchange rate system. Abandonment of a fixed exchange rate regime is largely due to unsustainable credit expansion and unsound economic fundamentals. A country with weak economic fundamentals is more vulnerable to	These models require agents to increase their estimates of the likelihood of devaluation. It doesn't explain why the currency crises spread to other countries. From the literature of first generation models it is difficult to understand why the government tries to keep the exchange rate

<p>Second (1986)- defined as those in which it can be self-fulfilling</p>	<p>Obstfeld, Ecichengreen, B., Rose, A., Wyplosz, C., Jeane, O., Masson, P.</p>	<p>Export, import, real exchange rate, terms of trade, production, real interest rate,</p>	<p>speculative attack. It emphasizes the relationship between speculation attack in foreign exchange market and macroeconomic variables. It focus on short run, multiple equilibrium, government policies and speculations expectations. Explains the relationship between economic fundamentals and speculative attack period. The government is an active agent that maximizes an objective function. Circular process exists, leading to multiple equilibrium. Suggests that crises are not affected by the position of the fundamentals. Instead, they may simply occur as a consequence of pure speculation against the currency. Self-fulfilling speculative attacks brought about by the government's time inconsistent policy goals appear to be the main cause of crisis.</p>	<p>fixed and conducts a policy which the government knows will ultimately lead to a currency crisis. The shift from one equilibrium to another is unexplained. Economists described only quite lightly the role of financial markets in the run-up crises. It did not attempt to review the Asia currency crisis, which was financial excess and then financial collapse.</p>
<p>Third (1998)- defined as in which it can be linkage between banking and currency crises and the contagion of crises</p>	<p>Krugman, P., Mckinnon, R.I., Pill, H., Corsetti, G., Pesenti, P., Roubini, N., Bhattacharya, A., Claessens, S., Ghosh, S., Hernandez, L., Alba, P.</p>	<p>Domestic credit/GDP, M2/international reserves, M2 multiplier, stock prices, bank deposits.</p>	<p>Explains relationship between financial fragility and currency crisis. Focus on the role of foreign currency denominated debt and its adverse balance sheet effects. Explains fundamentals driven, self- fulfilling and banking sector to analyze the Asian crisis. Suggests asset market prices may be useful leading indicators of crisis. Emphasizes macroeconomic analysis scope of exchange rate mechanism monetary policy, fiscal policy, and public policy. Focus on financial intermediaries, change in asset prices.</p>	<p>Solutions to currency crises are possible to appear too radical to be executed in practice and measures are to fail.</p>
<p>Fourth(2001)- defined as in which it can explains asset prices other than the exchange rate and social factors play main role.</p>	<p>Krugman, P.</p>	<p>Asset prices, ethic tension, politics, civil order including rule of law, trust, culture, social norms, property rights, legal origin and types of governance</p>	<p>Analyzes investments affected by moral hazard, bankruptcy, and balance-sheet implications of currency depreciation. Emphasizes economic and financial rules and regulations, shareholder rights, transparency and supervision over the financial system, and government distortions. Explains relationship between financial institutions and financial systems. It builds upon forward looking information contained in market prices.</p>	<p>Its reliance on market prices derived from liquid markets, which limits its applicability when such markets do not exist.</p>

This table presents a summary of the four generational models with authors and main variables. The table also shows important features of the models and related critical issues noted.

CONCLUDING COMMENTS

The aim of this paper was to review currency and financial crisis models by analyzing the nature of the models and their development over time in an attempt to understand why the 2007 financial crisis was not predicted by previous models. The models were critically reviewed and a number of underlying issues were highlighted. The analysis of the models led to a better understanding of the approaches undertaken in their development, and this in turn helped understand reasons why the models may have failed to capture crises in the modern financial system. The causes for financial crises are multiple but the models of financial crises revolve around four generational models. The recent financial crisis has challenged assumptions on which previous regulatory approaches were largely built, particularly the theory of rational and self-correcting markets. It is difficult to understand governments considering fixed exchange rates knowing the policy will ultimately lead to currency crisis. It seems crises occur because market participants expect them to materialize but the Asia crisis was neither due to fiscal deficits, as in first generation models, nor based on macroeconomic temptation, as in second generation models. Rather they were driven by simple financial excess followed by financial collapse. Some recent models suggest crises may develop without significant change in economic fundamentals.

More specifically, the analysis highlighted the fact that each model was adapted to specific situations to explain the financial crises faced rather than being visionary or systematic in approach in four generation models. The crises may develop without significant change in economic fundamentals, since policies usually respond to changes in the economy and agents consider these when forming expectations. Therefore, any set of indicators together may not provide an over-all picture of the system but certainly interactions among indicators should be pursued. Common sense and guesswork as used in rules based models may not be sufficient for representing real behavior. Agent based modeling suggests that stressed or fraudulent companies should be removed to avoid further crises.

In sum, it seems that any set of indicators together do not provide an over-all picture but correlations among indicators should be pursued. While the new models handle a wider range of nonlinear behavior, little new work is evident in this area. From this analysis it is clear that a patchwork-like approach has been used previously with after the event assessments of models. Also, there is little evidence of a longer term vision and therefore financial crises modeling has not been dealt with by researchers with any level of visionary approach. There is also little or no evidence of a new way thinking presently emerging suggesting a more complex dynamically based and robust mathematical modeling approach should be pursued.

Clearly, there is a need to do more research and in depth analysis of crisis modeling more generally and indeed financial crisis modeling in particular. The models analyzed in this paper could do with more in depth real data analysis. Such a process could have helped the authors understand other implications of the models. This issue will be examined in future research.

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REFERENCES

Abiad, A (2003) "Early Warning Systems: A Survey and a Regime-switching Approach," *IMF Working Paper*, 03/32

Agenor, P.R., Bhandari, J.S. & Flood, R.P (1991) "Speculative Attacks and Models of Balance of Payment Crises," *NBER Working Paper*, 3919

Agenor, P.R. & Aizenman, J. (1999) "Financial Sector Inefficiencies and Coordinate Failures: Implications for Crisis Management," *NBER Working Paper*, 7446

Alesina, A., Devleschawuer, A., Easterly, W., Kurlat, S. & Wacziarg, R. (2002) "Fractionalization," *Journal of Economic Growth*, Vol. 8, p. 155-94

Bacchetta, P (1990) "Temporary Capital Controls in a Balance-of-payments Crisis," *Journal of International Money and Finance*, Vol. 9, p. 246-257

Berg, A. & Pattillo, C. (1999) "Predicting Currency Crises: The Indicators Approach and an Alternative," *Journal of International Money and Finance*, Vol. 18, p. 561-586

Benside, B. & Jeanne, O. (1997) "The Instability of Fixed Exchange Rate System When Raising The Nominal Interest Rate is Costly," *European Economic Review*, Vol. 41, p. 1461-1478

Bezemer, D.J (2009) "No One Saw This Coming: Understanding Financial Crisis Through Accounting Models," *MPRA Paper*, 15892

Blackburn, K. & Sola, M. (1993) "Speculative Currency Attacks and Balance of Payments Crises," *Journal of Economic Surveys*, Vol. 7, p. 119-144

Bonin, J. & Wachtel, P. (2003) "Financial Sector Development in Transition Economies: Lessons From the First Decade," *Financial Markets, Institutions and Instruments*, Vol. 12, p. 1-66

Braggion, F., Christiano, L.J., & Roldos, J. (2005) "The Optimal Monetary Response to a Financial Crisis," *Seventh Bundesbank Spring Conference*, Berlin.

Breuer, J.B. (2004) "An Exegesis on Currency and Banking Crises," *Journal of Economic Surveys*, Vol. 18, p. 293-320

Buch, C.M. & De Long, G. (2008) "Do Weak Supervisory Systems Encourage Banks Risk-Taking?," *Journal of Financial Stability*, Vol. 4, p. 23-39

Burnside, C., Eichenbaum, M. & Robelo, S. (2001) "Prospective Deficits and The Asian Currency Crisis," *Journal of political economy*, Vol. 109, p.b 1155-1198

Bussiere, M. & Mulder, C. (2000) "Political Instability and Economic Vulnerability," *International Journal of Finance and Economics*, Vol. 5, p. 309-330

Calvo, G.A. (1987) "Balance of Payments Crisis in a Cash-in-Advance Economy," *Journal of Money, Credit and Banking*, Vol. 19, p. 19-32

Calvo, G.A. Izquierdo, A. & Mejia, L.F. (2004) "On the Empirics of Sudden Stops: The Relevance of Balancesheet Effects," *NBER Working Paper No. 10520*, Cambridge: National Bureau of Economic Research

Calvo, G.A. Izquierdo, A. & Loo-King, R. (2006a) “Relative Price Volatility Under Sudden Stops: The Relevance of Balance Sheet Effects,” *Journal of International Economics*, Vol. 69, p. 231–254.

Calvo, G.A. Izquierdo, A. & Talvi, E. (2006b) “Sudden Stops and Phoenix Miracles in Emerging Markets,” *American Economic Review*, Vol. 96, p. 405–410.

Calvo, G.A. Izquierdo, A. & Mejia, L. (2008) “Systematic Sudden Stops: The Relevance of Balance-sheet Effects and Financial Integration,” *NBER Working Paper No. 14026*, Cambridge: National Bureau of Economic Research

Calvo, S. & Reinhart, C.M. (1996) “Capital Flows to Latin America: Is There Evidence of Contagion Effects? In Private Capital Flows to Emerging Markets After the Mexican Crisis,” *ed. by Guillermo A. Calvo, Morris Goldstein, and Eduard Hochreiter, Washington: Institute for International Economics*, p. 151-71

Chang, R. & Velasco, A. (1998) “Financial Crises in Emerging Markets: A Canonical Model,” *NBER Working Paper No. 6606*.

Corsetti, G., Pesenti, P. & Roubini, N. (1999) “What Caused The Asian Currency and Financial Crisis?,” *Japan and The World Economy*, Vol. 11, p. 305-373

Connolly, M.B. & Taylor, D. (1984) “The Exact Timing of the Collapse of an Exchange Rate Regime and its Impact on the Relative Price of Traded Goods,” *Journal of Money, Credit and Banking*, Vol. 16, p. 192-207

Daniel, B. (2001) “The Fiscal Theory of The Price Level in an Open Economy,” *Journal of Monetary Economics*, Vol. 48, p. 293-308

Das, U.S., Quintyn, M. & Chenard, K. (2004) “ Does Regulatory Governance Matter for Financial System Stability? An Empirical Analysis,” *IMF Working Paper, 04/89*, Washington: IMF

De Kock, G. & Grilli, V. (1993) “Fiscal Policies and the Choice of Exchange Rate Regime,” *Economic Journal*, Vol. 103, p. 347-358

De Nicolo, G., Geadah, S. & Rozhkov, D. (2003) “Financial development in the CIS-7 Countries: Bridging the Great Divide,” *IMF Working Paper, 03/205*

Dellas, H. & Stockman, A. (1988) “Self-fulfilling Expectations, Speculative Attacks, and Capital Controls,” *Journal of Money, Credit and Banking*, Vol. 25, p. 721-730

Demirguc-Kunt, A. & Detragiache, E. (1998) “The Determinants of Banking Crises in Developing Developed Countries,” *IMF Staff Paper*, Vol. 45, p. 81-109

Demirguc-Kunt, A., Detragiache E., (1998) “The Determinants of Banking Crises: Evidence From Developed and Developing Countries,” *IMF Staff Paper*, Washington: International Monetary Fund, No.45,p. 81-109

Demirguc-Kunt, A. & Detragiache, E. (2005) “Cross-Country Empirical Studies of Systemic Bank Distress: A Survey,” *IMF Working Paper*, Washington: International Monetary Fund, 05/96

- Dooley, M.P. (1997) "A model of crises in emerging markets," *NBER working paper*, 6300
- Drazen, A. & Masson, P.R. (1994) "Credibility of Policies Versus Credibility of Policymakers," *Quarterly Journal of Economics*, Vol. 109, p. 735-754
- Dupor, W. (2000) "Exchange Rates and The Fiscal Theory of The Price Level," *Journal of Monetary Economics*, Vol. 45, 613-630
- Edison, H.J. (2003) "Do Indicators of Financial Crises Work? An Evaluation of an Early Warning System," *International Journal of Finance and Economics*, Vol. 8, p. 11-53
- Edwards, S. (1989) "Real Exchange Rates, Devaluation and Adjustment: Exchange Rate Policy in Developing Countries," *Cambridge: MIT Press*
- Edwards, S. & Santaella, J.A. (1993) "Devaluation Controversies in the Developing Countries: *Lessons from the Bretton Wood Era*," In *A Retrospective on the Bretton Woods System*, ed. by Michael D. Bordo and Barry Eichengreen, Chicago: University of Chicago Press
- Eichengreen, B., Rose, A. & Wyplosz, C. (1994) "Speculative Attacks on Pegged Exchange Rates: An Empirical Exploration With Special Reference to the European Monetary System," *NBER Working Paper*, 4898
- Eichengreen, B., Rose, A. & Wyplosz, C. (1995) "Exchange Market Mayhem: The Antecedents and Aftermath of Speculative Attacks," *Economic Policy*, Vol. 21, p. 249-312
- Eichengreen, B., Rose, A. & Wyplosz, C. (1996) "Contagious Currency Crises: First Test," *The Scandinavian Journal of Economics*, Vol. 98, p. 463-484
- Eichengreen, B. and Arteta, C. (2000) "Banking Crises in Emerging Markets: Presumptions and Evidence," *Paper C00'115*, Centre for international and Development Economics Research, Berkeley: University of California
- Esquivel, G. & Larrain, B.F. (1998) "Explaining Currency Crises," *Harvard Institute for International Development (HIID) Dev. Disc. Paper*, p. 666-672
- Farmer, J.D. & Foley, D. (2009) "A Model Approach," *Nature*, Vol. 460, p. 685-686
- Flood, R.P. & Garber, P.M. (1984) "Collapsing Exchange Rate Regimes: Some Linear Examples," *Journal of International Economics*, Vol. 17, p. 1-13
- Flood, R. & Marion, N. (1998) "Perspectives on the Recent Currency Crisis Literature." *IMF Working Paper*, 98/130
- Frankel, J. & Rose, A. (1996) "Currency Crashes in Emerging Markets: An Empirical Treatment," *Journal of International Economics*, Vol. 41, p. 351-366
- Froot, K., Scharfstein, D.S. & Stein, J. (1992) "Herd on the Street: Information Inefficiencies in a Market with Short Term Speculation." *Journal of Finance*, Vol. 47, p. 1461-1484

- Furman, J. & Stiglitz, J.E. (1998) "Economic Crises: Evidence and Insights From East Asia," *Brookings Papers on Economic activity*, Vol. 2, p. 1-135
- Gavin, M. & Hausman, R., (1996) "The Roots of Banking crises: The Macroeconomic Context", *Banking Crises in Latin America*, Washington, DC.: Inter-American Development Bank, P. 27-63.
- Gerlach, S. & Smets, F. (1996) "Contagious speculative attacks," *CEPR Discussion Papers*, 10551060
- Ghosh, S. and Ghosh, A.R. (2002) "Structural vulnerabilities and currency crises" , *IMF Working Paper No. 02/9*, International Monetary Fund .
- Girton, L. & Roper, D. (1977) "A Monetary Model of Exchange Market Pressure Applied to the Postwar Canadian Experience," *The American economic review*, Vol. 67, p. 537-548
- Goldsberg, L.S. (1991) "Collapsing Exchange Rrate Regimes: Shocks and Biases," *Journal of International Money and Finance*, Vol. 10, p. 252-263
- Goldstein, M., Kaminsky, G. & Reinhart, C.M. (2000) "Assessing Financial Vulnerability: An Early Warning System for Emerging Markets," *Institute for International Economics, Washington, DC*
- Honohan, P. (1997) "Banking System Failures in Developing and Transition Countries: Diagnosis and Prediction," *Bank for International Settlements Working paper*, No. 39.
- Hutchinson, M.M. & Mc Dill, K. (1999) "Are All Banking Crises Alike? The Japanese Experience in International Comparison," *Journal of the Japanese and International Economies*, Vol. 13, p. 155-180
- Hutchinson, M.M. (2002) "European Banking Distress and EMU: Instittional and Macroeconomic Risks," *Scandinavian Journal of Economics*, Vol. 104, p. 365-89
- Jeanne, O., & Masson, P. (2000) "Currency Crises, Sunspots and Markov-Switching Regimes," *Journal of international economics*, Vol. 50, p. 327-350
- Kaminsky, G., Lizondo, S. & Reinhart, C. (1998) "Leading Indicators of Currency Crises," *Staff Papers, International Monetary Fund*, Vol. 45, p. 1-48
- Kaminsky, G. & Reinhart, C. (1999) "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems," *American Economic Review*, Vol. 89, p. 473-500
- Kaminsky, G. (2000) "Currency and Banking Crises: The Early Warning of Distress," *Presented at the workshop on Early warning system modeling and joint regional monitoring jointly organized by the Asian development bank and Korea center for international finance, Korea*
- Korobeinikov, A. (2009) "Financial Crisis: An Attempt of Mathematical Modeling," *Applied Mathematics Letters*, Vol. 22, p. 1882-1886
- Kouri, P.J.K. (1976) "The Exchange Rate and the Balance of Payments in The Short Run and in Tthe Long Run: A Monetary Approach," *The Scandinavian Journal of Economics*, Vol. 78, p. 280-304
- Krugman, P. (1979) "A Model of Balance-of-Payments Crises," *Journal of Money, Credit and Banking*, Vol. 11, p. 311-325

- Krugman, P. (1997), "Currency Crises", *mimeo prepared for NBER conference*, Available on www.mit.edu/krugman/www.
- Krugman, P. (1998) "What Happened to Asia?," *Mimeo, MIT, Cambridge, MA*
- Krugman, P. (1999) "Balance Sheets, the Transfer Problem, and Financial Crises." *Massachusetts Institute of Technology, Cambridge, Mass, mimeo*
- Krugman, P. (2001) "Crises: The Next Generation?," *Paper Presented at Conference Honoring Assaf Razin, Tel Aviv*
- Krugman, P. & Rotemberg J.J (1992) "Speculative Attacks on Target Zones, In Target Zones and Currency Bands," *ed. By Krugman, P. and Miller, M., Cambridge: Cambridge Uty. Press, p. 117-132*
- Lestano J. J., & Kuper G. H. (2003) "Indicators of financial crises do work! An early-warning system for six Asian countries," *CCSO Working Papers 200313*, University of Groningen, CCSO Centre for Economic Research
- Liu, S. & Lindholm, C.K. (2006) "Assessing Early Warning Signals of Currency Crises: A Fuzzy Clustering Approach," *Intelligent Systems in Accounting, Finance and Management*, Vol. 14, p. 179-202
- Masson, P. (1999a) "Contagion: Macroeconomic Models with Multiple Equilibria," *Journal of International Money and Finance*, Vol. 18, p. 587-602
- Masson, P. (1999b) "Contagion: Monsoonal Effects, Spillovers, and Jumps between Multiple Equilibria," *in The Asian Financial Crisis: Causes, Contagion and Consequences*, ed. by P.R. Agenor, M. Miller, D. Vines, A.A. Weber, Cambridge, UK: Cambridge University Press, p. 265-280
- McKinnon, R. & Pill, H. (1996) "Credible Liberalization and International Capital Flows: The Over borrowing Syndrome," *In Financial Deregulation and Integration in East Asia*, ed. Takatoshi Ito and Anne Krueger, Chicago: Chicago University press, p. 7-42
- Obstfeld, M. (1986) "Rational and Self-fulfilling Balance of Payments Crises," *American Economic Review*, Vol. 76, p. 72-81
- Obstfeld, M. (1994) "The Logic of Currency Crises," *Cashiers Economiques Monetaires (Banque de France)*, Vol. 43, p. 189-213
- Obstfeld, M. (1996) "Models of Currency Crises With Self-fulfilling Features," *European Economic Review*, Vol. 40, p. 103701047
- Obstfeld, M. (1997) "Destabilizing Effects of Exchange Rate Escape Clauses," *Journal of International Economics*, Vol. 43, p. 61-77
- Ozkan, F.G. & Sutherland, A. (1995) "Policy Measures to Avoid a Currency Crisis," *Economic Journal*, Vol. 105, p. 510-519
- Ozkan, F.G. & Sutherland, A. (1998) "A Currency Crisis Model With an Optimizing Policy Maker," *Journal of International Economics*, Vol. 44, p. 339-364

Rangvid, J. (2001) "Second generation models of currency crises," *Journal of Economic surveys*, Vol. 15, p. 613-646

Sachs J, Tornell A, & Velasco A. (1996) "Financial Crises in Emerging Markets: The Lessons From 1995," *Harvard Institute of Economic Research Working Papers 1759*, Harvard Institute of Economic Research

Salant, S. & Henderson, D. (1978) "Market Anticipations of Government Policies and The Price of Gold," *Journal of Political Economy*, Vol. 86, p. 627-648

Schneider, M. & Tornell, A. (2004) "Balance Sheet Effects, Bailout Guarantees and Financial Crises," *Review of Economic studies*, Vol. 00, p. 1-31

Tamgac, U. (2011) "Crisis and Self-fulfilling Expectations: The Turkish Experience in 1994 and 2000-2001," *International review of economics and finance*, Vol. 20, p. 44-58

Turner, S., Farmer, J.D. & Geanakoplos, J. (2009) "Leverage Causes Fat Tails and Clustered Volatility," *Quantitative Finance Paper*, 0908.1555

Willman, A. (1988) "The Collapse of The Fixed Exchange Rate Regime With Sticky Wages and Imperfect Substitutability Between Domestic and Foreign Bond," *European Economic Review*, Vol. 32, p. 1817-1838

Wyplosz, C. (1986) "Capital controls and balance of payments crises," *Journal of International Money and Finance*, Vol. 5, p. 167-179

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