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**Performance Evaluation of Small Cap Equity Funds: How Fund Specific Variables, Business Conditions and Fund Objectives Affect the Abnormal Performance**

**Abhay Kaushik\***

Assistant Professor  
Department of Accounting, Finance, and Business Law  
Radford University  
[akaushik@radford.edu](mailto:akaushik@radford.edu)

**Douglas E. Brinckman**

Associate Professor  
Department of Accounting, Finance, and Business Law  
Radford University  
[dbrinckm@radford.edu](mailto:dbrinckm@radford.edu)

\* Corresponding author

### **Abstract**

This study analyzes a sample of 1,630 small cap domestic equity funds (174,790 fund month observations) over the over the first decade of the 21<sup>st</sup> century (2000-2010). The U.S. economy suffered two recessions during this period, the first one beginning in March 2001 and ending in August 2001, and the second one starting in December 2007 and ending in June of 2009. The main objective of this research is to analyze the performance of small cap funds over entire period and re-estimate performance net of economic recession. Results of this study indicate that small cap funds after adjusting for risk and investment style neither outperform nor underperform the market index overall; however, they outperform the market index by 386 basis points per month after controlling for recessionary periods. The findings of this research also support the general notion that small cap funds are not good investments during economic downturn and should not be used as a hedging tool during adverse market conditions; however, this study also indicates that small cap funds have potential to outperform the passive market index under favorable market conditions. Cross-sectional analysis shows that a fund's abnormal performance is directly affected by the fund's size, managerial tenure, average market cap of its holdings, and investment in its top holdings, whereas the fund's abnormal performance is negatively affected by its expense ratio and turnover ratio.

Key words: Mutual Funds, Expense Ratio, Turnover Ratio, Business Cycles

### **I. INTRODUCTION**

In the U.S., mutual funds are the second largest financial institutions after commercial banks. According to the Investment Company Institute (ICI) website, by the end of 2009

approximately 90 million U.S. investors have some sort of investment in mutual funds. According to ICI, assets under management for all equity mutual funds have grown from a paltry \$134.76 billion in 1980 to \$11.12 trillion in 2009, whereas the number of funds increased from 564 to 7,691 mutual funds over the same period. The astounding growth of roughly 269% per year in terms of assets under management validates the dependence and confidence of the U.S. investors in this industry. This study extends the literature on the performance of small cap<sup>1</sup> equity funds by including the recent recession in the U.S. economy to evaluate the average performance and cross-sectional attributes of small cap mutual funds over the period 2000-2010. In this study, we specifically ask 1) whether small cap funds are able to outperform the market index after controlling for risk and style investment strategies, 2) whether the downturn in the economy has any significant impact on the performance of small cap funds, and finally 3) what firm specific variables play a significant role in explaining the abnormal performance of small cap mutual funds. We specifically chose small cap funds because they are supposed to be the most vulnerable to business cycles and it is also assumed that small cap funds are not able to repeat their abnormal performance. Moreover, small cap funds grew at an overall growth of 31% over last ten years<sup>2</sup>. Thus the nature and the steady growth rate of small cap funds necessitate a thorough research in this segment of mutual funds.

## II. LITERATURE REVIEW

Jensen (1968) analyzed the performance of 115 domestic equity funds over the period 1955-1964. His findings show that mutual funds do not outperform passive benchmarks

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<sup>1</sup> According to Morningstar, any fund with market capitalization between \$300 million and \$2 billion is defined as a small cap mutual fund.

<sup>2</sup> Approximately 1005 small cap domestic equity funds that invest at least 90% in stocks existed in 2000 in Morningstar Direct database and this number increased to 1,319 by the end of year 2010.

and any abnormal performance is just by “luck”. Jensen’s findings resonate with the core concept of finance that markets are efficient and it is not possible to consistently beat the market indices. More recently Wermers (2000) while examining the performance of mutual funds finds selectivity skills of fund managers; however, his results also indicate that any above normal performance dissipates after adjusting for loads and fees. Carhart (1997) examined the performance of 1,892 domestic equity funds and finds that momentum and expenses explain most of the abnormal performance of his sample funds. Carhart also examined the persistence effect and document spillover effect of momentum of stocks, i.e. winner funds continue to outperform over next period; however, he finds this effect is stronger for loser funds that continue to underperform over long period of time. Bollen and Busse (2005) analyzed the persistence effect for 282 mutual funds and document that persistence prevails for short period of time.

### **III. DATA**

Most of the data is taken from Morningstar Direct database. In order to remove any survivorship bias, this study includes all funds that exist at anytime during the period 2000-2010. Monthly returns of sample funds and S&P index, and fund specific variables such as expense ratio, turnover ratio, net assets, cash holdings, percent invested in top 10 holdings, average manager tenure, and average market cap of holdings are taken from Morningstar Direct dataset. Since fund specific variables other than net assets are reported on annual basis therefore similar to other studies on mutual funds, we divide annual numbers by 12 to estimate their monthly equivalents. Business cycle dates are taken from the National Bureau of Economic Research (NBER) website. According to NBER website, the U.S. economy has suffered two business downturns over the period of

this study. The first recession is reported in March 2001 which ended in November 2001 and the other started in December of 2007 and ended in June 2009. Proxies for value, growth, momentum, and monthly T-bills rate are taken from Kenneth French's website.

#### **IV. DESCRIPTIVE STATISTICS**

In order to exclude survivorship bias, this study includes all small cap funds that exist at anytime during the time period of this study, i.e. during the period 2000-2010. Initial screening results 2,086 domestic equity small cap funds. Any fund that has less than 90 percent investment in stocks or any fund which is classified as an index or institutional fund is screened out from the final sample. In addition, consistent with the existing literature, any fund with less than 36 observations is removed from the sample. The final sample consists of 1,630 domestic small cap equity funds. Expense ratio is nearly constant over 11 year period; average expense ratio of the portfolio of small cap equity funds is 1.70 percent per year whereas average turnover ratio is 98.59 percent. On average, small cap funds manage \$153.58 million assets per month with highest of \$187.86 million in 2006 and lowest of \$120.18 million in 2009. Small cap funds in our sample seem to be well diversified; on average, a fund manages roughly 172 stocks over 11 year period.

<Insert Table 1 Here>

#### **V. METHODOLOGY**

To evaluate the performance of small cap mutual funds, we use Carhart (1997) 4-factor model. We use the four-factor model of Carhart (1997) because it adjusts fund excess return for the Fama-French (FF) factors, INDRF, SMB, and HML and Carhart's momentum factor. The Carhart 4-factor model is more suitable to explain the risk and style adjusted performance of mutual funds. Numerous research studies (for example

Carhart (1997), Wermers (2000)) have documented that market coefficient alone inflates the impact of the market on fund's abnormal performance. It is also documented that small stocks, value stocks and momentum of stocks affect abnormal performance economically and significantly. Given the nature of small cap funds, small stock bias and momentum are known to affect the abnormal performance and therefore use of 4-factor model is most appropriate for such a study. We first run a time series regression per fund over the entire period 2000-2010 and estimated the weighted average alpha of the portfolio of 1,630 funds, weighted by net assets. We then create a dummy variable to separate the effect of the business recessions in the economy and we re-estimate the alpha for each fund and weighted average alpha of the entire portfolio.

$$\text{Model: } r_{it} - r_{ft} = \alpha_i + \beta_{1i} * INDRF_t + \beta_{2i} * SMB_t + \beta_{3i} * HML_t + \beta_{4i} * MOM_t + \varepsilon_{i,t}$$

Where:

$r_{it} - r_{ft}$  is the excess monthly return (market return net of 1-month T-bill return) of each fund

$INDRF_t$  is the excess monthly return (market return net of 1-month T-bill return) on S&P Composite Index,

$SMB_t$  is the difference in returns between small and large capitalization stocks

$HML_t$  is the difference in returns between high and low book-to-market stocks.

$MOM_t$  is the difference in returns between stocks with high and low past returns



The FF performance specification may be more relevant for small cap funds because they have specific characteristics in terms of investment style, namely they invest in small, high growth firms. The Carhart (1997) momentum factor may be particularly relevant for small cap funds because the momentum effect is very strong when stocks belong to small cap firms (Jegadeesh and Titman (1993), Moskowitz and Grinblatt (1999), Eakins and Stansell, 2004).

### **Cross-Sectional Analysis:**

The evidence on the cross-sectional impact of fund characteristics for generalized mutual funds is mixed. For instance, while Ippolito (1989) finds that risk-adjusted performance (fund alpha) is unrelated to fund turnover and management fees, Carhart (1997) documents that fund alphas are negatively related to fund expense and turnover ratios. Grinblatt and Titman (1994) find that fund alphas are positively related to fund turnover, but not related significantly to either fund size or fund expense ratios. Chordia (1996) and Nanda, Narayanan, and Warther (2000) propose that expenses such as load fees and 12b-1 fees act as screens for short-term investors and improve fund performance because of reduced transaction costs. We use Fama and MacBeth (1973) time series cross sectional methodology to evaluate the impact of fund specific characteristics on a fund's abnormal performance. Fund specific variables such as a fund's size, expenses, turnover ratio, managerial tenure, investment in top holdings, number of holdings, and percent invested in cash tend to affect the fund's abnormal performance. Moreover, funds across the spectrum are not homogeneous in terms of their fund specific characteristics; therefore, it becomes more important to investigate the cross-sectional impact of fund specific characteristics on the fund's abnormal performance. Consistent with the existing literature, we run a time series cross-sectional regression using Fama and MacBeth

(1973) methodology to evaluate the impact of these fund specific variables on fund's abnormal performance. Consistent with Carhart (1997), Brown, Harlow, and Starks (1996), among others, we use 3 years of prior monthly returns to estimate the beta loadings of the 4-factor model, and use this rolling window to estimate alpha for each month. This method considers that beta changes over time, and time-varying alphas incorporate this effect.

The model for cross-sectional determinants of fund performance is as follows:

$$\alpha_{it} = \beta_0 + \beta_1 Size_{it} + \beta_2 Expense\ Ratio_{it} + \beta_3 Turnover_{it} + \beta_4 Manager\ Tenure_{it} + \beta_5 Cash_{it} + \beta_6 TTOP_{it} + \beta_7 Holdings_{it} + \beta_8 Average\ MarketCap_{it} + \beta_9 Size_{it} * Manager\ Tenure_{it} + \varepsilon_i$$

Where:

- $\alpha_{it}$  is the monthly abnormal performance for each fund obtained from the four factor model estimated over a 36 month rolling window.
- $Size$  is the log (Total Net Assets)
- $Expense\ Ratio$  is the management, administrative, and 12b-1 fees as percent of total net assets
- $Turnover$  is the minimum of aggregated sales or aggregated purchases of securities divided by the average 12-month total net assets of the fund
- $Manager\ Tenure$  is the average number of years manager stay with the fund
- $Cash$  is the percent of total funds invested in cash
- $TTOP$  is the investment of fund in its top 10% holdings
- $Holdings$  is the number of stocks in the fund
- $Average\ MarketCap$  is the average capitalization of the holdings of the fund

## VI. RESULTS

The Carhart (1997) 4-factor model shows positive alpha for the portfolio of 1,630 small cap funds; however, this alpha is economically insignificant. Table 2, panel A, shows that the asset weighted average alpha of 1,630 small cap funds is 0.4298 percent per month (5.16% per year), but consistent with the existing literature on equity funds, it is statistically insignificant. Table 2, panel A, also reveals that the abnormal performance of small cap funds is directly related to the market index and that these funds tend to have small stock bias. Surprisingly, momentum effect though positive, is statistically insignificant and this finding is contrary to some other findings which documented that small stocks do carry over momentum effects (for example Jegadeesh and Titman (1993)). Once the recession dummy is taken into account, the average weighted alpha of small cap funds becomes statistically significant. Table 2, panel B, shows that the average asset weighted alpha for small cap funds is 0.386 percent per month (4.63 percent per year) and it is statistically highly significant. Momentum effect is also positive and highly significant. Results in table 2 strongly demonstrate the negative effect of downturn in the economy on the performance of small cap funds. These results show that, in general, small cap funds are not the best investments during economic recession and should not be used as a hedging tool against market downturn. These results also validate the general fear of market participants that small cap funds are risky but also have a potential to outperform the market index.

<Insert Table 2 Here>

Results in table 3 show that, overall more funds have a positive alpha. Out of 1,630 funds, 1,297 funds have positive alpha over eleven year period and 333 funds have a

negative alpha. Out of 1,297 positive alpha funds, 467 alphas are statistically significant whereas only 22 negative alpha funds are statistically significant. Results change slightly when recession dummy variable is incorporated.

<Insert Table 3 Here>

Cross-sectional results are reported in table 4. Results indicate that on average, a 100 basis points increase in size improves abnormal performance by 1.3 basis points per year; an average increase of one year in manager tenure improves abnormal performance by 0.5 basis points per year, and that a 100 basis points increase in investments in top 10 holdings improves the abnormal performance by 19.2 basis points per year. These results also show that for every 100 basis points increase in a combination of size and average manager tenure improves the abnormal performance by 2 basis points per year. Consistent with numerous studies on mutual funds, the results of this study also show that the higher the expenses charged by the fund, the lower is the abnormal performance of the fund. On average, a 100 basis points increase in expense ratio decreases the abnormal performance by 9.7 basis points per year. Finally, these results indicate that rebalancing of a portfolio is expensive or at least does not bring about enough benefits to the investors to justify the costs. Based on the cross-sectional analysis, it is safe to assume that small cap funds that are big in size, have longer managerial tenure, invest more in their best assets, charge less expenses from investors and do not rebalance their portfolio often can deliver superior returns to investors under both normal and better than normal market conditions.

<Insert Table 4 Here>

## VII. CONCLUSION

Small cap equity funds have market capitalization between \$300 million and \$2 billion. Over the last two decades, investors in the United States have increased their dependence on mutual funds, but the main question is *do these funds generate superior returns after controlling for risk, investment style, and other fund specific characteristics?* A steady growth of small cap funds over last decade shows that investors are attracted towards these funds, but the U.S. economy also experienced economic shocks during the same period. In this study we examine whether small cap funds outperform the passive index, what have been the implications of economic recession on the performance of these funds, and what fund specific variables help explain the abnormal performance of these funds? Our results indicate that, in general, small cap funds earn positive alpha after controlling for risk and investment style and that they outperform the market index; however, these funds do not exhibit the same performance when the economy is going through downturns. These results strengthen the general perception that these funds are risky in nature and should not be used as a hedging tool during market downturn; however, these funds do have the potential to earn superior returns under normal and better than normal market conditions. Cross-sectional analysis supports the general findings on mutual funds that expenses reduce abnormal performance and that rebalancing costs outweigh any perceived benefits obtained from rebalancing of the portfolio. These results also support that larger funds with stable managers and higher investment in their top holdings have more potential to earn superior returns over a long period of time.

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**Table 1: Descriptive Statistics**

Following table shows average values of small cap funds over the period 2000-2010.

Cash is the average percentage of investment held as cash, Return is average annual return earned by funds in this study, TNA is the average monthly net assets under management, Expenses is the average expense ratio charged by the funds, holdings is the number of stocks held in the portfolio, tenure is the average number of years managers are retained by the fund, PTB is the price to book ratio, TTOP is the investment in top assets, and Medcap is the average market cap of the funds' holdings.

Year	Cash (%)	Return (%)	TNA (in million \$)	Expenses (%)	Turnover (%)	Holdings	Tenure (years)	PTB	TTOP (%)	Medcap (In million \$)
2000	6.37	9.07	174.45	1.74	113.82	155	5.92	3.28	26.30	1162.78
2001	5.67	3.36	136.19	1.79	106.48	149	5.75	2.37	24.94	920.85
2002	4.34	-21.84	126.66	1.79	101.40	152	5.68	2.12	23.80	894.26
2003	4.27	37.68	126.35	1.75	101.57	161	5.70	2.24	22.24	927.14
2004	3.75	15.84	162.60	1.70	97.89	166	5.68	2.59	21.24	1071.33
2005	3.31	7.08	172.67	1.69	93.68	167	5.62	2.64	21.65	1161.12
2006	3.23	13.44	187.86	1.66	91.24	166	5.61	2.75	21.48	1219.26
2007	2.74	2.38	184.83	1.63	93.57	186	5.56	2.69	20.75	1332.58
2008	2.96	-42.84	137.02	1.62	98.33	191	5.58	1.99	21.48	1165.94
2009	2.81	31.20	120.18	1.68	101.19	200	5.67	1.67	19.74	1034.94
2010	2.57	25.32	160.56	1.62	85.27	203	5.72	1.98	18.53	1235.88
<b>Average</b>	3.82	7.34	153.58	1.70	98.59	172	5.68	2.39	22.01	1102.37

**Table 2: Performance of Small Cap Funds Based on 4-Factor Model**

This table reports the performance of small cap funds over the period 2000-2010.

INDRF is the monthly excess S&P composite return over corresponding 1 month risk free (t bill) rate. The dependent variable is the individual fund's monthly excess return over the corresponding 1 month t-bill rate. SMB, HML, and MOM are monthly returns of size, book to market, and momentum portfolios respectively. Dependent variable is the individual fund's monthly excess return over the corresponding 1 month t-bill rate. N represents the number of fund-month observations over the period 01/2000 to 12/2010. The table reports regression estimates and corresponding t and p statistics for the 4-factor Carhart model. 1-880-905-2524, 0241427940101136.

**Panel A:**

$$Model \ r_{it} - r_{ft} = \alpha_i + \beta_{1i} * INDRF_t + \beta_{2i} * SMB_t + \beta_{3i} * HML_t + \beta_{4i} * MOM_t + \varepsilon_{i,t}$$

Variable	Estimate	p Value
A	0.004298	0.1461
INDRF	1.079564***	0.0000
SMB	0.502757**	0.0505
HML	0.223985	0.1459
MOM	0.125704	0.2103
N	174,790	

\*\*\*, \*\*, and \* represent the statistical significance at 1%, 5%, and 10% level respectively.

**Panel B**

The U.S. economy experienced recessions from March 1, 2001 to November 30, 2001 and from December 2007 to June 2009. To capture the impact of “downturn” I create a *dummy* variable that takes a value of 1 if the period is from 03/2001 to 11/2001 and from



12/2007 to 06/2009. The following table reports the regression estimates and corresponding p-values of the 5-factor model where the *dummy* is the 5th variable.

$$Model \ r_{it} - r_{ft} = \alpha_i + \beta_{1i} * INDRF_t + \beta_{2i} * SMB_t + \beta_{3i} * HML_t + \beta_{4i} * MOM_t + \beta_{5i} * Dummy_t + \epsilon_{i,t}$$

Variable	Estimate	p Value
A	0.00386***	0.0000
INDRF	1.085614***	0.0000
SMB	0.503492***	0.0000

MODEL	Number of Funds	Positive	Negative	Positive & Significant	Negative & Significant

HML	0.228091***	0.0000
MOM	0.128994***	0.0000
Dummy	0.002972***	0.0000
N	174,790	

\*\*\*, \*\*, and \* represent the statistical significance at 1%, 5%, and 10% level respectively.

**Table 3: Comparison of Abnormal Performance Across Various Models**

This table shows the comparison of the abnormal performance of the individual funds across two different models. Abnormal performance (alpha) is estimated by using Carhart 4-factor model, and Carhart 4-factor model with the “Dummy. The table also divides performance based on significant, insignificant, positive, negative, positive & significant, and negative & significant alphas.

4-Factor Unconditional Model <b>alpha</b>	1,630	1,297	333	467	22
4-Factor Unconditional Model with "Dummy" <b>alpha</b>	1,630	1,303	327	458	28

**Table 4: Cross-Sectional Analysis**

This table summarizes the multivariate Fama and MacBeth (1973) cross-sectional regressions for each month from 01/2003 to 12/2010. The dependent variable is the monthly intercept calculated using 4- factor beta loadings on the prior 3 years of monthly returns. The independent variables are: *Expense Ratio* is the monthly expense ratio including 12b-1 fees, *Turnover* is the monthly minimum of aggregated sales or aggregated purchases of securities divided by the average 12-month total net assets of the fund, *Manager Tenure* is the average number of years manager stay with the fund, *Size* is the log (Monthly Total Net Assets), *Cash* is the monthly percent of total funds invested in cash, *TTOP* is the investment of fund in its top 10% holdings, *Holdings* is the number of stocks in the fund and *Size \* Manager Tenure* is the interaction term between size and manager tenure. The reported estimates are time-series averages of monthly cross-sectional regression slope estimates as in Fama and MacBeth (1973).

$$\alpha_{it} = \beta_0 + \beta_1 Expense\ Ratio_{it} + \beta_2 Turnover_{it} + \beta_3 Manager\ Tenure_{it} + \beta_4 Size_{it} + \beta_5 Cash_{it} + \beta_6 TTOP_{it} + \beta_7 Holdings_{it} + \beta_8 Size_{it} * Manager\ Tenure_{it} + \varepsilon_{i,t}$$

Variable	Model 1	Model 2
Intercept	0.00087	0.00132**
Size	0.00013***	

Expense Ratio	-0.00097***	-0.00101***
Turnover Ratio	-0.00000***	-0.00000***
Manager Tenure	0.00005***	
Cash	0.00099	0.00078
TTOP	0.00192***	0.00198***
Holdings	0.000	0.00000
Average MarketCap	0.000***	0.00000***
Size*Manager Tenure		0.00002***
Adj. R <sup>2</sup>	0.186	0.181

\*\*\*, \*\*, and \* represent the statistical significance at 1%, 5%, and 10% level respectively.

**Impact of Financial Freedom on Economic Growth after Controlling for  
Long Term Interest Rates and Government Budget Deficits**

**Richard J. Cebula**

Walker/Wells Fargo Endowed Chair in Finance  
Jacksonville University, Davis College of Business  
Jacksonville, FL 32211  
[Dr.RichardCebula@gmail.com](mailto:Dr.RichardCebula@gmail.com)

### **Abstract**

This study empirically investigates of the impact of financial freedom on per capita real economic growth. After controlling for such macro-financial factors as nominal long term interest rates and federal/central government budget deficits, as well as a measure of political stability and other considerations, panel least squares (PLS) as well as panel two stage least squares (P2SLS) estimations using a three-year panel data set for the OECD nations as a group reveal that higher levels of financial freedom lead to higher per capita real economic growth rates. Furthermore, it is found that both higher nominal long term interest rates and larger government budget deficits reduce economic growth.

**J.E.L. codes:** P10, P16, E60, F43, H61

**Keywords:** Financial freedom; Per capita real GDP growth; Long term interest rates; Government budget deficits

## **I. INTRODUCTION**

As the global economy manifests a trend toward either recovery or expansion, there is a significant variation across nations in economic performance. For instance, consider the unemployment rate in the OECD nations (OECD, 2010, Table 2). On the one hand, the majority of OECD nations (especially Germany) seem to have shown signs of improvement in the unemployment rate, i.e., a discernable pattern of declining unemployment rates. On the other hand, the unemployment rate in the U.S., after showing an initial downward movement, shows serious signs of stagnation, i.e., that the U.S. recovery has lost at least some of its momentum, since its unemployment rate has been falling only very slowly. Furthermore, in several cases, including nations such as the

Czech Republic, Finland, Hungary, Ireland, Portugal, the Slovak Republic, Spain, and Greece, unemployment rates have also failed to decline sharply.

Within the context of the global economic and financial crisis, several distinct policy concerns of the OECD have surfaced. One of these concerns is reflected in the words of the OECD Secretary-General Angel Gurría (OECD, 2009A, p. 1), who has stressed that “We must ensure that today’s policies to manage the crisis not be the source of tomorrow’s problems...” The OECD has been working with its own members and, to a degree, with non-member governments and other organizations, to get economies back on the path of economic stabilization and expansion. Interestingly, as a central part of this effort, the OECD (2009A, p. 1, 2009B, p. 1) advocates the position that governments must be cautious not to jeopardize or sacrifice *economic freedoms* as they pursue policies to strengthen and revitalize their economies.

Within this context, the present study empirically investigates the impact of “financial freedom,” which is formally explained in the next section of this study, on per capita real economic growth. The context is that of the OECD nations and a panel data set covering the three years from 2005-2007. So as to provide more comprehensive and reliable insights and also in order to avoid omitted variables bias, this study also investigates the impact on per capita real economic growth of macro-financial/economic factors such as long term interest rates and federal/central government budget deficits, as well as the impact of political stability. Moreover, a dummy/binary variable to reflect the impact of a G-8 nation status is included in the analysis.

The background for the empirical framework is presented in Section 2 of this study. The empirical model and data are described in Section 3 of the study. Following that model,

in Section 4, the empirical analysis is provided. This analysis takes two alternative forms, that of PLS (panel least squares) and that of P2SLS (panel two stage least squares) estimates, using recent data from the OECD nations, to which of course the U.S. belongs. Conclusions are provided in Section 5 of the study.

### **Background for Analysis of Financial Freedom and Economic Growth**

Economic growth has been formally studied for decades. During the past 15-20 years, numerous studies have been conducted expressly to investigate the linkage between economic growth and economic freedom. Most of these studies conclude that there exists a strong, positive impact of economic freedom, especially a measure of *overall* economic freedom, on the rate of economic growth (Ali, 1997; Ali and Crain, 2001, 2002; Barro, 1997; Clark and Lawson, 2008; Dawson, 1998; De Haan and Siermann, 1998; De Haan and Sturm, 2000; Gwartney, Holcombe, and Lawson, 2006; Gwartney and Lawson, 2008; Heckelman and Stroup, 2000; Tortensson, 1994). Indeed, the study by Cole (2003, p. 196) concludes that “...economic freedom is a significant factor in economic growth, regardless of the basic theoretical framework.”

One of the best known series for measuring economic freedom by nation is the composite measure of economic freedom developed by Gwartney and Lawson (2008). For purposes of the present study, however, this measure of economic freedom is too aggregated and lacks the specificity required to isolate the impacts on real per capita economic growth of financial freedom *per se*. To achieve this specificity, the present study adopts the specific measure of financial freedom developed by the Heritage Foundation (2009, p.14).

Indeed, the Heritage Foundation (2009) has developed ten measures of Economic Freedom, one of which is referred to as “financial freedom.” To explain financial

freedom, we first observe that essentially all nations have established one form or another of supervision of commercial banks and other financial services industry firms. In theory, the objectives of such supervision is at least two-fold: (1) to help ensure the safety of and financial/economic soundness of the financial system, namely, commercial banks and other financial services firms, without which modern economic systems could not succeed; and (2) to help ensure that banks and other financial services industry firms responsibly meet their basic fiduciary duties and responsibilities to depositors, borrowers, and other economic agents while conducting financial services sector-related business.

In a free banking/financial services industry environment, in theory, the free market system naturally should be the principal source of protection for the financial markets in the form of such institutions as independent auditors and information services. *De facto* self-oversight of both banks and other components of the financial services industry is differentiated from (1) burdensome and/or intrusive government oversight and regulation of banks and financial services firms on the one hand and (2) outright government ownership and operation of banks and financial services firms on the other hand. Arguably, both of these forms of excessive banking and financial regulation by the government limit competition in the banking and financial services industries, interfere with firm and general market efficiency, and elevate the costs associated with financing entrepreneurial endeavors, endeavors that are crucial to long term innovation and economic development and expansion.

The Heritage Foundation measures the degree of government intervention in the financial markets in a nation with an index referred to as the “financial freedom index,” or simply, *FINFREE*. The value of *FINFREE* ranges from 0 to 100, with a higher value for the



*FINFREE* index indicating a greater degree of financial freedom. Since greater financial freedom implies a greater degree of freedom from government intervention in and distortion of a nation's financial markets, it also implies that that nation's financial markets will function with a higher degree of competition and greater *efficiency*, as well as in a manner that reduces the costs associated with financing entrepreneurship. All of these dimensions of the impacts of financial freedom act so as to promote innovation, economic growth, and economic development. Thus, *ceteris paribus*, economic growth is hypothesized (expected) to be an increasing functions of *FINFREE*. Interestingly, the scaling system for *FINFREE* is effectively continuous so that financial freedom scores with decimals are possible (Heritage Foundation, 2009, pp. 15-16).

This empirical study focuses principally on the relationship between economic growth on the one hand and financial freedom on the other hand. As observed above, the OECD has been working with its own members as well as with non-member governments and other organizations to restore economic stability and expansion, with a central part of this effort including the position that governments must be cautious not to reduce economic freedoms as they seek ways in which to strengthen and revitalize their economies. In other words, nations are strongly encouraged to continue to support and promote economic freedom while implementing domestic economic policies. Clearly, the concern of the OECD (2009A, p.1; 2009B, p.1) in this context is that a reduction in economic freedoms will result over time in *diminished* economic growth.

The focus on economic growth in OECD nations in this study and on the years 2005 through 2007 reflects the fact that the above concerns were expressed by the OECD *per se* and also were very recently conveyed (in 2009). In this study, following conventional

procedures that deal with growth rates among different nations, economic growth is measured by the natural log of the purchasing-power-parity adjusted per capita real GDP. Given that the OECD is expressly concerned with achieving economic growth, the nations that comprise the OECD are the focus of this study.

## II. THE EMPIRICAL FRAMEWORK

Following most previous studies, economic growth is measured as the natural log of the per capita real GDP over the study period,  $\log RPCY$ . The value of  $\log RPCY$  is made comparable across nations by *PPP* (purchasing-power-parity) adjustments. In turn, following a number of studies focused upon economic growth (Tortensson, 1994; Cebula, 1978, 1995; Goldsmith, 1995; Ali, 1997; Barro, 1997; Nelson and Singh, 1998; Norton, 1998; Dawson, 1998, 2003; Cole, 2003; Gwartney, Holcombe, and Lawson, 2006), it is hypothesized in this eclectic model that economic growth depends upon (a) economic freedom (*ECONFREE*), as well as (b) purely financial/economic factors (*FIN/ECON*), (c) political stability (*POLSTAB*), and (d) other factors (*OTHER*), such that:

$$\log RPCY_{pppjt} = f(ECONFREE_{jt}, FIN/ECON_{jt}, POLSTAB_{jt}, OTHER_{jt}) \quad (1)$$

where:  $\log RPCY_{pppjt}$  is the natural log of the purchasing-power-parity adjusted per capita real GDP in OECD nation  $j$  in year  $t$ ;  $ECONFREE_{jt}$  refers to the value of the economic freedom measure considered in this study, namely, financial freedom (*FINFREE*), in nation  $j$  in year  $t$  as obtained from the Heritage Foundation (2009);  $FIN/ECON_{jt}$  refers to the values of financial/economic factors in nation  $j$  in year  $t$ ;  $POLSTAB_{jt}$  refers to a measure of the degree of political stability manifested in nation  $j$  in year  $t$ , i.e., it is a measure of good governance; and  $OTHER_{jt}$  refers to other, i.e., additional, factors included in the model for nation  $j$  in year  $t$ .

As observed earlier, in each nation in each year included in this study, economic freedom (*ECONFREE*) assumes the form of financial freedom (*FINFREE*) and is measured using a scale ranging from 0 to 100, with 100 being the maximum freedom. In the present context, an index score of 100 indicates an economic environment or set of public policies that is the most conducive to and compatible with financial freedom. Paralleling the related literature to date and the arguments provided in the previous section of this study, it is hypothesized (*ceteris paribus*) that per capita real economic growth is an increasing function of *FINFREE*.

Following the *previous* literature, most of which, in contrast to the present study, has used a *composite* measure of economic freedom, this eclectic model controls for purely financial-economic determinants of economic growth by adopting the following two variables: (1) central government budget deficits, expressed as a percent of GDP, *DEFY*; and (2) the percentage nominal long term interest rate, *INTRATE*.

Presumably, a higher level of *DEFY* implies a lower rate of growth of real domestic production, *ceteris paribus* (Carlson and Spencer, 1975; Cebula, 1978, 1995; Ogbokor, 2005; Arora and Vamvakidis, 2006; Contessi, 2008; Chen, 2009; Dube, 2009). This is a manifestation of the “crowding out” effect of government budget deficits: higher budget deficits displace private sector investment in new plant and equipment (reduces capital formation outlays) and also reduce household purchases of new housing and other durables and thereby reduce long term economic growth. In addition, a higher *INTRATE*, which has numerous systematic causes, including inflation, net international capital outflows, and restrictive monetary policy (Cebula, 1998), is also expected to reduce investment in new plant and equipment and household purchases of new housing and

other durables, thereby resulting in lower economic growth, *ceteris paribus* (Carlson and Spencer, 1975; Cebula, 1978, 1995; Barro, 1997; Dawson, 1998; Nelson and Singh, 1998; Ogbokor, 2005; Gwartney, Holcombe, and Lawson, 2006; Arora and Vamvakidis, 2006; Contessi, 2008; Chen, 2009; Dube, 2009).

The *POLSTAB* dimension of governance is an index indicating the likelihood that government will *not* be destabilized by unconstitutional or violent means, including acts of terrorism. The higher the value of this index, the greater the likelihood that private sector investment will occur and that private enterprise will flourish, due in part to the lower risk and lower uncertainty associated with greater political stability, thereby resulting in greater economic growth, *ceteris paribus* (Ali and Crain, 2001). The potential range of this series goes from a low of -1.00 to a high of +2.00.

One possible concern with the model in equation (1) is whether the presence of the G8 nations in the study dataset might somehow bias the results. To account for this possibility, a binary (dummy) variable, *G8DUMMY*, is introduced into the model. Thus, the variable *G8DUMMY<sub>jt</sub>* takes the place of *OTHER<sub>jt</sub>* in equation (1). The value of variable *G8DUMMY* = 1 for each nation G8 nation observation, and the value of *G8DUMMY* = 0 otherwise. *Ceteris paribus*, it is expected that the coefficient on this variable is positive, as a reflection of the infrastructure, educational, technological, and other advantages enjoyed by G8 nations vis-à-vis other OECD nations.

Substituting *FINFREE* for *ECONFREE* in equation (1), substituting *DEFY* and *INTRATE* for *FIN/ECON* in equation (1), and substituting *G8DUMMY* for *OTHER* in equation (1), yields:

$$\log RPCY_{ppjt} = f(FINFREE_{jt}, DEFY_{jt}, INTRATE_{jt}, POLSTAB_{jt}, G8DUMMY_{jt}) \quad (2)$$

$$\text{where: } f_{FINFREE_{jt}} > 0, f_{DEFY_{jt}} < 0, f_{INTRATE_{jt}} < 0, f_{POLSTAB_{jt}} > 0, f_{G8DUMMY_{jt}} > 0 \quad (3)$$

### III. EMPIRICAL ANALYSIS

#### PLS and P2SLS Results

The estimates in this section of the study follow directly from the framework developed and expressed above in (1), (2), and (3). The first estimate is a panel least squares (PLS) estimate; the second estimate is a panel two stage least squares (P2SLS) estimate.

Given the variables identified in model (1) - (3), the following semi-log equation is to be estimated by PLS:

$$\log RPCY_{ppjt} = a_0 + a_1 FINFREE_{jt} + a_2 DEFY_{jt} + a_3 INTRATE_{jt} + a_4 POLSTAB_{jt} + a_5 G8DUMMY_{jt} + a_6 TREND + u \quad (4)$$

where:

$\log RPCY_{ppjt}$  = the natural log of the purchasing-power-parity adjusted real per capita GDP in nation j in year t;

$a_0$  = constant;

$FINFREE_{jt}$  = the value of the financial freedom index in nation j in year t;

$DEFY_{jt}$  = the ratio of the central government budget deficit to the GDP in nation j in year t, expressed as a percent;

$INTRATE_{jt}$  = the nominal average long term interest rate yield in nation j in year t, expressed as a percent per annum;

$POLSTAB_{jt}$  = the value of the index of political stability in nation j in year t;

$G8DUMMY_{jt}$  = binary variable for a G8 nation:  $G8DUMMY_{jt} = 1$  if nation j is a G8 nation and  $G8DUMMY_{jt} = 0$  otherwise;

$TREND$  = a linear trend variable;

$u$  = stochastic error term; and where  $t = 2005, 2006, 2007$  and  $j = 1, \dots, 29$ .

Descriptive statistics for all of the variables considered in this study are provided in Table

1. Data were available across the study period for 29 of the 30 OECD members; only Iceland had an incomplete dataset and therefore had to be excluded from the analysis. In each of the estimates,  $n = 87$  (29 nations, a three-year panel). Panel data estimates frequently include a trend variable to help control for the potential impact of trending of variables over time on the estimation outcomes; accordingly, a trend variable (*TREND*) is also included in the model. The data sources for the variables in the analysis are, as follows: for variable *log RPCYppp*, IMF (2008, Table 1); for the freedom index, *FINFREE*, Heritage Foundation (2009, p. 14); for the explanatory financial-economic variables, *DEFY*, and *INTRATE*, OECD (2008, Table 1); and for the variable *POLSTABjt*, (World Bank, 2009).

The White (1980) heteroskedasticity-corrected PLS estimate of equation (4) is provided in equation (5):

$$\begin{aligned} \log RPCYpppjt = & 5.33 + 0.004 FINFREEjt - 0.035 DEFYjt - 0.072 INTRATEjt \\ & (+2.43) \qquad \qquad (-8.05) \qquad \qquad (-2.80) \\ & + 0.323 POLSTABjt + 0.395 G8DUMMYjt - 0.047 TREND \\ & (+3.69) \qquad \qquad (+6.66) \qquad \qquad (-1.33) \\ R^2 = 0.57, \text{adj}R^2 = 0.53, F = 16.26 & \qquad \qquad \qquad (5) \end{aligned}$$

where terms in parentheses are t-values.

In PLS estimate (5), all five of the estimated (non-trend) coefficients exhibit the expected signs, with four statistically significant at the one percent level (*DEFYjt*, *INTRATEjt*, *G8DUMMYjt*, and *POLSTABjt*) and the remaining one statistically significant at beyond

the two percent level ( $FINFREE_{jt}$ ). The  $R^2$  and adjusted  $R^2$  imply that the model explains between half and three-fifths of the variation in the dependent variable ( $\log RPCY_{ppp}$ ). Finally, the  $F$ -statistic is statistically significant at far beyond the one percent level, attesting to the overall strength of the model. For the interested reader, a correlation matrix among the explanatory variables is provided in Table 2. Observe that in no case does the zero-order correlation coefficient exceed 0.500.

Based on these PLS findings, the real per capita economic growth rate in OECD nations ( $\log RPCY_{ppp}$ ) is an increasing function of the degree of political stability ( $POLSTAB$ ), whose estimated coefficient is statistically significant at the one percent level. Thus, as hypothesized, the more politically stable a nation is, the greater the inducements for and the better the environment for economic activities (such as entrepreneurial ventures and investment in new plant and equipment) that enhance real per capita economic growth.

Next, as hypothesized, the higher the nominal long term interest rate, whose coefficient is negative and statistically significant at the one percent level, the slower the economic growth rate. Thus, based on the results in (5), it appears that a higher  $INTRATE$  can be expected to reduce investment in new plant and equipment (reduce capital formation outlays) and household purchases of new housing and other durables, thereby resulting in less economic growth, *ceteris paribus* (Carlson and Spencer, 1975; Cebula, 1978, 1995; Barro, 1997; Dawson, 1998; Nelson and Singh, 1998; Ogbokor, 2005; Gwartney, Holcombe, and Lawson, 2006; Arora and Vamvakidis, 2006; Contessi, 2008; Chen, 2009; Dube, 2009).

According to the findings summarized in (5), the coefficient on variable  $DEFY$  is negative and statistically significant at the one percent level. This result implies, as

hypothesized, that the greater the ratio of the central government budget deficit to GDP, the lower the rate of real per capita economic growth will be, *ceteris paribus* (Carlson and Spencer, 1975; Cebula, 1978, 1995; Ogbokor, 2005; Arora, and Vamvakidis, 2006; Contessi, 2008; Chen, 2009; Dube, 2009). This outcome can be regarded as a manifestation of crowding out (Carlson and Spencer, 1975, Cebula, 1978).

The estimated coefficient on the *G8DUMMY* variable is positive and statistically significant at the one percent level, a result that presumably reflects the infrastructure, educational, technological, and other advantages enjoyed by G8 nations vis-à-vis other OECD nations. The estimated coefficient on the *TREND* variable is negative but not statistically significant at the ten percent level. Given the study period (2005-2007), the negative coefficient on *TREND* could be viewed, albeit statistically insignificant, as a precursor to the Global recession that arguably began in late 2007.

Finally, the estimated coefficient on the financial freedom variable (*FINFREE*) is positive, as hypothesized, and statistically significant at beyond the two percent level. Thus, there is strong evidence that higher levels of financial freedom act to significantly promote increased real per capita income growth. In principle, this finding is compatible with previous findings of a positive impact of economic freedom on economic growth (Tortensson, 1994; Ali, 1997; Nelson and Singh, 1998; Norton, 1998; Dawson, 1998, 2003; Cole, 2003; Gwartney, Holcombe, and Lawson, 2006)

As appealing and reasonable as this conclusion may be, this study treats this finding as preliminary. Further work on the issue at hand may be warranted. For example, the dependent variable reflecting real economic growth per capita, *log RPCYpppjt*, is treated in the panel data model as contemporaneous with the nominal long term interest rate,



$INTRATE_{jt}$ , as well as with the budget deficit variable,  $DEFY_{jt}$ . Applying the Hausman (1982) specification test, empirical evidence of a simultaneity issue was found to exist between  $\log RPCY_{ppj}$  on the one hand and both  $INTRATE_{jt}$  and  $DEFY_{jt}$  on the other hand. Accordingly, within the context of the Random Effects Model, the system is now estimated by P2SLS, with the instruments being the one-year lag of the natural log of the unemployment rate,  $\log UR_{jt-1}$  (OECD, 2010, Table 2) and the one-year lag of the level of the purchasing-power-parity adjusted per capita real GDP,  $RPCY_{ppj,t-1}$  (IMF, 2008, Table 1). Variable  $\log UR_{jt-1}$  was chosen as an instrument because it was highly correlated with the budget deficit variable ( $DEFY_{jt}$ ) while not being correlated with the error terms in the system;  $RPCY_{ppj,t-1}$  was chosen as the other instrument because it was highly correlated with the interest rate variable ( $INTRATE_{jt}$ ) while not being correlated with the error terms in the system.

The P2SLS estimate of semi-log equation (4) is provided in equation (6):

$$\begin{aligned} \log RPCY_{ppj} = & 6.88 + 0.008 FINFREE_{jt} - 0.102 DEFY_{jt} - 0.364 INTRATE_{jt} \\ & (+2.88) \qquad \qquad (-2.02) \qquad \qquad (-2.42) \\ & - 0.223 POLSTAB_{jt} + 0.374 G8DUMMY_{jt} - 0.118 TREND, F = 7.35 \quad (6) \\ & (-0.60) \qquad \qquad (+2.39) \qquad \qquad (-0.99) \end{aligned}$$

In this estimation, four of the five estimated coefficients on the explanatory (non-trend) variables exhibit the expected signs, with the estimated coefficient for one of the explanatory variables ( $FINFREE$ ) being statistically significant at the one percent level, the estimated coefficients on two of the explanatory variables ( $INTRATE$  and  $G8DUMMY$ ) being statistically significant at the two percent level, and the estimated coefficient for another explanatory variable ( $DEFY$ ) being statistically significant at

beyond the five percent level. Unlike the PLS results in equation (5), the estimated coefficient for the *POLSTAB* variable is not statistically significant at the ten percent level. Once again, the trend variable is found to be statistically significant at the ten percent level.

Thus, except for the case of the *POLSTAB* variable, the P2SLS findings in (6) can be regarded as an affirmation of the robustness of the results in equation (5). As for the influence of financial freedom on economic growth, based on the results in (5) and (6), a one unit increase in the property right freedom index for a nation, *ceteris paribus*, can be expected to lead to an increase of between 0.4 and 0.8 percent in the annual growth rate of real per capita income, measured here in terms of  $\log RPCY_{ppjt}$ . Clearly, this finding is resilient whether using the PLS or P2SLS estimation technique.

#### IV. OVERVIEW AND CONCLUSION

As a central part of its economic and political policy efforts in the economic climate of recent years and within the post-9-11 landscape, the OECD (2009A; 2009B) strongly takes the position that governments must be very cautious not to jeopardize economic freedom as they seek ways in which to strengthen and revitalize their economies. In other words, nations must strive to support and promote economic freedom (OECD, 2009A; 2009B). A major concern in this context is that the abandonment of economic freedoms will result over time in *diminished* real economic growth.

To the degree that financial freedom can be viewed as a proxy for economic freedom, the PLS and P2SLS estimations provided in this study constitute empirical support for this “official” OECD perspective. More specifically, this study investigates the impact of financial freedom on real per capita income growth. The study adopts a three-year panel

data set for the OECD nations for the period 2005-2007. Estimation by both PLS and P2SLS yields consistent results, albeit perhaps preliminary results, indicating that higher levels of financial freedom promote greater real per capita income growth. Thus, these PLS and P2SLS findings can be interpreted as implying that pursuing a set of policies that promotes or is at least consistent with *greater* financial freedom appears compatible with helping to propel the economies of the OECD in general (including that of the U.S.) on to the road to a full and sustainable economic recovery.

It would seem that policymakers would be wise to be very careful and circumspect when considering initiatives involving financial regulation/re-regulation and financial reform and heed the words of the OECD Secretary-General Angel Gurría (OECD, 2009A, p.1), who has stressed that “We must ensure that today’s policies to manage the crisis not be the source of tomorrow’s problems...” Furthermore, since both the PLS and P2SLS estimates in this study find that higher nominal long term interest rates as well as larger government budget deficits reduce economic growth, it would seem that policymakers might consider the wisdom of keeping budget deficits under control and pursuing other policies consistent with keeping nominal long term interest rate levels low.

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Table 1. Descriptive Statistics		
Variable	Mean	Standard Deviation
<i>log RPCYpppjt</i>	10.199	0.3769
<i>FINFREE</i>	70.000	17.144
<i>DEFY</i>	2.1	4.72
<i>INTRATE</i>	4.804	2.239
<i>G8DUMMY</i>	0.2414	0.4298
<i>POLSTAB</i>	0.771	0.533
<i>UR</i>	6.664	3.273

Table 2. Correlation Matrix for Basic Model Explanatory Variables					
	<i>FINFREE</i>	<i>DEFY</i>	<i>INTRATE</i>	<i>POLSTAB</i>	<i>G8DUMMY</i>
<i>FINFREE</i>	1.0				
<i>DEFY</i>	-0.078	1.0			
<i>INTRATE</i>	0.106	-0.093	1.0		
<i>POLSTAB</i>	0.197	-0.459	0.008	1.0	
<i>G8DUMMY</i>	-0.253	0.300	-0.188	-0.338	1.00

**Market Reaction to Interstate Banking: Re-examining the Gains from  
Increased Geographic Mobility for Acquiring and Target Banks**

**M. Andrew Fields**

Associate Professor  
Department of Finance  
University of Delaware  
[fieldsa@udel.edu](mailto:fieldsa@udel.edu)

**Breck L. Robinson**

Associate Professor  
School of Public Policy and Administration  
University of Delaware  
[robinsob@udel.edu](mailto:robinsob@udel.edu)

### **Abstract**

The passage of national interstate banking legislation by the United States Congress in 1994 eliminated state-imposed restrictions on geographic mobility and caused a positive market reaction for bank stocks. As noted in previous research, target banks are positively affected by interstate banking legislation since geographic mobility increases the number of potential bidders. This article re-examines the security price reaction of commercial banks during the passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act and finds that potential acquirers responded more favorably than potential targets. More importantly, banks from the largest asset group substantially outperformed the lower two-thirds of the sample, and large banks with pre-existing interstate affiliations responded the most favorably. These are the banks that are most able to take advantage of the opportunities for increased geographic mobility to establish a regional or national presence by acquiring and consolidating other banks. Regression results indicate that market reaction to the Interstate Banking and Branching Efficiency Act is positively related to bank size, but negatively related to bank ROA and capitalization ratios. These are characteristics consistent with acquirers and targets respectively.

### **INTRODUCTION**

After years of debate, the United States Congress removed many of the barriers impeding geographic mobility within the banking industry through the passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 (IBBEA). No longer would decisions regarding the interstate movement of banks be left primarily to the states. Instead, the federal government would provide banks with the opportunity to exercise a truly national presence. A number of states had passed some form of interstate



legislation allowing out of state acquisitions by the time that IBBEA was enacted, and a number of studies show very positive bank stock reaction to these new laws. However, as Black, Fields and Schweitzer (1990) note, many of the regional compacts were structured by the member states so that there were some banks able to benefit and some that were excluded initially. Thus, IBBEA continued the process of loosening regulation begun by the states. In addition, IBBEA extended new powers to banks that had been denied in prior legislation, such as the ability to consolidate interstate subsidiaries. For example, the top 100 bank holding companies reduced their subsidiaries by more than twenty-five percent in the six months following implementation of the act (Gold, 1997). Therefore, IBBEA benefited the banking system by expanding the market for corporate control and by allowing interstate consolidation.

Interstate branching was allowed by several states prior to IBBEA; however, the need for reciprocity rendered this ability to a minor role in interstate activity. Even after the passage of IBBEA, this option was rendered relatively ineffective given that interstate branching still requires reciprocity and many states have preferred that entry occur through acquisition. In a recent review, Johnson and Rice (2008) survey the past decade of interstate branching and conclude that, “states that were opposed to entry used IBBEA to erect barriers...” Therefore, bank stock reaction to the passage of IBBEA is attributable to factors that arise from the market for corporate control. As a result, market reaction to interstate banking legislation should reflect a bank’s potential benefits as either an acquirer or a target.

Certainly, many opportunities that arise from the relaxation of restrictions on the market for corporate control would allow acquirers to take full advantage of scale and scope

economies available from their acquisitions. Under IBBEA, bank holding companies are allowed to acquire institutions in another state regardless of previously existing state law. In addition, the act authorizes subsidiaries of bank holding companies in another state to perform certain bank functions without legally being considered a branch. Such agency operations include receiving deposits, renewing time deposits, closing loans, servicing loans, and receiving payments. Another feature of IBBEA allows bank holding companies operating subsidiaries in more than one state to consolidate these separate banks into one bank with many branches. The elimination of overlapping compliance costs should reduce expenses since each subsidiary of a holding company is required to have a separate board of directors, separate reports to regulators, separately audited financial statements, and separate regulatory examinations. Thus, these expenses have no productive purpose.

Two recent studies find that the passage of IBBEA had a tremendously positive impact on bank market values, especially those banks considered to be potential takeover targets. Carow and Heron (1998; hereafter CH), in a study that considers market reactions on key legislative dates, conclude that likely acquisition targets exhibit the largest positive reactions to IBBEA. In a more extensive study that considers the entire legislative period, Brook, Hendershott, and Lee (1998: hereafter BHL) report a significant equity market response for a sample of bank stocks to the legislation as well. They conclude that their results are consistent with an active market for corporate control; that poorly performing banks respond favorably to the prospect of market discipline being enhanced with the relaxation of restrictions on geographic mobility. They also find that banks with entrenched management were less affected by the change in regulatory environment

associated with the passage of IBBEA since they remained insulated from market disciplining mechanisms.

BHL note that gains to the banking industry from the removal of restrictions on interstate banking may have been an increase of more than \$85 billion in equity value. But, it is difficult to determine if the market reaction is solely attributable to target banks receiving the benefits of a wider pool of potential buyer banks, or substantial efficiency gains from other features of IBBEA, such as consolidation providing economies of scale and scope that would be shared by buyer and target banks, or a combination of these factors.

Results presented here do not refute the major conclusion of these two studies. Potential target banks do respond favorably to the loosening of restrictions in the market for corporate control. However, these earlier studies miss an important part of the picture by not focusing on the major impact of IBBEA. Banks positioned to enhance their national or regional presence through the opportunities created with the relaxation of restrictions on geographic mobility were the most positively affected during the passage of this act. Potential acquirers respond more favorably to the passage of IBBEA when compared to those banks that were likely to be acquired.

This article re-examines the security price reaction of commercial banks to the passage of IBBEA. Results show that bank stocks in general responded very favorably to the legislation. Potential target banks are positively affected since geographic mobility increases the number of potential bidders and potential acquirers are positively affected since these are the banks that are most able to take advantage of the opportunities for increased geographic mobility. However, potential acquirers responded more favorably than potential targets. As a matter of fact, banks from the largest third substantially

outperformed the lower two-thirds of the sample, and large banks with pre-existing interstate affiliations responded the most favorably to IBBEA. Consistent with previous work, factors that detract from the appeal of a target bank, including an entrenched management or being located in a state with limited branching opportunities, reduce its market reaction. Factors that enhance a target's attractiveness, such as a poorly performing bank, a bank with a higher concentration of outside blockholders, or a small bank located in a less competitive state that offers an attractive market for entry, increase its market reaction.

Even if issues related to corporate control are the sole source of benefits to the banking industry, it is an important result since previous research focusing on non-financial firms clearly indicates that the bidder's share of the gains during a takeover is modest if they even exist at all. Thus, the finding that potential acquiring firms capture the vast majority of the gains from this legislation provides an interesting insight into the benefits from an active market for corporate control and the impact of legislative restrictions on the respective gains of bidders and targets.

The remainder of the paper is organized in the following manner. Section I describes the legislative history of IBBEA and Section II discusses related research and presents the research hypotheses. Section III describes the sample and empirical methods employed. Section IV provides an analysis of the results and Section V presents a summary.

## I. LEGISLATIVE HISTORY of IBBEA

The Clinton administration indicated that interstate banking legislation was a high priority in the fall of 1993. On February 1, 1994, a United States House Subcommittee favorably reported an interstate banking bill to the House Banking Committee. Two days

later, Senator Dodd of Connecticut, a major opponent of interstate banking, announced that he would no longer insist on insurance provisions being included in the legislation. Shortly thereafter, Chairman Neal and members of the Banking Committee introduced H.R. 3841 into the House of Representatives. (Key legislative events are summarized in Table I.)

In late February, the Senate Banking Committee unanimously voted in favor of interstate banking and reported the bill to the full Senate with a recommendation for passage. On March 9, the House Banking Committee also voted in favor of interstate banking, and, on March 22, the bill passed the House. The bill was expected to face a fight in the Senate where the procedural rules work to the benefit of opponents. The Senate began debate and, on April 26 passed its version of the bill. However, the Senate version of the bill emerged with several important differences, thus, the issues were sent to the Conference Committee for consideration.

One serious difference concerned the applicability of state laws to out-of-state national banks. The House version recommended that these banks be subjected to state regulation and the Senate version favored national control being placed with the Comptroller of the Currency. In mid-June, American Banker indicated that a number of the most difficult issues had been settled, and the House-Senate Conference Committee reported its final version of the Interstate Banking and Branching Efficiency Act on July 25. Compromise language accepted by the Committee favored state regulation. The House of Representatives accepted the Committee report and passed the act on August 4. The Senate passed IBBEA on September 13, and President Clinton signed H.R. 3841 into law on September 29.

## II. LITERATURE REVIEW

Many authors have researched the benefits associated with greater geographic mobility for financial institutions. Benefits from interstate banking range from increased economies of scale [Hunter, Timme and Yang (1990); Berger and Humphrey (1992); Shaffer (1993); and McAllister and McManus (1993)] to an increased market for corporate control [James and Weir (1987); and Cornett and De (1991)]. This section establishes the framework through which to explain the reaction of banks to the reduction in geographic barriers in banking and uses it to develop six research hypotheses.

### A. *Interstate Banking Legislation*

Two recent papers have explored the impact of IBBEA on the banking industry. Carow and Heron (1998) use a sample of 180 banks that are equally divided between those with and without interstate affiliation. A seemingly unrelated regression model (SUR) is used to explore the market's reaction to IBBEA on key legislative dates as the bill progressed through the House and Senate. The results of the SUR model indicate that the market viewed the passage of IBBEA as a positive event for the banks in the sample. Cross-sectional results show that banks with characteristics consistent with a potential target (lower profitability and lower capitalization) were the largest benefactors from the passage of IBBEA. The authors report that there is a stronger response from banks in states without interstate branching provisions prior to IBBEA and interpret this result as an indication that de novo entry is the strongest provision of the act. However, as noted previously, given the deference to state law, this has not been the case. The authors also find that banks without interstate affiliations responded more favorably. CH concludes

that the major impact of interstate banking occurred with the passage of state legislation in the 1980's.

Brook, Hendershott and Lee (1997) measure the market response to IBBEA over the entire legislative period, and estimate that the legislation created a \$59 billion increase in the market values of the banks in their sample. Results indicate that poorly performing banks and banks with managers that are not entrenched respond most favorably to IBBEA. This suggests that the loosening of restrictions on corporate control activities allows the market to function properly to discipline poor managers or to reflect the probability of a successful takeover in banks with low levels of entrenchment. An entrenched management continues to impede the possibility of takeover and is measured by higher inside ownership, lower outside block ownership, and less independent boards of directors.

Several other studies measure the impact of legislation that liberalizes the geographic expansion of banks on shareholders. Results indicate that the market values geographic mobility for commercial banks. Black, Fields, and Schweitzer (1990) analyze the impact of state-initiated interstate banking legislation for a sample of money center and super-regional banks. The regional banks in the sample reacted positively, while money center banks reacted negatively to state legislation. Many states joined into regional compacts, such as in New England, exchanging reciprocity with other states in the region while avoiding California, Illinois, and New York. The authors conclude that state initiated interstate banking legislation effectively put money center banks at a disadvantage when compared to their regional competitors. In a recent study, Carow and Lee (1997) also conclude that deregulation of interstate banking is beneficial to the industry, but money

center banks appeared to be excluded from receiving these benefits. Billingsley and Lamy (1992) report that banks located in states with reciprocity agreements tend to benefit more from the Supreme Court's decision allowing reciprocal agreements. They conclude that target banks that are larger in size are the beneficiaries of more liberalized geographic mobility. These studies provide evidence that state legislation positively impacted potential bidder banks. However, Goldberg, Hanweck, and Sugrue (1992) find that banks located in states that pass reciprocal agreements do not receive significant price appreciation from easing restrictions on interstate movements; however, banks located in reciprocal states do experience significant price appreciation. The authors conclude that the positive market reaction is associated with an increase in the number of potential acquirers.

Although previous results are not in complete agreement on the issue, there is ample evidence that interstate banking legislation should elicit a significant response from a much broader cross-section of banks than potential targets.

Hypothesis I: The passage of IBBEA should cause an increase in the market value of a broader cross-section of banks than potential targets, such as larger banks being able to take advantage of the relaxation of restrictions on the market for corporate control to enhance their regional or national presence.

#### *B. Bidders and Targets*

One year following the passage of IBBEA, banks were allowed to engage in acquisitions anywhere in the country, regardless of current state legislation. This allows bidders to capture the benefits associated with increasing size (scale economies, technology, and diversification), while target banks will be able to extract larger acquisition premiums



from an expanded pool of bidders. Thus, the passage of IBBEA should create opportunities for both bidder and target banks. Specifically, the elimination of geographic barriers to mobility will cause higher performing banks to seek out underperforming banks as potential targets.

Previous studies clearly show that target shareholders receive significant positive returns upon the announcement of an acquisition. However, the impact of an acquisition on acquiring shareholders is less than conclusive. Several studies report that bidding firms have a positive market reaction to acquisition announcements [Lobue (1984); Desai and Stover (1985); James and Weir (1987); and Cornett and De (1991)]. However, other studies have found insignificant or negative returns as a result of an announcement [Neely (1987); Trifts and Scanlon (1987); Allen and Cebenoyan (1991); and Baradwaj, Dubofsky, and Fraser (1992)].

The interstate banking literature provides some insight concerning the market reaction of potential bidders to the passage of IBBEA. For example, Black, Fields and Schweitzer (1990) use a sample of large super-regional banks that were in position to derive benefits from increased geographic mobility. In a study of savings and loan associations, Fraser, Hooton, Kolari, and Reising (1997) suggest that IBBEA benefits large institutions without removing the ability of smaller institutions to compete. Specifically, larger banks should be more positively affected by the passage of IBBEA as a result of the removal of barriers.

Three studies measure the impact of state legislation on banks that were subsequent targets and acquirers in interstate transactions [Black, Fields, and Schweitzer (1996); Carow and Lee (1997); and Cornett and De (1991)]. All three studies find positive,

significant market reactions for the shareholders of potential target banks at the time of the passage of the legislation. Black et al and Carow and Lee both report a significant increase for acquirers, whereas Cornett and De do not. However, the latter tested the market reaction of the acquirer to the passage of legislation in the home state of its target, rather than its own state.

There have been a number of studies that consider the common characteristics of acquisition targets and develop target firm predication models, including Simkowitz and Monroe (1971) and Stevens (1973), and continuing with Wansley, Roenfeldt, and Cooley (1983); Carlton, Guilkey, Harris, and Stewart (1983); Palepu (1986); and Ambrose and Megginson (1992). Potential target firms should exhibit a greater reaction to legislation than other banks, if targets are the prime beneficiaries of the changes. All of the models mentioned above include a measure of size. For obvious reasons, smaller firms are more likely targets. Thus, evidence of a relationship between market reaction and size should provide evidence concerning the relative benefits of IBBEA to bidders or targets. Neither CH nor BHL find size to be a significant factor in their studies.

Hypothesis II: If the passage of IBBEA is of primary benefit to target (bidder) banks, there should be an inverse (direct) relationship between bank asset size and the market reaction.

If potential targets exhibit a favorable market reaction to IBBEA, then the specific characteristics that reflect the bank's acquisition attractiveness should exhibit a significant relationship with its market reaction. One indication of attractiveness results from the potential gain in efficiency to the bidder from acquiring an inefficient target bank. Acquirers search for banks with a poor return on asset ratio since these banks

provide the greatest potential for increased profitability. Several studies have shown that targets are, in fact, less profitable than acquirers [Amel and Rhoades (1989); and Rose (1991)]. If IBBEA eliminates constraints on mobility and increases the pool of potential bidders, then the most attractive targets will be less profitable banks. CH report a negative relationship between the market response to IBBEA and ROA, and BHL find a similar result for ROE.

Adequate capital also is needed in order to receive regulatory approval to acquire another bank. Banks with low capitalization ratios will be prohibited from being a bidder and in the worst cases, will be actively marketed for sale to another bank. Several studies including Beatty, Santomero, and Smirlock (1987), and Hannan and Rhoades (1987) provide evidence that acquired firms tend to have lower capitalization ratios. As a result, the passage of IBBEA will increase the number of potential bidders for those banks with low capitalization ratios. CH find a negative relationship between the market response to IBBEA and the capital ratio.

It has been noted in the literature that a firm's security price provides a signal of the market's evaluation of management's long-term performance [Manne (1965)]. If a firm is not performing well in the marketplace its share price will decline and this will create an incentive for more competent managers to acquire control of the firm. The q-ratio is often used as a proxy for prior poor performance, and Hasbrouck (1985), and Lang, Stulz, and Walkling (1989) show that firms with lower q-ratios are more likely to be takeover targets. BHL construct a q-ratio and apply it to their sample of banks. The authors define it as (total assets plus market value of equity less book value of equity) divided by (total assets plus market value of investment securities less book value of investment

securities). A similar variable to this definition of  $q$  is the market-to-book ratio that is quite often mentioned as an important measure in the acquisition attractiveness of a bank. Trade publications often cite a high market-to-book ratio as an impediment to a takeover proposal. Carleton, Guilkey, Harris, and Stewart (1983), in a study of industrial firms, find that firms with low market-to-book ratios are appealing takeover targets.

Brook, Hendershott, and Lee find an inverse relationship between management entrenchment and the market reaction to IBBEA, with inside ownership exhibiting a negative relationship and outside block ownership displaying a positive relationship. Higher levels of inside ownership make it increasingly difficult for a successful offer to take place without management's consent, thus insulating management from the market for corporate control. Stulz (1988), Mikkelson and Partch (1989), and Song and Walkling (1993) all report a negative relationship between inside ownership and the probability of a successful takeover. Also, Stulz (1988) shows that there is a positive relationship between inside ownership and the cost of the takeover to the acquirer. Also, it has been argued that large blockholders can be used as a mechanism to initiate takeovers. Shleifer and Vishny (1986) hypothesize that large blockholders have enough voting power to increase the likelihood of acquirer success without the corresponding increase in merger premium. Large blockholders are willing to vote for a change in ownership when such a change will cause an increase in firm value.

Hypothesis III: Banks that are potential targets will benefit from the passage of IBBEA.

A smaller bank is more likely to be a potential target if it:

- a.) is less profitable,
- b.) has a lower capital ratio,
- c.) has poor prior performance relative to its competitors, and

d.) has less entrenched management with 1) lower inside ownership and/or 2) a higher concentration of outside blockholders.

*C. State Regulatory Environments:*

With the passage of IBBEA, some of the legislation in place that restricts mobility for banks will be eliminated, notably regional compacts. However, the banking and competitive environment within a given state may provide some clues regarding the survivability of a specific bank or the desirability of a specific state. Although IBBEA may not have a specific impact on the banking laws within these states, the banking laws may provide some indication as to how banks within that state will be able to respond to the opportunities that are created from IBBEA.

As noted, Black, Fields and Schweitzer (1990, 1996), Carow and Lee (1997), Billingsley and Lamy (1992) and Goldberg, Hanweck and Sugrue (1992) argue that a reduction in the restrictions on geographic mobility results in a favorable market reaction to those banks located in states with the most restrictive banking environments. Specifically, those banks located in states with only regional reciprocal agreements prior to IBBEA are most likely to benefit. It has been postulated that IBBEA will provide opportunities by increasing the number of potential targets and bidders for all banks, but especially those banks located in the most restrictive banking environments where the market for corporate control had been restricted previously.

IBBEA also provides an opportunity for banks to allow interstate branch banking. Interstate branch banking allows banks to convert their non-branch organizations into a single bank with many branches. The ability to consolidate banks into branches has been viewed as a beneficial result of IBBEA due to the bank's ability to eliminate costs associated with redundancy in organizational structures, such as separate corporate

boards, along with the booking of transactions and negotiating contracts [Kane (1996)]. Carow and Heron (1998) argue that banks headquartered in a group of seven states that previously allowed for interstate branching prior to IBBEA are less likely to benefit from the interstate branching provision of IBBEA for they have already been afforded the opportunity to branch. However, Calem (1994) dismisses the impact of state sponsored interstate branching legislation for the banks' ability to actually take advantage of the opportunity to branch was not available. He cites legislation in Nevada that permitted out-of-state branching only into counties where the population was less than 100,00 persons, effectively eliminating any incentive for an out-of-state bank to branch on a de novo basis. The remaining six states allowed interstate branching but required reciprocity, which effectively eliminated at least the other 43 states that did not allow out-of-state branching and maybe eliminated some states that did allow de novo interstate branching. As a result, there should be little difference in stock price reaction for those banks headquartered in the seven states that initiated interstate branching legislation prior to the passage of IBBEA.

It has been argued that laws regulating geographic mobility within a state could cause differences in asset size, efficiency and the ability of the market to impose discipline [Jayaratne and Strahan (1997)]. Beatty, Reim and Schapperle (1985) state two competing views on how the loosening of geographic barriers could impact bank merger premiums. One scenario states that lower restrictions on geographic mobility could cause an increase in market premiums as the number of potential acquirers increase for a fixed supply of targets. The other alternative is that geographic barriers provide a protective barrier that allows the target bank to extract larger merger premiums from potential acquirers. Carow

and Lee (1998) state that although IBBEA does not explicitly impact intrastate branching laws, they conclude that firms headquartered in states with more restrictive branching laws benefit more from IBBEA.

It is expected that interstate banking and branching legislation will also increase the level of competition in all states once banks have the ability to enter markets that had barred entry. Previously, the discussion surrounding how the benefits of interstate banking legislation will be allocated in competitive markets were framed to weigh the negative impact of increased competition versus the benefits associated with increased geographic expansion. The banking literature seems to provide evidence that the benefits associated with interstate banking legislation outweigh its costs [Black, Fields and Schweitzer (1990), Goldberg, Hanweck and Sugrue (1992), Carow and Lee (1997)]. BHL find that banks headquartered in states that are considered less competitive tend to experience more price appreciation following IBBEA. The authors conclude that acquirers would tend to shy away from targets that reside in more competitive markets.

Hypothesis IV: Banks located in states that have 1) lower levels of competition, 2) more restrictive requirements for out-of-state acquisitions, or 3) more liberal branching laws will derive the greatest benefits from the passage of IBBEA.

Hypothesis V: Banks located in states that have initiated interstate branching legislation should not benefit more/or less than banks located in states that have not.

#### *D. Interstate Affiliation:*

One of the benefits associated with the passage of IBBEA is the ability to consolidate interstate banking operations into a single bank. As stated earlier, Kane (1996) outlines the benefits of this provision of IBBEA namely the ability to eliminate redundancy in

organizational costs, such as separate corporate boards, reduced costs from booking transactions and negotiating contracts. BHL attempt to measure the benefits of the interstate branching provision by identifying those banks that have offices in more than one state and by determining each bank's average branch size in assets. Both variables were found to be insignificant in explaining the market's reaction to bank stocks. CH use the percentage of assets that each bank holds outside of its home state as a variable to identify the primary beneficiaries of interstate banking and branching. CH find that there is a negative relationship between the percentage of assets out of state and the market reaction to IBBEA. The authors conclude,

“To the extent that a bank's existing interstate presence is indicative of an increased propensity to engage in future acquisitions, the significantly negative coefficient on this variable provides further evidence that probable acquisition targets experienced significantly higher returns as the IBBEA moved through the legislative process.” [Carow and Heron (1998, p. 193)]

Another variable that provides insight into the ability to consolidate interstate operations is to measure the percentage of banking organizations held outside the bank's home state. It would be expected that if interstate branching provided real cost savings through the elimination of redundancy in operations, those banks with the most extensive duplication of corporate structures from out-of-state operations should experience the largest security price increase.

Hypothesis VI: Banks that have a larger out-of-state presence are more likely to experience a positive market reaction to the passage of IBBEA, due to their ability to consolidate operations, when compared to banks that do not have established interstate affiliations.



### III. DATA and METHODS

#### A. *Data*

All banks listed on the NYSE, AMEX, or NASDAQ exchanges that have daily stock returns available in the Center for Research in Security Prices database from May 1993 through October 1994 are included in this study. The final sample contains 259 banks. Bank financial information, including total assets, the return on asset ratio, the capital-to-asset ratio, and the market-to-book ratio are obtained from Compustat for each bank in the sample.

Additional sources are used to determine other classifications used in the analysis. The Federal Reserve Bulletin provides information concerning the type of interstate compact existing in each state. States are segmented into compacts that include regional reciprocal, national-reciprocal, and national-non-reciprocal provisions. The Federal Reserve Bulletin was also used to determine the intrastate branching restrictions for each state.

Rhoades (1996) documents those banks that were the most active acquirers from 1980-1994. This list is used to provide a representative sample of potential bidders. Banks that were subsequently acquired following the passage of IBBEA are listed as potential targets. The list of super-regional banks is provided by BHL. The Deposit Insurance Corporation Call and Income (Call Reports) database was used to acquire information on interstate affiliation based on banking offices (or assets) located outside the bank's home state. Also, aggregate asset size data was obtained from the Call Reports for each state in order to create the competition variable. The Call Reports also provided the book and market value of investment securities. These variables were combined with Compustat

information to create the q-ratio. Compact Disclosure provided managerial ownership and outside block ownership information.

### *B. Methods*

Several methods are applied to evaluate the market reaction for the sample during the IBBEA legislative period, including a market model regression and cross-sectional regression of the event study residuals. It is important to note that both CH and BHL provide excellent discussions of event study methods applied to the passage of IBBEA, and present significant results from a number of short two-day event windows. Since previous work has established the significance of the overall event, it is not necessary to provide that background information here. Replicating the methods from the other studies provides similar results.

The market model is used to measure the stock price reaction of the banks in the sample to the passage of IBBEA during the 107-day legislative period, cumulative abnormal returns (CARs) are calculated beginning on March 11<sup>th</sup> and ending on July 26<sup>th</sup>. The event window begins one day following the House Committee Passage of a version of IBBEA and ends one day after the Conference Committee's reports that the final version of IBBEA has been sent to both houses of Congress. This event window is used to calculate cumulative abnormal returns that will be used in the cross-sectional model, because much of the uncertainty concerning IBBEA had been resolved with the passage of the Conference Committee's report. The market model consists of a single factor

framework that incorporates a market index comprised of the CRSP equal-weighted index.<sup>3</sup> A 150-day estimation period is used to establish the market model parameters.

The abnormal return ( $AR_{it}$ ) for firm  $i$  on day  $t$  is defined as:

$$AR_{it} = R_{it} - (\alpha_i + \beta_{1i}R_{mt}), \quad (2)$$

where:

$R_{it}$ : = the return for firm  $i$  on day  $t$  during the event period;

$R_{mt}$ : = the market return for the CRSP equal-weighted index on day  $t$ ; and

$\alpha, \beta$  = the estimated market model coefficients from the estimation period.

A series of cross-sectional regressions are employed to determine if the banks in the sample reacted to the passage of IBBEA according to the hypotheses presented in Section II. The dependent variable is the cumulative abnormal return for the 107-day event window calculated by the single factor market model. Independent variables include asset size, the return on asset ratio and the capital-to-asset ratio, managerial ownership, block ownership, market-to-book ratio, q-ratio, interstate affiliation and a series of dummy variables (active acquirers, potential targets, branching environment and states' competitive environment). All of the independent variables in the model are based on year-end 1993 information. The model is expressed as:

$$CAR_T = \alpha_0 + \beta_1 \text{Target} + \beta_2 \text{Acquirer} + \beta_3 \text{Size} + \beta_4 \text{ROA} + \beta_5 \text{Capital Ratio} + \beta_6 \text{Managerial Ownership} + \beta_7 \text{Block Ownership} + \beta_8 \text{Q} + \beta_9 \text{Market to Book} +$$

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<sup>3</sup> Consistent with Stone (1974), Lloyd and Shick (1977), and BHL, an interest rate index comprised of the 10-year U.S. Treasury Bond rate was included in the model. However, the single factor model is presented in the paper since the results do not change when the interest rate index is included in the market model.

$$\beta_{10}\text{Limit} + \beta_{11}\text{Less Competitive} + \beta_{12}\text{Interstate Affiliations} + \varepsilon$$

(3)

where:

$CAR_T$  = cumulative abnormal return for each bank during the legislative period T;

Target = categorical dummy variable equal to 1 if the bank was acquired subsequent to the passage of IBBEA, but prior to December 1995 and 0 otherwise;

Acquirer = categorical dummy variable equal to 1 if the bank was listed as an active acquirer during the 14 year period prior to the passage of IBBEA and 0 otherwise;

Size = the log of bank assets at the end of 1993 calendar year;

ROA = bank return on assets at the end of 1993;

Capital Ratio = bank capital-to-asset ratio at the end of 1993;

Q-ratio = q-ratio as defined by BHL;

Market-to-Book = bank market-to-book ratio at the end of 1993;

Mngt. Ownership = number of shares owned or controlled by management divided by the total number of shares outstanding;

Block Ownership = number of shares held by unaffiliated owners with 5% or more shares outstanding divided by the total number of shares outstanding;

Limit = categorical dummy variable equal to 1 if the bank is headquartered in a state that does not allow unrestricted intrastate branching and 0 otherwise;

Less Competitive = categorical dummy variable equal to 1 if the bank is from the lower half of home state market share percentage and from a less competitive states (defined as a state where less than three super-regional banks operate),

Interstate Affiliation = percentage of assets or the percentage of banking offices located outside the bank's home state; and

$\varepsilon$  = the residual error term.

A series of cross-sectional regressions are performed in order to isolate the specific influence of bank characteristics and operating environment on the bank reaction to the passage of IBBEA.<sup>4</sup>

#### IV. EMPIRICAL RESULTS

##### A. *Cumulative Abnormal Returns*

Table II provides the cumulative abnormal returns for the periods leading to the 1<sup>st</sup> House Passage, 1<sup>st</sup> Senate Passage, Conference Committee Report, and all three of these periods combined. There is little evidence of a reaction to the House Passage except for large banks, acquiring banks and super-regional banks. However, there is ample evidence of a significant-positive reaction during the other periods. The entire sample of banks increased by a significant (.001 level) 14.49 percent during the combined period. Every group shown in Table II responded significantly to the passage of IBBEA during the combined period except banks from states with limited branching.<sup>5</sup> However, there are significant differences between the various groups of banks in the sample. The results provide strong support for Hypothesis I, showing a significant reaction from a broader cross-section of banks than just potential targets.

Table II provides important insight into Hypothesis II as well. Bank asset size has a very important impact on market reactions. The abnormal return during the combined period for the Super –Regional banks are a significant 21.51 percent. This is the group of banks that BHL use to define a competitive state if three banks from the group are located there,

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<sup>4</sup> Several of the variables in the model are correlated. However, standard measures do not indicate a problem with multicollinearity.

<sup>5</sup> Table II notes returns that are significantly different from zero. In addition, a significant difference is noted between the returns (or the asset size) for the first entry in each grouping and all other entries.

and these banks are better described as acquirers than targets. The abnormal returns for the large bank group is a significant (at the .001 level) 23.51 percent; whereas the Medium and Small bank groups increase significantly (at the .001 and .05 levels) as well, but by only 10.95 percent and 8.91 percent respectively. The Large bank returns are significantly higher than the returns for the other two groups in all of the periods. The Acquirer group performed similarly to large banks, increasing 23.02 percent (significant at the .001 level), even more than the Target group, which earned 21.55 percent (significant at the .001 level) during the combined period. The Large, Acquirer, and Super-Regional groups have significantly higher total assets than comparison groups.

Other results of interest in Table II concern the impact of the legislative environment within a bank's home state. The cumulative abnormal returns show that banks from statewide branching states receive significantly larger cumulative abnormal returns during the combined period compared to banks located in limited branching states (15.72 percent versus 4.37 percent). This supports Hypothesis IV that banks in states with restrictive branching environments provide less opportunity for growth and are less attractive targets. This is contrary to the findings of CH. Hypothesis IV also asserts that banks in less competitive states are potential targets since less competition makes a market more attractive to a potential new entrant. Brook, Hendershott and Lee (1997) report a positive relationship between returns and banks in less competitive states.<sup>6</sup> Although the results are not significantly different, banks from less competitive states

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<sup>6</sup> Brook, Hendershott and Lee (1997) define less competitive as a combination of banks from states 1) that have fewer than three super-regionals with operations located there in 1994 and that have a Herfindal Index from the lower half of all states. Table II shows only those states with and without three super-regionals. Imposing the restriction from the Herfindal Index will be considered further in the next section.

respond more favorably to the passage of IBBEA compared to banks from more competitive states (16.82 percent versus 12.90 percent).

The final section of results presented in Table II notes that the market reaction to IBBEA for banks with interstate affiliations was significantly higher than for banks that do not have interstate affiliations (17.95 percent versus 12.80 percent). These banks also are significantly larger in size. This provides support for Hypothesis VI that asserts that banks with interstate affiliations will benefit more from the ability to consolidate operations and are the banks most able to enhance their regional or national market position. This result is contradictory to Carow and Heron (1998) who note a negative relationship between returns and interstate affiliations.

### ***B. Cross-Sectional Results***

#### **B1. Targets .vs. Acquirers**

Cross-sectional results during the legislative period and ending on the 26<sup>th</sup> of July are shown in Tables III-A and III-B.<sup>7</sup> Model 1 shows that both potential acquirers and targets benefit from the passage of IBBEA. Both coefficients are positive and significant at the .05 level. As other variables are added that relate to bidder and target characteristics, these two variables lose their significance – acquirer in Model 2 and target by Model 4. The positive result from the acquirer variable is contrary to the conclusion reached in CH that IBBEA only benefited target banks.

Hypotheses II and III are further explored in the second model, which includes variables that measure specific firm characteristics, such as size, profitability, and managerial ownership, that help identify a bank as a potential acquirer or target. Hypothesis II states that potential bidders that are larger in size will benefit substantially from the passage of

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<sup>7</sup> The coefficient for the intercept is not shown in either table, but it is significant in Model 1 only.

IBBEA. In contrast to the results from CH and BHL, the asset size coefficient is positively related to returns during the legislative period and significant at the .001 level. Hypothesis III states that potential targets are more likely to be less profitable, have a lower capital ratio, have poor prior performance, and have less entrenched management with 1) lower inside ownership and/or 2) a higher concentration of outside blockholders. Model 2 coefficients show that ROA and the Capital Ratio are negatively correlated with the CARs and significant at the .05 and .10 levels respectively. As noted, Amel and Rhoades (1987) and Rose (1991) provide evidence that banks with low profits and less capital are more likely to become takeover targets. The coefficients for managerial and block ownership are similar to those reported by BHL. Managerial ownership is negatively related to returns and significant at the .05 level. Higher ownership makes a bank a less attractive target since management is better able to block an offer. Managerial ownership is negatively related to returns and significant at the .05 level. Higher block ownership makes a bank more attractive since the blockholders can provide a monitoring role. The coefficient for block ownership is not significant; however, it does remain close to the .1 level in all of the models, and it is significant in Models 5-7. As noted previously, Hasbrouck (1985) and Lang, Stulz, and Walkling (1989) report that firms with lower q-ratios are more likely to become takeover targets because of poor performance and the need for a change of control. BHL develop a q-ratio for banks and find a negative and significant (at the .05 level) relationship between q and the market reaction to IBBEA. Model 3 uses the same variables as Model 2, but explores the Hasbrouck (1985) and Lang, Stulz, and Walkling (1989) result further by creating two new variables (High Q and Low Q) from the Q variable. BHL argue that low q firms are



attractive targets because of their poor performance. However, when segmenting the sample by HIGH Q and LOW Q, it is apparent that high q banks are reacting to IBBEA since the coefficient is significant at the .05 level. However, the LOW Q coefficient is not significant. The difference is subtle, but it appears that high performance banks are not attractive targets rather than poor performance banks making attractive targets.

Model 4 replaces the q-ratio variable with the Market-to-Book ratio. Market-to-book has been used similarly to the q-ratio in the banking literature. In fact, the BHL definition of q is very highly correlated with market-to-book and is essentially the same. The results in Model 4 show that the Market-to-Book coefficient is negative and significant (at the .001 level) and is a better measure than the BHL q-ratio. Thus, banks with lower market-to-book values are more likely to receive positive price appreciation because they are less expensive to acquire relative to their book cost. This result can be re-emphasized by examining the results presented in Table IV. Panel A considers the bottom two thirds of the sample of banks based on asset size. The results show that smaller banks with low market-to-book ratios experience a significantly larger market reaction associated with the passage of IBBEA when compared to banks with high market-to-book ratios. This result is consistent with the results found in Carelton, Guilkey, Harris, and Stewart (1983). Interestingly, banks with low market-to-book ratios tend to have larger CARs and be considerably smaller in asset size when compared to the High Market-to-Book group. Panel B examines the sample of banks from the largest asset size group to determine if the relationship between market-to-book and the market's reaction to interstate banking legislation continues to hold. The results show that large banks with low market-to-book ratios have a stronger market reaction when compared to large banks

with a high market-to-book ratio, although the difference in the market reactions between the two groups is not statistically significant. In summary, the results presented in Table IV show that banks with low market-to-book ratios are more likely to experience a stronger market reaction, which is consistent with these banks being future targets. However, the lack of distinction in the market reactions between the high and low market-to-book value groups for the sample of large banks shows that these large banks are not likely acquisition targets. Interestingly, the sample of large banks (high and low market-to-book) experience a larger market reaction when compared to those banks that come from the smallest two-thirds of the sample, including those banks that are future targets.

Based on the results presented in Table III-A (Models 2–4), banks with a lower percentage of managerial ownership experience a stronger market reaction to the passage of IBBEA. Contrary to the literature, our results show that the presence of large blockholders does not enhance the market values of the banks in the sample. Table V, Panel A shows the relationship between managerial ownership and market reaction. The results show that banks with a large percentage of managerial ownership experience a statistically smaller market reaction to interstate banking legislation. The other two groups of banks that have a lower percentage of managerial ownership have significantly larger market reactions when compared to the group of banks with the largest percentage of managerial ownership. This result is consistent with managerial entrenchment. Surprisingly, those banks that experience the smallest market reaction are the same banks that are considered to be potential targets because of their small asset size. Table V, Panel B separates the entire sample into two groups based on the presence of large

blockholders. Consistent with the literature, the presence of large blockholders increases the market's reaction for the banks in the sample. Again, those banks that have a large blockholder presence experienced the largest market reaction to interstate banking, and these banks were on average larger in asset size.

The last model to test Hypothesis III is Model 5 in Table III-B. This model segments the managerial ownership variable into three separate variables based on the percentage of managerial ownership, 0-5%, 5%-15% and over 15%. It was stated in hypothesis III that the market for corporate control can be obstructed when the level of managerial ownership becomes too high. The results show that there is a negative and significant coefficient for managerial ownership over 15%. This result is consistent with BHL. However, previous literature also has shown that there is a positive relationship between firm value and ownership, for levels of ownership between 0 and 5 percent. It is asserted that increasing levels of ownership can provide incentives to align the interest of management with those of shareholders and improve performance. This can occur until management entrenchment begins to reverse the relationship. The results from Model 5 support this. There is a positive relationship between the market response to IBBEA and ownership for banks with very low managerial ownership (0 to 5%). Perhaps banks with management interests aligned with shareholders will be more inclined to pursue the benefits provided by the passage of interstate banking legislation. The coefficient for the Managerial Ownership (5% to 15%) variable was not significant.

It is interesting to note that block ownership is positive and significant at the .01 and .05 levels in Models 5-7 when the managerial ownership variable is separated into the three

component variables noted above. This is consistent with previous work and provides additional support for Hypothesis III.

#### B2. State Environment and Interstate Affiliation

It is stated in Hypothesis IV that banks located in home states with more restrictive out-of-state acquisition agreements, with more liberal branching, or with less competition should benefit the most from interstate banking legislation. Also, Hypothesis VI states that banks with a greater out-of-state presence are more likely to experience a positive market reaction to IBBEA when compared to banks with no out-of state presence. Models 5 and 6 build upon Model 4, but remove the acquirer and target dummy variables since they were no longer significant. Three new variables are added in Model 6 to explore how the impact of the home state environment and previous interstate experience impact market reactions to IBBEA. The variables that are added to the remaining models are Limit, Less Competitive, and Interstate Affiliations. In Models 5-7, the variables from the previous models continue to hold their sign and significance. Among the new variables, both the Limit and Interstate Affiliations variables have negative and significant signs indicating that banks in statewide branching states or banks without interstate affiliations tend to benefit the most from the passage of IBBEA. The Limit variable provides evidence that banks in states with limited branching rights make less attractive targets. This result is contrary to CH. The result from the interstate affiliations variable is similar to CH, but is puzzling in light of the CARs reported previously in Table II. This discrepancy will be addressed in Model 7.

Model 6 also shows that banks located in less competitive states receive positive stock price appreciation. Again, this result is consistent with BHL. However, it is interesting

to focus more carefully on this variable. Table II shows the CARs for states with less or more than three super-regional banks with a presence in the state. The results show that banks that are located in states with fewer than three super-regionals located in the state have a stronger market reaction to IBBEA. BHL also require a state to have a Herfindahl index in the lower half of the distribution when compared to the other states in the sample to be considered less competitive. BHL argue that target banks would benefit more in a less competitive state since they offer a route of entry to an attractive or less competitive market. However, imposing the Herfindahl requirement focuses on states where there is lower concentration and smaller banks. Table V, Panel C considers the sample of banks in less competitive states separated on the basis of the Herfindahl index and it is apparent that low Herfindahl index states have smaller banks, although there is little difference in the market reactions of the two groups. Instead of focusing on market concentration within a state, it seems reasonable to assume that attractive targets in less competitive states would be smaller in size when compared to attractive targets in more competitive states. Thus, the less competitive variable used in the regressions in Table IV-B imposes the dual restriction of less than three super-regional banks and a bank from the lower half of the market share based on asset size in its home state. As noted above, the coefficient for this variable is both positive and significant at the .05 level.

Variables that are not reported in the results but were included in earlier regressions include a series of dummy variables representing the reciprocity agreement associated with interstate acquisitions for each state. Similar to the results found in CH and BHL the reciprocity variables were not found to be statistically significant. Another variable that is not included in the results, but presented in Hypothesis V identifies those banks

that are located in home states that initiated interstate branching legislation prior to the passage of IBBEA. Contrary to the results reported by CH, but similar to the conclusions reached by Calem (1994), interstate branching prior to 1994 did not provide the banks from these states any advantages relative to banks from states that did not initiate interstate branching legislation prior to IBBEA. As expected, these banks did not respond any differently to the passage of IBBEA because the states required reciprocity in order for interstate branching to take place and this ability was ineffective prior to 1994.

Hypothesis VI contends that banks with interstate affiliations are more able to take advantage of interstate banking legislation. It is expected that these banks will react more favorably to the legislation. Table II reports higher CARs for these banks. However, the coefficient for this variable is negative in Model 6, which is consistent with the results presented in CH. Table V, Panel D provides insight concerning this discrepancy. Banks with interstate affiliations are divided by asset size, those in the top third versus those in the bottom two thirds. The difference is striking. The large bank group has CARs of 24.15, whereas the returns for the small bank group are essentially zero. Thus, it appears that small banks with interstate affiliations are not viewed as capable of establishing a successful interstate presence, yet these banks do not appear to be attractive targets either. Model 7 provides a second variable to identify the larger banks with interstate affiliations and the coefficient is positive and significant at the .05 level. In the model, the interstate affiliation variable retains a negative coefficient that is statistically significant at the .001 level.

**V. SUMMARY**

After years of debate, the United States Congress removed many of the barriers impeding geographic mobility within the banking industry through the passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 (IBBEA). A number of states had passed some form of interstate legislation allowing out of state acquisitions by the time that IBBEA was enacted, and a number of studies show very positive bank stock reaction to these new laws. However, many of the regional compacts were structured by the member states so that there were some banks able to benefit and some that were excluded initially. Thus, IBBEA continued the process of loosening regulation begun by the states. In addition, it extended new powers to banks that had been denied prior to passage such as the ability to consolidate interstate subsidiaries. Therefore, IBBEA contained a number of features with the potential for a very significant impact.

Two recent studies find that the passage of IBBEA had a tremendously positive impact on bank market values, especially those banks considered to be potential takeover targets. But, it is difficult to determine if the market reaction is solely attributable to target banks receiving the benefits of a wider pool of potential buyer banks, or substantial efficiency gains from other features of IBBEA shared by buyer and target banks, or a combination of these factors. Certainly, many opportunities that arise from the relaxation of restrictions on the market for corporate control would allow acquirers to take full advantage of scale and scope economies available from their acquisitions.

Results presented here do not refute the major conclusion of these two studies. Potential target banks do respond favorably to the loosening of restrictions in the market for corporate control. However, these earlier studies miss an important part of the picture;

banks positioned to enhance their national or regional presence through the opportunities created with the relaxation of restrictions on geographic mobility were the most positively affected during the passage of this act. Potential acquirers responded more favorably even than those banks that were likely to be acquired; banks from the largest third of the sample substantially outperformed the lower two-thirds, and large banks with pre-existing interstate affiliations responded the most favorably. These are the banks that are most able to take advantage of the opportunities for increased geographic mobility by acquiring other banks. Previous research focusing on non-financial firms clearly indicates that the bidder's share of the gains during a takeover is modest if they even exist at all. Thus, the finding that potential acquiring firms capture the vast majority of the gains from this legislation provides an interesting insight into the benefits from an active market for corporate control and the impact of legislative restrictions on the respective gains of bidders and targets

Regression results indicate that bank size is positively related to the market reaction to IBBEA. At the same time, ROA and the capitalization ratio are negatively related. These are characteristics consistent with acquirers and targets respectively. In addition, factors that detract from a target's appeal, such as an entrenched management or being located in a state with limited branching opportunities, reduced its market reaction. And, factors that enhance a target's attractiveness, such as poor performance, a higher concentration of outside blockholders, or being a small bank in a less competitive state, increased its market reaction.



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**Table I**

**Significant Dates in the Passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994**

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02/08/94	H.R. 3841 is introduced into the House of Representatives.
02/23/94	Senate Banking Committee endorses a different version of the bill ( <b>Senate Committee Pass</b> ).
03/09/94	House Banking Committee votes in favor of its interstate bill ( <b>House Committee Pass</b> ).
03/22/94	House of Representatives passes its version of the interstate banking bill ( <b>1<sup>st</sup> House Pass</b> ).
04/26/94	Senate passes its version of the bill. The bill moves to the Conference Committee to address the differences between the two versions ( <b>1<sup>st</sup> Senate Pass</b> ).
07/25/94	House-Senate Conference Committee reports a final version of the Interstate Banking and Branching Efficiency Act. ( <b>Conference Committee Report</b> ).
08/04/94	House of Representatives accepts the Conference Committee report ( <b>2<sup>nd</sup> House Pass</b> ).
09/13/94	Senate agrees to the Conference Committee report ( <b>2<sup>nd</sup> Senate Pass</b> ).
09/29/94	President Clinton signs H.R. 3841 into law ( <b>President Signs</b> ).

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**Table II**

**Cumulative Abnormal Returns During the Passage of IBBEA**

Cumulative abnormal returns (CARs) are shown for all 259 banks during the passage of IBBEA for the periods leading to the First House Pass, the First Senate Pass, the Conference Committee Report, and the Combined Period. (All CARs in percent.) The subgroups are based on the super-regionals provided in BHL, bank asset size (Large, Medium, and Small), the presence of interstate affiliations, statewide or limited branching, and a competitive banking environment in the state (defined as the presence of three or more of the super-regionals there). In addition, a bank is a Target if it was acquired in an interstate transaction subsequent to the passage of IBBEA, but prior to December 1995, and a bank is an Acquirer if it was identified as an active acquirer in Rhoades (1996).

Groups	N	Assets (\$ bil.)	1 <sup>st</sup> House Pass	1 <sup>st</sup> Senate Pass	Committee Report	Combined
			3/11-3/23	3/24-4/28	4/29-7/26	3/11-7/26
All Banks	259	7.64	1.00**	5.25***	8.23***	14.49***
Super-Regional Banks	21	55.10	4.47***	6.54***	10.49***	21.51***
Larger Banks	87	21.25	3.08***	9.25***	11.17***	23.51***
Medium Banks	86	1.33 <sup>c</sup>	-0.17 <sup>c</sup>	4.53***,c	6.59***,b	10.95***,c
Small Banks	86	0.33 <sup>c</sup>	0.08 <sup>c</sup>	1.93 <sup>c</sup>	6.90* <sup>b</sup>	8.91* <sup>c</sup>
Acquirer	18	56.66	4.17***	7.77***	11.08***	23.02***
Target	30	9.65 <sup>c</sup>	0.96 <sup>b</sup>	8.04***	12.55***	21.55***
Other	211	3.23 <sup>c</sup>	0.74 <sup>c</sup>	4.65***,a	7.37***,a	12.76***,c
Statewide Branching	231	7.86	1.19***	5.51***	9.02***	15.72***
Limited Branching	28	6.24	-0.48	3.18*	1.67 <sup>c</sup>	4.37 <sup>b</sup>
Less Competitive State	105	6.59	1.11*	6.34***	9.36***	16.82***
More Competitive State	154	8.44	0.93*	4.52***	7.45***	12.90***
Interstate Affiliations	85	19.61	2.38***	6.97***	8.60***	17.95***
Non-Interstate Affiliations	174	1.86 <sup>c</sup>	0.33 <sup>c</sup>	4.42***,a	8.05***	12.80***,a

\*, \*\*, \*\*\* indicates that the cumulative average residuals are significantly different from zero at the .05, .01, or .001 levels respectively.

a, b, c indicates that the mean of the variable in the first group in that section is significantly different from the variable for the group that is noted at the .05, .01, or .001 levels respectively..

**Table III-A**

**Cross-Sectional Regression Results**

Cross-sectional regression results using the cumulative abnormal returns (CARs) are shown for the entire sample of 259 banks during the IBBEA legislative period. Independent variables include categorical dummy variables for Target and Acquirer. A bank is a Target if it was acquired in an interstate transaction subsequent to the passage of IBBEA, but prior to December 1995, and a bank is an Acquirer if it was identified as an active acquirer in Rhoades (1996). Other independent variables include the log of bank assets (Size), the return on assets ratio (ROA), the capital-to-assets ratio, the log of the q-ratio (Q), the market-to-book ratio (MTB), the percentage of managerial ownership (including all officers, directors, and trusts controlled by insiders), and the percentage of outside block ownership. The High Q (Low Q) variable is equal to the log of the q-ratio if it is greater (less) than zero, and zero otherwise. Coefficients (and t-statistics) are shown. Intercept is not shown.

REGRESSION MODELS				
Variable	(1)	(2)	(3)	(4)
Target	0.880** (2.324)	0.059* (1.740)	0.057* (1.682)	0.054 (1.625)
Acquirer	0.103** (2.155)	-0.073 (-1.452)	-0.073 (-1.451)	-0.076 (-1.552)
Size	-	0.043*** (5.156)	0.042*** (5.092)	0.046*** (5.676)
ROA	-	-3.812** (-2.500)	-3.803** (-2.490)	-4.383*** (-2.987)
Capital Ratio	-	-0.892* (-1.721)	-0.854 (-1.634)	-0.953* (-1.888)
Q	-	-0.585** (-2.226)	-	-
HIGH Q	-	-	-0.686** (-2.223)	-
LOW Q	-	-	0.011 (0.011)	-
Market-to-Book	-	-	-	-0.079*** (-4.250)
Managerial Ownership	-	-0.002*** (-3.279)	-0.002*** (-3.162)	-0.002** (-2.426)
Block Ownership	-	0.002 (1.570)	0.002 (1.618)	0.002 (1.577)
R <sup>2</sup>	3.45	26.10	26.22	29.71
Adjusted R <sup>2</sup>	2.69	23.73	23.55	27.46
F-statistic	4.57	11.04	9.83	13.21

\*\*\*, \*\*, \* denotes significance at the 1%, 5%, and 10% levels respectively.

Table III-B

## Cross-Sectional Regression Results

Additional cross-sectional regression results using the cumulative abnormal returns (CARs) are shown for the entire sample of 259 banks during the IBBEA legislative period. Independent variables include five categorical dummy variable, including Block Ownership, Limit, Less Competitive, Interstate Affiliations, and Interstate Affiliations-Large. The block ownership dummy variable identifies those banks with any block ownership greater than 0%. Limit identifies banks located in limited-branching home states. Less-competitive is defined as a bank that 1.) is from a home state with less than three super-regionals located there, and 2.) a bank that has a home state market share that ranks in the lower half. Banks with interstate affiliations and larger banks (from the top third in asset size) with interstate affiliations are identified. Managerial Ownership (0%-5%) is equal to ownership if less than 5% while those banks with ownership > 5% are set equal to 5%. Managerial Ownership (5%-15%) is defined as ownership less 5% for ownership between 5% and 15%, while ownership less than 5% is equal to 0% and greater than 15% is equal to 10%. Managerial Ownership (>15%) is defined as ownership less 15% for ownership greater than 15% while all others are equal to 0%. The remaining variables are as defined in Table IV-A. Coefficients (and t-statistics) are shown. Intercept is not shown.

Variable	REGRESSION MODELS		
	(5)	(6)	(7)
Size	0.039*** (5.516)	0.053*** (6.059)	0.042*** (4.306)
ROA	-3.894*** (-2.669)	-4.208*** (-2.933)	-4.085*** (-2.872)
Capital Ratio	-1.147** (-2.316)	-0.943* (-1.943)	-0.924* (-1.923)
Market-to-Book	-0.081*** (-4.438)	-0.073*** (-4.082)	-0.070*** (-3.888)
Managerial Ownership (0%-5%)	0.027** (2.559)	0.026** (2.487)	0.027*** (2.610)
Managerial Ownership (5%-15%)	-0.003 (-0.956)	-0.003 (-0.749)	-0.003 (-0.946)
Managerial Ownership (>15%)	-0.002** (-2.476)	-0.003*** (-2.763)	-0.002*** (-2.736)
Block Ownership Dummy	0.058*** (2.764)	0.056*** (2.700)	0.049** (2.387)
Limit	- -	-0.079** (-2.428)	-0.079** (-2.427)
Less Competitive	- -	0.059** (2.371)	0.065*** (2.618)
Interstate Affiliations	- -	-0.077*** (-2.686)	-0.136*** (-3.607)
Interstate Affiliations – Large	- -	- -	0.111** (2.380)
R <sup>2</sup>	31.88	36.06	37.50
Adjusted R <sup>2</sup>	29.79	33.21	34.45
F-statistic	14.63	12.66	12.30

\*\*\*, \*\*, \* denotes significance at the 1%, 5%, and 10% levels respectively.

**Table IV**  
**Cumulative Abnormal Returns for Banks with Low and High Market-to Book Ratios by Size**

Cumulative Abnormal Returns for the Combined Period (3/11-7/26) and average asset size are shown for banks with low market-to book and high market-to book ratios. A low market-to book ratio is defined as a bank from the lower half of the sample. Panel A presents the results for banks from both the Small and Medium thirds of the sample in asset size. Panel B presents the results for banks from the Large third of the sample in asset size

Groups	N	Assets (\$ bil.)	Combined Period CARs
<b>Panel A: Banks from both the Small and Medium Thirds in Asset Size</b>			
Low Market-to-Book	92	0.64	14.59 <sup>***</sup>
High Market-to-Book	80	1.05 <sup>c</sup>	4.57 <sup>b</sup>
<b>Panel B: Banks from the Large Third in Asset Size</b>			
Low Market-to-Book	37	26.60	23.94 <sup>***</sup>
High Market-to-Book	50	17.30	23.21 <sup>***</sup>

\*, \*\*, \*\*\* indicates that the cumulative average residuals are significantly different from zero at the .05, .01, or .001 levels respectively.

a, b, c indicates that the mean of the variable in the first group in that section is significantly different from the variable for the group that is noted at the .05, .01, or .001 levels respectively



Table V

**Cumulative Abnormal Returns for Banks with Different Levels of Managerial and Block Ownership, in Less Competitive States, and with Interstate Affiliations**

Cumulative Abnormal Returns for the Combined Period (3/11-7/26) and average asset size are shown for banks with different levels of managerial ownership and block ownership, banks from less competitive states, and banks with interstate affiliations. Panel A divides the entire sample of banks between those with 0% -5%, 5% - 15%, and over 15% managerial ownership. Panel B divides the entire sample of banks between those with and without block ownership. Panel C divides the 105 banks from less competitive states between those with low and high Herfindahl indexes. Panel D divides the 85 banks with interstate affiliations between large banks (from the top third in asset size) and small banks (from the middle and lower thirds).

Groups	N	Assets (\$ bil.)	Combined Period CARs
<b>Panel A: Banks with 0% -5%, 5% - 15%, and over 15% Managerial Ownership</b>			
0% - 5%	38	13.76	16.49 <sup>***</sup>
5% - 15%	111	9.70	18.48 <sup>***</sup>
Over 15%	110	3.57 <sup>c</sup>	9.79 <sup>** ,b</sup>
<b>Panel B: Banks with and without Block Ownership</b>			
With Block Ownership	118	9.94	19.09 <sup>***</sup>
Without Block Ownership	141	5.80 <sup>a</sup>	10.65 <sup>*** ,c</sup>
<b>Panel C: Banks with Low versus High Herfindahl Indexes in Less Competitive States</b>			
Low Herfindahl	51	4.42	16.21 <sup>***</sup>
High Herfindahl	54	8.63 <sup>c</sup>	17.41 <sup>***</sup>
<b>Panel D: Small versus Large Banks with Interstate Affiliations</b>			
Small Banks	22	1.38	0.21
Large Banks	63	25.98 <sup>c</sup>	24.15 <sup>*** ,c</sup>

\*, \*\*, \*\*\* indicates that the cumulative average residuals are significantly different from zero at the .05, .01, or .001 levels respectively.

a, b, c indicates that the mean of the variable in the first group in that section is significantly different from the variable for the group that is noted at the .05, .01, or .001 levels respectively

**Financial Performance of Public Sector Enterprises in India Classified on the basis of Profit-Making and Loss-Incurring Enterprises: An Empirical Study**

**Dr. Seema Gupta\***

Lecturer of Finance,  
Guru Nanak Institute of Management and IT, Delhi  
[gupta\\_seema02@yahoo.co.in](mailto:gupta_seema02@yahoo.co.in)

**P. K. Jain**

Professor of Finance,  
Department of Management Studies,  
Indian Institute of Technology, Delhi  
[pkjain@dms.iitd.ac.in](mailto:pkjain@dms.iitd.ac.in)

**Surendra S. Yadav**

Professor of Finance,  
Department of Management Studies,  
Indian Institute of Technology, Delhi  
[ssyadav@dms.iitd.ac.in](mailto:ssyadav@dms.iitd.ac.in)

- Corresponding Author

### **Abstract**

This paper measures and compares the financial performance of profit-making and loss-incurring central public sector enterprises (CPSEs) in India over a period of sixteen years (1991-92 to 2006-07) in terms of profitability, efficiency, leverage, liquidity and productivity. As expected, the findings suggest that profitability, operating efficiency, liquidity and productivity of profit-making CPSEs is better compared to loss-incurring CPSEs. However, inventory holding period, leverage position and productivity per manpower have recorded satisfying performance in loss-incurring CPSEs. The loss-incurring CPSEs (as a group) have ceased their losses and have started earning profits w.e.f.2005-06 and 2006-07. However, they have continued to be beset with low assets turnover ratios, dissatisfactory liquidity position, usage of high debt and deterioration (decrease) in net-income efficiency over the years; they seem to be in worrisome zone, needing urgent attention and effective governmental policies. It is important to mention that among the loss-incurring CPSEs, one-fourth enterprises (belongs to upper quartile) have recorded a good amount of improvement and satisfactory trend in almost all the parameters across the phases.

### **I. INTRODUCTION**

Public enterprises have played a pivotal role in overcoming not only the socio-economic problems but also in the development of Indian economy after independence. The rationale for setting up public enterprises was to ensure easier availability of vital articles for mass consumption, to introduce check on prices of important products and to promote emerging areas like tourism etc. (Government of India, 2002-03); public sector enterprises (PSEs) as per their charter, perform certain social obligations which are poorly defined and hard to quantify. This

has led to a heavy burden of borrowings; which, in turn, has entailed heavy interest burden. This further compounded their increased losses (Kaur and Singh, 2005).

These socio-economic responsibilities of central public sector enterprises (CPSEs) have been identified as one of the major reasons for non-profitable operations of a larger number of such enterprises. At the same time, government has reduced subsidies and budgetary support from these CPSEs. This has entailed financial crunch, causing/forcing the government to bring strategic and economic reforms in the Indian CPSEs. This constitutes the genesis of the ‘statement of Industrial Policy’ (announced on July 24, 1991) which, *inter-alia*, includes statement on public sector reforms. Among them one of the major recommendation of the policy is to review the portfolios and to revive/ rehabilitate/ turn-around sick enterprises by assigning high accountability and responsibility to the top executives, extending greater autonomy in decision making, introducing variegated professional practices etc. Therefore, subsequent to Economic Reforms 1991, the Government has desired that these CPSEs should be financially profitable; they should not depend on government for budgetary support (to meet their mounting losses and expansion needs) in view of its own rising fiscal deficits.

Given the importance of the subject, the paper aims at assessing the financial performance of virtually all the non-financial central CPSEs by categorizing them into two groups on the basis of their earnings, namely, profit-making and loss-incurring CPSEs in India. For better exposition, the paper has been divided into four sections. Section one presents literature review. Section two discusses the methodology, data source and scope of the study. The financial performance of profit-making and loss-incurring CPSEs has been determined and compared in section three. Section four presents the summary of results (at a glance) and major findings.

**II. LITERATURE REVIEW**

This part of literature review consists of various studies which indicate the contribution of CPSEs for the development of the economy, problems being faced, suggestive measures and recommendations to be considered for the policy formulation in PSEs based on Indian and international experiences.

Kumar (1994), Sharma (1974), Trivedi (1986), Ghuman (1999 and 2001) and Naib (2004) have discussed the important role played by PSEs in the economic and social development of Indian economy; this has been stated that PSEs serve best public interest by fulfilling all the desired financial and economic obligations as per the government's plans and perspectives, since, an increase in financial profitability is neither a necessary nor a sufficient condition for the enhancement of society's well-being; they have opined to devise a policy which simultaneously fulfill both the social and commercial needs. They have also diagnosed the reasons for the poor performance of PSEs in India, such as, intrinsically inefficient managers, price fixation, controlled output prices while input prices continue to increase, setting up non-commercial objectives, poor monitoring, different output mix, over-employment, corruption, lack of autonomy, multiple objectives, principle-agent problem, non-competitive industrial structure, high cost etc.

Further, Ahmad (1982) and Jones and Mason (1982) use a political-economy approach to show that size and nature of the public sector in a country depends upon the class interest of the dominant political groups; they recommend that the government is to decide on the criteria to monitor public enterprises and to devise a control mechanism, with appropriate incentives and disincentives to motivate its agents (public enterprise) to pursue their criteria. Patnaik (2007) states that the recruitment in CPSEs is carried out by individuals who (themselves) have poor

incentives to maximize the performance of the firm as well as contains variety of conflicts. Interference by the political system plays its own part in reducing the quality of recruitment; once a person is recruited, the PSEs fail to adequately incentivize the person; whether a person performs well or badly, there is little variation in the wage; the probability of being sacked from a PSE is negligible.

Trivedi (1986) and Narain (1990) have evaluated the performance of the organization in the light of its objectives; they find no clarity in objectives of government companies in India; many of the objectives are vague, difficult to quantify and, to an extent, conflicting with each other. In fact, the economic and non-economic objectives have got so inextricably mixed up in the case of public enterprises that it is not easy to judge their overall performance; a public enterprise may be located at an economically unviable place in backward region, adopt a technology with high employment potential which may be economically unsuitable. In the face of these constraints, its performance, in financial terms, may not be up to the mark; not only this, social achievements may even be used as a convenient cloak for its unsatisfactory economic performance. They are of the view that more autonomy in the presence of multiple objectives will lead to more self-determining behavior by public enterprise management.

The emergence of economic reforms has been enumerated by Reddy (1988) and Naib (2004), they state that need of reforms in India has been attributed by fiscal crisis which has been caused by unbridled non-plan government expenditure and failure of the public sector to generate investible resources; due to this, government finds necessary to lend some urgency to reform public enterprises and emphasize the need to examine/quantify the loss, attributable to subserve social obligations. They are of the opinion that most of the profit and loss leaders (implying enterprises) operate in an atmosphere of price-regulation and a large part of the markets in which

they operate (input or output) are in the exclusive domain of PSEs themselves. This makes any analysis of profitability very unrealistic. Further, it is not clear which of the loss leaders have had 'locational' problems and how much its effect on the costs are taken into account in price-fixation by government. Moreover, non-availability of inputs like power, fuel etc. indicates mismatch between supply and demand within the CPSEs. In some cases, even profitable PSEs have been adversely affected, while in some other cases, the losses of the loss-incurring PSEs have compounded. More importantly, pricing restrictions or general price policies appear as much relevant to profit leaders as to loss leaders. Price increases in most loss leaders would have led to higher input prices to other public enterprises. Jain and Yadav (2005) have empirically evaluated on the growing concern over poor financial performance of the central PSEs in India. Their study indicates that service enterprises have better profitability than manufacturing enterprises during the aggregate period (1991-2003) of their study. World Bank (2004) states that India has provided an interesting environment for study. Rapid liberalization in the service sector during the 1990s followed the economic and political success of the liberalization of the manufacturing sectors in the late 1980s and early 1990s. Amiti and Konings (2007) are of the opinion that liberalization affects productivity and find that the reduction in tariffs has positive productivity effects in Indonesia through both input and output tariffs, but gains are larger than reduction in input tariffs.

Windsor et.al. (2011) suggest that more transparent (i.e., more predictable) monetary policy has an uncertain effect on the variance of aggregate output and a reduction in the variance of the monetary innovation will unambiguously reduce the variance of aggregate output. Vickers and Yarrow (1991) measure profitability of the public and private industrial firms in the UK from 1970 to 1985 and Boardman and Vining (1992) compare the performance of private corporations

(PCs), state owned enterprises (SOEs) and mixed enterprises (MEs) among the largest non-US industrial corporations (500 in number); they find the average profitability and efficiency for private firms is consistently higher than that of public firms. In the case of competition, private ownership is preferable from an efficiency perspective.

Bradbury (1999) enumerates that from the point of view of equity-holder, cross sectional comparison requires an examination of the returns earned by firms with similar systematic risk characteristics. Goknur and Mehmet (2011) test the market timing theory by employing a sample of Asia and Eastern Europe Initial Public Offerings (IPO). They suggest that the pecking order is relevant in Asia and Eastern Europe rather than market timing. Increase in market-to-book ratio is associated with higher leverage and profitable firms with more internal sources use less leverage. Barbro (1985) examines twelve Swedish cases and observes that the cost-benefit analysis does not seem preferable as a basis for decision-making where ordinary business accounts are available. Government of India (2005-06) has outlined the salient features of National Common Minimum Programme (NCMP) in India, such as the government is committed to a strong and effective public sector whose social objectives are met by its commercial functioning; government is contemplating to devolve full managerial and commercial autonomy to successful and profit-making PSEs operating in a competitive environment; government is to retain existing "navratna" companies (performing very well) in the public sector and these companies raise resources from the capital market; modernize and restructure sick public sector companies and revive sick industry; chronically, loss-incurring companies will either be sold-off or closed, after all workers have got their legitimate dues and compensation; induct private industry to turn-around companies that have potential for revival.



Miciaei. Fung et.al (1999) study the relationship between accounting profits and technical efficiency of more than two thousand manufacturing enterprises in Shanghai during the period 1989-1992 and examine the factors which affect the profitability of manufacturing enterprises. The results confirm that technical efficiency is a significant factor in explaining profitability; it is affected by types of ownership. The study confirms the success of industrial reforms in the state sector; state-owned enterprises are ranked the first, in terms of technical efficiency, among domestic enterprises in three industries (textile, clothing, machinery and equipment). The reasons for relatively low technical efficiency of domestic enterprises in China's manufacturing industries are inaccurate production planning, poor inventory control and insufficient quality control.

In an another study, Dass and Keith (2008) review the experience of Malaysian public sector reforms for the period between 1980 and 2000; they combine the elements of new public management theories with theories of privatisation and total quality management. The model replaces the classical mode of public sector governance and administration in Malaysia with the western countries practices of new public management. It includes the removal of traditional management practices, introduction of more competitive behaviour, usage of private sector management practices and reduction of the size of the public sector. It seems to modify its constituent parts in ways that will allow for the assessment and analysis of public sector reforms in industries.

### **III. SCOPE AND METHODOLOGY**

The study is limited to the non-financial central public sector enterprises (CPSEs) in India which are 209 in number; for the purpose of analysis the sample size has been categorized into two groups on the basis of their earnings, namely, profit-making and loss-incurring CPSEs. The

sample is representative of the entire industrial group and varies from year to year on account of year of incorporation/closure of the sample CPSEs and availability of data. The secondary data for this purpose has been collected from the various volumes of Public Enterprises Survey.

The questionnaire survey has been carried out to collect information related to various aspects, having a bearing on their financial performance. The questions were simple, specific and objective type, designed in keeping view the busy time schedule of the head/director/chief of the finance division (target respondents). The analysis is based on 30 responses received out of 209 enterprises after two reminders, email and telephonic conversation. *Prima facie*, the response level is low. However, this response level needs to be seen in the light of what is commonly perceived as sensitive nature of information sought for the purpose of the study and much smaller size of sample for the past such studies on the subject in India and abroad.

The period of the study consists of 16 years i.e. 1991-92 to 2006-07; the period of the study has been bifurcated into three phases i.e. 1991-92 to 1995-96 (First Phase), 1996-97 to 2000-01 (Second Phase) and 2001-02 to 2006-07 (Third Phase) with intent to judge whether their performance has improved over the years (in these phases) or not. The rationale of the period coverage of the phase has been outlined in the footnote<sup>8</sup>.

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<sup>8</sup>During 1990's fiscal crisis and liberalization process have forced the Government of India to introduce strategic and economic reforms; disinvestment of CPSEs was one of the major recommendation of economic reforms. Disinvestment process and liberalization policies were initiated in 1991 and up to 1995-96 partial disinvestments were taking place in piecemeal manner. Therefore, first phase from 1991-92 to 1995-96 has been considered as the initial phase of disinvestment and liberalization. Whereas, during the year 1996-97 the government introduced global depository receipts (GDRs) in international market (Public Enterprises Survey, 2000-01) as well as institutionalized the disinvestment process by constituting the Disinvestment Commission in August 1996. Till 1999-2000, disinvestment was mainly through sale of minority shares in small lots; this phase has been referred to as the second phase of disinvestment or intermediate phase of liberalization policies (defined as 1996-97 to 2000-01) when many institutions are streamlined. From 2000-2001 the emphasis of disinvestment policy has shifted from partial disinvestment to strategic disinvestment. But, the large volume of strategic disinvestment has taken place from the year 2001-02 onwards. Hence, the third phase for the study relates to 2001-02 to 2006-07, referred to matured phase of liberalization policies. The first year (2001-02) of this matured phase has been used/taken as a cut-off year for categorizing central PSEs into profit-making and loss-incurring PSEs.

To determine the significant difference over the phases, paired t test and t test have been carried out within a group of firms and with the other group of firms respectively; paired t test indicates whether the change in performance (within a group of firms) across the phases is significant or not and t test compares the statistical significance difference in performance of two groups of firms (having same or different sample size). On the basis of time series data of sixteen years of the sample CPSEs (209 in number) mean, median and quartile values of all the 18 ratios (pertaining to profitability, efficiency, liquidity, leverage and productivity) have been computed. To overcome the distortion in the results during different phases, the enterprises having minimum three years data out of five or six years (as the case may be) have been considered only.

Profitability has been measured in terms of rate of return (ROR) on investment and sales; there are three major concepts of investment, namely, return on total assets (ROTA), return on capital employed (ROCE) and return on net worth or shareholder's equity (RONW); the first two RORs determine how efficiently the financial resources are deployed by the CPSEs and the third ROR indicates the return earned for their equity owners (government). These rates of return have been computed based on average assets, average capital employed and average net worth. ROTA has been determined on the basis of earnings before interest and taxes (EBIT) (which includes other income/receipts); it expresses the relationship between total EBIT earned and average total assets in use (which includes net block of fixed assets, other items in the nature of fixed assets, investments, total current assets and deferred revenue/preliminary expenditure, excludes accumulated deficits, capital work-in-progress and unallocated expenditures during construction).

Similarly, ROCE indicates how efficiently the long-term funds of the owners and lenders are being used and focus directly on operating efficiency. RONW has been computed dividing net-profit after taxes minus preference divided to the average net-worth (share capital plus reserves minus accumulated deficit and deferred expenditures).

Secondly, return on the basis of sales has been computed in terms of operating profit margin (OPM) and net profit margin (NPM). OPM indicates the magnitude of operating profit in terms of sales; NPM determines the relationship of reported net-profit after taxes to sales; these margins indicate the management ability to perform the business profitably and express the overall cost/price effectiveness (Helfert, 2003).

Similarly, efficiency/effectiveness in utilization of resources has been determined on the basis of three dimensions, i.e., the first one is concerned with the extent of utilization of assets, namely, total assets turnover ratio (TATR), fixed assets turnover ratio (FATR) and current assets turnover ratio (CATR) which have been computed by dividing average net sales to average total assets in use, average fixed assets and average current assets respectively. Net-sales exclude excise duty, commission, rebates and discount from gross sales. Low turnover is indicative of under-utilization of available resources and presence of idle capacity; TATR indicates the efficiency with which the firm uses its assets to generate sales, generally, higher the firm's TATR, the more efficiently are the assets being used (Gitman, 2009).

The second dimension of efficiency is based on analyzing the change in holding period (in number of days) of various types of inventories and collection period of debtors which are the sub-constituents of current assets; raw material inventory holding period (RMIHP) is the ratio of raw material consumed during the year and average raw materials. Work-in-process inventory holding period (WPIHP) has been computed on the basis of cost of production and average

work-in-progress. Finished goods inventory holding period (FGIHP) is based on the relationship between cost of goods sold and average finished goods. Debtor collection period (DCP) presents the relationship between gross sales (numerator) and average debtor.

The third part provides insight of their capital structure practices and liquidity position. Total debt to total equity (TD/TE) has been used to determine the capital structure practices; it is the relationship between borrowed funds and owners funds/shareholders funds or net-worth. Total debt is inclusive of short term debt and long term loans ; the reason is the short term advances are ostensibly short term but they are generally renewed year after year and hence, serve the long term need of the firm (Jain and Yadav, 2005). Liquidity has been assessed by current ratio (CR) and acid test ratio (ATR). CR takes into account five items of current assets, i.e., cash and bank balances, sundry debtors, inventories, loans and advances and stock of other current assets.

The successful operation and productivity to an extent depends on the skill and capability of the workforce. Thus, fourth test is based on analyzing the productivity of capital per manpower which has been determined in terms of level of employment, sales efficiency and net income efficiency ratios per employee. It highlights the employment position (no. of employees, excluding casual and daily wage workers) over a period of time.

The entire set of data has been analyzed by using Statistical Package for Social Sciences (SPSS) and Excel worksheet. To do away with the influence of extreme values, they have been excluded from the data. The details of the excluded values have been described in the footnote of the initial tables of the respective ratios.

#### **IV. Performance Analysis of Profit-Making and Loss-Incurring CPSEs**

This section compares the financial performance of profit-making and loss-incurring CPSEs primarily in terms of profitability, efficiency, liquidity, leverage and productivity. It is expected that liberalization and globalization have initiated several economic reforms for sustainable

development in Indian PSEs which were expected to enhance the financial performance of the sample PSEs.

### **A. Profitability Test**

Profitability under each group has been computed in respect of their investments (RONW, ROCE and ROTA) and sales (OPM and NPM); the mean and positional (median, lower and upper quartile) values of profit-making (PM) and loss-incurring (LM) enterprises have been presented in Tables I, II (PM) and III, IV (LM). It is hypothesized that the profitability position of profit-making CPSEs is better than that of loss-incurring CPSEs. The hypothesis, *prima-facie*, may not make sense as the PM CPSEs are undoubtedly to have better financial performance than the LM CPSEs. The rationale of the hypothesis is that it would indicate whether the LM CPSEs have shown turnaround (having profits and have ceased to incur losses). Equally important aspect would be to ascertain the quantum of losses; it is expected that that their losses would have shown a decline over the years.

As expected, the profitability of the profit-making enterprises has increased over the different phases; the percentage increase is about 7.5% and 32% (RONW), 12% and 2% (ROCE), 8% and 17% (ROTA), 5% and 7% (OPM), 33% and 17% (NPM) during the second phase compared to first phase and in third phase when compared to second phase respectively. The difference is statistically significant in the parameters of RONW and NPM during phases two and three and phases three and one correspondingly (Table I).

In contrast, the losses of loss-incurring enterprises (depicted in Table III) have mounted further during the second phase (when compared to phase-one); such enterprises have decreased their losses in phase three (though, still incurring losses). Reddy (1988) enumerates that the loss is attributable to sub-serve social obligations. Naib (2004) identifies the reasons for poor

performances of CPSEs are overstaffing, outdated technology and lack of funds to invest.

Ghuman (1999) manifests overcapitalization, under utilization of the installed capacity, delay in implementation of the projects, overstaffing and inadequate attention to R&D have been the ascribed reasons of their poor performance.

However, these CPSEs have positive operating profit margins as well as positive rates of return on their investments during the last two years (2005-06 and 2006-07) of this phase. Positional values are more revealing in this regard. The positive value of quartile 3 indicates that one-fourth of such LM enterprises have adequate OPM (15.40 per cent) and NPM (of 7.98 per cent) and very satisfactory ROCE (16.29 per cent) and RONW (26.79 per cent) as per Table IV.

The findings have policy implications. Though, these CPSEs may continue to have accumulated losses in their balance-sheet, the positive RONW of more than half of loss-incurring enterprises (median is 2.58 per cent) in phase three is a signal of their turnaround; there is need to review the policy of closure of the loss-incurring CPSEs, recommended to the government by various committees. In concrete/operational terms, closure of loss/sick CPSEs should be taken on the merits of each case.

**Table-I: Mean Values of Key Profitability Ratios of the Profit-Making CPSEs, 1991-92 to 2006-07**

(Figures are in percentages)

Years	RONW		ROCE		ROTA		OPM		NPM	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
1991-92	10.04	78	10.58	87	8.72	95	15.31	91	6.73	87
1992-93	12.60	81	8.55	90	7.89	97	14.70	90	6.56	89
1993-94	11.99	85	8.48	90	8.07	97	15.45	92	6.71	89
1994-95	11.56	84	10.30	86	8.21	97	15.69	92	6.85	90
1995-96	13.12	78	8.82	83	8.44	97	15.95	94	7.64	91
1996-97	11.98	84	11.47	93	9.17	100	16.96	94	9.03	93
1997-98	14.15	84	12.40	94	10.49	98	17.90	94	10.22	94
1998-99	13.24	86	9.39	97	9.11	99	15.56	95	8.25	94
1999-00	12.60	86	7.52	95	7.82	100	13.20	91	7.76	94
2000-01	12.57	88	9.25	97	9.00	102	15.41	93	9.21	94
2001-02	14.91	91	9.97	94	11.27	100	17.36	91	10.48	94
2002-03	15.55	89	8.49	95	9.42	98	15.19	94	8.96	95
2003-04	18.83	89	10.68	96	10.86	100	15.47	91	9.71	93
2004-05	18.25	90	12.63	94	10.17	99	16.48	94	10.40	97
2005-06	18.45	90	12.42	91	10.55	97	18.78	92	12.64	93
2006-07	17.39	88	8.55	89	9.37	90	17.28	85	12.35	92
Mean 1991-92 to 1995-96 (phase-1)	11.91	85	8.84	91	8.35	99	15.34	96	6.84	92
Mean 1996-97 to 2000-01 (phase-2)	12.80	88	9.89	98	8.99	102	16.23	95	9.09	95

Mean 2001-02 to 2006-07 (phase-3)	16.71	94	10.58	99	10.36	101	17.35	96	10.62	98
Mean 1991-92 to 2006-07 (1+2+3)	13.81		9.77		9.23		16.31		8.85	

**Paired Sample T Test**

Ratios	Paired mean difference						Significance (two tailed)		
	Phases 1&2	df	Phases 2&3	df	Phases 3&1	df	Phases 1&2	Phases 2&3	Phases 3&1
RONW	-0.16	80	-3.91	84	-4.75	78	0.90	0.00**	0.00**
ROCE	0.09	88	0.38	93	-0.69	84	0.94	0.81	0.74
ROTA	-0.66	98	-1.16	97	-1.72	94	0.44	0.22	0.11
OPM	-0.65	92	-0.11	90	-1.07	88	0.58	0.93	0.57
NPM	-1.5	90	-1.58	92	-3.57	87	0.11	0.06	0.01**

Notes: 1. ROTA- return on total assets, ROCE-return on capital employed and RONW- return on net worth.

2. OPM and NPM stand for operating profit margin and net-profit margin on sales.

3. ROTA is based on earnings before interest and taxes (EBIT).

4. ROCE is based on operating profit which excludes non-operating incomes (or other incomes) from EBIT.

5. CPSEs having negative net-worth have been excluded and RONW has been based on net profit.

6. RONW- plus/minus 75 per cent, ROCE- plus/minus 75 per cent, ROTA- plus/minus 50 per cent, OPM- plus/minus 75 per cent and NPM- plus/minus 60 per cent have been excluded.

7. \*\* signifies to significant difference at 1% level and \* signifies to significant difference at 5% level.

These points hold true for other Tables mentioned in this section.

**Table-II: Median, Lower (Q1) and Upper Quartile (Q3) Values of Key Profitability Ratios of the Profit-Making CPSEs, 1991-92 to 2006-07**

(Figures are in percentages)

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
RONW	11.09	11.69	14.12	2.40	3.40	4.95	22.94	21.20	29.59
ROCE	8.14	9.73	10.92	-0.67	-2.31	-1.44	20.08	22.07	28.69
ROTA	7.92	8.63	8.83	2.59	3.44	2.90	14.54	14.84	18.33
OPM	12.37	11.21	12.46	4.51	3.74	2.53	30.65	29.23	29.69
NPM	4.63	4.47	7.11	0.17	0.82	1.21	17.48	19.37	20.81

**Table-III: Mean Values of Key Profitability Ratios of Loss-Incurring CPSEs, 1991-92 to 2006-07**

(Figures are in Percentages)

Years	RONW		ROCE		ROTA		OPM		NPM	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
1991-92	0.72	37	2.09	54	-3.66	89	-3.94	79	-7.13	63
1992-93	0.03	37	-1.71	56	-2.85	85	-4.48	79	-9.31	64
1993-94	-6.10	38	-3.41	54	-4.07	83	-7.25	77	-11.01	64
1994-95	-5.83	38	-4.62	54	-4.37	84	-5.65	73	-9.49	61
1995-96	0.98	36	-1.15	52	-3.10	82	-4.33	74	-5.35	60
1996-97	0.73	28	-5.27	51	-3.84	75	0.14	66	-4.20	55
1997-98	-4.81	28	-11.47	54	-5.30	75	-6.47	67	-12.71	55
1998-99	-4.70	29	-12.44	54	-8.11	74	-8.55	68	-12.80	54
1999-00	-8.49	27	-19.87	51	-10.79	76	-13.08	65	-18.68	58
2000-01	-18.36	20	-14.78	47	-11.65	73	-12.87	59	-16.49	51
2001-02	-22.17	16	-19.83	40	-11.65	72	-14.52	56	-21.99	45
2002-03	-6.60	19	-11.42	42	-7.79	71	-11.72	58	-17.41	48
2003-04	5.77	21	-2.60	40	-3.62	71	-4.97	56	-11.07	45
2004-05	13.98	21	1.31	42	-3.19	71	-3.64	56	-1.33	45
2005-06	15.95	23	0.38	43	0.40	70	3.42	57	-0.16	46
2006-07	16.30	22	3.86	37	2.86	56	2.86	46	2.20	39
Mean 1991-92 -1995-96 (phase 1)	-2.23	39	-2.29	57	-5.17	90	-6.24	80	-9.03	66
Mean 1996-97- 2000-01 (phase 2)	-6.04	29	-13.65	56	-8.49	79	-8.41	70	-13.32	59
Mean 2001-02 -2006-07 (phase 3)	4.91	26	-4.88	48	-5.14	78	-5.80	61	-8.77	51
Mean 1991-92 - 2006-07 (1+2+3)	-1.12		-6.94		-6.27		-6.81		-10.37	

**Paired Sample T Test**

Ratios	Paired mean difference						Significance (two tailed)		
	Phase 1&2	df	Phase 2&3	df	Phase 3&1	df	Phase 1&2	Phase 2&3	Phase 3&1
RONW	8.02	24	-10.15	17	-2.97	18	0.01**	0.13	0.53
ROCE	12.28	47	-6.33	41	3.02	39	0.00**	0.08	0.41
ROTA	6.50	75	-2.35	65	2.37	65	0.00**	0.11	0.19
OPM	7.69	63	-0.10	56	6.74	52	0.00**	0.97	0.02*
NPM	6.67	51	-2.40	43	4.74	39	0.00**	0.29	0.15



**Table-IV: Median, Lower (Q1) and Upper Quartile (Q3) Values of Key Profitability Ratios of the Loss-Incurring CPSEs, 1991-92 to 2006-07**

(Figures are in Percentages)

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
RONW	3.19	-4.83	2.58	-18.58	-19.83	-19.70	11.71	5.86	26.79
ROCE	-1.08	-8.19	-3.21	-14.45	-34.37	-27.17	10.39	3.31	16.29
ROTA	-0.93	-5.63	-0.66	-20.21	-22.38	-21.67	7.62	5.34	8.60
OPM	0.95	-3.39	-0.33	-27.85	-28.36	-30.63	11.52	7.76	15.40
NPM	-2.10	-10.10	-6.08	-27.44	-29.57	-27.52	4.42	1.16	7.98

**Table V: Opinion Related to the Impact of Liberalization Policies on Financial Performance of Sample CPSEs in India**

Options	Profit-Making (out of 21)		Loss-Incurring (out of 9)		Combined (out of 30)	
	In No.	In %	In No.	In %	In No.	In %
Yes	20	95.2	4	50.0	24	82.76
No	1	4.8	4	50.0	5	17.24
Total	21	100%	8	100%	29	100%

**Table VI: Policy on Communicating Financial Targets to Subordinates among Sample CPSEs in India**

Options	Profit-Making (out of 21)		Loss-Incurring (out of 9)		Combined (out of 30)	
	In No.	In %	In No.	In %	In No.	In %
Generally	16	75.00	9	100.00	25	86.21
Sometimes	1	5.00	0	0.00	01	3.45
Very Rarely	3	15.00	0	0.00	03	10.34
Total	20	100%	9	100%	29	100%

Virtually all the profit-making enterprises (responding to the survey) feel that the government liberalization policies (initiated in 1991) have yielded salutary impact on the financial performance (Table V). In marked contrast, only half of the loss-incurring organizations feel so. It is gratifying to learn from the survey that the financial targets are generally communicated to the subordinates as well as to the government in almost all the organizations (Tables VI and VII).

**Table VII: Policy on Communicating Financial Targets to Government among Sample CPSEs in India**

Options	Profit-Making (out of 21)		Loss-Incurring (out of 9)		Combined (out of 30)	
	In No.	In %	In No.	In %	In No.	In %
Generally	19	90.5	9	100.0	28	93.34
Very Rarely	2	9.5	-	0.00	02	6.67
Total	21	100%	9	100%	30	100%

**Table VIII: Levels where Financial/New-Investment Proposals are initiated among Sample CPSEs**

Levels	Profit-Making (out of 21)		Loss-Incurring (out of 9)		Combined (out of 30)	
	In No.	In %	In No.	In %	In No.	In %
Head office	13	61.90%	5	55.56%	18	60.00%
Regional office	4	19.05%	0	0.00%	4	13.33%
Operation level	4	19.05%	4	44.44%	8	26.67%
Total	21	100.00%	9	100.00%	30	100.00%

**Table IX: Period Required for Approval of Project/Proposals among Sample CPSEs in India**

Period	Profit-Making (out of 21)		Loss-Incurring (out of 9)		Combined (out of 30)	
	In No.	In %	In No.	In %	In No.	In %
Less than 3 month	14	66.7	5	55.5	19	63.3
3-6 month	0	0	2	22.2	2	6.7
more than 6 month	7	33.3	2	22.2	9	30
Total	21	100%	9	100%	30	100%

**Table X: Period for Implementation of Project/Proposals among Sample CPSEs in India**

Period	Profit-Making (out of 21)		Loss-Incurring (out of 9)		Combined (out of 30)	
	In No.	In %	In No.	In %	In No.	In %
Less than 3 month	9	42.8	5	55.5	14	46.7
3-6 month	5	23.8	2	22.2	7	23.3
more than 6 month	7	33.3	2	22.2	9	30
Total	21	100%	9	100%	30	100%

Tables VIII, IX and X have described the various levels at which financial and new-investment proposals are initiated and the time span generally used for the approval and implementation of these proposals respectively. Although, more than three-fifth of the new-investment proposals are originated at head office only; it is interesting to note that more than two-fifth of the investment proposals are initiated/routed at operational level in loss-incurring CPSEs (Table VIII). The positive aspect of this part of survey finding is that the operating managers are likely to put-in their best efforts to ensure the success of their proposed investment proposals; evidently, such proposals have better potentials of profit. More than three-fifth (PM) and two-fifth (LM) CPSEs investment proposals are approved within the time span of three months (Table IX). Whereas, two-fifth of PM and one-half of LM enterprises implement them within three months (Table X); in fact, majority of the profit-making CPSEs are taking more than three months to implement the proposals.

Independent t test (shown in Table XI) in respect of mean values of profit-making CPSEs (Table I) and mean values of loss-incurring CPSEs (Table III) signifies that there is a significant difference between them in profitability ratios. The test reinforces better profitability position of profit-making CPSEs. As expected, a large number of LM CPSEs continued to incur losses;

however, the solace is the rate of losses has shown a decline. More important to note that more than one-fourth of such CPSEs have started earning profits.

Government of India (2002-03) suggests that reasons for losses/sickness are manifold and may vary from unit to unit; however, some common problems faced/being faced by sick and loss-incurring CPSEs include inherent problems of sick taken over enterprise, resource crunch, erosion of net-worth due to continuous losses incurred, heavy interest burden, high input cost, stiff competition, reluctance of financial institutions to provide funds for revival/rehabilitation of obsolete plants and machinery, low capacity utilization, excess manpower, weak marketing strategies etc.

**Table XI: Independent Sample t-test of Profitability Ratios to find out Significance of Difference between the Sample Profit-Making and Loss-Incurring CPSEs during 1991-to 2006-07**

Ratios	Coding	Phase 1		Phase 2		Phase 3		Overall	
		N	Mean	N	Mean	N	Mean	N	Mean
RONW	Loss-incurring	39	-3.34	29	-6.42	25	3.89	29	-4.24
	Profit-Making	85	11.91	88	12.80	94	16.91	89	14.08
ROCE	Loss-incurring	57	-2.75	56	-13.15	48	-4.38	70	-8.50
	Profit-Making	91	8.84	98	9.88	99	10.12	105	9.03
ROTA	Loss-incurring	90	-5.11	79	-8.49	75	-4.09	95	-6.44
	Profit-Making	99	8.35	102	8.99	101	10.49	105	9.39
OPM	Loss-incurring	80	-6.24	70	-8.58	61	-5.21	86	-8.36
	Profit-Making	96	15.42	95	16.23	96	16.75	103	16.59
NPM	Loss-incurring	66	-9.03	59	-13.32	50	-7.98	78	-11.27
	Profit-Making	92	7.01	96	8.40	98	10.40	102	8.83

#### Independent t test

t-test for Equality of Means													
Ratios	Variances	Phase 1			Phase 2			Phase 3			1991-2007		
		t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)
RONW	EV	-6.42	122	0.00**	-7.47	115	0.00**	-4.29	117	0.00**	-9.17	116	0.00**
	NEV	-5.56	54	0.00**	-7.11	44	0.00**	-3.21	29	0.00**	-7.87	38	0.00**
ROCE	EV	-4.55	146	0.00**	-8.25	152	0.00**	-4.34	145	0.00**	-7.20	173	0.00**
	NEV	-4.68	130	0.00**	-7.99	104	0.00**	-4.02	77	0.00**	-7.08	139	0.00**
ROTA	EV	-7.82	187	0.00**	-11.0	179	0.00**	-8.88	174	0.00**	-11.33	198	0.00**
	NEV	-7.69	157	0.00**	-0.67	145	0.00**	-8.48	128	0.00**	-11.15	170	0.00**
OPM	EV	-7.90	174	0.00**	-9.38	163	0.00**	-7.12	155	0.00**	-10.00	187	0.00**
	NEV	-7.84	162	0.00**	-9.21	138	0.00**	-7.03	123	0.00**	-9.87	169	0.00**
NPM	EV	-7.15	156	0.00**	-9.75	153	0.00**	-7.19	146	0.00**	-10.03	178	0.00**
	NEV	-7.02	130	0.00**	-9.78	124	0.00**	-6.72	83	0.00**	-9.82	151	0.00**

EV- Equal variances assumed, NEV- Equal variances not assumed.

In view of the above, the policy makers must devise a policy to improve the performance of public enterprises in order to serve public purpose as well (Kumar, 1994). Gupta (2005) suggests

for technology up-gradation, organizational restructuring, dependence on public borrowings and some degree of linkage of wages and productivity would enhance the performance of loss-incurring CPSEs; LM non-core enterprises should be studied in detail so that they could be made economically viable and those enterprises which incurred losses over a period of time, their value added per employee had been less than the average emoluments and where equity capital had been wiped out by mounting deficits should be closed down.

### B. Efficiency Test

Efficiency assesses the operational performance of profit making (PM) and loss-incurring (LM) CPSEs. Analysis has been carried out primarily on the basis of assets turnover ratio (total, current and fixed), inventory holding period and debtor collection period (major constituents of current assets). *On-a-priori* basis, though it is expected that PM CPSEs would have better efficiency levels compared to LM CPSEs, the analysis would be useful to know whether there has been an improvement in efficiency ratios of the LM CPSEs over the years. It is hypothesized that the efficiency of loss-incurring CPSEs has shown an improvement in utilization of resources in phases two and three compared to phase one.

**Table-XII: Mean Values of Key Turnover Ratios of the Profit-Making CPSEs, 1991-92 to 2006-07**  
(Figures are in Times)

Years	TATR		FATR		CATR	
	Mean	N	Mean	N	Mean	N
1991-92	0.76	92	3.04	77	1.25	89
1992-93	0.81	96	2.98	79	1.40	95
1993-94	0.79	95	3.03	79	1.29	93
1994-95	0.77	94	3.20	80	1.38	94
1995-96	0.85	96	3.55	80	1.44	94
1996-97	0.83	95	3.48	75	1.34	94
1997-98	0.84	95	3.47	78	1.34	93
1998-99	0.86	96	3.15	76	1.32	95
1999-00	0.89	96	3.42	76	1.37	93
2000-01	0.87	95	3.22	75	1.42	94
2001-02	0.91	99	3.23	73	1.39	96
2002-03	0.93	97	3.11	71	1.58	98
2003-04	0.91	99	3.44	74	1.42	99
2004-05	0.90	98	3.88	75	1.43	98
2005-06	0.87	97	4.06	72	1.38	95

2006-07	0.81	94	3.85	71	1.29	93
Mean 1991-92 to 1995-96 (phase-1)	0.81	97	3.25	81	1.41	95
Mean 1996-97 to 2000-01 (phase-2)	0.87	96	3.54	80	1.38	95
Mean 2001-02 to 2006-07 (phase-3)	0.90	99	3.76	78	1.43	99
Mean 1991-92 to 2006-07 (phases 1+2+3)	0.86		3.51		1.41	

### Paired Sample T Test

Ratios	Paired mean difference						Significance (two tailed)		
	Phases 1&2	df	Phases 2&3	df	Phases 3&1	df	Phases 1&2	Phases 2&3	Phases 3&1
TATR	-0.10	93	-0.04	91	-0.13	91	0.00**	0.37	0.01**
FATR	-0.45	73	-0.38	72	-0.65	71	0.01**	0.01**	0.02*
CATR	-0.07	90	-0.03	91	-0.18	88	0.16	0.68	0.05*

Notes: 1. TATR-total assets turnover ratio, FATR- fixed assets turnover ratio and CATR-current assets turnover ratio.

2. TATR- 4 and above, CATR-6 and above and FATR-12 and above have been excluded.

3. \*\* signifies to significant difference at 1% level and \* signifies to significant difference at 5% level.

These abbreviations and exclusion of extreme items also apply for other Tables mentioned in this sub section.

**Table-XIII: Median, Lower (Q1) and Upper Quartile (Q3) Values of Key Turnover Ratios of the Profit-Making CPSEs, 1991-92 to 2006-07**

(Figures are in Times)

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
TATR	0.60	0.67	0.68	0.26	0.38	0.34	1.10	1.18	1.32
FATR	2.02	2.10	2.45	0.77	0.84	1.10	6.53	6.50	6.77
CATR	1.05	1.15	1.00	0.55	0.59	0.56	1.93	2.05	2.13

The relevant data contained in Tables XII and XIV suggest that the TATR of both types of enterprises is less than one for the entire period of the study (sixteen years); evidently, the TATR, *prima-facie*, does not seem to be satisfactory and is indicative of under-utilization of resources. For instance, TATR is the highest in the year 2002-03 (0.93, range being 0.76 to 0.93) in the case of PM CPSEs and the highest in 1991-92 (0.81, range of 0.54 to 0.81) for LM CPSEs. Positional values indicate that median, lower and upper quartile TATR of the profit-making enterprises are between 0.38 to 0.68, less than 0.38 and ranges in 0.68 to 1.32 respectively (Table XIII). As per trend, it is disheartening to note a decline in TATR in almost all the phases of LM organisations (save one-fourth enterprises affiliated to upper quartile, Table XV). The difference of TATR is significant in both types of organisations (Tables XII and XIV) as per paired t test. It may be recalled that one-fourth of loss-incurring CPSEs are having adequate profit margins and satisfactory rates of return (Table IV). In practical terms, one-fourth of CPSEs (in the loss incurring category) have ceased their losses and have started earning profits. Their efficiency levels seem to match with those of profit-making CPSEs.

**Table-XIV: Mean Values of Turnover Ratios of the Key Loss-Incurring CPSEs, 1991-92 to 2006-07**

(Figures are in Times)

Years	TATR		FATR		CATR	
	Mean	N	Mean	N	Mean	N
1991-92	0.81	94	3.55	83	1.29	94
1992-93	0.73	94	3.25	86	1.24	93
1993-94	0.70	95	3.01	87	1.14	94
1994-95	0.70	95	2.91	87	1.16	94
1995-96	0.75	95	3.13	86	1.26	94
1996-97	0.71	96	3.26	90	1.17	96
1997-98	0.68	95	3.20	91	1.10	96
1998-99	0.65	95	2.94	92	1.07	96
1999-00	0.63	96	3.30	94	1.08	95
2000-01	0.65	96	3.03	92	1.13	95
2001-02	0.54	98	2.48	95	1.01	94
2002-03	0.55	98	2.62	94	1.06	93
2003-04	0.55	98	2.40	94	1.06	93
2004-05	0.62	94	2.61	84	1.12	88
2005-06	0.59	90	2.47	81	1.00	84
2006-07	0.63	80	2.48	70	1.08	74
Mean 1991-92 to 1995-96 (phase-1)	0.74	95	3.16	87	1.21	95
Mean 1996-97 to 2000-01 (phase-2)	0.67	96	3.26	94	1.11	96
Mean 2001-02 to 2006-07 (phase-3)	0.59	97	2.69	94	1.05	94
Mean 1991-92 to 2006-07 (phase-1+2+3)	0.67		3.04		1.12	

**Paired Sample T Test**

Ratios	Paired mean difference						Significance (two tailed)		
	Phases 1&2	df	Phases 2&3	df	Phases 3&1	df	Phases 1&2	Phases 2&3	Phases 3&1
TATR	0.07	94	0.06	90	0.12	89	0.04*	0.20	0.03*
FATR	0.13	86	0.43	86	0.43	82	0.56	0.11	0.13
CATR	0.10	94	0.06	86	0.11	85	0.11	0.41	0.21

**Table-XV: Median, Lower (Q1) and Upper Quartile (Q3) Values of Key Turnover Ratios of the Loss-Incurring CPSEs, 1991-92 to 2006-07**

(Figures are in Times)

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
TATR	0.69	0.58	0.51	0.38	0.24	0.09	1.01	0.91	1.01
FATR	2.63	2.23	2.04	1.08	0.81	0.39	4.91	5.66	4.14
CATR	1.12	0.96	0.82	0.56	0.38	0.27	1.77	1.61	1.74

In contrast, FATR has presented better picture in utilization of fixed assets in all the public sector enterprises. For instance, FATR of PM firms is greater than 3 (highest i.e., 4.06 in 2005-06) in 15 out of 16 years period of the study, mean figure being 3.51. Similar conclusions follow based on median and quartile values. As per trend, there is an improvement, duly corroborated by paired t test showing significant difference during all the sub-phases (Table XII).

Table XIV is indicative of better utilization of fixed assets in loss-incurring CPSEs; the FATR is greater than 3 in 8 out of 16 years and the aggregative mean is 3.04. However, Table XV suggests that the performance is not evenly distributed; one-fourth of such CPSEs have FATR

quite low at 0.76 or less; next one-fourth in the range of 0.76 to 2.3 (as per median) and only one-fourth such CPSEs have FATR 2.3 to 4.9 or above.

The CATR is quite low in both types of enterprises (Tables XII and XIV); the corresponding range lies between 1.25 to 1.58 for PM and 1.00 to 1.29 for LM CPSEs. Positional values (presented in Table XIII) highlight that one-fourth of PM CPSEs (as per lower quartile) have CATR in the range of 0.55 and 0.59 or less, next one-fourth such CPSEs (as per median) have this ratio between 0.59 to 1.15; only next one-fourth generate CATR above 1.93 to 2.13. On the other hand, steep decline has been observed in the trend of utilization of current assets in the case of LM CPSEs (presented in Table XIV) compared to PM enterprise (in Table XII).

**Table-XVI: Mean Values of Inventory Holding Period and Debtor Collection Period (DCP) of the Profit-Making CPSEs, 1991-92 to 2006-07** (Figures are in Days)

Years	RMIHP		WPIHP		FGIHP		DCP	
	Mean	N	Mean	N	Mean	N	Mean	N
1991-92	189.95	63	26.72	59	26.50	68	90.20	86
1992-93	187.62	67	30.17	59	27.00	70	93.37	89
1993-94	191.76	67	29.54	59	30.21	71	97.09	91
1994-95	193.70	66	27.25	60	30.00	71	87.22	90
1995-96	165.16	63	26.23	60	28.73	71	86.13	90
1996-97	179.65	70	26.32	61	21.03	71	86.77	92
1997-98	188.83	69	27.28	62	16.51	72	91.00	93
1998-99	187.70	68	27.76	62	15.99	72	94.05	94
1999-00	172.36	68	31.41	62	15.39	72	87.24	93
2000-01	154.66	68	23.95	63	15.78	73	85.40	94
2001-02	168.76	68	23.02	61	18.16	73	88.47	95
2002-03	164.63	68	24.20	61	17.90	71	94.26	97
2003-04	128.41	76	21.80	61	16.41	71	87.40	98
2004-05	128.71	79	17.56	61	14.72	71	78.55	99
2005-06	118.69	76	22.02	60	14.87	70	74.39	96
2006-07	124.42	74	28.12	59	16.81	69	77.33	94
Mean 1991-92 to 1995-96 (phase-1)	189.60	67	27.70	60	28.88	71	92.08	91
Mean 1996-97 to 2000-01 (phase-2)	181.06	71	27.30	63	16.74	73	90.30	94
Mean 2001-02 to 2006-07 (phase-3)	138.87	79	26.79	62	16.37	74	84.34	100
Mean 1991-92 to 2006-07 (1+2+3)	169.84		27.27		20.66		88.9	

#### Paired Sample T Test

Ratios	Paired mean difference						Significance (two tailed)		
	Phases 1&2	df	Phases 2&3	df	Phases 3&1	df	Phases 1&2	Phases 2&3	Phases 3&1
RMIHP	6.11	63	50.15	66	57.21	60	0.63	0.00**	0.00**
WPIHP	0.24	59	5.82	59	5.35	56	0.95	0.12	0.07
FGIHP	11.67	70	0.57	71	12.08	69	0.00**	0.69	0.00**
DCP	-0.02	88	8.82	90	8.48	86	1.00	0.10	0.15

Notes: 1. DCP- debtors Collection period, RMIHP- raw materials inventory holding period, WPIHP- work-in-progress inventory holding period and FGIHP- finished goods inventory holding period

2. RMIHP- 770 days and above, DCP- 365 days and above, WPIHP-365 and FGIHP-270 days and above have been excluded.

**These abbreviations and exclusion of extreme items also apply for other Tables mentioned in this section.**

**Table-XVII: Median, Lower (Q1) and Upper Quartile (Q3) Values of Inventory Holding Period and Debtor Collection Period of Profit-Making CPSEs, 1991-92 to 2006-07**

(Figures are in Days)

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
RFIHP	146.87	136.39	81.38	64.82	51.91	24.04	278.76	264.41	238.22
WFIHP	5.20	5.38	7.31	0.57	0.89	0.77	53.32	43.23	41.61
FGIHP	17.00	11.00	9.50	2.00	1.00	1.00	43.00	25.75	26.25
DCP	71.60	76.84	66.74	25.36	27.16	21.25	149.03	142.27	140.02

Second dimension of operational efficiency assesses the holding period of various types of inventories and debtor collection period of the sample enterprises. Mean and positional values in respect of inventory and debtors of PM CPSEs are presented in Tables XVI and XVII; these values are available in Tables XVIII and XIX for LM CPSEs.

Raw materials and spare-parts holding period (RFIHP) of both types of enterprises is fairly high; the aggregative mean over the sixteen years period is nearly six months, i.e., 170 days for PM CPSEs and 175 days for LM CPSEs; however, an appreciable reduction from six months to nearly four and half months (i.e., nearly 25 per cent) in holding period of raw materials has been observed in the PM organisations during phase three *vis-à-vis* phase two; the same is less than 10 per cent in the case of LM organisations. Similar conclusions follow based on positional values. Paired t test has identified the significant difference in the PM enterprises during the second and third phases as well as during third and first phases only.

**Table-XVIII: Mean Values of Inventory Holding Period and Debtor Collection Period (DCP) of the Loss-Incurring CPSEs, 1991-92 to 2006-07**

(Figures are in Days)

Years	RFIHP		WFIHP		FGIHP		DCP	
	Mean	N	Mean	N	Mean	N	Mean	N
1991-92	174.36	81	26.70	74	39.54	81	89.88	91
1992-93	163.41	81	29.56	74	42.40	80	90.51	89
1993-94	163.48	81	27.62	75	42.33	81	96.61	91
1994-95	158.95	77	26.82	75	39.44	81	107.73	92
1995-96	161.69	79	25.25	75	32.78	82	100.68	87
1996-97	174.17	77	22.17	74	33.10	81	105.89	87
1997-98	186.16	76	24.54	75	31.22	82	104.61	87
1998-99	192.82	76	24.09	76	26.85	82	104.59	86
1999-00	175.41	74	21.32	76	22.99	82	105.48	86
2000-01	173.51	71	14.22	73	27.49	82	110.16	86
2001-02	192.81	67	19.23	68	25.09	78	108.94	79
2002-03	177.87	67	14.94	67	21.54	78	100.45	81
2003-04	152.69	69	18.37	66	26.11	76	94.70	79
2004-05	151.75	68	15.74	64	23.51	71	84.46	74



2005-06	155.28	66	14.37	63	25.86	64	79.40	72
2006-07	116.62	57	15.59	56	21.71	62	81.65	61
Mean 1991-92 to 1995-96 (phase-1)	168.77	84	27.05	75	39.15	82	99.49	93
Mean 1996-97 to 2000-01 (phase-2)	186.98	79	23.51	76	28.26	82	107.92	88
Mean 2001-02 to 2006-07 (phase-3)	168.20	73	18.39	70	23.04	79	92.32	81
Mean 1991-92 to 2006-07 (1+2+3)	174.65		22.98		30.15		99.91	

### Paired Sample T Test

Ratios	Paired mean difference						Significance (two tailed)		
	Phases 1&2	df	Phases 2&3	df	Phases 3&1	df	Phases 1&2	Phases 2&3	Phases 3&1
RMIHP	-12.26	70	30.72	65	15.22	61	0.46	0.10	0.42
WPIHP	6.76	74	7.40	66	14.08	65	0.00**	0.04*	0.00**
FGIHP	10.89	81	7.54	74	18.26	74	0.00**	0.01**	0.00**
DCP	-13.54	84	11.85	73	-1.45	72	0.01**	0.06	0.82

\*\* signifies to significant difference at 1% level and \* signifies to significant difference at 5% level.

**Table-XIX : Median, Lower (Q1) and Upper Quartile (Q3) Values of Inventory Holding Period and Debtor Collection Period of Loss-Incurring CPSEs, 1991-92 to 2006-07**

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
RMIHP	112.92	138.61	96.14	55.62	66.94	48.40	256.58	312.03	255.93
WPIHP	12.23	7.17	6.38	2.03	1.39	0.31	45.78	30.88	33.21
FGIHP	26.50	17.50	11.00	8.00	5.00	2.63	72.00	45.00	43.25
DCP	76.83	85.27	67.06	34.89	33.37	22.33	168.80	180.54	157.00

The average debtor collection period is less for profit-making CPSEs compared to loss-incurring CPSEs; the respective figures are nearly three months (89 days) and more than three months (100 days). It is a matter of some satisfaction to note the reduction in DCP (statistically significant) in the case of LM CPSEs in phases two and three. Positional values also indicate (Table XIX) that one-fourth of LM CPSEs have reduced their DCP to 22.83 days (lower quartile) and one-half CPSEs to 67 days (median) during phase three; only one-fourth of the LM enterprises (represented by upper quartile) are responsible to have DCP at precarious level of more than 157 days which merits management attention. Hence, the findings partially support the hypothesis of better assets utilization capacity of LM CPSEs during phases two and three compared to phase one.

**Table XX: Independent Sample t-test of Efficiency Ratios to find out Significance of Difference between Sample Profit-Making and Loss-Incurring CPSEs during 1991-92 to 2006-07**

### Group Statistics

Ratios	Coding	N	Mean Phase 1	Mean Phase 2	Mean Phase 3	Mean Overall
TATR	LM	95	0.74	0.67	0.59	0.64
	PM	97	0.81	0.87	0.90	0.89
FATR	LM	87	3.16	3.26	2.69	3.04
	PM	81	3.25	3.54	3.76	3.70

CATR	LM	94	1.55	96	1.43	94	1.38	102	1.41
	PM	97	1.84	97	1.86	99	1.81	104	1.89
DCP	LM	93	99.49	88	107.92	81	92.32	101	102.74
	PM	91	92.08	94	90.30	100	84.34	104	90.67
RMIHP	LM	84	168.77	79	186.98	73	168.20	96	178.02
	PM	66	191.09	70	182.03	78	139.25	84	169.62
WIPIHP	LM	75	27.05	76	23.51	70	18.39	78	24.07
	PM	60	27.70	63	27.30	62	26.79	65	29.54
FGIHP	LM	82	39.15	82	28.26	79	23.04	86	29.86
	PM	71	28.88	73	16.74	74	16.37	75	20.07

### Independent Samples Test

t-test for Equality of Means													
Ratios	Variances	Phase 1			Phase 2			Phase 3			1991-2007		
		t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)
TATR	EV	-0.87	190	0.39	-2.31	190	0.02*	-3.44	194	0.00**	-2.97	204	0.00**
	NEV	-0.87	156	0.38	-2.31	164	0.02*	-3.45	177	0.00**	-2.98	165	0.00**
FATR	EV	-0.22	166	0.83	-0.65	172	0.52	-2.60	170	0.01**	-1.83	188	0.07
	NEV	-0.22	150	0.83	-0.65	162	0.52	-2.55	144	0.01**	-1.79	159	0.08
CATR	EV	-1.46	189	0.15	-2.24	191	0.03*	-2.33	191	0.02*	-2.78	204	0.01**
	NEV	-1.47	160	0.14	-2.25	166	0.03*	-2.33	191	0.02*	-2.80	176	0.01**
DCP	EV	0.73	182	0.47	1.73	180	0.09	0.81	179	0.42	1.37	203	0.17
	NEV	0.73	181	0.47	1.73	178	0.09	0.80	161	0.43	1.37	203	0.17
RMIHP	EV	-1.00	148	0.32	0.20	147	0.84	1.32	149	0.19	0.44	178	0.66
	NEV	-0.98	127	0.33	0.20	135	0.84	1.32	149	0.19	0.43	154	0.67
WIPIHP	EV	-0.10	133	0.92	-0.47	137	0.64	-1.16	130	0.25	-0.71	141	0.48
	NEV	-0.10	128	0.92	-0.47	136	0.64	-1.12	99	0.26	-0.69	120	0.49
FGIHP	EV	1.94	151	0.05*	2.89	153	0.00**	1.61	151	0.11	2.65	159	0.01**
	NEV	1.92	141	0.06	2.95	146	0.00**	1.61	150	0.11	2.65	158	0.01**

PM stands for profit-making CPSEs and LM-for loss-incurring CPSEs

EV- Equal variances assumed, NEV- Equal variances not assumed.

\*\* signifies to significant difference at 1% level and \* signifies to significant difference at 5% level.

Independent t test has been conducted in Table XX to examine the operating and productive efficiency difference between profit-making and loss-incurring PSE; over the entire period of the study (1991-2007), the difference is significant in the measures of TATR, CATR and FGIHP. Similarly, significant difference has been observed during phase three (for TATR, FATR and CATR), phase two (for TATR, CATR, and FGIHP) and phase one (for FGIHP). Group statistics suggests that profit-making CPSEs have reinforced better efficiency in almost all the measures compared to loss-incurring enterprises.

### C. Solvency and Liquidity Test

A comparison of capital structure practices and liquidity position has been made between profit-making and loss-incurring CPSEs over a period of sixteen years; the mean and positional values have been presented in Tables XXI and XXII of profit-making (PM) enterprises and Tables XXIII and XXIV contain these values for loss-incurring (LM) enterprises. A test of significance,

carried out, has been recorded in Tables XXI and XXIII of PM and LM enterprises respectively.

In the light of economic reforms, liberalized policies and modern financial practices it has been hypothesized that the usage of debt has decreased and the position of liquidity improves in loss-incurring CPSEs (due to better operational efficiency, such as decrease in debtor's collection period and reduction in inventory holding period) over the phases.

Debt is the major source of financing for both types of the CPSEs; the aggregative TD/TE is 2.27 for LM CPSEs and 1.81 for PM CPSEs during the 16 years period; declining trend of debt has been observed during all the phases of profit-making as well as of loss-incurring CPSEs. As far as test of significance is concerned, it has been observed not to be significant in any of the phases of the study in the LM CPSEs; its significance has been restricted to phases one and two only in PM CPSEs. The reduction in external obligations to internal equity (TD/TE) has also been corroborated by all positional values in both categories of CPSEs over the years. Broadly, the finding is in conformity of the hypothesis that the usage of debt has decreased in loss-incurring CPSEs. This, in turn, is likely to reduce their interest cost in years to follow and improve their net-profits.

**Table-XXI: Mean Values of Key Leverage and Liquidity Ratios of the Profit-Making CPSEs, 1991-92 to 2006-07**

(Figures are in Times)

Years	Leverage Ratios		Liquidity Ratios			
	TD/TE		CR		ATR	
	Mean	N	Mean	N	Mean	N
1991-92	2.01	72	1.85	92	0.95	93
1992-93	1.84	76	1.94	93	0.96	94
1993-94	2.05	80	1.86	92	0.96	96
1994-95	1.86	78	1.85	95	0.94	96
1995-96	1.68	75	1.86	98	1.01	96
1996-97	1.59	78	2.04	94	1.00	95
1997-98	1.50	79	2.00	94	1.04	94
1998-99	1.44	79	1.93	94	1.04	95
1999-00	1.73	80	1.92	95	1.08	96
2000-01	1.47	81	2.03	95	1.11	94
2001-02	1.68	85	1.90	96	1.11	97
2002-03	1.60	83	1.97	95	1.15	96
2003-04	1.40	79	1.90	96	1.19	97
2004-05	1.55	80	1.80	96	1.07	96
2005-06	1.70	83	1.81	94	1.03	91
2006-07	1.89	84	2.18	93	1.24	91
Mean 1991-92 to 1995-96 (phase-1)	2.00	81	1.88	98	0.98	97

Mean 1996-97 to 2000-01(phase-2)	1.64	82	2.01	98	1.06	97
Mean 2001-02 to 2006-07(phase-3)	1.78	90	1.96	99	1.17	100
Mean 1991-92 to 2006-07 (phases-1+2+3)	1.81		1.95		1.07	

### Paired Sample T Test

Ratios	Paired mean difference						Significance (two tailed)		
	Phases 1&2	df	Phases 2&3	df	Phases 3&1	df	Phases 1&2	Phases 2&3	Phases 3&1
TD/TE	0.28	73	0.00	77	0.28	72	0.02*	0.98	0.11
CR	-0.11	94	0.03	92	-0.09	92	0.21	0.72	0.38
ATR	-0.08	93	-0.09	92	-0.18	91	0.22	0.15	0.03*

Notes: 1. CR- current ratio, ATR- acid test and TD/TE-total debt/total.

2. CR consisting value 6 and above, ATR- 4 and above and TD/TE-7 and above have been excluded.

These abbreviations and exclusion of extreme items also apply for other Tables mentioned in this section.

**Table-XXII: Median, Lower (Q1) and Upper Quartile (Q3) Values of Key Leverage and Liquidity Ratios of the Profit-Making CPSEs, 1991-92 to 2006-07** (Figures are in Times)

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
TD/TE	1.54	1.33	1.23	0.68	0.64	0.54	3.52	2.21	2.77
CR	1.74	1.83	1.61	1.09	1.19	1.12	2.57	2.70	2.76
ATR	0.85	0.91	0.97	0.39	0.56	0.49	1.48	1.61	1.77

The PM enterprises have maintained an adequate amount of liquidity in almost all the phases (Table XXI); the mean CR (1.95) and ATR (1.04) is considered to be satisfactory; the difference is insignificant (except in phases 3 and 1 of ATR) as per paired t test of profit-making CPSEs. However, unequal distribution of liquidity has been observed in Table XXII (median and quartiles); one-fourth of the PM CPSEs (as per lower quartile) operate at unsatisfactory liquidity level, the range being 1.09 to 1.19 (CR) and 0.39 to 0.56 (ATR), might be encountering working capital shortage. Next one-fourth (median) seem to have satisfactory position, in this regard, lying in range 1.19 to 1.83 (CR) and 0.56 to 0.97 (ATR) during all phases. The position of liquidity is very much satisfactory (in fact, may be carrying excessive liquidity) in the case of one-fourth of the PM enterprises affiliated to upper quartile.

In contrast, the working capital/ liquidity position of loss-incurring CPSEs is highly dissatisfactory (Table XXIII); declining trend in mean values of liquidity has also been noted over the phases; it is significant during phase two and three as well as in phase three and one for CR. Positional values (indicated in Table XXIV) also corroborate the mean observation. The

results are not in tune with the hypothesis of an improvement in the liquidity position of loss-incurring PSEs over a period of time.

**Table-XXIII: Mean Values of Key Leverage and Liquidity Ratios of the Loss-Incurring CPSEs, 1991-92 to 2006-07**  
(Figures are in Times)

Ratios	Leverage Ratios		Liquidity Ratios			
	TD/TE		CR		ATR	
	Mean	N	Mean	N	Mean	N
1991-92	2.14	36	1.56	91	0.72	90
1992-93	2.14	37	1.33	94	0.62	93
1993-94	2.91	36	1.16	93	0.58	92
1994-95	2.98	33	1.16	95	0.55	92
1995-96	2.57	32	1.10	95	0.57	94
1996-97	2.18	25	1.37	96	0.68	96
1997-98	2.11	25	1.31	96	0.62	96
1998-99	2.14	25	1.26	96	0.59	96
1999-00	2.14	21	1.01	94	0.50	96
2000-01	2.37	16	1.03	91	0.52	91
2001-02	2.29	12	1.05	93	0.44	88
2002-03	2.20	12	1.05	94	0.46	89
2003-04	1.71	17	0.96	90	0.45	87
2004-05	1.59	20	0.99	89	0.49	85
2005-06	1.69	23	1.12	85	0.69	80
2006-07	1.50	23	1.29	77	0.78	76
Mean 1991-92 to 1995-96 (phase-1)	2.70	39	1.26	95	0.61	94
Mean 1996-97 to 2000-01(phase-2)	2.28	25	1.21	97	0.58	96
Mean 2001-02 to 2006-07(phase-3)	1.84	27	1.11	94	0.55	88
Mean 1991-92 to 2006-07 (phase-1+2+3)	2.27		1.19		0.58	

**Paired Sample T Test**

Ratios	Paired mean difference						Significance (two tailed)		
	Phase 1&2	df	Phase 2&3	df	Phase 3&1	df	Phase 1&2	Phase 2&3	Phase 3&1
TD/TE	-0.29	21	-0.30	14	0.16	19	0.17	0.35	0.68
CR	0.03	93	0.19	86	0.21	84	0.63	0.01**	0.02*
ATR	0.01	92	0.04	82	0.03	79	0.85	0.44	0.59

\*\* signifies to significant difference at 1% level and \* signifies to significant difference at 5% level.

**Table-XXIV: Median, Lower (Q1) and Upper Quartile (Q3) Values of Key Leverage and Liquidity Ratios of the Loss-Incurring CPSEs, 1991-92 to 2006-07**  
(Figures are in Times)

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
TD/TE	2.22	2.01	1.44	1.27	1.04	0.35	4.19	3.52	3.13
CR	0.89	0.94	0.77	0.44	0.42	0.32	1.96	1.84	1.76
ATR	0.41	0.40	0.38	0.13	0.17	0.15	0.97	0.89	0.83

It was of interest to ascertain experiences to deal with working capital requirements and sources of its financing from the public sector executives. The survey highlights that the shortage of working capital has been experienced by more than one-fourth of the profit-making CPSEs and virtually by all the loss-incurring CPSEs (Table XXV). The large numbers of loss-incurring

CPSEs are using short-term credit from banks and government to meet their working capital needs, though the profit-making enterprises are filling this gap greatly through the usage of internal resources (Table XXVI). Further, the survey findings indicate that the excess of cash is available in more than three-fourth of the profit-making and one-third of the loss-incurring enterprises (Table XXVII).

**Table XXV: Working Capital Shortage Experienced among Responded CPSEs in India**

Options	Profit-Making (out of 21)		Loss-Incurring (out of 9)		Combined (out of 30)	
	In No.	In %	In No.	In %	In No.	In %
Yes	6	28.6	8	88.9	14	46.7
No	15	71.4	1	11.1	16	53.3
Total	21	100%	9	100%	30	100%

**Table XXVI: Sources Used to Finance Working Capital Needs by Responded CPSEs in India**

S.no	Sources	Profit-Making		Loss-Incurring		Combined	
		In No.	In %	In No.	In %	In No.	In %
1	Long term sources	3	15.8	2	22.2	5	17.9
2	Short term credit from commercial	6	31.5	4	44.4	10	35.7
3	Short term loans from Government	0	0	2	22.2	2	7.1
4	Utilization of internal resources	10	52.7	1	11.1	11	39.3
	Total	19	100%	9	100	28	100%
	Missing	2				2	

**Table XXVII: Cash Surplus Situation among Responded CPSEs in India**

Options	Profit Making (out of 21)		Loss-incurring (out of 9)		Combined (out of 30)	
	In No.	In %	In No.	In %	In No.	In %
Yes	16	76.2	3	33.3	19	63.3
No	3	14.2	6	66.7	9	30.0
Total	19	100%	9	100%	28	100%

**Table XXVIII: Independent Sample t-test of Leverage and Liquidity Ratios to find out Significance of Difference between the Sample Profit-Making and Loss-Incurring CPSEs during 1991-92 to 2006-07**

Ratios	Coding	N	Mean Phase 1		Mean Phase 2		Mean Phase 3		Mean Overall
			N	Mean	N	Mean	N	Mean	
TD/TE	Loss- Incurring	39	2.70	25	2.28	27	1.84	48	2.60
	Profit-Making	81	2.00	82	1.64	90	1.78	98	1.86
CR	Loss- Incurring	96	1.00	101	0.96	99	0.86	104	0.94
	Profit-Making	99	1.45	101	1.54	101	1.55	105	1.52
ATR	Loss- Incurring	94	0.61	96	0.58	88	0.55	102	0.58
	Profit-Making	97	0.98	97	1.06	100	1.17	105	1.07

#### Independent Samples Test

t-test for Equality of Means													
Ratios	Variances	Phase 1			Phase 2			Phase 3			1991-2007		
		t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)
TD/TE	EV	2.28	118	0.02*	2.22	105	0.03*	0.18	115	0.85	3.02	144	0.00**

	NEV	2.17	66	0.03*	2.29	42	0.03*	0.20	51	0.84	2.86	82	0.01**
CR	EV	-4.1	193	0.00**	-5.15	200	0.00**	-5.78	198	0.00**	-6.26	207	0.00**
	NEV	-4.1	193	0.00**	-5.15	199	0.00**	-5.78	198	0.00**	-6.26	204	0.00**
ATR	EV	-4.2	189	0.00**	-6.10	191	0.00**	-7.19	186	0.00**	-7.06	205	0.00**
	NEV	-4.2	187	0.00**	-6.11	181	0.00**	-7.38	172	0.00**	-7.07	203	0.00**

EV- Equal variances assumed, NEV- Equal variances not assumed.

\*\* signifies to significant difference at 1% level and \* signifies to significant difference at 5% level.

Independent t test (shown in Table XXVIII) has identified significant difference in leverage (TD/TE) and liquidity (CR and ATR) ratios of profit-making and LM CPSEs across the phases as well as over the entire period of the study (1991-2007), except TD/TE of phase three. It suggests debt is the major source of finance for loss-incurring CPSEs; though, the trend is declining. In the same way, the position of liquidity of LM CPSEs has deteriorated during the different phases.

#### D. Productivity Test

Productivity of capital deals with the statistics of work force employed with CPSEs as well as with the measurement of sales and net income generated per employee (referred to as sales efficiency and net-income efficiency, NIE). It is hypothesized that economic reforms and liberalized policies have enhanced the productivity of manpower in loss-incurring CPSEs.

It goes to the credit of the management of PM CPSEs as an incredible (about four-fold) increase in sales efficiency and NIE has taken place during all the sub-phases of such organisations (Table XXIX). For instance, there has been more than 7 times increase in sales efficiency and more than 12 times in net income efficiency during phase three *vis-à-vis* phase one of PM CPSEs. The difference is significant in all the parameters during all the phases of profit-making CPSEs. Median and quartiles values (depicted in Table XXX) are also impressive; the redeeming feature of quartile values is that they are indicative of significant improvement perhaps among all PM CPSEs. Equally notable observation is that there has been a modest growth rate of 12 per

cent only in employment during the period of the study. This statistics related to manpower manifests a significant improvement in man-power policies of the CPSEs in India.

**Table-XXIX: Mean Values of Key Productivity Ratios of the Profit-Making CPSEs, 1991-92 to 2006-07**

Years	Employment		Sales Efficiency		Net Income Efficiency	
	Mean	N	Mean	N	Mean	N
1991-92	9995	95	15.99	95	0.63	95
1992-93	9826	97	18.21	97	1.08	97
1993-94	9719	97	18.75	97	0.99	97
1994-95	9648	97	21.77	97	1.10	97
1995-96	9499	98	26.04	97	0.87	98
1996-97	9504	100	28.10	100	1.74	98
1997-98	9407	100	34.57	100	2.26	99
1998-99	9350	100	39.75	100	2.45	99
1999-00	8934	100	54.15	100	2.53	99
2000-01	8700	100	65.16	101	3.12	98
2001-02	11722	104	76.88	102	4.60	101
2002-03	11398	102	104.31	102	4.41	101
2003-04	10953	102	148.57	102	5.92	100
2004-05	10809	101	186.38	101	6.82	99
2005-06	10784	99	200.93	99	6.05	95
2006-07	10789	97	267.06	97	6.83	91
Mean 1991-92 to 1995-96 (phase-1)	9662	98	20.10	97	0.93	98
Mean 1996-97 to 2000-01 (phase-2)	9179	100	44.04	101	2.46	99
Mean 2001-02 to 2006-07 (phase-3)	10852	104	163.34	102	6.24	101

**Paired Sample T Test**

Ratios	Paired mean difference						Significance (2 tailed)		
	Phases 1&2	df	Phases 2&3	df	Phases 3&1	df	Phases 1&2	Phases 2&3	Phases 3&1
Employment	495	97	1223	98	1823	96	0.02*	0.00**	0.00**
Sales Efficiency	-21.28	96	-117.46	97	-123.92	93	0.00**	0.00**	0.00**
NIE	-1.31	97	-10.33	96	-9.13	94	0.00**	0.04*	0.04*

\*\* signifies to significant difference at 1% level and \* signifies to significant difference at 5% level.

**Table-XXX: Median, Lower (Q1) and Upper Quartile (Q3) Values of Key Productivity/Output Ratios of the Profit-Making CPSEs, 1991-92 to 2006-07**

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
Employment	2653	2696	1906	425	420	333	9963	9973	7091
Sales Efficiency	5.13	9.11	23.20	2.02	4.51	7.70	17.32	36.33	86.17
Net Income Efficiency	0.36	0.60	1.61	0.00	0.07	0.29	1.82	3.12	9.29

**Table-XXXI: Mean Values of Key Productivity Ratios of the Loss-Incurring CPSEs, 1991-92 to 2006-07**

Years	Employment		Sales Efficiency		Net Income	
	Mean	N	Mean	N	Mean	N
1991-92	11748	94	4.05	94	-0.26	94
1992-93	11461	94	4.03	94	-0.40	94
1993-94	10695	95	4.08	95	-0.81	95
1994-95	10694	95	4.85	95	-0.62	95
1995-96	10678	95	5.40	95	-0.62	95
1996-97	10389	97	6.22	97	-0.82	97
1997-98	11235	97	6.91	97	-1.20	97
1998-99	9540	97	6.84	97	-1.44	97
1999-00	9920	97	7.20	97	-1.67	97



2000-01	8650	96	7.90	96	-2.41	96
2001-02	7746	99	9.93	96	-3.10	92
2002-03	7004	98	16.84	96	-2.64	93
2003-04	6535	96	25.41	96	-3.33	92
2004-05	6490	91	28.97	90	-2.97	84
2005-06	6258	90	27.97	88	-2.62	82
2006-07	6519	79	40.77	78	-3.09	72
Mean 1991-92 to 1995-96 (phase-1)	11006	95	4.46	95	-0.54	95
Mean 1996-97 to 2000-01 (phase-2)	9929	97	7.00	97	-1.51	97
Mean 2001-02 to 2006-07 (phase-3)	6482	99	23.66	96	-3.08	93

**Paired Sample T Test**

Ratios	Paired mean difference						Significance (two tailed)		
	Phases 1&2	df	Phases 2&3	df	Phases 3&1	df	Phases 1&2	Phases 2&3	Phases 3&1
Employment	913	94	3472	91	4487	89	0.12	0.00**	0.00**
Sales Efficiency	-1.81	94	-13.22	88	-15.57	86	0.01**	0.08	0.06
NIE	0.96	94	37.69	89	39.46	87	0.00**	0.06	0.06

\*\* signifies to significant difference at 1% level and \* signifies to significant difference at 5% level.

**Table-XXXII: Median, Lower (Q1) and Upper Quartile (Q3) Values of Key Productivity Ratios of the Loss-Incurring CPSEs, 1991-92 to 2006-07**

Ratios	Median			Q1			Q3		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
Employment	2509	2313	940	778	642	132	9091	6336	3412
Sales Efficiency	1.85	2.67	4.41	0.77	0.65	0.52	4.91	5.35	13.82
Net Income Efficiency	-0.26	-0.94	-1.27	-0.91	-2.07	-5.28	0.08	0.01	0.33

Improvements are also notable in the case of LM CPSEs. There has been a considerable decrease in employment (nearly 40 per cent) during phase three *vis-à-vis* phase one which is statistically significant during phases two and three as well as in phases three and one (Table XXXI); as a result, the sales efficiency has shown an increase to one and half times during phase two compared to phase one and more than three times in phase three *vis-à-vis* phase two. However, these factors have not yielded improvement in NIE. On the contrary, there has been a marked deterioration in the already existing dismal position of negative NIE, the negative NIE figures being -0.54 in phase one and -3.08 in phase three. However, sales efficiency and NIE have proved to be statistically significant during phases one and two. The probable reasons of negative NIE may include high cost of retrenchment in employment by following voluntary retirement scheme, losses, high interest, poor technology, pricing policy and high production cost. Emphasizing pricing policy, Reddy (1988) contends that general pricing policy seems to be

equally relevant to both the profit as well as loss leaders. Price increases in most loss leaders would have led to higher input prices to other public enterprises.

Significant difference has been identified in sales efficiency and NIE across the phases between both types of CPSEs as per independent t test (Table XXXIII). Group statistics of mean values suggest the better performance of profit-making CPSEs and an alarming situation of loss-incurring CPSEs warranting remedial measures to be initiated on the part of management/ Government.

**Table XXXIII: Independent Sample t-test of Productivity Ratios between the Sample Profit-Making and Loss-Incurring CPSEs during 1991-92 to 2006-07**  
**Group Statistics**

Ratios	Coding	N	Mean Phase 1		Mean Phase 2		Mean Phase 3		Mean Overall
Sales Efficiency	LM	95	4.46	97	7.00	96	23.66	104	14.23
	PM	97	20.10	101	44.04	102	163.34	105	87.12
NIE	LM	95	-0.54	97	-1.51	92	-1.22	104	-0.80
	PM	98	0.94	100	3.24	100	6.32	105	4.46

#### Independent Samples Test

t-test for Equality of Means													
Ratios	Variances	Phase 1			Phase 2			Phase 3			1991-2007		
		t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)	t	df	Sig. (2-tailed)
Sales Efficiency	EV	-4.14	190	0.00**	-4.61	196	0.00**	-3.55	196	0.00**	-3.72	207	0.00**
	NEV	-4.18	109	0.00**	-4.69	110	0.00**	-3.64	113	0.00**	-3.73	119	0.00**
NIE	EV	-4.74	191	0.00**	-5.07	195	0.00**	-5.22	190	0.00**	-4.76	207	0.00**
	NEV	-4.79	146	0.00**	-5.13	115	0.00**	-5.25	190	0.00**	-4.77	174	0.00**

EV- Equal variances assumed, NEV- Equal variances not assumed

\*\* signifies to significant difference at 1% level and \* signifies to significant difference at 5% level.

## V. Summary of Results, Main Findings and Contribution to the body of Knowledge

### Summary of Results

This section summarizes results of paired t test (Table XXXIV) and independent t test (Table XXXV) of all the aspects pertaining to the profit-making and loss-incurring CPSEs. Broadly, significant difference has been observed mainly in productivity and inventory holding period in large number of cases as per paired t test in both types of CPSEs; the difference is also significant in the parameter of profitability during phases one and two of the loss-incurring

CPSEs. Though, minor difference in the parameters of profitability (RONW) and assets turnover ratios of profit-making CPSEs has also been observed in almost all the phases.

Independent t test corroborates significant difference between profit-making and loss-incurring CPSEs in the parameters of profitability (all the phases), assets turnover (except phase one), liquidity (save CR in phase three), leverage and productivity (sales efficiency and NIE) which signifies better performance of profit-making CPSEs over loss-incurring CPSEs over a period of time.

**Table-XXXIV: Summary of Results Based on Paired Sample T Test Pertaining to Financial Performance of the Sample CPS Es, 1991-92 to 2006-07**

Ratios/phases	Profit-Making			Loss-Incurring		
	Phases			Phases		
	1&2	2&3	3&1	1&2	2&3	3&1
RONW		**	**	**		
ROCE				**		
ROTA				**		
OPM				**		*
NPM			**	**		
TATR	**		**	*		*
FATR	**	**	**			
CATR			*			
DCP						
RMIHP		**	**	**		
WIPIHP				**	*	**
FGIHP	**		**	**	**	**
TD/TE	*					
CR					**	*
ATR			*			
Sales Efficiency	*	**	**	**		
NIE	**	**	**	**		
Employment	**	*	*		**	**

**Table-XXXV: Summary of Results Based on Independent Sample T Test Pertaining to Financial Performance of the Sample CPS Es, 1991-92 to 2006-07**

Ratios/Phases	Profit-Making/Loss-Incurring CPS Es			
	Phase 1	Phase 2	Phase 3	All Phases
RONW	**	**	**	**
ROCE	**	**	**	**
ROTA	**	**	**	**
OPM	**	**	**	**
NPM	**	**	**	**
TATR		*	**	**

FATR			**	**
CATR		*	**	**
DCP				
RMIHP				
WPIHP				
FGIHP	*	**		**
TD/TE	*	*		**
CR	**	**	**	**
ATR	**	**	**	**
Sales Efficiency	**	**	**	**
NIE	**	**	**	**
Employment				

### ***Main Findings and contribution to the body of knowledge***

The analysis based on earning capacity of the PSEs indicates an increasing trend in the profitability ratios of profit-making CPSEs over the phases; the select loss-incurring CPSEs (as a group) have ceased their losses and have started earnings profits for the last two years of the study (i.e., 2005-06 and 2006-07). It is a matter of some satisfaction that inventory holding period has shown improvement in both types of CPSEs. Whereas, majority of loss-incurring PSEs have continued to beset with low assets turnover ratios, dissatisfactory liquidity position, usage of high debt and deterioration (decrease) in net-income efficiency (NIE) over the years; they seem to be in worrisome zone, needing urgent attention (on the part of management of such enterprises) and effective governmental policies.

The loss-incurring CPSEs may be facing several problems such as locational problem, high input cost, resource crunch, erosion of net-worth, heavy interest burden, stiff competition, outdated technology, adoption of sick-taken over enterprises, low usage of capacity and excess manpower; they are reckoned as the probable causes for their poor performance which directly has an adverse impact on their profitability. Further, vast majority of the respondents (based on questionnaire survey) are of the opinion that compensation in terms of reward to chairman or top executives and power to increase selling price are not in accordance with the organizational requirement of the loss-incurring CPSEs.

In view of the fact that the majority of LMEs continue to incur losses, there is need on the part of the government to consider their closure as suggested by several committees. However, some of the loss-incurring PSEs are meant to fulfill socio-economic needs for other enterprises, such as providing low price input, following pricing restrictions, employing large number of people etc. Apart from this, there are more than one-fourth of such enterprises which have shown an appreciable improvement in that; their losses have ceased to exist and their operations have become commercially profitable. Being commercially viable in their operations, their continued existence is justifiable.

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**Nonlinear modeling of the exchange rate dynamics: The contribution of Markov regime switching regression models with endogenous switching**

**Lotfi Kechim\***

SAMOS-MATISSE, Université de Paris 1  
90, Rue de Tolbiac  
75634 Paris Cedex 13, France  
[kechilotfi@yahoo.fr](mailto:kechilotfi@yahoo.fr)

**Sami Rezgui**

[rez\\_sami2001@yahoo.fr](mailto:rez_sami2001@yahoo.fr)

\* Correspondent author: [kechilotfi@yahoo.fr](mailto:kechilotfi@yahoo.fr), FSEG TUNIS, Tunisia.



### **Abstract**

In this paper, the Markov switching model with endogenous switching is used to describe the exchange rate dynamics based on the extension suggested within this framework by Gray (1996), Kim and al. (2008). These rates stipulate that there is an endogenous mechanism, in which the switching regimes or states are endogenous, dependants and thus contradict the traditional Hamiltonian approach (1989) that supposes the assumption of the exogeneity of the states to dynamic structures of the model. We prove in our empirical study, the effect of the endogenous character of the switching regimes or states on the transition probabilities, which are considered the aim of the statistical inference. The estimation results of the Markov regime switching regression models with endogenous switching prove the utility of this approach based on the Macdonald model (2005). Indeed, our contribution in this study is to criticize the traditional approach of Hamilton (1989) by supposing that the transition probabilities from one regime to another can be governed by an exogenous variable(s) where these last variable(s) can on the one hand affect the exchange rate, on the other hand, they can present a considerable endogenous influence on the values of the transition probabilities.

**JEL classification:** C13, C22, f31

**Keywords:** Markov regime switching, Endogeneity, Exchange rate

### **I. INTRODUCTION**

Traditional approach of exchange rate is based on fundamental economic variables which have appeared unable to explain the exchange rate dynamics. Recent studies, such as Macdonald and al. (2005) reformulate Markov switching regime specification which tends to model the exchange rate behavior integrating a mechanism with a probabilistic structure, calling upon a particular theory, putting into consideration the effect of the exogenous switching regime in time

by the determination of the transition probabilities which specifies the jump from one regime to another and describing the non linear dynamic of exchange rate according to fundamental economic variables. Using univariate specification of exchange rate, Engel and Hamilton (1990), were the first which showed the performance of Markov Switching Models (MSM) to explain the exchange rate dynamics.

A specific and intentional process of control of the dynamics of exchange rate which represents a major determinant in the decision making concerning several economic problems, such as import and /or export, leads the economists to find an acceptable model which intervenes determining factors of the dynamics of the exchange rate on short term or long term basis and thus makes it possible to mitigate the undesirable macroeconomic effects of the non identifiable variability of exchange rate on the countries which are considered relatively as open economies where export represents a significant share of the economic policy.

An advantageous strategy of exchange regime must put forward the effects of the misalignments of the exchange rate which each country must control instantaneously since the robustness of a strategy refers to its adaptation ability to different effects of scenarios of the misalignments of the exchange rate and as confirmed by Mussa and Al (2000) << No single exchange rate regime is most appropriate for all such countries, and the regime that is appropriate for a particular country may change over time >>.

Within the framework of this paper where the focus will be on the Markov switching regime model which makes it possible to apprehend better monetary approach to overcome\_the difficulties of the traditional models which explain the random variability of the exchange rate according to the whole fundamental macroeconomic variables, such as prices, money interest rate,...

The performance of the Markov switching regime approach to suitably reformulate the dynamics of the exchange rate was shown for the first time by Engel and Hamilton (1990) and Engel (1994) where these authors explained the exchange rate dynamics by using Markov switching regime model while specifying this evolution with two states to capture the exchange rate dynamics.

In order to exceed the limits of the traditional approaches of exchange rate such as the PPA, the NATREX, the FEER, the BEER...to determine true factors of the exchange rate variability, several empirical studies started again these kind of approaches by proposing Markov switching modeling to specify the exchange rate dynamics. Indeed, many authors such as Hamilton (1998, 2005), Van Norden (1996), Kim (1993), Francq and Gautier (2004)...founded the idea of the importance of markov switching regime regression to suitably re-examine the behavior of the long term exchange rate which can be in several different states.

Indeed, the extension suggested by different authors such as Filardo (1994), Kim, Pigerc, startz (2008) directed new applications of the MSM towards a more robust way which suppose the time variability of transition probabilities (TVTP). A new approach deserves to be exploited in our study where we examine again the monetary model proposed by Macdonald and al (2005) while using the new assumptions thus incorporating the dependence of transition probabilities to certain explanatory variables holding account from the endogenous switching regime.

The remaining part of this paper is organized as follows: A first section describing the Markov switching regime mechanism with exogenous switching where we present the superiority of this model compared to the traditional linear formulations of exchange rate. In the second section, we present a new approach of the MSM where supposed the endogeneity of the transition probabilities and thus the Markov switching regime model with endogenous switching is

proposed. The last part of this paper describes and interprets the empirical results of this new approach with endogenous switching based on the differential real interest rates model renamed by Macdonald and al (2005) to explain the dynamic of exchange rate. The end of this work present conclusion.

### **I-Markov switching mechanism :( MSM)**

#### **1) The Hamilton approach (1989): Exogenous switching**

The studies of Goldfeld et Quandt (1973) are advanced by the Hamiltonian approach (1989) which recommends another mechanism in Markov switching formulations where it exposes a stochastic process; describing that the observed variables depend randomly to the unobserved variables states.

Hamilton exposes a new approach to be compared with the existing formulations analyzing the exchange rate dynamics by introducing the MSM which tends to describe a nonlinear representation of the process that explains the evolution of this variable. Indeed, the evaluation of MS regressions is based exactly on the assumption that the switching regime is governed by an unobserved variable supposed exogenous to the dynamic structures of the model where the definition of the state or regime is strongly related to the basic economic theory.

Our study focuses on the mechanism of the evolution of the exchange rate variable and which governed by a Markov chain supposing that the future state depends only on the most recent state. At this end, the estimation procedure depends on the specification of the MSM where the central focus on the exogenous switching regime model lies in the unobserved state variable which leads the switching regime process. However, the specification of the state or regime in the system and the way of defining the switching mechanism between the regimes enable us to put forward the mechanism specification of this type of switching regime modeling.

Uncertainly through the realization of the states of the system, it calls upon the notion of stochastic process which suitably meets this particular characteristic concerning the realization of the state of economy represented by an unobserved variable which can be considered as exogenous or endogenous to the dynamic structures of the model. Indeed, we start by representing the exogenous switching of Markov model within the framework of the Markov switching regime modeling which arises so as to reproduce the possibility of changes in average and in variance in the following manner :

$$Y_t = \mu_0(1 - s_t) + \mu_1 s_t + (\sigma_0(1 - s_t) + \sigma_1 s_t)\varepsilon_t$$

where  $s_t$  : unobserved state variable

The last equation is based on the idea that the dynamic of the dependant variable is function of the value of the hidden variable which takes two possible states **0** or **1**. The generating process of regimes is governed by a hidden variable which follows a first order Markov chain where the transition probabilities from a state to another are controlled by exogenous mechanism. Thus all the jumps probabilities are given by the matrix **P** :

$$P = \begin{bmatrix} p_{11} & p_{21} \\ p_{12} & p_{22} \end{bmatrix}$$

with  $p_{ij}$  the probability of moving from the state **i** to the state **j** supposing that the economy is in the regime **i** at **(t-1)**.

To be able to determine these probabilities; we should form a statistical inference with this type of modeling which is based on a succession of iteration necessarily depends on several restrictions such as the determination of the non-conditional probabilities of the initial states and supposing that  $\sum_{j=0}^n p_{ij} = 1$ . Since the transition probabilities are controlled by a markov chain, and then the probability of the realization of a specified state at time **(t)** depends only on the state carried out at time **(t-1)**.

The following table provides a summary that distinguishes the contribution of MSM and introduces the fundamental economic variables and particularly of the use of the monetary model (Frankel, 1979) within the framework with switching regime which uses the two most recognized criteria such as : the Root Mean Squared Error (**RMSE**) and the Mean Average Error (**MAE**) for the three exchange rate series. Indeed, Macdonald and al (2005) show that by using these conventional measures that the two MSM [(1),(2)], with and without fundamental variables produce minimal error compared to traditional models that prove the possibility of adapting these Markov models to particular situations of given exchange rate where instability is the fundamental element characterizing the relationship between exchange rate and fundamental economic variables. So Macdonald and al (2005) prove that the difference between coefficients lighting that switching regime are in fact caused by different fundamental economic variables explaining the exchange rate.

	DEM/USD	JPY/USD	GBP/USD
Markov Switching RID model: (1) RMSE MAE	0.06075 0.04767	0.02324 0.01822	0.06042 0.04663
Pure Markov Switching model : (2) RMSE MAE	0.06527 0.04692	0.02449 0.01995	0.06486 0.05102
Constant coefficient RID model : RMSE MAE	0.11992 0.09872	0.03821 0.02869	0.11367 0.09059
Random walk with drift : RMSE MAE	0.12402 0.10230	0.04123 0.03026	0.12434 0.10167

Source: According to Macdonald and al (2005)

In addition, several empirical studies witnessed an extended interest in the exchange rate dynamics such as the work of Macdonald and al (2005) which treated this problematic by

defining a monetary model which was initially carried out by Frankel (1979) within the framework of switching regime thus translating the nonlinear modeling of the variability of the exchange rate as follows :

$$r_t = \begin{cases} c_1 + \alpha_1 \Delta m_t + \beta_1 \Delta y_t + \delta_1 \Delta i_t^s + \gamma_1 \Delta i_t^l + \varepsilon_t & \text{si } s_t = 1 \\ c_2 + \alpha_2 \Delta m_t + \beta_2 \Delta y_t + \delta_2 \Delta i_t^s + \gamma_2 \Delta i_t^s + \varepsilon_t & \text{si } s_t = 2 \end{cases}$$

with ,

$r_t$ : Exchange rate in logarithm at the date t

$\Delta m_t$ : Differential of the money supply

$\Delta y_t$ : Differential of the industrial production.

$\Delta i_t^s$ : Differential of the real interest rate of short term

$\Delta i_t^l$ : Differential of the real interest rate of long term

Macdonald and al (2005) show that monetary approach using Markov switching regime mechanism within the framework of variability of the three series of exchange rates such as JPY/USD, DEM/USD and GBP/USD, leads to the following results where the exchange rate DEM/USD and JPY/USD present the attitude of switching regime explained by different coefficients of concerning the differential interest rate variables at the short and long term ,while the results of inference states do not affirm any significant difference in the coefficients associated to the differential of money supply and of production industrial variables.

In addition, recent decades have witnessed an important interest in switching regime in the determination of the exchange rate introducing exogenous variables in switching regime regression where the suitable differences between regimes seem to be related to the differences in switching coefficients associated with the exogenous variables. Indeed, according to the Macdonald's study (2005), an important result concerning the performance of MSM to suitably describe the behavior of the exchange rate where the interest rate proves to be the only

determinant for the release of switching regime mechanism and so as to reexamine true factors responsible for the exchange rate fluctuations.

In front of the importance of MSM in the study of the exchange rate ,Engel and Hamilton (1990),it appears to be interesting to improve the switching regime mechanism within the framework of the study of the determinants of exchange rate by proposing the Markov switching regime' logic with the possibility of relating the transition probabilities to fundamental economic factors and thus by proposing a Markov switching mechanism with endogenous switching : Filardo (1994), Gray (1996), Beine, Laurent, Lecourt (2003) , Isogai, Kanoh, Tokunago (2004) ,Kim and al(2008) ... .

## **2) Endogenous Switching regime : The Kim approach (2008)**

Several authors such as Diebold, Weinbach and Filardo (1994) studied the Markov switching regime model within a different framework by supposing that the transition probabilities from a state to another vary in time (TVTP). A model which can be exploited within the framework of the study of the determinants of exchange rates in a double objective: on one hand, to fill the limits of the linear approach to explain the exchange rate dynamics, on the other hand, I want to look further into the Markov switching regime's logic while questioning the exogeneity of the states of the system. Indeed, the question concerns the possibility to introduce an unobserved variable which allows the switching regime mechanism conditioned with endogenous switching of the exchange rate in an indirect way.

The use of an inference approach introducing the endogenous character with the transition probabilities which vary in time must prove its contribution within the framework of resolution of the identification problem of dynamic exchange rate. Thus it is central to define the log likelihood function where it considers the transition probabilities in particular will depends on



the exogenous variables i.e. fundamental economic variables such as those that were shown by Filardo (1994) and Kim, Piger, Startz (2008).

Indeed, Kim, Piger, Startz (2008) proposed a new approach similar to the basic model of Hamilton (1989) while extending the assumption of exogeneity of states variables to the dynamic structures of the model, throughout a most advanced modeling within the framework of MSM which rests in an initial way on the endogeneity of switching regime between different states where the economy is situated. At this stage, it is necessary to formulate the following assumption test so as to expose the new alternative approach in the exchange rate modeling:

**H<sub>0</sub>** : Markov regime modeling of exchange rate with exogenous switching.

**H<sub>1</sub>** : Markov regime modeling of exchange rate with endogenous switching.

Kim and al (2008) show that it is possible to fund a statistical inference more adapted in terms of recursive filters of Hamilton (1989) in the class of Markov switching regime with endogenous switching based on the modified maximum likelihood method. The Markov switching models are useful tools to capture brutal and recurring jumps and endogenous switching regime in time series. Hamilton (1989) supposes that the transition probabilities from a state to another are constant thus implies the constancy of the duration of regime. The extension of MSM with endogenous switching allows the likely use of the transition probabilities variables in time. While, supposing that  $\mathbf{Z}_{t-1}$  is a vector of fundamental economic variables which can affect the switching regime, the transition probabilities follow an endogenous specification.

According to the studies of Filardo (1994), Gray (1996), the transition probabilities are defined as follows :

$$p_{i,j,t} = \Pr[s_t = j / s_{t-1} = i, \mathbf{z}_{t-1}] = \frac{\exp(\lambda_{i,j,0} + \mathbf{z}'_{t-1} \lambda_{i,j,1})}{1 + \exp(\lambda_{i,j,0} + \mathbf{z}'_{t-1} \lambda_{i,j,1})}$$

where  $i = 1, 2, \dots, M, j = 1, 2, \dots, M - 1$

In this paper, our methodology takes as a starting point the idea of random walk process where the past is an important determinant by supposing intuitively that the last values of exchange rate can indirectly affect the transition probabilities from a state to another. The variable  $r_{t-1}$  represents the most recent past of exchange rate, which is regarded as an explanatory variable of the transition probability.

**a) The Markov switching regime model with endogenous switching**

Our application of MSM with endogenous switching is extended within the framework of the target zones theory and the mechanism of intervention of the monetary authorities on the market exchange to take into account the endogenous switching of the states. Indeed, the model provides a conciliation between two closely dependent processes of modeling: a first class of Markov switching regime model which makes the dynamics dependent with non observable variable. In its turn, this states variable reformulates the second model presenting the aspect of probit specification for the realization of hidden variables. So, we could reasonably consider that the MSM within this framework is an endogenous Markov switching model, where the process which governs the state variable carries out.

Kim and al (2008) introduce this new approach of Markov regime model with endogenous switching that will be invested after studying the determinants of the exchange rate and to find a solution to the incompatibility between exchange rate and fundamental economic variables. These authors provide that this modeling presents particular aspects for Markov switching regressions. The Markov model that we will present in this paper can be interpreted as an extension to the switching regime approach of Hamilton (1989), in which the state process is conditionally dependent and governed by an endogenous evolution mechanism.

We present the Markov regime model with endogenous switching which was developed by Kim and al (2008) in the following manner:

$$\begin{cases} Y_t = x_t' \beta_{s_t} + \sigma_{s_t} \varepsilon_t, \quad \varepsilon_t \rightarrow N(0, 1) \\ Y_t = (y_{t-1} \ y_{t-2}, \dots), \quad x_t = (y_{t-1} \ y_{t-2}, \dots, x_{1t}, x_{2t}, \dots) \end{cases}$$

$x_t$ : Vector of the explanatory variables of order

$s_t$ : The state variable

The transition probability is written in the following way :

$$\Pr(s_t = i / s_{t-1} = j, z_t) = P_{ij}(z_t)$$

The calculus of the transitions probabilities is influenced by the totality of variables  $z_t$  which are predetermined and they contain elements of  $x_t$ . We announce that the Markov chain is supposed to be stationary and advanced independently from all the observations of the elements  $x_t$  not included in  $z_t$ .

To be able to see the fact of modeling the influence of variables  $z_t$  on the transition probabilities, we use the probit specification for the states  $s_t$  which can reformulate it in an endogenous way as follows :

$$s_t = \begin{cases} 1 & \text{si } \eta_t < a s_{t-1} + z_t' b s_{t-1} \\ 2 & \text{si } \eta_t \geq a s_{t-1} + z_t' b s_{t-1} \end{cases}$$

where,  $\eta_t \rightarrow N(0,1)$

The new expression of transition probabilities compared to the traditional expression of probabilities reformulated in the following way :

$$p_{1j}(z_t) = \Pr(\eta_t < a_j + z_t' b_j) = \Phi(a_j + z_t' b_j)$$

$$p_{2j}(z_t) = \Pr(\eta_t \geq a_j + z_t' b_j) = 1 - \Phi(a_j + z_t' b_j)$$

With  $\Phi$  is a cumulative function with normal distribution; besides, the transition probability from state  $j$  to state  $i$  do not depend only on the most recent achievement as in the case of exogenous switching mechanism but the jump from the state  $j$  to state  $i$  depend only on the variable  $\eta_t$ . So, the transition probabilities matrix is defined as follows :

$$\pi = \begin{bmatrix} p_{11,t} & p_{21,t} \\ p_{12,t} & p_{22,t} \end{bmatrix}$$

where , the transition probabilities are presented in the following manner :

$$p_{11,t} = p_{11}(z_t) = \Pr(\eta_t < a_1 + z_t' b_1) = \Phi(a_1 + z_t' b_1)$$

$$p_{12,t} = p_{12}(z_t) = \Pr(\eta_t \geq a_1 + z_t' b_1) = 1 - \Phi(a_1 + z_t' b_1)$$

$$p_{22,t} = p_{22}(z_t) = \Pr(\eta_t \geq a_2 + z_t' b_2) = 1 - \Phi(a_2 + z_t' b_2)$$

$$p_{21,t} = p_{21}(z_t) = \Pr(\eta_t < a_2 + z_t' b_2) = \Phi(a_2 + z_t' b_2)$$

Indeed, it supposes the dependence of the probabilities on the explanatory variables of the exchange rate, in particular, its most recent past is considered as a determinant factor of the transition probabilities from where the two following expressions :

$$p_{1t} = \Phi(c_1 + d_1 r_{t-1}) = \Pr(s_t = 1 / s_{t-1} = i, r_{t-1})$$

$$p_{2t} = \Phi(c_2 + d_2 r_{t-1}) = \Pr(s_t = 2 / s_{t-1} = i, r_{t-1})$$

$$\text{with , } \begin{cases} 0 < p_t < 1, & 0 < q_t < 1 \\ r_{t-1} : & \text{The value of the exchange rate at the moment } (t-1) \end{cases}$$

To model an endogenous switching regression, we suppose the joint density function  $f(\eta_t, \varepsilon_t)$  as a bivariate normal function, which allows describing :

$$\begin{pmatrix} \varepsilon_t \\ \eta_t \end{pmatrix} \sim N(0, \Sigma), \quad \Sigma = \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix} \quad \text{while supposing that } \text{cov}(\varepsilon_t, \eta_{t-h}) = 0 \quad \forall h \neq 0$$

It is to be noticed that for a regression with exogenous switching model, one supposes that  $\rho = \eta_t = 0$  and  $f(\cdot)$  is a normal univariate function in the other words.

At this level, we must found an obvious statistical feature to allow the formalization of the endogenous switching in the Markov model and we try to present modifications in terms of procedure estimation compared to the exogenous Markov switching approach, so that we can take into account the substantial effects of the endogeneity of states on the estimation parameters while integrating the two expressions in the estimation procedure :  $\Phi(c_1 + d_1 r_{t-1})$  and  $\Phi(c_2 + d_2 r_{t-1})$ .

**b) Limits of exogenous switching regression**

Maximum likelihood estimation that puts forward that the state is exogenous allows the presentation of the expression of conditional density function in the following way :

$$f(y_t/s_t = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) = \frac{1}{\sigma_i} \varphi\left(\frac{y_t - x_t' \beta_i}{\sigma_i}\right)$$

$\theta = (\beta_1, \sigma_1, a_1, b_1, \beta_2, \sigma_2, a_2, b_2, \rho)$ : indicates parameters vectors to be estimated using likelihood method where the likelihood function is determined within the framework of MSM.

We will prove the inconsistency of this approach in which case  $s_t$  is endogenous by presenting the conditional Esperance of residues which are defined in the following way while adapting the proceeding followed by Kim and al (2008) :

$$E(\varepsilon_t/s_t = 1, s_{t-1} = j; \theta) = E(\varepsilon_t/\eta_t < a_j + z_t' b_j) = -\rho \frac{\varphi(a_j + z_t' b_j)}{\Phi(a_j + z_t' b_j)}$$

$$E(\varepsilon_t/s_t = 2, s_{t-1} = j; \theta) = E(\varepsilon_t/\eta_t \geq a_j + z_t' b_j) = \rho \frac{\varphi(a_j + z_t' b_j)}{1 - \Phi(a_j + z_t' b_j)}$$

We notice that the two expressions depend on  $\rho$  which represents an indicator of an endogenous switching mechanism if  $\rho \neq 0$ . So, when  $\rho \neq 0$  conditional Esperance of  $\varepsilon_t$  is different to zero thus causing the problem of dependence of residue to the regime or state variables. Indeed, these aspects prove that exogenous mechanism does not take account of this specificity since it supposes that  $\rho = 0$  and does not meet the problem faced in the case  $\rho \neq 0$ , which makes the likelihood function in exogenous case suffers from the omitted variables problem.

**c) Test of endogeneity**

The choice of phenomenon of endogenous switching procedure must establish its justifications; on the one hand, we must find a theoretical framework which allows us to endogenize the transition probabilities and in particular makes these probabilities dependent of exogenous variables and more precisely of fundamental economic variables. On the other hand, the passage

to the endogenous Markov switching model is not done in an arbitrary way but it is attached to the problem of choice of test validating the alternative hypothesis. Indeed, Kim and al (2008) expose these problems and specify that the validation of the Markov switching regime model must necessarily pass by specifying the mechanism of endogeneity.

In addition, according to the mathematical definition of endogenous transition probabilities where the exogenous variable state or regime represents our basic assumption. It is equivalent to say  $\rho = \mathbf{0}$ . It should be noted that ‘Davies’ problem (1977) does not arise where the parameters are not identifiable under the null hypothesis. The assumption of linear modeling as null hypothesis implies that the parameters of transition probabilities are not identifiable and thus poses Davies’ problem. To this end, the passage from exogenous to endogenous switching regime is certainly based on the restriction that  $\rho = \mathbf{0}$ . In addition, Kim and al (2008) formalized this technical passage by a definition of the usual tests to examine endogeneity using the statistic of likelihood ratio (LR) and statistic of student presenting this usual assumption distributions site the absence of Davies’ problem :

$$LR = 2(L(\hat{\theta}) - L(\hat{\theta}_r))$$

where  $L(\hat{\theta})$  and  $L(\hat{\theta}_r)$  represent respectively the maximized value of the likelihood function, and the maximized value of the likelihood function under the restriction that  $\rho = \mathbf{0}$ . Indeed, the student specification is as follows :

$$t = \frac{\hat{\rho}}{se(\hat{\rho})}$$

with  $se(\hat{\rho})$  is an estimation of the standard error of  $\hat{\rho}$

We suppose that the likelihood function is correctly specified, a standard error can be built from the estimation of the inverse information matrix as indicated by Kim and al (2008).

#### **d) Endogenous switching Markov model estimation procedure**

We adopt the procedure estimation suggested by Kim and al (2008) who starts by presenting the two vectors  $\Omega_t$  and  $\xi_t$  with  $\Omega_t = (x'_t, x'_{t-1}, \dots, x'_1, z'_t, z'_{t-1}, \dots, z'_1)$  and  $\xi_t = (y_t, y_{t-1}, \dots, y_1)'$  two vectors of observations until the date  $t$ .  $\theta$  indicates parameters vectors to be estimated using likelihood method where the likelihood function is determined within the framework of MSM with endogenous switching as follows :

$L(\theta) = \prod_{t=1}^T f(y_t/\Omega_t, \xi_{t-1}; \theta)$  that asks for a definition of the conditional density function  $f(y_t/\Omega_t, \xi_{t-1}; \theta)$ .

Indeed, Kim and al (2008) show that the calculus of conditional density functions is expressed in the following way :

$$f(y_t/\Omega_t, \xi_{t-1}; \theta) = \sum_i \sum_j f(y_t/s_t = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) \\ \times \Pr(s_t = i, s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta)$$

Using the Bayesian approach to calculate recursively the probabilities :

$\Pr(s_t = i, s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta)$  as weightings on the calculus of the conditional density function :

$$\Pr(s_t = i, s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta) = p_{ij}(z_t) \Pr(s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta)$$

$$\Pr(s_t = i/\Omega_{t+1}, \xi_t; \theta) = \Pr(s_t = i/\Omega_t, \xi_t; \theta)$$

$$= \frac{1}{f(y_t/\Omega_t, \xi_{t-1}; \theta)} \sum_j f(y_t/s_t = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) \\ \times \Pr(s_t = i, s_{t-1} = j/\Omega_t, \xi_{t-1}; \theta)$$

To initialize the preceding expression, we must approximate the initial conditional probability where Kim and al (2008) prove that this initial probability can be treated as an additional parameter to be estimated.

To achieve this recursive approach, it should be determine the conditional density function.

Indeed, in the case of exogenous switching approach, i.e.  $\rho = \mathbf{0}$ , the conditional density function is expressed as follows :

$$f(y_t/s_t = i, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) = \frac{1}{\sigma_i} \varphi\left(\frac{Y_t - X_t' \beta_i}{\sigma_i}\right)$$

Thus, this conditional function respects the normality assumption of alea. Meanwhile, to be able to reformulate the framework of endogenous switching regime, we must suppose that  $\rho \in [-1, 1]$  i.e. conditional density functions integrate the quantity  $\Phi(a_j + z_t' b_j)$  while referring to Arnold and Beaver (2002) :

$$f(Y_t/s_t = 1, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) = \frac{\varphi\left(\frac{Y_t - X_t' \beta_1}{\sigma_1}\right) \Phi\left(\frac{a_j + z_t' b_j - \rho((Y_t - X_t' \beta_i)/\sigma_i)}{\sqrt{1 - \rho^2}}\right)}{\sigma_i p_{1j}(z_t)}$$

$$f(Y_t/s_t = 2, s_{t-1} = j, \Omega_t, \xi_{t-1}; \theta) = \frac{\varphi\left(\frac{Y_t - X_t' \beta_2}{\sigma_2}\right) \Phi\left(\frac{-(a_j + z_t' b_j) + \rho((Y_t - X_t' \beta_2)/\sigma_2)}{\sqrt{1 - \rho^2}}\right)}{\sigma_2 p_{2j}(z_t)}$$

## II- Estimation and interpretation of results

### 1) Presentation of the model

#### a) Methodology and Database

The new Markov approach presents its contributions from the fluctuations' treatment of financial series' point of view and more precisely the exchange rate where we suppose the following formulation of Kim and al (2008) :

$$Y_t = x_t' \beta_{s_t} + \sigma_{s_t} \varepsilon_t, \quad \varepsilon_t \rightarrow N(0, 1)$$

$x_t$  : Vector of fundamental economic variables.

To evaluate the Markov approach, in our empirical investigation compared to the traditional approach which supposes an exogenous switching regimen, the vector  $x_t$  of fundamental economic variables is selected according to the differential real interest rates model of Macdonald and al (2005). Within this context, the whole of fundamental cover are the relative variation of supply money, relative variation of industrial production, relative variation of short term interest rate and relative variation of long term interest rate.



Frankel and Rose (1995) confirmed the weak performance of structural models of exchange rate thus providing a normal motivation in the research of more sophisticated modeling which allows the reexamining of the real effects of the fundamentals on the exchange rate dynamics. A motivation which brings Macdonald and al (2005) to suppose a Markov switching regime modeling while reformulating the linear approach of monetary model which was proposed initially by Frankel (1979) can be rewritten in the following way :

$$r_t = \begin{cases} a_{10} + a_{11}r_{t-1} + b_{11}\Delta m_t + c_{11}\Delta y_t + d_{11}\Delta i_t^l + e_{11}\Delta i_t^c + \varepsilon_t & \text{si } s_t = 1 : \text{Eq1} \\ a_{20} + a_{12}r_{t-1} + b_{12}\Delta m_t + c_{12}\Delta y_t + d_{12}\Delta i_t^c + e_{12}\Delta i_t^c + \varepsilon_t & \text{si } s_t = 2 : \text{Eq2} \end{cases}$$

The present modeling allows us again to examine the monetary model in the context of time - varying coefficients models using Markov switching regime approach. Indeed, this switching regime representation then translates the concept of Markov switching regime where the jump from state to another is governed by an exogenous switching mechanism. It should be noted that under the regime 1, the exchange rate is explained by the equation 1, and under the regime two, it is explained by equation 2.

Our contribution is to propose another mechanism which controls the moving of a state to another according to Filardo (1994), Gray (1996) and Kim and al (2008) where we determine the transition probabilities in the endogenous manner:

$$p_{1t} = \Phi( c_1 + d_1 r_{t-1} )$$

$$p_{2t} = \Phi( c_2 + d_2 r_{t-1} )$$

where,  $r_{t-1}$  : The value of the exchange rate at the moment  $(t-1)$

#### **b) Construction of variables**

The calculus of variables used in the model of Macdonald and Al (2005) is given by the following formula:

$$\Delta x_t = \frac{x_t^{\text{Dom}} - x_{t-12}^{\text{Dom}}}{x_{t-12}^{\text{Dom}}} - \frac{x_t^{\text{Etr}} - x_{t-12}^{\text{Etr}}}{x_{t-12}^{\text{Etr}}}$$

$x_t$  : Fundamental economic variable

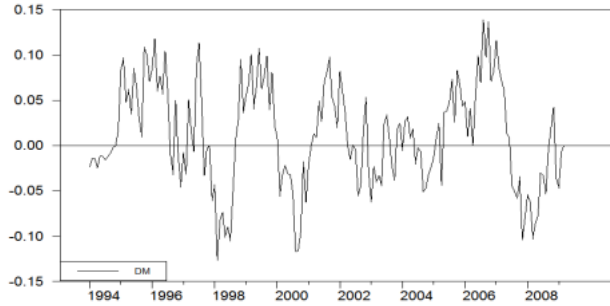
We approach the proceeding suggested by Macdonald and al (2005) who argue primarily with the mechanism of definition of the variables in this method; dealing with the problem of seasonality. The choice of this mechanism allows us, on the one hand, to avoid the effects of seasonality in the data used. On the other hand, this mechanism makes possible to specify well the movements of short term exchange rate and the fundamentals variables; and consequently more stable results are promised.

## 2) Inference state and Results

The estimation of the real interest differential (RID) model represents the starting point of our empirical methodology so that we can appreciate the contribution of MSM in the determination of exchange rates dynamics. Indeed, we will consider the two series of exchange rate JPY/USD and NSZ/USD which respectively represent the exchange rate of Japan and New Zealand against the American dollar. These data are from the CD-ROM of IFS 2009 with monthly frequency over the period going from January 1994 until December 2008. As far as the choice of explanatory variables is concerned, we adopt the Macdonald representation (2005) which defines the variable of the model as follows :

➤ Differential of money supply :

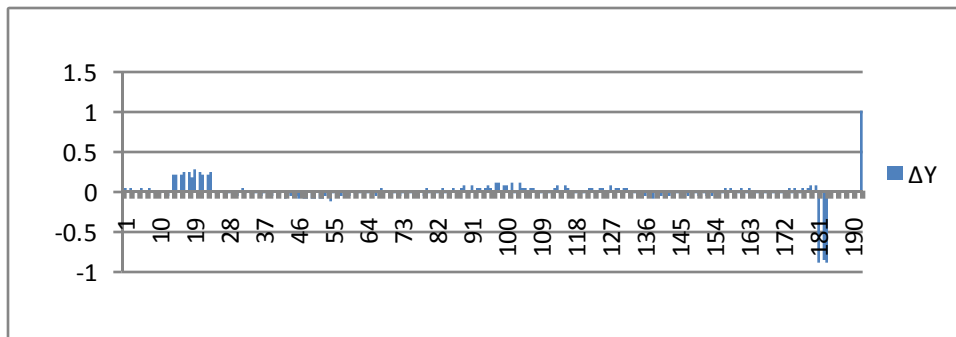
$$\Delta m_t = \frac{M2_t^{\text{jap}} - M2_{t-12}^{\text{jap}}}{M2_{t-12}^{\text{jap}}} - \frac{M2_t^{\text{us}} - M2_{t-12}^{\text{us}}}{M2_{t-12}^{\text{us}}}$$



Graphic 1

➤ Differential of production industrial :

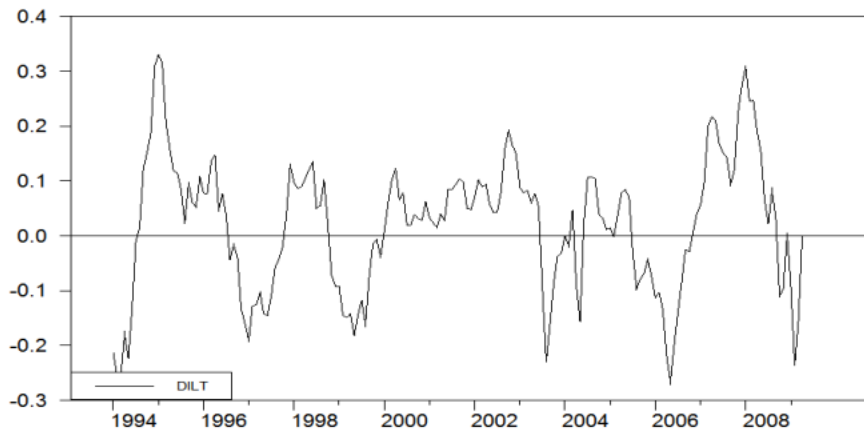
$$\Delta y_t = \frac{Y_t^{\text{jap}} - Y_{t-12}^{\text{jap}}}{Y_{t-12}^{\text{jap}}} - \frac{Y_t^{\text{us}} - Y_{t-12}^{\text{us}}}{Y_{t-12}^{\text{us}}}$$



Graphic 2

➤ Differential of long-term interest rate :  $\Delta ILT_t$

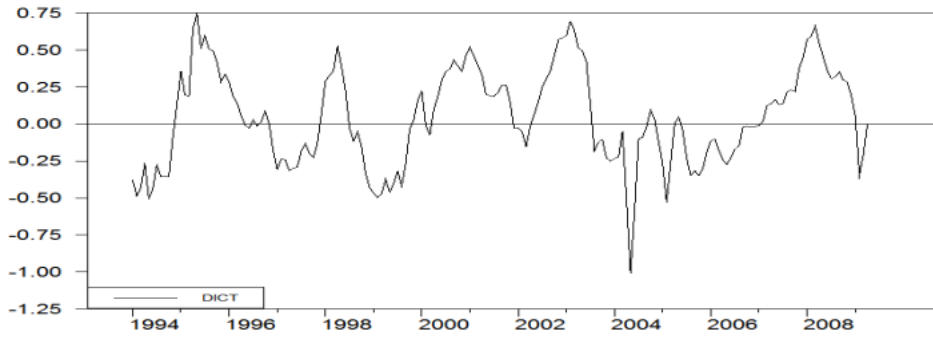
$$\Delta ILT_t = \frac{ILT_t^{\text{jap}} - ILT_{t-12}^{\text{jap}}}{ILT_{t-12}^{\text{jap}}} - \frac{ILT_t^{\text{us}} - ILT_{t-12}^{\text{us}}}{ILT_{t-12}^{\text{us}}}$$



Graphic 3

➤ Differential of short-term interest rate :  $\Delta ICT_t$

$$\Delta ICT_t = \frac{ICT_t^{jap} - ICT_{t-12}^{jap}}{ICT_{t-12}^{jap}} - \frac{ICT_t^{us} - ICT_{t-12}^{us}}{ICT_{t-12}^{us}}$$



Graphic 4

The graphic analysis proves the stationary character of the variables of our model, so as the use of the MSM is within a framework where the average, the variance and all the coefficients of model vary according to the regime. In addition, if the variables are not stationary, we must treat the switching regime in the cointegration relation ship between exchange rate and fundamental economic variables.

**a) Estimation of the real interest differential (RID) model with one regime**

	JPY/USD	P value	NZD/USD	P value
<b>ETAT1</b>				
<b>a<sub>01</sub></b>	3.5615	0.3121	0,0114	0,16376
<b>a<sub>11</sub></b>	0.9676	0.0000	0,9818	0,00000
<b>b<sub>11</sub></b>	4.388	0.0804	0,0314	0,19079
<b>c<sub>11</sub></b>	-2.325	0.3961	0,0112	0,5634
<b>d<sub>11</sub></b>	-1.1815	0,1862	-0,00274	0,4114
<b>e<sub>11</sub></b>	0.0799	0,12869	0,00023	0,575

Table 1

Indeed, the real interest differential (RID) model fails to make better results compared to random walk where only the variable  $r_{t-1}$  present a significant contribution. Nevertheless, the influence of the other variables (differential of money supply, industrial production, short term and long term interest rates) are non significant where these variables are determinant factors of the fluctuation of the exchange rate. Indeed, the linear formulation does not enable us to capture the effects of liquidity through the variable of differential of short term interest rate and the effects of inflation through the differential of long term interest rate.

#### b) Estimation of the real interest differential (RID) model with exogenous Markov switching

	JPY/USD	NZD/USD
<b>Etat 1</b>		
<b>a<sub>01</sub></b>	3.6246	0.0114
<b>a<sub>11</sub></b>	0.9670	0.98186
<b>b<sub>11</sub></b>	4.3639	0.03140
<b>c<sub>11</sub></b>	-2.3321	0.01122
<b>d<sub>11</sub></b>	-1.1802	-0.00274
<b>e<sub>11</sub></b>	0.0800	0.00023
<b>Etat 2</b>		
<b>a<sub>02</sub></b>	0.0006	0.00044
<b>a<sub>12</sub></b>	0.00123	0.00095
<b>b<sub>12</sub></b>	0.00043	0.00139
<b>c<sub>12</sub></b>	-0.00021	0.00398
<b>d<sub>12</sub></b>	0.00175	0.00440
<b>e<sub>12</sub></b>	0.00760	0.00726
<b>P<sub>11</sub></b>	0.99999	0.99999
<b>P<sub>12</sub></b>	0.35964	0.58463

Table 2

Table 2 presents the estimation results of exogenous Markov switching regime for the two exchange rate series JPY/USD and NSZ/USD where we notice that the coefficients associated with the variables of RID model concerning the regime 1 to draw near to the coefficients of

linear RID model while allowing the coefficient  $e_{11}$  schematizing thus the contribution of the differential short term interest rates is positive and significant at the threshold  $\alpha = 5\%$  for the JPY/USD exchange rate.

The results of the Markov switching regime analysis for the series of the NSZ/USD exchange rate reflects a similar situation where we can only find the short and long term interest rates which are also subject to switching regime, but it is not the case for the other variables.

It is also noteworthy that only the interest rate variable presents the contribution of Markov switching regime in the situation which is characterized by complete absence of information on the realization of regime while adopting the Hamilton model (1989) based on the idea in which the states of the system move according to a discrete Markov chain independently to the information concerning endogenous and exogenous variables. Indeed, our contribution in this paper is to criticize the traditional approach of Hamilton (1989) by supposing that the transition probabilities from one regime to another can be governed by an exogenous variable(s) where these last variable(s) can on the one hand affect the exchange rate. On the other hand, they can present a considerable endogenous influence on the values of the transition probabilities  $p_{ij}$ .

Indeed, the mechanism of dependence of the exchange rate to the regimes is mainly schematized by two stochastic processes. Our proposal is to introduce the recent past of exchange rate as a consistent and determinant information in the mechanism of calculus of the transition probability allowing us to propose the new approach of Markov regime model with endogenous switching as follows:

**Process 1:** Non linear exchange rate dynamics of  $r_t$

$$r_t = \begin{cases} a_{10} + a_{11}r_{t-1} + b_{11}\Delta m_t + c_{11}\Delta y_t + d_{11}\Delta i_t^l + e_{11}\Delta i_t^c + \varepsilon_t & \text{si } s_t = 1 \\ a_{20} + a_{12}r_{t-1} + b_{12}\Delta m_t + c_{12}\Delta y_t + d_{12}\delta\Delta i_t^c + e_{12}\Delta i_t^c + \varepsilon_t & \text{si } s_t = 2 \end{cases}$$

**Process 2:** Linear dynamics of transition probabilities

$$p_{1t} = \Phi(c_1 + d_1 r_{t-1}) = \Pr(s_t = 1 / s_{t-1} = i, r_{t-1})$$

$$p_{2t} = \Phi(c_2 + d_2 r_{t-1}) = \Pr(s_t = 2 / s_{t-1} = i, r_{t-1})$$

c) Estimation of the real interest differential (RID) model with endogenous markov switching

	JPY/USD	NZD/USD
<b>Etat 1</b>		
<b>a<sub>01</sub></b>	3.56157	0.07793
<b>a<sub>11</sub></b>	0.96762	0.00185
<b>b<sub>11</sub></b>	4.38848	0.02066
<b>c<sub>11</sub></b>	-2.32512	-0.00036
<b>d<sub>11</sub></b>	1.18159	0.05130
<b>e<sub>11</sub></b>	0.07995	0.02408
<b>c<sub>1</sub></b>	7.88889	1.13373
<b>d<sub>1</sub></b>	0.00241	0.81042
<b>Etat 2</b>		
<b>a<sub>02</sub></b>	-0.00076	0.01513
<b>a<sub>12</sub></b>	0.00242	0.97455
<b>b<sub>12</sub></b>	-0.00259	0.03713
<b>c<sub>12</sub></b>	0.00518	0.00789
<b>d<sub>12</sub></b>	0.00932	0.03843
<b>e<sub>12</sub></b>	0.00808	-0.00774
<b>c<sub>2</sub></b>	1.71332	8.51272
<b>d<sub>2</sub></b>	0.00203	0.06805
<b>σ<sub>1</sub></b>	0.21487	0.00525
<b>σ<sub>2</sub></b>	0.14260	0.02993
<b>P<sub>11</sub></b>	0.99999	0.87154
<b>P<sub>12</sub></b>	0.04326	0.05527

Table 3

Table 3 presents the estimation results of Markov switching regime model where this specification includes the additional equation ( $\sigma_{1t}^2 = \sigma_{1t-1}^2 + \lambda(\sigma_{1t-1}^2 - \sigma_{1t}^2)$ ,  $\lambda = 0, 1$ ) which allows the

controlling of the mechanism of moving from one regime to another. Indeed, the significativity of the coefficients associated with this new representation appears where the contribution of this new approach compared to the Hamiltonian approach (1989) is justified by the significativity of variables in the two regimes of the system. So, the influence of money industrial production appears in the fluctuations of the two exchange rate series where these variables differ appreciably from a state to another and in particular priming the switching regime process for the exchange rate.

As far as the Markov switching model with endogenous switching is concerned, the results obtained reveal significant coefficients for the variables differential of industrial production and differential of money supply, which justify the explanatory performance within the framework of the endogenous mechanism in the two states of the system. It is the same for the variables: differential for long term and short term interest rates where their coefficients are positive and significant at the threshold  $\alpha = 5\%$ .

## CONCLUSION

We used a new approach within the framework of Markov switching regime model where the hidden variable of the state which schematizes discontinuity in the exchange rate dynamics and its determinants can be given in endogenous way such as the STAR Models. Such as it was shown by Kim and al (2008) the parameters models can be estimated by the maximum likelihood method with relative modifications in the recursive filter of Hamilton (1989).

We applied this new technique to determine the implicit endogenous Markov switching in the differential of real interest rate model founded by Macdonald and al (2005) and to exceed the gaps of the real interest differential (RID) model within the framework of Markov regime model with exogenous switching. It is to be announced that the proof is not only the contribution of the traditional approach compared to linear approaches, but it is also to justify the application of the



new version of the Markov switching model where the transition probabilities become dependent on the explanatory variables, while supposing that the recent past of the exchange rate variable, on the one hand can be regarded as a determinant factor of its future values, and on the other hand, the most recent past of the exchange rate allows us to know the exchange rate dynamics by the determination of the most probable regime by endogenizing the transition probabilities from one regime to another.

The results drawn following the estimation provided by the software RATS consolidate the performance and the contribution of MSM with endogenous switching by exposing the significant effects of certain variables which were not considered as responsible factors in the exchange rate dynamics according to the traditional approach.

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