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Contents

Obituary: Dr Stya Paul (1919-2010)	4
Editorial	6
Investigating the Tracking Error of Exchange Traded Funds Gerasimos G Rompotis	7
Managing Supply and Demand of Liquidity in Islamic Banking: A Case of Indonesia Rifki Ismal	23
Organizational Justice Perceptions as Predictors of Job Satisfaction and Organizational Commitment Arti Bakshi, Kuldeep Kumar & Ekta Rani	40
Making Knowledge a Strategic Corporate Resource Deepankar Chakrabarti	54
Book Review	62

Obituary

Dr Stya Paul (1919-2010): A Philanthropist Entrepreneur

The pursuit of excellence is a never-ending quest. It is not a disgrace if dreams remain unfulfilled, but it is, if we have no dreams to dream.” - Dr. Stya Paul

Dr Stya Paul –a noted industrialist, educationist, freedom fighter, and philanthropist at the core of his heart, passed away peacefully at his New Delhi residence on June 7, 2010. A multifaceted personality and one of the most inspiring leaders, Dr Paul was the Chairman Emeritus of Apeejay Stya and Svaran Group, Founder President of Apeejay Education Society and the Chancellor of the recently established Apeejay Stya University.

Eldest of four brothers and three sisters, Dr Stya Paul was born on October 4, 1919, in the state of Haryana. In spite of being afflicted with polio at an early age, he matriculated in 1935 with merit scholarship, graduated with Honours and first division in Mathematics (obtaining a gold medal), and was placed on the merit list in M A (Mathematics) in 1941. He participated in the freedom struggle quite enthusiastically and was arrested and jailed in 1942 for distributing anti-British literature.

After the death of his father in 1944, Dr Stya Paul shouldered the responsibility of running the family business along with his family members and developed the family concern M/s Amin Chand Pyare Lal successfully into one of the largest industrial houses of the country. Apeejay Stya Group grew significantly with diversified interests in verticals such as Pharmaceuticals and Life Sciences, Chemicals and Plastics, Real Estate & Development, International Trading and Distribution, Information Technology, Financial Services, Merchant Banking and Publishing. The Group also has several alliances, collaborations, and considerable presence in Europe, Middle East, and East Asia.

Education was a lifelong passion for Dr Stya Paul. He was one of the pioneering industrialists who recognized the great role that industry could play in providing quality education and contribute towards nation building. He established the Apeejay Education Society in 1967 to realize his vision and mission. He successfully created a unique umbrella organization to nurture institutions where education is blended with human values and a genuine appreciation of Indian culture, arts and heritage.

Dr Stya Paul exhibited meticulous planning, concern for detail and flawless execution that were his hallmark throughout his life. Each of the institutions set up by him was an act of love that he nurtured to become centres of excellence by creating a family-like environment through his personal touch and shared vision of excellence and ownership with all the stakeholders. Starting with small school in Jalandhar, the Apeejay Education Society runs 13 schools and 16 institutions of higher learning which under his guidance have flowered to become symbols of excellence in various disciplines, moulding the lives and careers of future generations of the country. The year 2010 also saw the establishment of Apeejay Stya University –the culmination of a lifelong dream of Dr Stya Paul to set up a seat of global learning that brings about

transformation of the society through value-based education by amalgamating the dual identities of a technology and research-based university with a liberal arts institution.

Dr Styra Paul enriched several social, cultural and professional bodies with his overriding competencies and leadership. He received the coveted 'Udyog Ratna Award' from the Government of Punjab and PHDCCI in recognition of his contribution to industry, education and economic development of the state. Thames Valley University (UK) and B R Ambedkar National Institute of Technology, Jalandhar conferred the degree of Doctor of Philosophy (Honoris Causa) on Dr Styra Paul in the year 2000 and 2008 respectively. Rotary International bestowed on him the highest Rotarian Award 'Service before Self' and 'Best Rotarian of District 3010' for his outstanding humanitarian service.

Dr Styra Paul is survived by his wife Rajeshwari Paul, his daughter Sushma Berlia, brother Lord Swaraj Paul and three grandchildren.

Editorial Board of International Journal of Management Research and Apeejay School of Management pay tributes to the departed soul of its founder Chairman Dr Styra Paul. May his glory flourish till civilization lasts on the earth!

Editorial

International Journal of Management Research (IJRM) is a collaborative publication of the Apeejay Education Society and Philadelphia University. Both the institutions have an extraordinary interest in academic excellence as well as creation and dissemination of knowledge that may, in any way, augment prosperity of people and enrich quality of their lives all over the world. As every mission starts with the very first step, we are humbled in presenting this inaugural issue to the community of practitioners and academics. In this edition, we have included four research papers drawn from different functional areas of Management. There is a book review as well.

Gersimos G Rompotis has studied the tracking error of Exchange Traded Funds (ETFs) vis-à-vis their ability to accurately track the performance of the benchmarks in his paper titled 'Investigating the Tracking Error of Exchange Traded Funds'. The findings in this paper demonstrate that tracking error is positively affected by volatility and the non-full replication strategy adopted by ETFs.

Rifki Ismal has tried to capture the future scenario vis-à-vis Islamic banking and check the resiliency of the industry against any liquidity pressure in his paper titled 'Managing Supply and Demand Liquidity in Islamic Banking: A Case of Indonesia'. The paper starts with identifying and analyzing sources of demand and supply of liquidity and uses ARIMA models to produce a future estimated number. The paper finds that the industry is managing the liquidity very well as of now.

Arti Bakshi, Kuldeep Kumar & Ekta Rani have examined the relationship between perceived organizational justice, job satisfaction and organizational commitment in their empirical paper titled 'Organizational Justice Perceptions as Predictors of Job Satisfaction and Organizational Commitment'. Results of the study indicate that distributive justice is significantly related to job satisfaction whereas procedural justice is not found to be related significantly with job satisfaction. Moreover, both distributive justice and procedural justice are significantly related to organizational commitment. Theoretical and practical implications of the results are also discussed in the paper.

Deepankar Chakrabarti has made a fitting case for aligning knowledge management with strategy formulation in his conceptual paper titled 'Making Knowledge a Strategic Corporate Resource'. The paper explores the interdependency between knowledge, knowledge management and business from a managerial/strategic perspective. Indeed, there are not enough generic models or even guidelines for incorporating the management of knowledge into business and especially business strategy formulation. This article not only attempts to bridge the gap in extant literature but also provides a fresh insight on the need of connecting knowledge management efforts with strategy formulation as well as implementation.

We invite the readers to send their feedback on the articles to add further value to IJMR.

–Editors

Investigating the Tracking Error of Exchange Traded Funds

Gerasimos G. Rompotis^{*}

Abstract

This paper examines the tracking error of Exchange Traded Funds (ETFs) vis-à-vis their ability to accurately track the performance of the benchmarks. The average tracking error estimated equals the 13.8 b.p. and is strongly persistent through time either at the short-term or the long-term level. Further, the paper investigates whether investment style impacts tracking error. Moreover, seasonal patterns in tracking error have also been studied. The findings in this paper demonstrate that tracking error is positively affected by volatility and the non-full replication strategy adopted by ETFs.

Keywords: Exchange Traded Funds, Average Tracking Error, Investment Styles

Introduction

The inception of Exchange Traded Funds (ETFs) in AMEX in 1993 and their successful proliferation among investors that took place during the last 15 year boosted the institution of collective investing. The benefits of ETFs are similar to those of mutual funds but they also offer investors the ability to trade continuously throughout the day and apply active trading strategies, such as short-selling and arbitrage, along with the potential for higher cost and tax efficiency relative to mutual funds.

ETFs are investment hybrids of ordinary corporate stocks and open-ended mutual funds. They are baskets of shares aimed at closely replicating the performance and risk levels of specific indices. However, ETF managers usually fail to replicate accurately the return of their corresponding indices. This pattern is more intent in the case of the ETFs tracking indices from international capital markets due to the higher expenses they charge relative to their domestically invested counterparts and the non-overlapping trading hours between the U.S and foreign exchanges.

In general, the deviation of passively managed funds' performance from the performance of the tracking indices is defined as "tracking error". The literature has suggested various factors that are supposed to affect the level of tracking error. In particular, Frino and Gallagher (2001) report that the major factors that enlarge the size of tracking error are the dividend payments arising from the stocks of an index as well as the size and the timing of index's rebalancing. Elton *et al.* (2002) also attribute the tracking error of the SPDRS (tracking the S&P 500 Index) to that they

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keep the dividends they receive on the underlying assets in non-bearing accounts. This pattern is also highlighted by Kostovetsky (2003), who further demonstrates that index funds and ETFs' tracking error is affected by common as well as by different elements. The main factors inducing the tracking error of index funds are the bid-ask spread, the obligation of index funds to maintain a significant amount of money in cash to meet redemptions, the dividend policies and the transaction costs arising from index changes or corporate activity. The cash drag effect is applicable to ETFs too, even if it is much smaller.

Furthermore, the impact of a portfolio's components on its tracking efficiency is the focus of a study by Larsen and Resnick (1998). Their investigation on both high and low-capitalization portfolios reveals that the high-capitalization portfolios present inferior tracking error and volatility than the low-capitalization counterparts. They also find that the magnitude of tracking error approximates zero when the composition of the stocks' portfolio reaches the absolute synthesis of the index portfolio. Finally, Blume and Edelen (2004) study the impact of S&P 500 composition's change to the abnormal returns of index funds. These abnormal returns are attainable if the indexers choose to adjust their portfolio immediately at the opening price on the consequent day of the change's announcement, rather than waiting until the closure on the day of change. This strategy induces the observed tracking error.

In this paper, we extend the research on tracking error using data from a sample of 50 iShares for the period 2002-2007. At first, we assess whether ETFs are fully invested in the assets of their underlying index portfolios finding evidence of a slight departure from the full replication strategy. We then study whether ETFs are able to deliver return equal to that of the indices. Findings show that ETFs fail to replicate accurately the performance of their benchmarks. An average tracking error of 13.8 b.p. is estimated. Regression analysis reveals that the tracking error of sample's ETFs strongly persists through time either at the short-term or the long-term level. Moreover, we investigate the relationship between ETFs' investment style and tracking error classifying ETFs in value, blend and growth ones. Results reveal weak evidence on that growth ETFs replicate more efficiently their benchmarks than the value and blend ETFs. Going further, we search for calendar effects on tracking error and find that tracking error is significantly higher in December relative to the other months. Finally, we apply cross-sectional regression analysis to investigate the impact of risk, non-full replication strategy and age on tracking error. Results show that tracking error is positively affected by the first two factors but not by the age of ETFs.

Methodology

In this section we develop the methodology that will be followed to examine a number of issues surrounding the tracking error of ETFs.

Performance Regression Analysis

We perform a simple regression in order to examine a variety of interesting issues. The single index model is presented in equation (1):

$$R_{pt} = \alpha_i + \beta_i R_{bt} + \varepsilon_{pt} \quad (1)$$

where R_{pt} indicates the raw return of the ETF on day t , R_{bt} presents the return of the tracking index portfolio on day t , and ε_{pt} is the residual error on that day. In this regression, the alpha (α) coefficient estimates the return an ETF could achieve above the return that relates to the index

portfolio. However, since ETFs pursue a passive investment approach, alpha estimates are not expected to be significantly positive.

The beta (β) coefficient in model (1) is an estimate for the systematic risk to which an ETF is exposed and reflects the aggressiveness of management strategy. Beta estimations are also viewed as indicators of an ETF's replication strategy. A beta of unity suggests a full replication strategy whereby the ETF invests to all components of the tracking index in the same weights. In contrast, a beta which differs from unity, represents a departure from the full replication strategy. In this case the ETF manager rather implements selection techniques choosing stocks expected to outperform.

Tracking Error

In the second step we estimate the level of ETFs' tracking error as the standard deviation of return differences between ETFs and indices. The estimation of tracking error is presented in equation (2):

$$TE = \sqrt{\frac{1}{n-1} \sum_{t=1}^n (e_{pt} - \bar{e}_p)^2} \quad (2)$$

where e_{pt} is the difference of returns on day t and $\bar{e}_p$ is the average return's difference over n days.

Furthermore, we search for persistence patterns in tracking error. We examine persistence applying the regression analysis used, among others, by Grinblatt and Titman (1992) and Bollen and Busse (2004) to assess the persistence of mutual fund performance.¹ This analysis concerns the cross-sectional regression of ETFs' tracking error in a specific year or period on their previous year's or period's tracking error. The beta coefficient of the model is the indicator of persistence. Positive and significant betas imply persistence and persistence's evidence strengthens when beta reaches unity. Negative and significant betas reflect inversions to tracking error while insignificant betas imply unsystematic variation in tracking error.

Examining the Relation between Tracking Error and Investing Style

Having estimated the tracking error, we search the relationship between the tracking error of ETFs and their investing style. To do so, we group ETFs in three portfolios investing in value, blend and growth stocks and we calculate the tracking error of each group as the mean of tracking errors of all the ETFs included in each group.

Furthermore, we apply a dummy regression analysis to evaluate the significance of the differences in tracking errors among the value, blend and growth ETFs. The model we apply is represented by the following cross-sectional multiple regression equation (3):

$$TE = g_0 + g_1 \text{Value} + g_2 \text{Blend} + \varepsilon \quad (3)$$

where TE is the tracking error of ETFs and the dependent variable of the model. Value is a dummy variable equal to one for an ETF investing in value stocks and zero otherwise. Blend is a dummy variable equal to one for an ETF investing in blend stocks and zero otherwise. In this model g_0 captures the effect of tracking error estimation for an ETF which invests in growth

¹ Grinblatt and Titman (1992) report that the performance of mutual funds persists at the long-run level while Bollen and Busse (2004) found evidence of a more short-term persistence in funds performance.

stocks. The g_1 and g_2 coefficients indicate the difference in tracking error between value and growth and blend and growth ETFs respectively. If style does not affect tracking error at all, we will expect gammas to be insignificant.

Searching for Seasonal Patterns in Tracking Error

In this section we examine whether the tracking error of an ETF category (or all ETFs) is subject to calendar effects. At first, we isolate the tracking error of each category of ETFs (value, blend and growth) among the calendar months and then we calculate the average tracking errors of ETFs for each individual month. Afterwards, we evaluate seasonality in monthly tracking errors, MTrack, for each individual ETF category via model (4):

$$MTrack = a + \sum_{i=1}^{11} b_i D_i + \varepsilon_{pt} \quad (4)$$

The dependent variable is utilized in pool basis posturing vertically all the monthly tracking errors of each ETF. The independent variables in the model are eleven dummy variables for all months except December that take the value of one if the return is calculated in the specific month and the value of zero otherwise.² The “b” coefficients measure the difference in tracking error of December and the other months. If tracking error is higher in December in respect to other monthly tracking errors, the estimates of “b” coefficients will be negative and statistically significant. If tracking error in December is lower relative to other months, the estimates of betas will be positive and significant. Finally, if there are not any significant differences in tracking errors between December and other months, beta estimates will be insignificant. The term ε_{pt} represents the random error. Model (5) is estimated for each single year of the period.

Explaining Tracking Error

In the last step, we assess the factors that affect tracking error applying the following cross-sectional model (5):

$$TE = a_0 + a_1 Risk + a_2 NFR + a_3 Age + \varepsilon \quad (5)$$

where TE is the tracking error of ETFs and the dependent variable of the model. The first independent factor is the risk of ETFs estimated as the standard deviation of daily returns. Risk is assumed to be positively related to tracking error and therefore we expect a significantly positive estimation for this variable. The second determinant variable, NFR, reflects the level in which ETFs’ replication strategy departs from the full replication strategy. NFR is estimated as the difference between unity and beta for each ETF. Rompotis (2008) reports a positive correlation between these two variables and therefore we expect a positive and significant estimate for NFR. The last independent factor is the age of ETFs. More specifically, we consider a dummy variable which takes value one for an ETF incepted before 2000 and zero for an ETF incepted after 2000. To our knowledge, the literature does not report any age bias on tracking error and therefore this relationship is to be tested.

Data and Statistics

The study covers the seven-year period from 2001 to 2007 and our sample consists of 50 Barclay’s iShares. The sample only includes ETFs that have full historical data for the studying period. Data include the daily returns of ETFs, which were calculated using closing net assets

² We should point out that Frino and Gallagher (2001) report a January effect on tracking error using data from index funds tracking the S&P 500 Index.

values instead of closing trading prices. Net asset values are free of managerial expenses and were gathered from the website of iShares.

Table 1 provides information about the major trading characteristics of the sample's ETFs. More specifically, the table presents the symbols and the full names of ETFs, their investing style, inception date, expenses ratio, average daily return and risk. Return is calculated in percentage terms by subtracting the net asset value of an ETF on day $t-1$ from its net asset value on day t and dividing the difference by the net asset value on day $t-1$. Symbols, names, styles, inception dates and expenses ratios were obtained from the us.ishares.com.

As inferred by names, the ETFs of the sample invest in indices which cover a variety of domestic broad, domestic sector and international markets. In addition, the sample includes 27 ETFs that invest in value stocks, 13 ETFs allocated in blend stocks and 10 ETFs choosing stocks from growing companies. Furthermore, Table 1 shows that the majority of ETFs employed in the sample have been incepted in the market after 2000. More specifically, 17 ETFs had been incepted before 2000 and 33 ETFs incepted after 2000. The average expense ratio of ETFs equals the 40 b.p. being low enough to reflect the cost advantage of ETFs. Finally, the average ETF of the sample delivers a daily return that equals the 4.6 b.p. while the average risk of the sample's ETFs is equal to 1.159%.

Empirical Results

Performance Regression Analysis

In this section, we present the results of the time-series performance regression (1) in Table 2. The mean alpha estimate of the entire ETF sample is negative and statistically significant at the 1% level. In addition, 34 of the individual alpha estimations are negative and statistically significant, 14 alphas are negative but insignificant and 3 alphas are positive but not significantly different from zero. Overall, results are in accordance with our expectations, since all of the sample's ETFs are passive indexers having no material trading flexibility to produce superior returns to these of the underlying indices.

In contrast to alpha values, all beta coefficients are economically significant and statistically differ from zero at the 1% level. The mean measurement of beta is equal to 0.985, indicating that the sample's ETFs, on average, are more conservative in comparison to their related benchmarks. The t-test examining the difference of all betas at the cross-sectional level from unity indicates that this difference is statistically significant at the 1%. Furthermore, t-statistics on the differences of individual beta estimates from unity show that 30 betas are significantly different from unity. The average difference between betas and unity is equal to 0.019. The results about betas suggest that the majority of sample's ETFs do not follow a full replication strategy.

As a last examination of ETFs replication policy, we use the value of R-square. The average R-square is 0.981, which implies a very good fit for the regression applied to explain the performance relationship between ETFs and indices. On the other hand, the difference of the average R-square from unity, statistically significant at the 1%, indicates that the ETFs of the sample are not fully invested in the assets of their underlying index portfolios.

Tracking Error

Table 3 reports the estimates of tracking error for each ETF of the sample and the average tracking error of the whole sample. Results are presented on an annual basis along with the mean tracking error of each ETF and entire sample for the whole studying period. According to the results, the average tracking error of the sample during the entire period is equal to 13.8 b.p. Moreover, the annual average tracking error ranges from 9.3 b.p. for 2004 to 18.4 b.p. for 2002. Overall, the results indicate that ETFs fail to replicate accurately the performance of their benchmarks.

Scanning through the individual tracking error estimates we find some evidence that the ETFs that invest either in international markets or in some domestic sector indices present the higher tracking error estimates. For instance, the higher mean tracking error of the period is equal to 58.4 b.p. and relates to the ETF that tracks the MSCI Brazil index. Applying cross sectional analysis (not clearly reported in the paper) we find slight evidence that both domestic sector and international ETFs have greater tracking errors than domestic broad ETFs.³

Regression results for tracking error's persistence are presented in Table 4. Presented are the constant (alpha) and slope (beta) estimates of the model, the t-tests, which count for the statistical significance of estimates, and the values of R-squares. In addition, Panel A presents the results for the short-term regressions where the cross-sectional annual tracking errors of ETFs are regressed on their one-lagged values. Panel B reports the results for the mid-term regressions where the two-year tracking errors are regressed on the tracking errors computed with data from the previous two years. Finally, Panel C shows the regression results where the tracking errors calculated with data from the last three years are regressed on the tracking errors estimated with data from the first three years.

According the results, tracking error persists through time. In Panel A, the majority of individual beta estimations are positive and significant (except for the first estimation concerning the regression between 2002 and 2003). Results in Panel A indicate strong short-term persistence. In Panels B and C the beta coefficients are all positive and strongly significant at the 1% level. These results show that tracking error persists at the mid- and long-term level too.

Examining the Relation between Tracking Error and Investing Style

The classification of tracking error according to the investing style of ETFs is presented in Table 5. ETFs are classified in three categories: the first one includes 27 ETFs that invest in value stocks, the second category contains 13 ETFs that are invested in blend assets and the third category includes 10 ETFs that are allocated to growth stocks. The table presents the tracking error of each ETF in each category and the average tracking error of each category on an annual basis. The period's mean tracking error of each ETF is also presented in the table.

³ We applied a dummy regression model having the period's mean tracking error as the dependent variable and two dummy variables standing for sector and international ETFs while the constant of the model represents the domestic broad markets ETFs. The coefficient of sector ETFs dummy is equal to 0.081 and significant at the 5% level and the estimate of the international ETFs dummy is equal to 0.111 and significant at the 1% level. These estimates represent the difference of tracking errors between broad and sector and broad and international ETFs respectively. The size of estimates implies that these differences are not very high.

Results indicate that there is no significant difference between the mean tracking error of value and blend ETFs. More specifically, the period's mean tracking error of value ETFs equals the 15.1 b.p. while the corresponding tracking error of blend ETFs is slightly higher and equals the 15.9 b.p. Furthermore, results show that there is relevantly significant difference of growth ETFs' mean tracking from the respective tracking errors of value and blend ETFs. More specifically, the mean tracking error of growth ETFs is equal to 7.5 b.p.

Considering the annual tracking error measurements, the tracking error of value ETFs range from the 10 b.p. for 2004 to 20.7 b.p. for 2002. The tracking error of blend ETFs ranges from the 9.8 b.p. for 2003 to 19.7 b.p. Finally, the average annual tracking error of growth ETFs fluctuates from 4.9 b.p. for 2006 to 10.2 b.p. for 2002. 2002 is constantly the year that all ETFs (regardless of the investing style) achieve their worst replication performance while they year of the best replicating efficiency is not common among the three classes of ETFs.

Table 6 presents the results of the dummy regression model (3) which evaluates the significance of the differences in tracking errors between the growth and value and growth and blend ETFs. Presented are the estimates of model's coefficients, the value of t-tests applied on the significance of estimates, the R-square and the number of observations which represents the number of ETFs employed in the sample. In addition, the model is applied both for each single year and for the period's mean tracking errors.

The statistical significance of estimates is limited. In particular, the estimates of the constant in the yearly regressions are all positive but significant only in the first three years. In addition, the corresponding estimations of dummy variables are also positive but they are lacking of sound statistical significance. More specifically, the coefficient of value ETFs is significant only in 2003 while the coefficient of blend ETFs is significant only in 2006. Considering the regressions of period's mean tracking errors, results are strongly significant. The constant of the model is positive and significant at the 5% and this is also the case for the g_1 and g_2 estimates. Overall, results indicate that the growth ETFs are slightly better replicators than the value and blend ETFs.

Searching for Seasonal Patterns in Tracking Error

The monthly tracking error's estimations of the three considered ETF categories are analyzed in this section. Table 7 reports the monthly tracking error of ETFs which is estimated as the standard deviation of the difference between the performance of ETFs and indices. According to the results, throughout the grouping of ETFs by investing style, the December mean tracking error is the highest among the mean tracking errors in the other months both at the annual level and the period's mean level with a few exceptions.

The value ETFs achieve, on average, their worst replication performance in December since the mean November tracking error of the period is the highest among all mean monthly tracking errors approximating the 30 b.p. The blend ETFs also present the period's greatest mean tracking error, which equals the 23.1 b.p., in December. The same pattern applies to growth ETFs, whose mean December tracking error is equal to 12.6 b.p. The comparison of monthly tracking errors among the investing categories of ETFs shows that the growth ETFs apply more efficiently their replication strategies in relation to value and blend ETFs.

Considering the individual years, results show that the December tracking error of value ETFs is the highest among all monthly tracking errors during the period 2003-2007. The results of blend ETFs for each individual year indicate that December tracking error is the highest monthly tracking error for all the years from 2003 to 2007. Finally, the results of growth ETFs indicate that December tracking error is the highest monthly tracking in all years excepting 2003, where March tracking error is superior to that of December.

Overall, these results (both the period means and the annual estimations) indicate the existence of a significant December effect on ETFs' replication efficiency, which implies that the failure of ETFs to replicate accurately the performance of their underlying indices strengthens during December.

Table 8 presents the results of equation (4) which estimates the significance of the tracking error differences between December and the other months. The model is estimated separately for each individual year of the studying period and the results are presented considering the categorization of ETFs by the investing style. The "a" estimates of all the groups are positive and statistically significant at the 1% level. Furthermore, the majority of "b" estimates are negative and significant at the 10% or better confirming the existence of the negative December effect on tracking error of ETFs. Additionally, the values of F-statistics are significant at the 1% level for the value ETFs in all the years, significant for the blend ETFs in the first three years and insignificant for growth ETFs in all the years while the statistical significance of "b" coefficients for these two groups in the respective years is not universal.

Explaining Tracking Error

In this section, we present the estimations of tracking error's determinants shown in model (5). Model (5) explores the relation between tracking error on the one hand and ETFs' volatility, replication strategy and age, on the other. This model is applied on a cross-sectional basis for the entire sample's ETFs.

Viewing the regression results in Table 9, we first see that the constant coefficient is equal to -0.111 and is statistically significant at the 10% level. This estimate suggests that there some factors that constantly make tracking error decrease. We could assume that these factors relate to the effort of ETF managers to timely adjust their portfolios to index rebalances so as to enhance their replication efficiency.

Furthermore, in accordance to our expectations, the coefficient of ETFs mean risk is positive and significant at the 1% level. So, we infer that the volatility in ETF daily net asset values is crucial for the determination of their replication efficiency. As implied by the positive and significant risk coefficient, the more volatile the net asset values are the more the tracking error is expected to be.

Going further, results in Table 9 indicate that the departure from the full replication impacts significantly their ability to return the performance of their underlying assets. The estimate of NFR (non-full replication strategy) coefficient is positive and statistically significant at the 1%

level. Therefore, we suggest that as the gap between unity and ETFs' beta increases, tracking error increases too.

Finally, the estimation of age dummy variable is negative but lacking of any statistical significance. Therefore, we reject the hypothesis that there is a material relationship (of any kind) between tracking error and ETFs' age.

Considering the explanatory power of the applied regression model, both the values of R-square and F-statistic indicate that the model is able enough to explain the factors that impact the size of tracking error. R-square is equal to 0.434 and F-statistic is equal to 11.775 being significant at the 1%. Yet, we should point out that the factors considered in the model are not the only factors that affect tracking error. Other elements, such as expenses, transactions costs, cash, market frictions, index rebalances, bid-ask spread are also crucial for the determination of tracking error. However, we could not include these variables in the model as we were lacking of such data.

Conclusion

This paper investigates the ability of ETFs to track accurately the performance of their benchmarks. We first assess whether ETFs manage to replicate the indices and then examine four significant issues surrounding the tracking error. These issues concern the persistence of tracking error, the influence of ETFs' investing style on their replication efficiency, the calendar effects on tracking error and the factors that affect the level of tracking error. These issues are examined employing data for a sample of 50 Barclay's iShares during the period 2002-2007.

At first, results reveal that the performance of ETFs is not equal to the performance of indices. An average tracking error of 13.8 b.p. is estimated. Regression analysis shows that tracking error strongly persists through time either at the short-term or the long-term level. Considering the relationship between tracking error and ETFs' investing style, the results provide weak evidence on that the growth ETFs have lower tracking error than the value and blend ETFs. This relationship holds at the mean level of the entire studying period but does not hold at the individual years of the study. Going further, results reveal a significant December effect on ETFs' tracking error. More precisely, the tracking error of ETFs is higher during December relative to other months. This seasonal pattern applies either at the annual or the period's mean level. Finally, cross-sectional regression analysis finds that the tracking error is positively related to ETFs' volatility and replication strategy.

The main contribution of this paper is that it expands the research on the ability of passively managed portfolios to replicate the performance of their underlying indices using recent data of an extended sample of ETFs while the previous literature has mainly focused on tracking error of index funds or SPDRs (from the bundle of ETFs) examining patterns such as the impact of portfolio capitalization on tracking error. Moreover, it provides empirical evidence on issues that may be of practical implication for investors. For instance, investors wishing to receive as accurate as possible returns relative to index returns should rather invest in growth ETFs than value or blend ETFs. while they should also take into consideration other factors such as the seasonal effects, volatility and systematic risk when they make their investment decisions.

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Table 1: Trading Characteristics

This table presents the trading characteristics of ETFs which are the symbol, name, investing style, expense ratio, inception date, average daily return (in net asset value terms) and risk (in terms of returns' standard deviation) during the period 2002-2007.

Symbol	Name	Style	Inception Date	Expense Ratio (%)	Return (%)	Risk (%)
EWA	iShares MSCI Australia IF	Blend	3/12/1996	0.51	0.081	1.142
EWG	iShares MSCI Canada IF	Blend	3/12/1996	0.52	0.078	1.031
EWD	iShares MSCI Sweden IF	Value	3/12/1996	0.51	0.065	1.499
EWG	iShares MSCI Germany IF	Blend	3/12/1996	0.51	0.068	1.446
EWH	iShares MSCI Hong Kong IF	Value	3/12/1996	0.52	0.064	1.123
EWI	iShares MSCI Italy IF	Value	3/12/1996	0.52	0.054	1.072
EWJ	iShares MSCI Japan IF	Blend	3/12/1996	0.52	0.044	1.298
EWK	iShares MSCI Belgium Investable Mrk IF	Value	3/12/1996	0.51	0.059	1.189
EWL	iShares MSCI Switzerland IF	Growth	3/12/1996	0.51	0.054	1.052
EWM	iShares MSCI Malaysia IF	Value	3/12/1996	0.51	0.064	0.863
EWN	iShares MSCI Netherlands Invest Mrk IF	Value	3/12/1996	0.51	0.046	1.292
EWO	iShares MSCI Austria Investable Mrk IF	Blend	3/12/1996	0.51	0.113	1.073
EWP	iShares MSCI Spain IF	Growth	3/12/1996	0.51	0.081	1.158
EWQ	iShares MSCI France IF	Value	3/12/1996	0.51	0.056	1.296
EWS	iShares MSCI Singapore IF	Value	3/12/1996	0.51	0.073	1.139
EWT	iShares MSCI Taiwan IF	Value	6/20/2000	0.68	0.034	1.505
EWU	iShares MSCI United Kingdom IF	Value	3/12/1996	0.51	0.039	1.112
EWV	iShares MSCI Mexico Investable Mrk IF	Growth	3/12/1996	0.51	0.097	1.406
EWY	iShares MSCI South Korea IF	Value	5/9/2000	0.68	0.101	1.690
EWZ	iShares MSCI Brazil IF	Blend	7/10/2000	0.68	0.147	2.122
EZU	iShares MSCI EMU IF	Value	7/25/2000	0.51	0.058	1.209
IDU	iShares Dow Jones U.S. Utilities Sec IF	Value	6/12/2000	0.48	0.038	1.104
IEV	iShares S&P Europe 350 IF	Value	7/25/2000	0.60	0.051	1.121

IJH	iShares S&P MidCap 400 IF	Blend	5/22/2000	0.20	0.040	1.057
IJJ	iShares S&P MidCap 400 Value IF	Value	7/24/2000	0.25	0.043	1.040
IJK	iShares S&P MidCap 400 Growth IF	Growth	7/24/2000	0.25	0.036	1.101
IJR	S&P SmallCap 600 IF	Blend	5/22/2000	0.20	0.042	1.163
IJS	S&P SmallCap 600 Value IF	Value	7/24/2000	0.25	0.040	1.192
IJT	S&P SmallCap 600 Growth IF	Growth	7/24/2000	0.25	0.044	1.156
IOO	iShares S&P Global 100 IF	Value	12/5/2000	0.40	0.025	0.931
IVE	S&P 500 Value IF	Value	5/22/2000	0.18	0.027	1.065
IVV	S&P 500 IF	Blend	5/15/2000	0.09	0.021	1.014
IVW	iShares S&P 500 Growth IF	Growth	5/22/2000	0.18	0.016	1.001
IWB	iShares Russell 1000 IF	Blend	5/15/2000	0.16	0.023	1.006
IWD	Russell 1000 Value IF	Value	5/22/2000	0.22	0.029	0.993
IWF	iShares Russell 1000 Growth IF	Growth	5/22/2000	0.20	0.017	1.058
IWM	Russell 2000 IF	Growth	5/22/2000	0.24	0.037	1.230
IWN	iShares Russell 2000 Value Index	Value	7/24/2000	0.33	0.040	1.179
IWO	Russell 2000 Growth IF	Growth	7/24/2000	0.25	0.033	1.312
IWV	iShares Russell 3000 IF	Blend	5/22/2000	0.21	0.024	1.015
IWW	iShares Russell 3000 Value IF	Value	7/24/2000	0.27	0.030	0.996
IWZ	iShares Russell 3000 Growth IF	Growth	7/24/2000	0.25	0.018	1.068
IYC	iShares Dow Jones U.S. Cons Ser Sec IF	Value	6/12/2000	0.48	0.013	1.106
IYF	iShares Dow Jones U.S. Financial Sec IF	Value	5/22/2000	0.48	0.018	1.169
IYG	iShares Dow Jones U.S. Financial Ser IF	Value	6/12/2000	0.48	0.016	1.252
IYH	iShares Dow Jones U.S. Health Sec IF	Value	6/12/2000	0.48	0.014	0.991
IYJ	iShares Dow Jones U.S. Industrial Sec IF	Value	6/12/2000	0.48	0.031	1.106
IYK	iShares Dow Jones U.S. Con Good Sec IF	Value	6/12/2000	0.48	0.028	0.781
IYY	Dow Jones U.S. IF	Blend	6/12/2000	0.20	0.025	1.014
OEF	iShares S&P 100 IF	Blend	10/23/2000	0.20	0.016	1.033
Average				0.40	0.046	1.159

Table 2: Performance Regression

This table presents the results of performance regression during the period 2002-2007. The t-test for alpha estimates evaluates the statistical difference of the estimates from zero while the t-test for beta and R-square estimates evaluates the statistical difference of the estimates from unity. ^a, ^b and ^c reflect statistical significance at the 1, 5 and 10% level respectively.

Symbol	Alpha	T-test	Beta	T-test	R ²	1-Beta	Obs.
EWA	-0.012 ^b	-2.024	0.993	-1.245	0.957	0.007	1510
EWB	-0.005 ^b	-2.580	0.996 ^b	-2.069	0.995	0.004	1510
EWD	-0.009 ^c	-1.744	0.952 ^a	-13.060	0.978	0.048	1510
EWG	-0.001	-0.169	0.951 ^a	-12.189	0.974	0.049	1510
EWH	-0.007 ^b	-2.427	0.996 ^c	-1.614	0.991	0.004	1510
EWI	-0.012	-1.462	0.945 ^a	-7.676	0.920	0.055	1510
EWJ	-0.008 ^a	-5.261	0.998	-1.489	0.997	0.002	1510
EWK	0.000	0.100	0.926 ^a	-25.306	0.985	0.074	1510
EWL	-0.010	-1.464	0.962 ^a	-6.345	0.945	0.038	1510
EWM	-0.007 ^b	-1.976	0.997	-1.531	0.993	0.003	1510
EWN	0.000	-0.043	0.998	-1.303	0.997	0.002	1510
EWO	-0.005 ^b	-2.188	0.988 ^a	-7.401	0.996	0.012	1510
EWQ	-0.011 ^a	-3.036	1.002	0.597	0.984	-0.002	1510
EWK	-0.004	-0.981	0.991 ^b	-2.038	0.973	0.009	1510
EWS	-0.006 ^a	-2.662	0.996 ^a	-2.685	0.996	0.004	1510
EWT	-0.010 ^c	-1.728	0.976 ^a	-5.010	0.965	0.024	1510
EWU	-0.006 ^a	-5.072	0.999	-0.972	0.998	0.001	1510
EWV	-0.010 ^b	-2.067	0.988 ^b	-2.550	0.968	0.012	1510
EWY	-0.004 ^b	-2.278	0.998 ^c	-1.845	0.998	0.002	1510
EWZ	-0.001	-0.188	0.924 ^a	-13.914	0.949	0.076	1510
EZU	-0.007 ^a	-3.218	0.997 ^c	-1.617	0.994	0.003	1510
IDU	-0.009 ^a	-5.328	0.998	-1.047	0.995	0.002	1510
IEV	-0.003 ^a	-4.875	1.000	-0.022	1.000	0.000	1510
IJH	-0.008 ^a	-2.970	0.995 ^a	-2.885	0.995	0.005	1510
IJJ	-0.014 ^a	-2.881	0.992 ^c	-1.849	0.972	0.008	1510
IJK	-0.003	-0.783	0.994	-1.502	0.978	0.006	1510
IJR	-0.003	-0.639	0.972 ^a	-8.342	0.983	0.028	1510
IJS	0.000	0.032	0.944 ^a	-17.309	0.983	0.056	1510
IJT	-0.006 ^c	-1.756	0.982 ^a	-8.657	0.993	0.018	1510
IOO	-0.004 ^a	-4.514	0.999	-0.797	0.999	0.001	1510
IVE	-0.006 ^c	-1.794	0.966 ^a	-9.684	0.981	0.034	1510
IVV	-0.003	-1.243	0.998	-0.835	0.992	0.002	1510
IVW	-0.010 ^c	-1.839	0.985 ^a	-3.379	0.970	0.015	1510
IWB	-0.010 ^a	-5.768	0.998	-1.273	0.997	0.002	1510

IWD	-0.009 ^a	-5.222	0.999	-0.665	0.995	0.001	1510
IWF	-0.005	-0.815	0.960 ^a	-6.717	0.944	0.040	1510
IWM	-0.012	-0.804	0.986 ^c	-1.863	0.924	0.014	1510
IWN	-0.013 ^a	-2.721	0.990 ^c	-1.769	0.956	0.010	1510
IWO	-0.005 ^a	-5.310	0.999	-1.223	0.999	0.001	1510
IWV	-0.004 ^a	-4.678	0.999	-1.320	0.999	0.001	1510
IWW	-0.002 ^a	-4.958	1.000	-0.979	1.000	0.000	1510
IWZ	-0.005	-1.025	0.979 ^a	-4.810	0.972	0.021	1510
IYC	-0.005 ^a	-4.801	0.998 ^b	-2.151	0.999	0.002	1510
IYF	-0.007 ^a	-5.243	0.999	-1.252	0.998	0.001	1510
IYG	-0.002 ^b	-2.071	0.999 ^c	-1.687	0.999	0.001	1510
IYH	-0.009 ^a	-4.706	1.000	0.053	0.991	0.000	1510
IYJ	-0.007 ^a	-5.201	0.999	-1.005	0.997	0.001	1510
IYK	-0.007	-1.016	0.975 ^c	-3.175	0.910	0.025	1510
IYY	-0.007 ^a	-5.294	0.999	-0.887	0.998	0.001	1510
OEF	-0.008	-1.523	0.989 ^b	-2.211	0.965	0.011	1510
Average	-0.006	-2.644	0.985	-4.010	0.981	0.015	1510
T-test	-12.868^a		-5.190^a		-6.112^a		

Table 3: Tracking Error

This table presents the tracking error of ETFs during the period 2002-2007. Tracking error is estimated as the standard deviation in return differences between ETFs and indices.

Symbol	2002	2003	2004	2005	2006	2007	Mean
EWA	0.190	0.211	0.220	0.221	0.295	0.275	0.238
EWC	0.052	0.101	0.084	0.049	0.073	0.081	0.075
EWD	0.111	0.112	0.054	0.120	0.072	0.227	0.128
EWG	0.096	0.099	0.076	0.045	0.121	0.094	0.091
EWH	0.134	0.129	0.149	0.180	0.127	0.115	0.140
EWI	0.181	0.201	0.164	0.135	0.160	0.279	0.192
EWJ	0.064	0.057	0.052	0.052	0.058	0.077	0.060
EWK	0.268	0.508	0.120	0.264	0.155	0.217	0.284
EWL	0.231	0.198	0.124	0.101	0.100	0.101	0.152
EWM	0.146	0.126	0.152	0.268	0.149	0.205	0.181
EWN	0.275	0.241	0.131	0.161	0.122	0.229	0.202
EWO	0.199	0.213	0.136	0.127	0.159	0.234	0.182
EWV	0.291	0.157	0.136	0.137	0.078	0.135	0.169
EWQ	0.084	0.093	0.086	0.080	0.088	0.061	0.082
EWS	0.180	0.182	0.252	0.237	0.186	0.244	0.216
EWT	0.049	0.053	0.061	0.082	0.143	0.179	0.106
EWU	0.154	0.198	0.125	0.192	0.213	0.218	0.186
EWV	0.318	0.176	0.130	0.145	0.134	0.170	0.190
EWY	0.201	0.174	0.175	0.107	0.077	0.059	0.143
EWZ	0.225	0.151	0.404	0.749	0.744	0.839	0.584
EZU	0.079	0.090	0.117	0.109	0.116	0.158	0.114
IDU	0.751	0.111	0.098	0.091	0.085	0.075	0.318
IEV	0.311	0.296	0.269	0.225	0.249	0.232	0.265
IJH	0.391	0.163	0.030	0.040	0.040	0.042	0.175
IJJ	0.044	0.166	0.043	0.057	0.060	0.052	0.083
IJK	0.016	0.017	0.018	0.021	0.017	0.036	0.022
IJR	0.415	0.025	0.027	0.030	0.027	0.033	0.171
IJS	0.031	0.032	0.041	0.035	0.039	0.054	0.039
IJT	0.019	0.017	0.019	0.022	0.013	0.012	0.017
IOO	0.554	0.196	0.194	0.191	0.176	0.146	0.280
IVE	0.058	0.058	0.054	0.067	0.064	0.069	0.061
IVV	0.052	0.054	0.060	0.058	0.058	0.059	0.057
IVW	0.032	0.040	0.065	0.043	0.040	0.037	0.044
IWB	0.328	0.051	0.059	0.065	0.053	0.051	0.143
IWD	0.064	0.070	0.066	0.079	0.070	0.071	0.070
IWF	0.025	0.031	0.039	0.031	0.032	0.054	0.036
IWM	0.044	0.034	0.034	0.045	0.038	0.032	0.038
IWN	0.060	0.048	0.047	0.058	0.055	0.058	0.054
IWO	0.019	0.016	0.011	0.017	0.012	0.094	0.041
IWV	0.054	0.051	0.055	0.059	0.048	0.051	0.053
IWW	0.061	0.068	0.064	0.074	0.066	0.070	0.067
IWZ	0.028	0.027	0.040	0.031	0.029	0.056	0.037
IYC	0.138	0.201	0.012	0.015	0.027	0.025	0.101
IYF	0.477	0.060	0.059	0.068	0.063	0.075	0.203
IYG	0.057	0.061	0.064	0.072	0.084	0.071	0.069

IYH	0.577	0.028	0.022	0.024	0.030	0.043	0.237
IYJ	0.449	0.042	0.038	0.041	0.040	0.039	0.187
IYK	0.103	0.091	0.045	0.052	0.064	0.059	0.072
IYY	0.045	0.047	0.056	0.051	0.050	0.050	0.050
OEf	0.452	0.055	0.079	0.058	0.053	0.059	0.193
Average	0.184	0.113	0.093	0.106	0.101	0.120	0.138

Table 4: Persistence of Tracking Error

This exhibit presents the results of a cross-sectional regression model which searches for persistence patterns in ETFs' tracking error. Three types of persistence are assessed: short-term persistence (one-year period to one-lagged year period), mid-term persistence (two-year period to two-lagged year period) and long-term persistence (three-year period to three-lagged year period). ^a and ^b reflect statistical significance at the 1 and 5% level respectively.

Panel A: Short-term Persistence					
Period	Alpha	T-test	Beta	T-test	R ²
03 on 02	-0.006 ^a	-5.166	0.114	0.686	0.029
04 on 03	-0.004 ^a	-3.752	0.426 ^a	2.715	0.231
05 on 04	-0.004 ^a	-3.227	0.628 ^a	4.319	0.292
06 on 05	-0.003 ^a	-3.024	0.443 ^a	3.831	0.234
07 on 06	-0.003 ^a	-2.714	0.703 ^a	4.714	0.386
Panel B: Mid-term Persistence					
Period	Alpha	T-test	Beta	T-test	R ²
04-05 on 02-03	-0.004 ^a	-3.399	0.614 ^a	4.746	0.509
05-06 on 03-04	-0.001 ^b	-2.545	0.851 ^a	9.311	0.643
06-07 on 04-05	-0.001	-1.322	0.827 ^a	7.262	0.524
Panel C: Long-term Persistence					
Period	Alpha	T-test	Beta	T-test	R ²
05-07 on 02-04	-0.003 ^a	-2.740	0.752 ^a	5.464	0.557

Table 5: Tracking Error Classified by ETFs' Style

This table reports the average tracking error of value, blend and growth ETFs during the period 2002-2007. Table also presents the average annual tracking error of each ETF within each category and the mean tracking error of each ETF for the whole period. N represents the number of ETFs within each category.

Panel A: Value ETFs							
Symbol	2002	2003	2004	2005	2006	2007	Mean
EWD	0.111	0.112	0.054	0.120	0.072	0.227	0.128
EWB	0.134	0.129	0.149	0.180	0.127	0.115	0.140
EWI	0.181	0.201	0.164	0.135	0.160	0.279	0.192
EWK	0.268	0.508	0.120	0.264	0.155	0.217	0.284
EWM	0.146	0.126	0.152	0.268	0.149	0.205	0.181
EWN	0.275	0.241	0.131	0.161	0.122	0.229	0.202
EWQ	0.084	0.093	0.086	0.080	0.088	0.061	0.082
EWS	0.180	0.182	0.252	0.237	0.186	0.244	0.216
EWT	0.049	0.053	0.061	0.082	0.143	0.179	0.106
EWU	0.154	0.198	0.125	0.192	0.213	0.218	0.186
EWY	0.201	0.174	0.175	0.107	0.077	0.059	0.143
EZU	0.079	0.090	0.117	0.109	0.116	0.158	0.114
IDU	0.751	0.111	0.098	0.091	0.085	0.075	0.318
IEV	0.311	0.296	0.269	0.225	0.249	0.232	0.265
IJJ	0.044	0.166	0.043	0.057	0.060	0.052	0.083
IJS	0.031	0.032	0.041	0.035	0.039	0.054	0.039
IOO	0.554	0.196	0.194	0.191	0.176	0.146	0.280
IVE	0.058	0.058	0.054	0.067	0.064	0.069	0.061
IWD	0.064	0.070	0.066	0.079	0.070	0.071	0.070
IWN	0.060	0.048	0.047	0.058	0.055	0.058	0.054
IWW	0.061	0.068	0.064	0.074	0.066	0.070	0.067
IYC	0.138	0.201	0.012	0.015	0.027	0.025	0.101
IYF	0.477	0.060	0.059	0.068	0.063	0.075	0.203
IYG	0.057	0.061	0.064	0.072	0.084	0.071	0.069
IYH	0.577	0.028	0.022	0.024	0.030	0.043	0.237
IYJ	0.449	0.042	0.038	0.041	0.040	0.039	0.187
IYK	0.103	0.091	0.045	0.052	0.064	0.059	0.072
Average	0.207	0.135	0.100	0.114	0.103	0.123	0.151
N	27	27	27	27	27	27	27
Panel B: Blend ETFs							
Symbol	2002	2003	2004	2005	2006	2007	Mean

EWA	0.190	0.211	0.220	0.221	0.295	0.275	0.238
EWC	0.052	0.101	0.084	0.049	0.073	0.081	0.075
EWG	0.096	0.099	0.076	0.045	0.121	0.094	0.091
EWJ	0.064	0.057	0.052	0.052	0.058	0.077	0.060
EWO	0.199	0.213	0.136	0.127	0.159	0.234	0.182
EWZ	0.225	0.151	0.404	0.749	0.744	0.839	0.584
IJH	0.391	0.163	0.030	0.040	0.040	0.042	0.175
IJR	0.415	0.025	0.027	0.030	0.027	0.033	0.171
IVV	0.052	0.054	0.060	0.058	0.058	0.059	0.057
IWB	0.328	0.051	0.059	0.065	0.053	0.051	0.143
IWV	0.054	0.051	0.055	0.059	0.048	0.051	0.053
IYY	0.045	0.047	0.056	0.051	0.050	0.050	0.050
OEF	0.452	0.055	0.079	0.058	0.053	0.059	0.193
Average	0.197	0.098	0.103	0.123	0.137	0.150	0.159
N	13	13	13	13	13	13	13

Panel C: Growth ETFs							
Symbol	2002	2003	2004	2005	2006	2007	Mean
EWL	0.231	0.198	0.124	0.101	0.100	0.101	0.152
EWP	0.291	0.157	0.136	0.137	0.078	0.135	0.169
EWV	0.318	0.176	0.130	0.145	0.134	0.170	0.190
IJK	0.016	0.017	0.018	0.021	0.017	0.036	0.022
IJT	0.019	0.017	0.019	0.022	0.013	0.012	0.017
IVW	0.032	0.040	0.065	0.043	0.040	0.037	0.044
IWF	0.025	0.031	0.039	0.031	0.032	0.054	0.036
IWM	0.044	0.034	0.034	0.045	0.038	0.032	0.038
IWO	0.019	0.016	0.011	0.017	0.012	0.094	0.041
IWZ	0.028	0.027	0.040	0.031	0.029	0.056	0.037
Average	0.102	0.071	0.062	0.059	0.049	0.073	0.075
N	10	10	10	10	10	10	10

Table 6: Regression Analysis of Tracking Errors Classified by ETFs' Style

This table presents the estimations of the cross-sectional regression that investigates whether the ETFs' style biases their tracking error. The dependent variable of the model is the tracking error of ETFs. The independent variables of the model are two dummies standing for the value and blend ETFs respectively. The constant of the model expresses the growth ETFs. Gammas express the differences in tracking errors between value and growth and blend and growth ETFs respectively. Obs. is the number of all ETFs in the sample. ^b and ^c reflect statistical significance at the 5 and 10% level respectively.

Symbol	g_0	T-test	g_1	T-test	g_2	T-test	R ²	Obs.
2002	0.102 ^c	1.884	0.105	1.652	0.095	1.313	0.057	50
2003	0.071 ^b	2.524	0.063 ^c	1.915	0.027	0.719	0.080	50
2004	0.062 ^b	2.568	0.038	1.370	0.041	1.295	0.044	50
2005	0.059	1.632	0.055	1.291	0.064	1.326	0.043	50
2006	0.049	1.420	0.054	1.320	0.088 ^c	1.896	0.071	50
2007	0.073	1.793 ^c	0.051	1.067	0.077	1.426	0.042	50
Period	0.075 ^b	2.398	0.077 ^b	2.101	0.085 ^b	2.049	0.100	50

Table 7: Monthly Tracking Error

This table reports the average tracking error of value, blend and growth ETFs for each calendar month within the period 2002-2007. Table also presents the mean monthly tracking error within each year and the mean tracking error within each single month. N represents the number of ETFs within each category.

Panel A: Value ETFs							
Month	2002	2003	2004	2005	2006	2007	Mean
January	0.067	0.072	0.058	0.040	0.037	0.026	0.050
February	0.064	0.117	0.055	0.033	0.037	0.027	0.056
March	0.089	0.116	0.089	0.088	0.073	0.076	0.089
April	0.072	0.071	0.048	0.047	0.049	0.025	0.052
May	0.058	0.084	0.047	0.034	0.041	0.027	0.049
June	0.114	0.101	0.079	0.067	0.083	0.071	0.086
July	0.382	0.058	0.036	0.037	0.036	0.026	0.096
August	0.082	0.052	0.037	0.029	0.031	0.037	0.045
September	0.120	0.089	0.073	0.073	0.074	0.072	0.084
October	0.130	0.051	0.038	0.035	0.024	0.029	0.051
November	0.088	0.045	0.035	0.037	0.026	0.042	0.046
December	0.238	0.282	0.243	0.317	0.285	0.367	0.289

Mean	0.125	0.095	0.070	0.070	0.066	0.069	0.083
N	27	27	27	27	27	27	27
Panel B: Blend ETFs							
Month	2002	2003	2004	2005	2006	2007	Mean
January	0.046	0.055	0.038	0.053	0.070	0.045	0.051
February	0.043	0.043	0.039	0.081	0.089	0.067	0.060
March	0.068	0.079	0.061	0.135	0.115	0.138	0.099
April	0.049	0.054	0.036	0.093	0.053	0.051	0.056
May	0.046	0.096	0.092	0.055	0.134	0.059	0.080
June	0.073	0.071	0.089	0.110	0.132	0.146	0.104
July	0.082	0.036	0.046	0.096	0.077	0.108	0.074
August	0.096	0.036	0.057	0.097	0.051	0.123	0.077
September	0.145	0.077	0.081	0.111	0.103	0.135	0.109
October	0.442	0.034	0.065	0.088	0.042	0.092	0.127
November	0.049	0.036	0.053	0.075	0.050	0.100	0.061
December	0.180	0.204	0.233	0.210	0.267	0.291	0.231
Mean	0.110	0.068	0.074	0.100	0.098	0.113	0.094
N	13	13	13	13	13	13	13
Panel C: Growth ETFs							
Month	2002	2003	2004	2005	2006	2007	Mean
January	0.062	0.071	0.042	0.027	0.041	0.025	0.045
February	0.071	0.084	0.040	0.035	0.038	0.093	0.060
March	0.063	0.105	0.056	0.069	0.048	0.057	0.066
April	0.061	0.067	0.040	0.034	0.033	0.034	0.045
May	0.055	0.058	0.042	0.040	0.033	0.030	0.043
June	0.091	0.071	0.055	0.046	0.056	0.053	0.062
July	0.132	0.051	0.038	0.025	0.032	0.031	0.052
August	0.109	0.038	0.035	0.029	0.028	0.037	0.046
September	0.113	0.056	0.057	0.064	0.061	0.056	0.068
October	0.076	0.043	0.032	0.033	0.030	0.033	0.041
November	0.069	0.041	0.036	0.030	0.027	0.046	0.042
December	0.173	0.094	0.134	0.127	0.092	0.136	0.126
Mean	0.090	0.065	0.050	0.047	0.043	0.053	0.058
N	10	10	10	10	10	10	10

Table 8: Regression Results in ETF Tracking Error's Seasonality The Determinants of Tracking Error

This table reports the coefficients of a pool regression model, which evaluates the statistical significance of the differences in tracking errors of ETFs between December and the other months. The dependent variable of the model is the monthly tracking error of ETFs in pool shape and the independent variables are dummy variables, which take the value one or zero according to the month of reference. ^a, ^b and ^c reflect statistical significance at the 1, 5 and 10% level respectively.

Panel A: Value ETFs												
	2002		2003		2004		2005		2006		2007	
Mont	Coef.	T-test	Coef.	T-test	Coef.	T-test	Coef.	T-test	Coef.	T-test	Coef.	T-test
Dec	0.238 ^a	7.250	0.242 ^a	3.726	0.243 ^a	4.244	0.317 ^a	3.517	0.285 ^a	4.479	0.367	3.473
Jan	-0.171	-4.757	-0.170 ^b	-2.517	-0.185 ^a	-3.080	-0.277 ^a	-3.053	-0.248 ^a	-3.851	-0.341	-3.222
Feb	-0.175 ^a	-4.742	-0.133 ^c	-1.834	-0.188 ^a	-3.123	-0.284 ^a	-3.132	-0.249 ^a	-3.855	-0.340	-3.214
Mar	-0.149 ^a	-4.218	-0.116 ^c	-1.713	-0.154 ^a	-2.596	-0.229 ^a	-2.497	-0.213 ^a	-3.301	-0.291	-2.740
Apr	-0.166 ^a	-4.186	-0.164 ^b	-2.453	-0.195 ^a	-3.328	-0.270 ^a	-2.966	-0.236 ^a	-3.579	-0.342	-3.228
May	-0.180 ^a	-5.033	-0.156 ^b	-2.266	-0.196 ^a	-3.343	-0.283 ^a	-3.119	-0.244 ^a	-3.774	-0.340	-3.214
Jun	-0.124 ^a	-3.291	-0.152 ^b	-2.277	-0.164 ^a	-2.814	-0.250 ^a	-2.758	-0.203 ^a	-3.143	-0.296	-2.778
Jul	0.144	1.043	-0.166 ^b	-2.505	-0.207 ^a	-3.565	-0.280 ^a	-3.089	-0.249 ^a	-3.867	-0.341	-3.226
Aug	-0.156 ^a	-4.036	-0.188 ^a	-2.843	-0.206 ^a	-3.551	-0.288 ^a	-3.184	-0.255 ^a	-3.968	-0.330	-3.110
Sep	-0.118 ^a	-3.093	-0.169 ^b	-2.547	-0.170 ^a	-2.934	-0.244 ^a	-2.682	-0.211 ^a	-3.243	-0.295	-2.767
Oct	-0.109	-1.647	-0.171 ^b	-2.570	-0.205 ^a	-3.524	-0.282 ^a	-3.115	-0.262 ^a	-4.086	-0.338	-3.190
Nov	-0.150 ^a	-3.841	-0.195 ^a	-2.972	-0.208 ^a	-3.565	-0.280 ^a	-3.067	-0.259 ^a	-4.035	-0.325	-3.024
R ²	0.130		0.126		0.322		0.433		0.466		0.484	
F-Stat	4.237 ^a		4.092 ^a		13.444 ^a		21.645 ^a		24.74 ^a		26.55 ^a	
Panel B: Blend ETFs												
	2002		2003		2004		2005		2006		2007	
Mont	Coef.	T-test	Coef.	T-test	Coef.	T-test	Coef.	T-test	Coef.	T-test	Coef.	T-test
Dec	0.180 ^a	3.757	0.204 ^a	3.158	0.233 ^a	7.168	0.210 ^a	3.641	0.267 ^a	4.480	0.291 ^a	4.400
Jan	-0.134 ^b	-2.547	-0.150 ^b	-2.142	-0.195 ^a	-4.248	-0.157 ^c	-1.927	-0.196 ^b	-2.335	-0.246 ^a	-2.631
Feb	-0.136 ^a	-2.645	-0.161 ^b	-2.396	-0.193 ^a	-4.211	-0.130	-1.588	-0.178 ^b	-2.112	-0.224 ^b	-2.395
Mar	-0.112 ^b	-2.239	-0.126 ^c	-1.927	-0.171 ^a	-3.735	-0.075	-0.921	-0.151 ^c	-1.799	-0.153	-1.634
Apr	-0.131 ^b	-2.550	-0.150 ^b	-2.136	-0.197 ^a	-4.295	-0.117	-1.431	-0.213 ^b	-2.536	-0.240 ^b	-2.567
May	-0.134 ^b	-2.538	-0.108	-1.343	-0.140 ^a	-3.054	-0.155 ^c	-1.901	-0.133	-1.581	-0.232 ^b	-2.481

Jun	-0.107 ^b	-2.208	-0.134 ^b	-2.059	-0.144 ^a	-3.129	-0.100	-1.225	-0.135	-1.603	-0.145	-1.548
Jul	-0.098 ^c	-1.679	-0.168 ^b	-2.534	-0.187 ^a	-4.063	-0.114	-1.399	-0.190 ^b	-2.254	-0.182 ^c	-1.951
Aug	-0.084	-1.230	-0.168 ^b	-2.543	-0.175 ^a	-3.820	-0.113	-1.387	-0.215	-2.558	-0.168 ^c	-1.796
Sep	-0.035	-0.512	-0.127 ^c	-1.948	-0.151 ^a	-3.299	-0.099	-1.211	-0.164 ^c	-1.944	-0.156 ^c	-1.665
Oct	0.263 ^c	1.685	-0.170 ^b	-2.573	-0.167 ^a	-3.646	-0.122	-1.496	-0.225 ^a	-2.670	-0.199 ^b	-2.128
Nov	-0.131 ^b	-2.322	-0.169 ^b	-2.426	-0.180 ^a	-3.915	-0.135	-1.650	-0.217 ^b	-2.579	-0.191 ^b	-2.041
R ²	0.251		0.237		0.172		0.038		0.076		0.071	
F-Stat	4.385 ^a		4.070 ^a		2.721 ^a		0.519		0.380		0.448	

Panel C: Growth ETFs												
	2002		2003		2004		2005		2006		2007	
Mont	Coef.	T-test	Coef.	T-test	Coef.	T-test	Coef.	T-test	Coef.	T-test	Coef.	T-test
Dec	0.173 ^a	4.170	0.094 ^a	3.762	0.134 ^a	3.642	0.127 ^b	2.327	0.092 ^a	6.311	0.136 ^a	6.306
Jan	-0.111 ^c	-1.890	-0.023	-0.638	-0.092 ^b	-2.096	-0.100 ^c	-1.774	-0.050 ^b	-2.449	-0.111 ^a	-3.628
Feb	-0.103	-1.745	-0.010	-0.295	-0.094 ^b	-2.159	-0.091	-1.574	-0.054 ^b	-2.623	-0.043	-1.406
Mar	-0.111	-1.883	0.011	0.322	-0.078 ^c	-1.937	-0.058	-1.054	-0.043 ^b	-2.106	-0.079 ^b	-2.593
Apr	-0.112	-1.915	-0.027	-0.756	-0.094 ^b	-2.178	-0.093	-1.608	-0.059 ^a	-2.875	-0.102 ^a	-3.338
May	-0.118 ^b	-2.007	-0.036	-1.017	-0.092 ^b	-2.098	-0.087	-1.474	-0.059 ^a	-2.865	-0.106	-3.476
Jun	-0.082	-1.396	-0.023	-0.657	-0.079 ^b	-2.053	-0.080	-1.465	-0.036 ^c	-1.747	-0.084 ^a	-2.732
Jul	-0.041	-0.698	-0.043	-1.229	-0.096 ^b	-2.273	-0.102 ^c	-1.822	-0.060 ^a	-2.909	-0.106	-3.461
Aug	-0.064	-1.096	-0.056	-1.574	-0.099 ^b	-2.412	-0.098 ^c	-1.731	-0.064 ^a	-3.102	-0.100	-3.258
Sep	-0.060	-1.029	-0.038	-1.063	-0.077 ^b	-2.012	-0.063	-1.132	-0.031	-1.508	-0.081 ^b	-2.636
Oct	-0.097	-1.657	-0.051	-1.432	-0.102 ^b	-2.515	-0.094	-1.625	-0.061 ^a	-2.993	-0.104 ^a	-3.388
Nov	-0.104 ^c	-1.771	-0.053	-1.490	-0.098 ^b	-2.205	-0.097	-1.624	-0.065 ^a	-3.169	-0.091 ^a	-2.960
R ²	0.071		0.069		0.202		0.213		0.146		0.185	
F-Stat	0.746		0.723		2.492 ^a		2.658 ^a		1.680 ^c		2.230 ^b	

Table 9: The Determinants of Tracking Error

This table presents the results of the cross-sectional regression, which combines the factors that affect the tracking error of the sample's ETFs. The dependent variable of the model is the mean tracking error of ETFs for the whole period. The independent variables of the model are the risk of ETFs, the NFR (non-full replication strategy) which is estimated as the difference between unity and ETFs' beta derived from the performance regression and a dummy variables that takes the value one if the inception date of ETF is before 2000 and zero if the inception date is after 2000. Obs. is the number of all ETFs in the sample ^a and ^c reflect statistical significance at the 1 and 10% level respectively.

Variable	Coefficient	T-test
Constant	-0.111 ^c	-1.793
Risk	0.183 ^a	3.493
NFR	2.775 ^a	4.608
Age	-0.011	-0.441
R ²	0.434	
F-statistic	11.775 ^a	
Obs.	50	

Managing Supply and Demand of Liquidity in Islamic Banking: A Case of Indonesia

Rifki Ismal*

Abstract

This paper appraises demand and supply of liquidity in Islamic banking industry. The author has particularly attempted to consider the future scenario vis-à-vis Islamic banking and check the resiliency of the industry against any liquidity pressure. The paper starts with identifying and analysing sources of demand and supply of liquidity and uses ARIMA models to produce a future estimated number. The paper finds that the industry is managing the liquidity very well as of now. Nevertheless, its resiliency against liquidity problems is not fully satisfactory. Permanent liquidity mismatch might possibly exist during unpleasant economics conditions. Finally, the paper suggests Islamic banks to strengthen their liquid instruments, improve the liquidity management as well as business operation and further educate the public about Islamic banking principles.

Keywords: Liquidity, Islamic Banking, Indonesia

Introduction

As financial institution, banks should manage their liquidity in an appropriate manner in order to safely run the business, maintain good relation with investors and borrowers and ultimately avoid liquidity risk problem. Liquidity risk commonly happens because of failures in fund management or unfavourable economic conditions which may lead to unpredictable liquidity withdrawal from depositors. Unfortunately, maintaining a robust liquidity management is more challenging and difficult in a very competitive and open economic system nowadays with strong external influences and sensitive market players (see figure 1). In fact, the failures of banks^[1] in the current global financial environment occurred due to insufficient liquidity management system solving adverse circumstances (Goldman Sachs, 2007).

Theoretically, liquidity risk arises when depositors collectively decide to withdraw more funds than the bank has immediately on hand (Hubbard, Glen, 2002:323). In simple word, liquidity risk management is simply the risk of being unable to raise funds without incurring unusually high costs (Moreno, 2006:74). Hence, liquidity risk applies symmetrically to borrowers in their relationship with banks^[2] and to banks in their relationship to depositors^[3] (Greenbaum and Thakor, 1995:137).

Practically, the banks regularly finds imbalances between asset and liability side that need to be equalized because by nature banks issue liquid liabilities but invest in illiquid assets (Zhu,

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Haibin, 2001:1). If a bank fails to balance the gap, liquidity risk might occur followed by some unwillingness exposures such as high interest rate risk, high bank reserve or capital requirement, lower bank's reputation, etc^[4]. The failure or inefficient liquidity management in this case is somehow determined by how strong the liquidity pressure is, how good the bank prepares its liquid instruments under strong liquidity management policy, how bad the banking condition is, the inability to find liquid sources either inside or outside the bank, etc. Figure 2 lists factors that may possibly lead to liquidity risk problem.

Islamic banks, in this case, have potential demand of liquidity from at least three instruments: Wadiah demand deposit, Mudarabah saving deposit and short term tenor (1-month) of Mudarabah time deposit. On the other hand, supply of short-term liquidity comes from internal and external side of the banks.

This paper attempts to assess demand and supply of liquidity in Indonesian Islamic banking industry and by using econometrics tools called Autoregressive integrated Moving Average (ARIMA) model, it tries to look at the future condition as well as checks the resiliency of the Islamic banking industry against any liquidity pressure.

Demand of Liquidity

There are three main sources of fund in Indonesian Islamic banking industry namely: (1) Wadiah demand deposit; (2) Mudarabah saving deposit and; (3) Mudarabah time deposit. With demand deposit, Islamic banks obtain an explicit or implicit authorization to use it for whatever purpose permitted by sharia, but pay no (do not guarantee) return or profit to investors (Obaidullah, 2005:49). Meanwhile, with the last two sources, Islamic banks can actively use them and share risks with the investors without any voting right (Grais and Pellegrini, 2006:1). Hence, in relation with liquidity risk management, these three deposits require an adequate liquidity to be maintained by the banks.

Wadiah demand deposit is the most unpredictable deposit account since depositors may take their money out without any prior notice to the bank. In this sense, an Islamic bank has to accurately predict how much the potential regular liquidity withdrawal is. In reality, based on data from December 2000 into March 2009, average depositors' withdrawal is 7.69% per month. Next, Mudarabah saving deposit is also the less predictable one because there is no requirement for depositors to tell the bank if they want to take some cash. Data points out an average of 4.13% withdrawal rate per month in this deposit.

Finally, dissimilar with the previous two, Mudarabah time deposit is the most predictable account. Islamic bank may exactly know the demand of liquidity from tenor and maturity date of such deposit. In this case, most of depositors place funds in a 1-month tenor (19.53% of total deposits) with automatic roll over (ARO) (Ismal, 2009:7). Nevertheless, data recognizes only 11.13% of this tenor which is terminated shortly; the rest of it is always being rolled over.

That information is the basis to compute both historical and future demand of liquidity in the following sections. The former will explain the performance of Islamic banks in managing liquidity whilst the later, with ARIMA models, tries to identify any potential liquidity pressure as

a result of greater demand of liquidity from depositor than the available liquidity held by the banks.

Suppliers of Short-term Liquidity

Following three sources of short-term liquidity demanded above, there are sets of liquid instruments prepared by Islamic banks to fulfill any regular or irregular liquidity demanded from depositors. For simplicity, such liquid instruments are grouped into 1st, 2nd and 3rd tier liquid instruments based on its function (see figure 3). First of all, any unpredictable liquidity withdrawal from Wadiah demand deposit and Mudarabah saving deposit is served by the 1st tier liquid instruments which are (a) Cash reserve; (b) Placement of funds in Bank Indonesia (BI) and; (c) Borrowing from Islamic money market (PUAS).

Then, combining liquid instruments in the 1st tier with the other three instruments creates the 2nd tier liquid instruments prepared to tackle any demand of liquidity from termination of 1-month Mudarabah time deposit. The three liquid instruments in this sense are: (i) Withdrawing inter-bank placement and (ii) Repurchasing BI Sharia Certificate or SBIS (formerly named as BI Wadiah Certificate or SWBI) to BI and (iii) Withdrawing equity participation. Finally, in case of liquidity run, the 1st and the 2nd tier above are coupled with the 3rd tier containing (a) Central bank's intra-day emergency fund (FLI and FPJP) (b) Deposit Guarantee Institution (LPS) and (c) Bank's capital. All of it is figured in area A, B and C of figure 3.

Suppliers of Liquidity for Wadiah Demand Deposit and Mudarabah Saving Deposit

First instrument used by Islamic banks to serve regular liquidity withdrawal from both Wadiah demand deposit and Mudarabah saving deposit is cash reserve. On average December 2000-March 2009, Islamic banks reserve 1.83% of their total deposit in this instrument. If the demand exceeds stock of cash reserve, banks will use the second instruments namely placement of funds in BI which consists of reserve requirement and excess reserve. BI does not pay any remuneration to these two accounts as their ultimate function is for settlement of the transactions. In total, Islamic banks locate 17.95% of total deposits into these two liquid instruments.

If demand for liquidity still goes beyond cash reserve and placement of funds in BI, borrowing funds from PUAS by using IMA instrument is the next alternative. This is the tradable instrument and the quickest way of getting instant liquidity although it needs a strong cooperation among Islamic banks. Further, its amount is counted 3.22% of total deposits. As displayed in figure 4, the 1st tier liquid instruments have settled down any withdrawal from both accounts.

Supplier of Liquidity for Mudarabah Time Deposit

If liquidity demanded is added with withdrawal from Mudarabah time deposit, the 2nd tier liquidity reserve is available to provide extra liquidities. Besides instruments in the 1st tier, withdrawing inter-bank placement supplies additional liquidities. This is actually a short-term allocation of Islamic bank's fund into other banks readily to be taken upon needed. Its amount is recorded 5.41% of total deposits on average. If it is still not enough, alternatively, Islamic banks may repurchase their funds in SBIS to BI. SBIS is actually functioning as Islamic monetary instrument to absorb short-term excess liquidity in the industry. Thus SBIS gives direct return to

banks. Nonetheless, for banks, SBIS functions as a liquid instrument to fill out liquidity needs by repurchasing it to BI. In proportion to total deposits, SBIS only takes 6.01% of them.

Finally, small portion of another supplier of liquidity namely equity participation can be withdrawn to strengthen the role of the 2nd tier of liquid instruments upon needed. This instrument only record 0.11% of total deposit, but can complete the supply of liquidity from this tier. In total, the 2nd tier liquid instruments offer liquidities equivalent to 34.53% of total deposit (see figure 5).

Suppliers of Liquidity in Liquidity Distress

When the needs for short-term liquidities still surpass liquidities prepared above, Islamic banks can use the last option which is the 3rd tier liquid instruments. First of all is occupying FLI. Although it requires some specific pre-requisite from the monetary authority, this is the instant way to gain the on the spot liquidity. Secondly, Islamic banks can also use their capital as long as it does not violate capital adequacy ratio (CAR) requirement. Finally, asking for help from government institution called LPS may guarantee depositors' funds in the banks.

So far, fortunately, Islamic banks rarely use the 3rd tier liquid instruments because they can balance a growing trend of deposit and high demand of financing from real sector. Moreover, the market share only captures around 2% of the total banking industry and its interactions, operations, etc are not as complicated as conventional one. Islamic depositors on the other hand also show strong motivation and religious intention to deal with the banks and seem far away from rushing the banks for some unrealistic and un-Islamic reasons.

Performance of Short-term Liquidity Management

The performance of the 1st and 2nd tier to provide requested liquidity to depositors has been quite successful. Based on previous information of the historical of depositors' withdrawals, total amount of short-term liquid instruments stands above the demand of liquidity. Figure 6 and 7 approve the argument.

Nonetheless, this performance may not possibly apply if:

- a) Severe economic crisis hits the country followed by very tight monetary policy like the one occurred in 1997-1998. Some of Islamic banking depositors are rational people who can switch their deposit into conventional one for a higher return.
- b) Islamic banks are proven to be un-Islamic and do not have either proper banking facilities or services. Up to now, Indonesian Sharia Scholar has strictly guided the operation of Islamic banking to prevent it from non-compliant activities. Further, there is also a mutual cooperation between Islamic windows and their parent banks to arrange office channeling^[5] to reach Islamic depositors.
- c) Islamic banks do not implement short-term financing orientation. Due to the characteristics of the deposits and depositors (short-term, continuous and positive expectation of profit, etc), Islamic banks play safe by advancing most of the funds in short-term, safe, liquid and pre-determined financing instruments.

The subsequent section will investigate the future trend of short-term liquidity demanded. Technically, every liquid instruments and deposit will be modeled and forecasted with ARIMA

model. At the end, the future performance of short-term liquidity management will be checked and analyzed particularly for the next two years ahead.

Autoregressive Integrated Moving Average

ARIMA was firstly developed by Box and Jenkins in 1970's (Firdaus, 2006:19). Unlike structural model which composes of some independent variables, ARIMA employs autoregressive (AR) dan moving average (MA) plus integration order term. AR is describing dependent variable (Y_t) based on its past (lag) value (p-th order) or the same as dynamic model. AR is also commonly said as the one uses lag value of the residual of the regression.

On other hand, MA is explaining dependent variable (Y_t) based on past value of error (ε_t) which is moving average of past error term (q-th order) added into mean value of Y_t . MA is also commonly said as the one occupies lag value of forecast error to improve current forecast. The general equation of ARIMA is:

$$Y_t = \beta_0 + \theta_1 Y_{t-1} + \theta_2 Y_{t-2} + \dots + \theta_p Y_{t-p} + \varepsilon_t + \Phi_1 \varepsilon_{t-1} + \Phi_2 \varepsilon_{t-2} + \dots + \Phi_q \varepsilon_{t-q} \quad (1)$$

The process of modeling with ARIMA approach follows four steps (Firdaus, 2006:19): (i) Identification of variables (ii) Estimation of model (iii) Model evaluation (iv) Model forecasting. In identification, a series is investigated whether it has seasonal pattern or not; stationary or non stationary and; pattern of auto correlation function (ACF) and partial auto correlation function (PACF). A series of variable which has been stationary will take formula as:

$$Z_t = \mu + \theta_1 Z_{t-1} + \theta_2 Z_{t-2} + \dots + \theta_p Z_{t-p} + \varepsilon_t - \Phi_1 \varepsilon_{t-1} - \Phi_2 \varepsilon_{t-2} - \dots - \Phi_q \varepsilon_{t-q} \quad (2)$$

which means that it has fitted requirements of (i) Constant mean for all investigation period or $E(Z_t) = \mu$ for all t; (ii) Constant variance or $\text{Var}(Z_t) = E[(Z_t - \mu)^2] = \sigma_x^2$ for all t and; Constant covariance or $\text{Covar}(Z_t, Z_{t-k}) = E[(Z_t - \mu)(Z_{t-k} - \mu)] = \gamma_k$ for all t.

Next, estimation step will find out the most robust estimated model combining AR and MA or both of them. Model evaluation will conduct some diagnostic test to check the accuracy of the estimated model and the actual one such as residual test, coefficient of variables, etc. Finally, forecasting will produce future data of every model under two assumptions (a) Linear forecasting and; (b) Selected model with the most efficient variables.

ARIMA process in the subsequent section takes nine variables and are grouped into two: (i) Liquidity demanders: Wadiah demand deposit (WD), Mudarabah saving deposit (MS) and 1-month Mudarabah time deposit (MT1); (ii) Liquidity suppliers: cash reserve (CR), placement of funds in BI (PB), inter-bank placement (IP), BI Sharia Certificate (SB), equity participation (EP) and, borrowing funds from Islamic money market (PS). Lately, group of liquidity suppliers will be regrouped as the 1st tier and the 2nd liquid instruments to serve liquidity demanded from Wadiah demand deposit and Mudarabah saving deposit (the 1st tier) and Mudarabah time deposit (the 2nd tier).

Identification of Variables

First of all, statistical summaries of variables of liquidity demanders and suppliers are given by table 1 and 2. From standard deviation value, all of variables have indication of upward trend as previously illustrated in figure 5 and 6. In fact, this is one of the non stationary causes thus every variable needs to be modified to fulfill stationary requirement.

In this case, unit root test is conducted to check stationary of every variable which can be explained by taking a simple AR (1) process:

$$Y_t = a_0 + a_1 Y_{t-1} + \varepsilon_t \quad (3)$$

where Y_{t-1} is lag independent variable which might contain a constant and trend; a is a constant and; ε is assumed to be a white noise (Enders, 1995: 70). If $|a_1| \geq 1$, Y_t is a non stationary series meaning it has a trend; does not have constant mean and; the variance is time variant. So, stationary can be evaluated by testing whether absolute value of a_1 is strictly less than one.

Two common tests used in this stage are Augmented Dickey-Fuller (ADF) and Phillip and Perron (PP). ADF re-estimates (3) by subtracting Y_{t-1} (Lutkepohl and Kratzig, 2004:54):

$$\Delta Y_t = \alpha Y_{t-1} + \sum_{j=1}^{p-1} a_j \Delta Y_{t-j} + \varepsilon_t \quad (4)$$

where $\alpha = -a$, null and alternative hypothesis of $H_0: \alpha = 0$ and $H_1: \alpha < 0$; with $t_\alpha < \alpha / (\text{se}(\alpha))$. The basic idea of ADF is to correct high order serial correlation by adding lagged difference terms in the right hand side of the equation. Meanwhile, Phillips and Perron (PP) use nonparametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms (Gujarati, 2004: 818). The result of ADF and PP test is given by table 3 and 4.

Table 3 and 4 reveal that all variables of liquidity suppliers and demanders are stationary (1% statistical significance) in 1st difference (integrated in order 1). Therefore, the estimated models will integrates all variables in order 1 plus relevant AR and MA variables. Rather than ARMA, the model takes form of ARIMA with order p for AR and order q for MA or (p,d,q) .

The next identification process is checking the pattern of AR and MA through correlogram test for behaviour patterns of ACF and PACF. There are at least three patterns commonly found in ARIMA model, (i) Correlogram test which produces zero value in all periods of auto correlation function (ACF = 0). This is called white noise ACF function; (ii) Correlogram test which shows cut off ACF pattern (usually) between the first period of auto correlation function and the second or third one and lastly; (iii) Correlogram test with decreasing pattern of ACF from the beginning of the period until end of the period or normally named as dying down pattern.

In relation to ARIMA modeling, when ACF shows a dying down pattern and PACF indicates a cut off pattern, pure auto regressive (AR) model should be employed with formula of:

$$Z_t = \delta + \theta_1 Z_{t-1} + \theta_2 Z_{t-2} + \dots + \varepsilon_t \quad (5)$$

where Z_t and Z_{t-q} as the current and prior value of stationary series; δ and θ as value of parameters (coefficient and constant values) and; ε_t as residual with expected value of zero. In its construction, this model has to comply with stationarity condition which requires summation of all coefficient value to be less than one.

However, when ACF shows a cut off pattern while PACF is dying down, pure moving average (MA) model should be employed with formula of:

$$Z_t = \mu + \varepsilon_t - \Phi_1 \varepsilon_{t-1} - \Phi_2 \varepsilon_{t-2} - \dots - \Phi_q \varepsilon_{t-q} \quad (6)$$

where Z_t is the current value of stationary series; ε_t and ε_{t-q} are a white noise residual and historical residual and; Φ_1 and μ are value of a constant and coefficient of variables. Like pure AR model, this model has to comply with invertability condition which requires summation of all coefficient value to be less than one. Finally, when both ACF and PACF depict a dying down pattern, combination of AR and MA (ARMA) is used with the formula written in previous equation (2). Thus, because of the combination of the former models, it has to fit with both stationarity and invertability condition.

Computation on ACF and PACF suggests that all of variables, have dying down pattern as seen in table 5 above. As such, every variable is modeled with ARIMA since it is integrated in order 1, except EP which uses pure MA as it has dying down in PACF only.

Estimation of Models and Evaluation

Estimation of nine models has fitted the ARIMA regression requirements above and every estimated model below is written with values of coefficients; t-statistics (in bracket); r-squared and; LM test.

$$\Delta CR_t = \mu + \theta_1 AR_{t-1} + \theta_2 AR_{t-3} + \varepsilon_t - \Phi_1 MA_{t-1} \quad (7)$$

20589.52	0.2048	0.7612	-0.9745
[0.7606]	[2.8524]	[10.0308]	[-67.2516]
R-squared 0.5948	AIC 23.9182	LM test 0.4618	

$$\Delta EP_t = \mu + \varepsilon_t - \Phi_1 MA_{t-17} - \Phi_1 MA_{t-22} \quad (8)$$

196.5324	0.8520	-0.9193
[0.6890]	[8.6871]	[-8.9350]
R-squared 0.6179	AIC 19.4789	LM test 0.3305

$$\Delta PB_t = \mu + \theta_1 AR_{t-1} + \theta_2 AR_{t-2} + \theta_2 AR_{t-5} + \theta_2 AR_{t-12} + \varepsilon_t - \Phi_1 MA_{t-1} \quad (9)$$

54209.38	0.5833	-0.2874	-0.3367	0.4442	-0.5467
[1.8323]	[4.4265]	[-3.2398]	[-3.9144]	[4.3044]	[-4.0260]
R-squared 0.4823	AIC 28.4693	LM test 0.8727			

$$\Delta IP_t = \mu + \theta_1 AR_{t-3} + \theta_2 AR_{t-4} + \varepsilon_t - \Phi_1 MA_{t-1} - \Phi_1 MA_{t-3} - \Phi_1 MA_{t-8} - \Phi_1 MA_{t-10} \quad (10)$$

21214.69	-0.4660	-0.3466	-0.2928	0.2509	0.4575	0.3543
[1.9982]	[-3.6180]	[-2.8743]	[-3.5197]	[3.0288]	[7.9919]	[4.0671]
R-squared 0.2648	AIC 26.0471	LM test 0.5940				

$$\Delta PS_t = \mu + \theta_1 AR_{t-1} + \theta_2 AR_{t-2} + \varepsilon_t - \Phi_1 MA_{t-2} - \Phi_1 MA_{t-7} \quad (11)$$

1694.40	-0.2416	-0.8663	0.8867	-0.6639
[1.3557]	[-3.8966]	[-11.0627]	[16.9652]	[-6.3353]
R-squared 0.5676	AIC 28.1357	LM test 0.8851		

$$\Delta SB_t = \mu + \theta_1 AR_{t-2} + \theta_2 AR_{t-3} + \theta_2 AR_{t-12} + \varepsilon_t - \Phi_1 MA_{t-2} - \Phi_1 MA_{t-6} \quad (12)$$

46181.68	0.5487	-0.3697	0.5590	0.8587	-0.3237
[1.9816]	[5.1892]	[-3.9667]	[4.5360]	[-7.6370]	[-2.5100]
R-squared 0.4537	AIC 28.5186	LM test 0.5179			

$$\Delta WD_t = \mu + \theta_1 AR_{t-2} + \theta_2 AR_{t-4} + \theta_3 AR_{t-13} + \varepsilon_t - \Phi_1 MA_{t-2} - \Phi_2 MA_{t-5} - \Phi_3 MA_{t-11} \quad (13)$$

30605.88	-0.4670	0.2524	-0.3265	0.4074	-0.3263	0.3548
[1.8033]	[-3.4078]	[-2.3475]	[-2.7482]	[4.1483]	[-3.6767]	[3.2402]

R-squared 0.3758 AIC 27.3614 LM test 0.7026

$$\Delta MS_t = \mu + \theta_1 AR_{t-2} + \theta_2 AR_{t-3} + \varepsilon_t - \Phi_1 MA_{t-1} - \Phi_2 MA_{t-2} \quad (14)$$

725486.3	0.4854	0.5025	-0.4016	-0.5936
[0.6496]	[6.1393]	[5.6458]	[-3.9092]	[-6.1113]

R-squared 0.3216 AIC 26.9131 LM test 0.1087

$$\Delta MT1_t = \mu + \theta_1 AR_{t-7} + \theta_2 AR_{t-11} + \varepsilon_t - \Phi_1 MA_{t-13} \quad (15)$$

1749879	0.2920	0.6657	-0.8203
[0.2722]	[2.7406]	[4.7455]	[-23.5606]

R-squared 0.3824 AIC 29.0983 LM test 0.1761

Forecasting of Models

ARIMA models produce a forecasted series from April 2009 to December 2010. The decisions to choose this extended period are because of three reasons: first, the accuracy of model is believed still strong in the short-term rather than long-term; second, more than two years ahead can lead to a bias forecast because of the dynamic progress of this industry and third, the paper aims at providing initial ideas to manage liquidity risk and anticipate scenarios. In the near future, some new Islamic banks and Islamic banking units might join the industry; new norms from regulators might strengthen and support the development of Islamic banks because the grand strategy of Indonesian Islamic banking industry is to be the most attractive and the leader in ASEAN in 2009 and 2010 (Grand Strategy, 2008:4). Moreover, progressive issuance of *sukuk* might give another stimulus to this industry.

The emerging scenarios for Islamic banking are quite interesting and varied. The first scenario is regular liquidity withdrawal vis-à-vis the current management of liquidity. The second one is irregular liquidity withdrawal where demand of liquidity raises above the former scenario. This scenario is possible when depositors want to hold more cash due to unstable economic condition. Lastly is liquidity run when Islamic banks loose trust from depositors or banking crisis occurs in the country like the one happened in 1997-1998. Depositors in this case take all of their deposits out of Islamic banks.

Resiliency of Liquid Instruments

Resiliency of the 1st Tier Liquid Instruments: The final output of this analysis is to map three scenarios of liquidity withdrawal from both WD and MS in order to check the resiliency of liquidity suppliers (the 1st tier liquid instruments). Under regular liquidity withdrawal, future demand of liquidity on both accounts is computed based on historical pattern of liquidity withdrawal. As mentioned earlier, average monthly liquidity withdrawal of WD and MS is 7.69% and 4.13% of each monthly balance. Based this regular pattern and the output of ARIMA forecasting of each liquidity demanders and suppliers, the resiliency of the 1st tier liquid instruments against regular liquidity withdrawal is drawn in thick line in figure 8.

Further, irregular liquidity withdrawal is assumed when liquidity withdrawal from both accounts increases up into a quarter (25%) of each monthly balance. As such, the resiliency of the 1st tier liquid instruments against irregular liquidity withdrawal is drawn in thin dots line in figure 9. Lastly, liquidity run is assumed when half (50%) of each monthly balance is gone. Severe scenario of liquidity run (i.e more than 50%) is not considered as this assumption should have given a strong signal to take actions to avoid further worst scenario. The resiliency of the 1st tier liquid instruments against liquidity run is drawn in thick dots line in figure 8.

Resiliency of the 2nd Tier Liquid Instruments: The appearance of the 2nd tiers should strengthen the supply of liquidity of the banks especially to handle additional demand of liquidity from MT1 besides the previous two accounts. Historical data shows that an average monthly liquidity termination of MT1 is only 11.13% of each monthly balance. This fact together with ARIMA's output tests the ability of the 2nd tier to accomplish such demand of liquidity. A thick line in figure 9 depicts this condition.

Next, irregular liquidity withdrawal is when termination of MT1 reaches 25% of each monthly balance. This assumption and the supply of liquidity from the 2nd tier liquid instruments are illustrated in thin dots line in figure 10. Finally, the hardest condition comes if termination of MT1 occurs 50% of each monthly balance and explained by thick dots line in figure 9.

Findings and Recommendations

The whole analyses of liquidity risk management above leave some important findings:

- a) In general, the 1st and 2nd tier liquid instruments performs well to supply and match demand of liquidity during regular and even irregular liquidity withdrawal conditions. This is clearly seen in the performance of the 1st tier liquid instruments to serve every month liquidity withdrawal from both WD and MS. However, although it is similarly happen to the 2nd tier liquid instruments, liquidity mismatch starts to arise during last semester of 2009 and 2010 as seen in grey line in figure 10.
- b) However, both liquidity suppliers fail to mitigate liquidity run condition. The 1st tier liquid instruments cannot serve the depositors demand of liquidity between May 2004 and December 2005; last quarter of 2006 and; last semester of 2007. It permanently stops working from July 2008 into December 2010. The 2nd tier on the other hand begins to loose its function from January 2007 to December 2010.
- c) These facts warn that the 1st and 2nd tier do not work properly in liquidity run and some cases of irregular liquidity withdrawal. Fortunately, such unfavorable liquidity problems have not hit the industry yet but the current global financial crisis following some internal and external Islamic banking problems (lack of infrastructure, human resources and banking facilities; less competitiveness Islamic return; the existence of rational depositors, etc) can make such irregular and liquidity run scenarios possible to exist.
- d) The assumption of liquidity run delivers the important message that the resiliency of Islamic banks against liquidity run is in this level of liquidity drain. Intensifying socialization and education to depositors, public, etc.; improving banking facilities, products and services; optimizing banking financing in order to be able gain and pay competitive return to depositors and stakeholders are amongst efforts that can be pursued by all market players and banking regulators to prevent liquidity run.

- e) It is realized that there is still another tier, the 3rd tier, to finally solve the liquidity problem. Nonetheless, using such tier brings many negative consequences prior to settling down the problem such as negative perception in the market and among depositors which may potentially impact the whole banking system, negative image of the quality of liquidity management of a needy Islamic bank, sanctions from banking regulators, etc.

Conclusion

Islamic banking industry in Indonesia has a remarkable growth and performance potential. With respect to liquidity management, it has shown a good management under the assumption of regular liquidity withdrawal, immature but growing industry and high intension of the public. Nevertheless, once unfavorable conditions occur, this industry is very fragile to suitably manage its liquidity. At the end, many efforts need be taken in order to prepare a better liquidity management and guard this industry from any eventuality arising out of phenomenal growth and development.

Endnotes

1. For example, Barclays Bank, Westpac (Australian Bank) (1992), German BFG Bank (1993), (Greenbaum and Thakor, 1995:584) and Lehman Brothers, Merrill lynch (2008).
2. The banks decide not to renew their loan when borrowers want it.
3. The depositors decide not to extend their deposits in bank while banks need it.
4. Government (central bank) can take over bank's failure in solving liquidity risk or close it.
5. Using parent bank's networks to reach depositors in all provinces.

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Glossary of Arabic Words

Mudarabah: A form of partnership where one party provides funds while the other provides expertise and management. Any profits accrued are shared between the two parties on a pre-agreed basis, while loss is borne by the provider(s) of the capital.

Murabahah: It is a contract of sale in which the seller declares his cost and the profit. It can involve a request by the client to the bank to purchase a certain item for him. The bank does that for a definite profit over the cost which is stipulated in advance.

Musharakah: It is a mutual consent business contract to share profits and losses in the joint business. Islamic bank and enterprise provides funds together. Any profit will be distributed among partners in pre-agreed ratios and loss will be borne by every partner in proportion to respective capital contributions.

Bay Salam: The buyer makes advance payment for goods to be delivered by the seller later on. It is necessary that the quality of the commodity intended to be purchased is fully specified leaving no ambiguity leading to dispute.

Bay Istishna: It is a contractual agreement for manufacturing goods and commodities, allowing cash payment in advance and future delivery or a future payment and future delivery. A manufacturer or builder agrees to produce or build a well described good or building at a given price on a given date in the future. Price can be paid in installments, step by step as agreed between the parties.

Ijarah: Sale of a definite usufruct of any asset in exchange of definite reward. It refers to a contract of land leased at a fixed rent payable in cash and also to a mode of financing adopted by Islamic banks.

Kafalah (Suretyship): In Kafalah, a third party become surety for the payment of debt. It is a pledge given to a creditor that the debtor will pay the debt, fine etc. Suretyship in Islamic law is the creation of an additional liability with regard to the claim, not to the debt or the assumption only of a liability and not of the debt.

Hiwalah: Legally, it is an agreement by which a debtor is freed from a debt by another becoming responsible for it, or the transfer of a claim of a debt by shifting the responsibility from one person to another – contract of assignment of debt.

Wakalah: A contract of agency in which one person appoints someone else to perform a certain task on his behalf, usually against a certain fee.

Figure 1 Interconnection among Risks and Affecting Environment

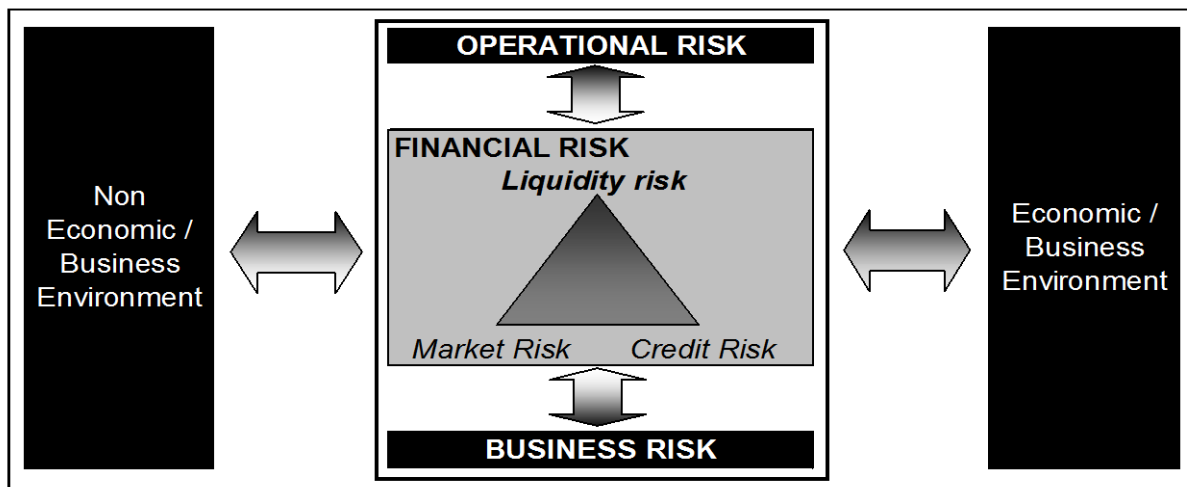
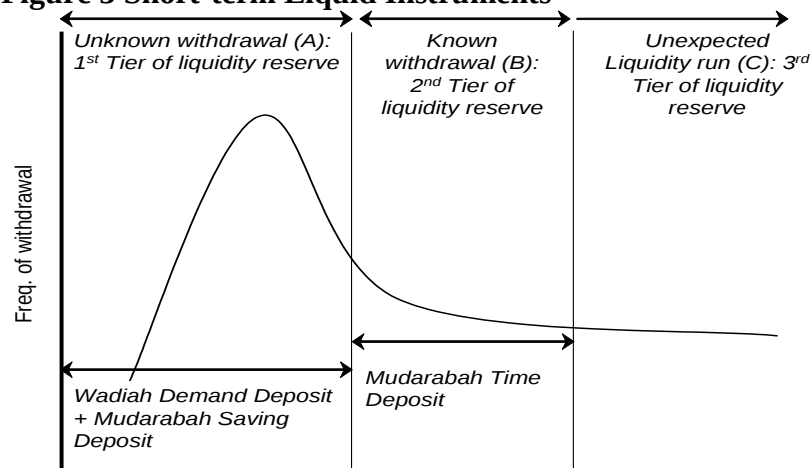


Figure 2 Internal and External Factors Leading to Liquidity Risk

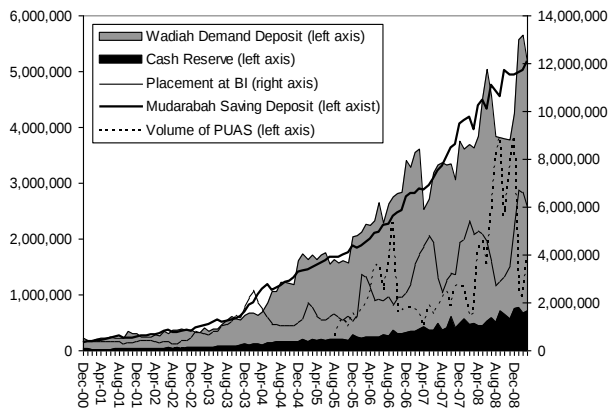
Internal Factors	External Factors
High off-balance sheet exposure	Very sensitive financial market and depositors
Rely heavily on short-term corporate deposit	External and internal sudden economic shocks
A gap in asset liability maturity date	Low economic performances
Rapid asset expansion exceeding liability side	Decreasing trust to banking sector
Short-term deposit concentration	Non economic factors (political unrest, etc).
Less allocation in liquid government instruments	Sudden cash needed for project financing
No incentive offered in long term deposit	Government's need for external obligation purpose

Figure 3 Short-term Liquid Instruments



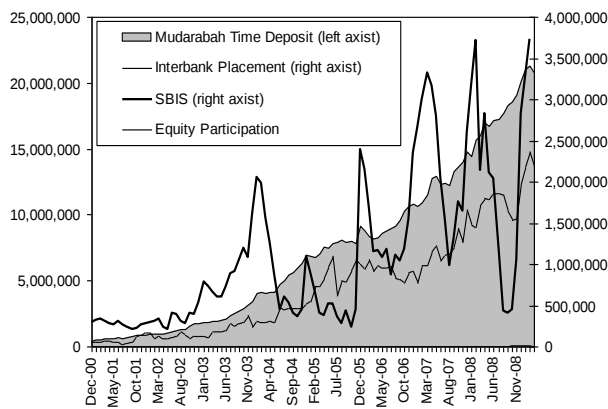
Source: Modification of Khan Tariqullah from Arani, Shahin, 2006

Figure 4 The 1st Tier Liquid Instruments



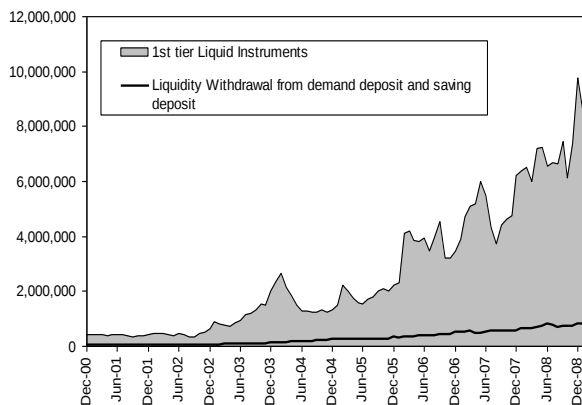
Source: BI Statistics

Figure 5 The 2nd Tier Liquid Instruments



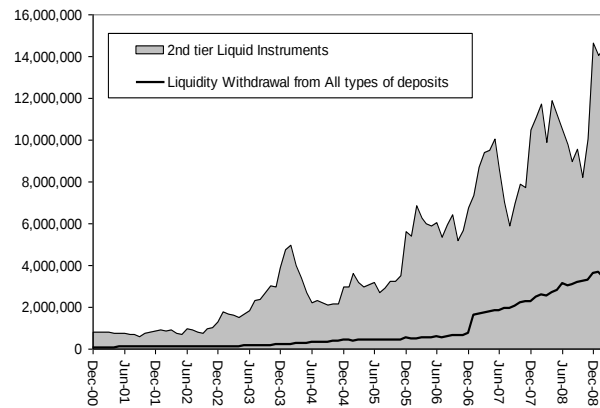
Source: BI Statistics

Figure 6 The 1st Tier and Liquidity Demanded



Source: BI Statistics

Figure 7 The 2nd Tier and Liquid Demanded



Source: BI Statistics

Figure 8. Resiliency of the 1st Tier

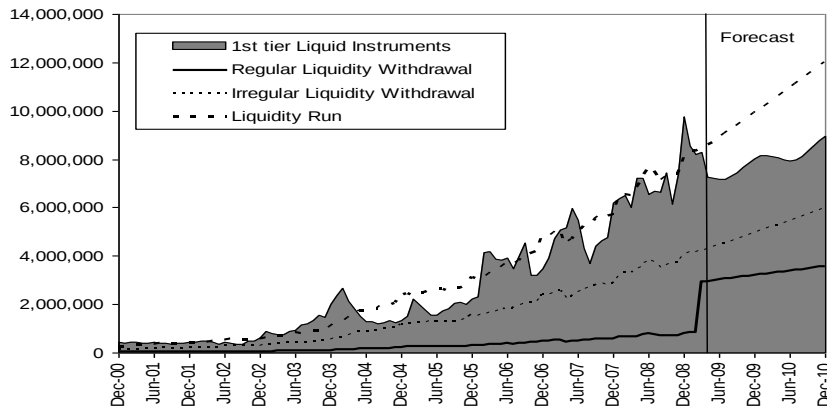


Figure 9 Resiliency of the 2nd Tier

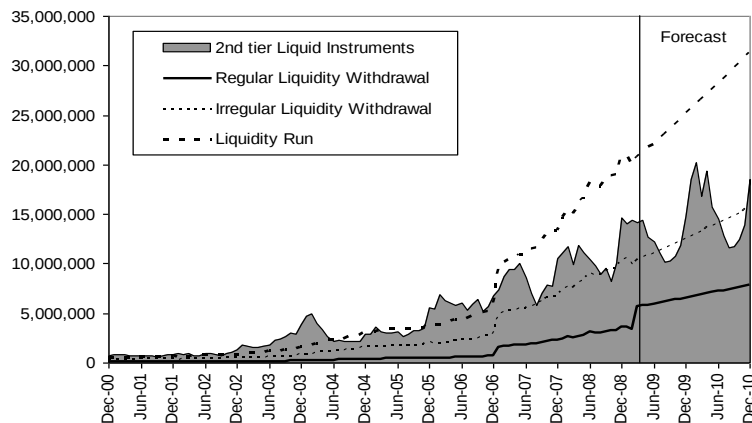


Figure 10 Performance of the 2nd Tier

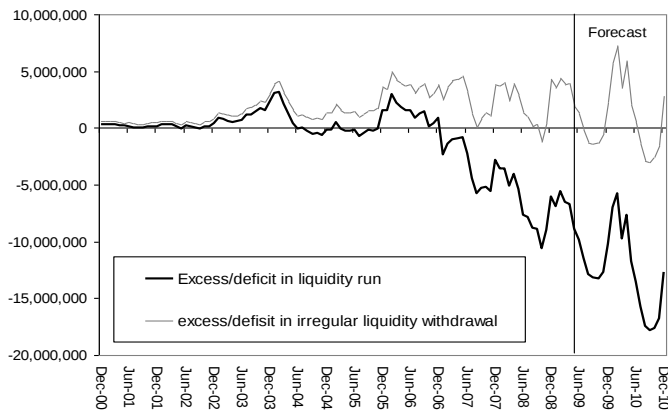


Figure 11 Performance of the 1st Tier

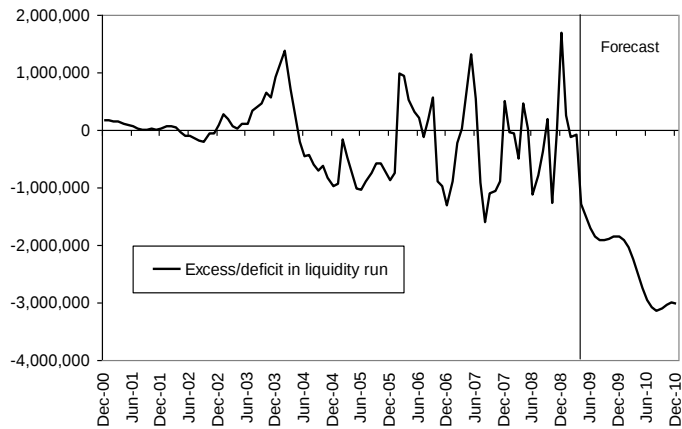


Table 1 Statistical Summary (million Rp)

Variable	Mean	Median	Std Deviation
Cash Reserve (CR)	232,664	170,058	200,865
Placement of Funds in BI (PB)	1,982,137	1,425,390	1,617,321
Inter Bank Placement (IP)	723,687	587,528	611,458
Equity Participation (EP)	14,026	5,660	20,779
Islamic Money Market (PS)	568,069	70,300	862,433
BI Sharia Certificate (SB)	1,117,677	784,000	940,561

Table 3 Stationary Test of Liquidity Suppliers

Variable Name	Augmented Dickey-Fuller		Phillip and Perron	
	Level	1st Difference	Level	1st Difference
CR	3.3959**	-18.2237***	1.1207	-22.8291***
PB	-1.5632	-7.1403***	-0.9042	-6.2920***
IP	0.2668	-11.8793***	1.4331	-12.8215***
EP	-1.3317	-5.9586***	-1.3706	-7.9949***
PS	-0.5274	-5.0954***	-2.1378	-11.8975***
SB	-2.3568	-8.1176***	-2.2182	-8.1714***

Note: *** refers to stastical significance of 1%

Table 2 Statistical Summary (million Rp)

Variable	Mean	Median	Std Deviation
Wadiah Demand Deposit (WD)	1,524,531	1,348,000	1,269,524
Mudarabah Saving Deposit (MS)	4,164,605	3,305,000	3,622,862
Mudarabah Time Deposit (MT1)	7,756,312	6,749,069	6,790,541

Table 4 Stationary Test of Liquidity Demanders

Variable Name	Augmented Dickey-Fuller		Phillip and Perron	
	Level	1st Difference	Level	1st Difference
WD	-0.0412	-8.7088***	1.1313	-10.9541***
MS	6.2270	-3.2308**	6.0965	-10.7473***
MT1	2.1006	9.9756***	2.9774	-9.9753***

Note: *** refers to stastical significance of 1%

Table 5. Correlogram of ACF and PACF

Period	EP		CR		PB		IP		SB		PS		WD		MS		MT1	
	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF
1	-0.014	-0.014	-0.486	-0.486	0.328	0.328	-0.2	-0.2	0.175	0.175	-0.147	-0.147	0.07	0.07	-0.071	-0.071	-0.094	-0.094
2	-0.006	-0.006	-0.259	-0.648	-0.023	-0.146	0.027	-0.014	0.133	0.106	-0.435	-0.466	-0.264	-0.27	0.067	0.062	0.019	0.01
3	-0.006	-0.006	0.584	0.14	-0.175	-0.135	-0.113	-0.115	-0.125	-0.172	0.294	0.173	-0.137	-0.102	0.371	0.383	-0.012	-0.009
4	-0.007	-0.008	-0.315	0.067	-0.166	-0.071	-0.18	-0.238	-0.084	-0.054	0.191	0.093	-0.143	-0.215	0.083	0.163	0.171	0.17
5	-0.356	-0.356	-0.142	0.008	-0.347	-0.336	0.073	-0.019	-0.26	-0.212	-0.223	0.019	-0.069	-0.133	0.165	0.165	0.062	0.098
6	-0.004	-0.017	0.363	0.031	-0.274	-0.131	0.002	-0.006	-0.243	-0.193	-0.221	-0.261	0.107	-0.003	0.154	0.049	0.102	0.119
7	-0.004	-0.011	-0.252	-0.076	-0.086	-0.056	-0.063	-0.131	-0.202	-0.121	0.067	-0.203	0.021	-0.1	0.061	-0.023	0.193	0.23
8	0	-0.007	-0.027	-0.012	-0.02	-0.173	0.224	0.168	-0.127	-0.129	0.145	-0.009	-0.069	-0.107	0.332	0.245	-0.081	-0.064
9	0	-0.009	0.289	0.177	-0.039	-0.17	-0.123	-0.032	-0.145	-0.21	-0.183	-0.079	0.062	0.024	0.085	0.084	0.005	-0.041
10	-0.004	-0.151	-0.328	-0.077	0	-0.173	0.151	0.114	0.023	-0.067	-0.088	0.007	-0.05	-0.124	0.04	-0.019	-0.021	-0.078
11	-0.004	-0.018	0.121	0.037	0.175	0.002	-0.139	-0.07	0.177	0.06	0.139	-0.072	0.134	0.175	0.282	0.073	0.255	0.165
12	-0.004	-0.014	0.202	0.091	0.408	0.293	0.049	0.091	0.356	0.201	0.09	0.049	0.132	0.07	0.053	-0.023	-0.065	-0.043
13	-0.004	-0.011	-0.289	0.114	0.219	-0.039	-0.02	-0.008	0.174	-0.007	-0.112	-0.056	-0.249	-0.215	0.164	0.1	-0.113	-0.175
14	-0.008	-0.017	0.085	-0.03	0.08	0.066	0.034	0.063	0.144	0.005	-0.046	-0.035	-0.166	-0.059	0.066	-0.09	0.206	0.207
15	-0.004	-0.072	0.182	0.004	-0.042	0.03	0.036	0.058	0.004	-0.018	0.067	-0.119	0.155	0.102	0.125	0.047	-0.095	-0.108
16	-0.004	-0.019	-0.179	0.148	-0.119	0.001	-0.001	0	-0.043	-0.016	0.047	-0.014	0.087	0.023	0.095	-0.097	0.045	0.02
17	0.317	0.362	-0.002	0.042	-0.433	-0.235	-0.008	0.046	-0.147	-0.005	-0.09	-0.037	0.075	0.083	0.008	-0.1	-0.138	-0.141
18	-0.004	0.006	0.151	0.015	-0.254	0.069	-0.031	-0.072	-0.244	-0.143	-0.096	-0.101	0.092	0.058	0.136	0.044	0.076	-0.08
19	-0.004	-0.018	-0.081	0.113	0.023	0.099	-0.129	-0.092	-0.273	-0.182	0.085	-0.041	-0.08	0.05	0.056	-0.063	-0.073	0.03
20	-0.003	-0.033	-0.061	-0.018	0.076	-0.058	0.037	-0.077	-0.146	-0.032	0.006	-0.124	-0.095	0.029	-0.037	-0.095	0.076	0.065
21	-0.004	-0.003	0.059	-0.128	-0.002	-0.051	-0.05	-0.045	-0.07	-0.001	-0.092	-0.041	-0.011	0.002	0.12	-0.034	-0.007	0.009
22	-0.328	-0.092	0.095	0.161	0.155	0.116	0.092	-0.024	0.082	0.032	-0.049	-0.171	-0.036	-0.015	0.031	-0.004	-0.027	-0.018
23	-0.001	-0.004	-0.197	-0.105	0.09	-0.199	0.055	0.035	0.076	-0.11	0.082	-0.05	-0.07	-0.136	-0.017	-0.032	-0.125	-0.103
24	-0.001	-0.026	0.175	0.162	0.113	0.067	-0.035	-0.037	0.296	0.081	0.131	0.059	0.163	0.188	0.085	-0.003	0.043	0.161
25	-0.001	-0.019	-0.016	-0.032	0.035	-0.043	0.055	0.046	0.136	-0.042	-0.151	-0.108	0.056	0.096	0.001	0.041	0.18	0.08
26	-0.001	-0.008	-0.099	0.112	0.104	0.025	0.022	0.107	0.103	-0.083	-0.031	-0.044	0.024	0.027	0.05	0	-0.029	0.043
27	-0.001	-0.146	0.109	-0.079	0.048	0.059	-0.09	-0.032	-0.121	-0.236	0.338	0.17	-0.007	-0.06	0.016	0.013	-0.062	-0.042
28	-0.001	-0.012	-0.032	-0.028	-0.026	0.019	0.012	0.008	0.104	0.086	-0.082	-0.023	-0.058	0.04	-0.044	-0.018	0.007	0.008
29	-0.002	-0.05	-0.075	-0.042	-0.146	0.158	-0.122	-0.071	-0.029	0.083	-0.167	0.056	0.011	0.114	-0.001	-0.077	-0.058	-0.037
30	0.029	0.029	0.102	-0.045	-0.139	0.028	0.087	0.043	-0.049	0.086	0.101	-0.08	0.051	0.079	0.023	0.007	0.049	-0.018
31	-0.032	-0.046	-0.027	-0.066	-0.067	-0.023	0.043	0.025	-0.134	0.056	0.057	-0.06	-0.018	0.022	0.015	0.09	-0.051	-0.124
32	0.029	-0.066	-0.101	0.013	-0.102	-0.077	0.001	0.014	-0.158	-0.138	-0.08	-0.006	-0.047	0.009	-0.031	0.013	-0.014	-0.122
33	-0.001	-0.013	0.167	-0.036	-0.059	-0.008	-0.077	-0.124	-0.122	-0.061	-0.013	0.158	0.01	-0.017	0.033	0.036	-0.016	0.08
34	-0.002	-0.109	-0.063	0.045	0.16	0.058	0.13	0.156	-0.07	-0.06	-0.008	0.004	-0.116	-0.083	0.037	0.044	-0.001	0.044
35	-0.002	0.017	-0.086	0.006	0.129	-0.025	-0.119	-0.081	0.055	-0.015	0.023	-0.031	-0.042	-0.1	-0.074	-0.048	0.002	-0.003
36	-0.002	-0.04	0.117	-0.085	0.025	-0.008	-0.044	-0.153	0.258	0.1	0.022	0.024	0.089	-0.11	-0.023	-0.06	0.029	-0.021

Organizational Justice Perceptions as predictors of Job Satisfaction and Organizational Commitment

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Abstract

The present study explores the relationship between perceived organizational justice, job satisfaction and organizational commitment using a field sample. Results of the study indicate that distributive justice is significantly related to job satisfaction whereas procedural justice is not found to be related significantly with job satisfaction. Moreover, both distributive justice and procedural justice are significantly related to organizational commitment. Theoretical and practical implications of the results are also discussed in the paper.

Keywords: Organizational Justice, Job Satisfaction, Organizational Commitment

Introduction

Of late, the study of organizational justice perceptions has received great attention from the researchers and scholars in the field of industrial-organizational psychology, human resource management and organization behavior (Cropanzano & Greenberg, 1997). The researches have shown that organizational justice perceptions strongly affect the attitude of the workers such as job satisfaction, turnover intentions and organizational commitment as also workplace behavior such as absenteeism and organizational citizenship behavior (Colquitt, et al 2001). In addition, studies have also unfolded the linkages between perceived organizational justice and individual work performance (Colquitt et al., 2001, Earley and Lind, 1987).

Although the association between justice perceptions and various work outcomes are well established in Western literature, few scholars have examined the relationship of justice perceptions with work attitude and work behavior in Indian culture. In fact, culture does influence the justice perceptions of the employees and it is an important determinant of how justice perception would affect work outcomes. Several scholars have observed that procedural justice concerns are ubiquitous across diverse societal and cultural settings (Lind & Tyler, 1988; Tyler, Boeckmann, Smith, & Huo, 1997). Cross-cultural researches on procedural justice have started only recently (Brockner, Chen, Mannix, Leung, & Skarlicki 2000; Lind & Earley, 1992; Lind, Tyler, & Huo, 1997). Often they have wondered if the collectivist communities care about procedural justice issues as well (see LaTour, Houlden, Walker, & Thibaut, 1976). Interestingly, Sugawara and Huo (1994) found that the Japanese show a strong concern about procedural

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justice in conflict resolutions. White, Tansky, and Baik (1995) reported that the Koreans exhibit concerns about procedural justice, although their concerns were lower than those of the Americans. While the nuances of organizational justice perceptions are still unfolding, we try to find out how it affects various job-related outcomes in a typically Indian situation.

Conceptualization of variables

Perceived organizational justice

When employees react to the way they are treated at work, their motivation to respond cannot be understood adequately without taking into account perceived fairness of the outcomes and the procedure used to reach those outcomes (Folger & Konovsky, 1989; Greenberg, 1986). The organizational justice construct has three dimensions: distributive justice, procedural justice, and interactional justice. Adams (1965) conceptualized fairness by stating that employees determine whether they have been treated fairly at work by comparing their own payoff ratio of outcomes (such as pay or status) to inputs (such as effort or time) to the ratio of their co-workers. This is called distributive justice and it presents employees' perceptions about the fairness of managerial decisions relative to the distribution of outcomes such as pay, promotions, etc (Folger & Konovsky, 1989). In contrast, procedural justice focuses on the fairness of the manner in which the decision-making process is conducted (Folger & Konovsky, 1989). In other words, the focus shifts from what was decided to how the decision was made (Cropanzano & Folger, 1991). As a third dimension, interactional justice reflects the quality of interpersonal treatment during the implementation of formal procedures of decisions (Bies & Moag 1986).

Distributive justice

Before 1975, the study of justice was primarily concerned with distributive justice. Much of this research was derived from initial work conducted by Adams (1965), who used a social exchange theory framework to evaluate fairness. According to Adams, what people were concerned about was not the absolute level of outcomes per se but whether those outcomes were fair.

Whereas Adams's theory advocated the use of equity rule to determine fairness, several other allocation rules such as equality and need were also advanced (e.g., Leventhal, 1976). Studies have revealed that different contexts (e.g., work vs. family), different organizational goals (e.g., group harmony vs. productivity), and different personal motives (e.g., self-interest motives vs. altruistic motives) might activate the use or primacy of certain allocation rules (Deutsch, 1975). Nevertheless, all the allocation standards have as their goal the achievement of distributive justice; they merely attempt to create it through the use of different rules.

Procedural justice

Thibaut and Walker's (1975) research on individuals' reactions to dispute resolution procedures led to the development of procedural justice theory, which is concerned with judgments about the process or means by which allocation decisions are made. Although Thibaut and Walker (1975) introduced the concept of procedural justice, their work focused primarily on disputant reactions to legal procedures. Credit goes to Leventhal and his colleagues for extending the notion of procedural justice into non-legal contexts such as organizational settings (Leventhal, 1980; Leventhal et al., 1980). In doing so, they also broadened the list of determinants of procedural justice far beyond the concept of process control. Leventhal's theory of procedural justice judgments focused on six criteria that a procedure should meet if it is to be perceived as

fair i.e. procedures should (a) be applied consistently across people and across time, (b) be free from bias (e.g., ensuring that a third party has no vested interest in a particular settlement), (c) ensure that accurate information is collected and used in making decisions, (d) have some mechanism to correct flawed or inaccurate decisions, (e) conform to personal or prevailing standards of ethics or morality, and (f) ensure that the opinions of various groups affected by the decision have been taken into account.

Interactional Justice

Bies and Moag (1986) introduced the notion of interactional justice by focusing on the importance of the quality of interpersonal treatment people received when procedures were implemented. More recently, interactional justice has come to be seen as comprising two specific types of interpersonal treatment –interpersonal justice and informational justice (see Greenberg, 1990a, 1993b). Interpersonal justice reflects the degree to which people are treated with politeness, dignity, and respect by authorities or third parties involved in executing procedures or determining outcomes. On the other hand, informational justice focuses on the explanations provided to the people about why procedures were used in a certain way or why outcomes were distributed in a certain fashion.

Justice perceptions have been linked to important outcome variables (Dailey & Kirk, 1992; Folger & Konovsky, 1989; Martin & Bennett, 1996; McFarlin & Sweeney, 1992). For instance, perceptions of procedural justice are negatively related to intentions to quit (Dailey & Kirk, 1992), significantly correlated with organizational commitment (Folger & Konovsky, 1989; Martin & Bennett, 1996), and produce high subordinates' evaluation of supervisors (McFarlin & Sweeney, 1992). In other words, if employees perceive that the decision making process is fair, they are less likely to form an intention to quit. On the other hand, distributive justice perceptions are associated with pay raise satisfaction (Folger & Konovsky, 1989), and tend to be a strong predictor of job satisfaction (Martin & Bennett, 1996; McFarlin & Sweeney, 1992). Greenberg (1990) also reports that organizational justice – people's perceptions of the fairness of treatment received from organizations – is important as a basic requirement for the effective functioning of organizations.

Job Satisfaction

Job satisfaction or employee satisfaction is one of the most used variables in Organizational Behaviour research. It is an employee's attitudinal response to his or her organization. As an attitude, job satisfaction is conceptualized as evaluative, cognitive and affective components.

Evaluative: An individual's overall response to the organization –whether the employee considers the organization as a worthwhile place to work, for example.

Cognitive: An individual's perceptions, opinion, beliefs and expectations regarding the organization. –an individual perceives that his or her expectations have been met, for example. Cognitive component influences evaluative component because positive evaluation is more likely when cognitions (expectations) support a positive and secure future with the organization.

Affective: This represents the feelings evoked by the organization –whether the organization call to mind pleasurable or uncomfortable feelings; feelings of anger or joy; feelings of security or

stress; feelings of affirmation or invalidation. In general, positive affect results from information, feedback, and situations that affirms or reinforces the individual's self-worth and self-concept, while negative affect is evoked by invalidating situations. Self-worth is validated when individuals feel accepted as valuable members of the organization and their competencies and core values are affirmed. When individuals are in a positive affect state while working, they tend to evaluate the organization positively.

Organization commitment

Organizational commitment has been identified as a critical factor in understanding and explaining the work-related behaviour of employees in organizations. Often the construct has been explained in terms of the extent to which an employee identifies with and is involved with an organization (Curry, Wakefield, Price, & Mueller, 1986). Steer (1977) defined organizational commitment as the relative strength of an individual's identification with and involvement in a particular organization. Further, Mowday et al. (1979) defined organizational commitment as an affective response which moves beyond passive loyalty to an organization. Porter et al (1974) identified three related factors of organizational commitment: (a) a strong belief in an organization's goals and values, (b) a willingness to exert considerable effort for the organization, and (c) a strong desire to maintain membership in the organization. Meyer and Allen (1991) argued that the psychological states reflected in these different definitions of organizational commitment were not mutually exclusive. They referred to these states as components of organizational commitment. These include affective commitment (emotional attachment), continuance commitment (cost-based), and normative commitment (obligation). Mathieu and Zajac (1990) noted that the various definitions and measures share a common theme in that organizational commitment is considered to be a bond or linking of the individual to the organization.

Hypothesized relationship between perceived organizational justice; organizational commitment and job satisfaction

Many studies also explore relation between employees' satisfaction and their jobs in general. McFarlin and Sweeney (1992) showed that distributive justice was a more powerful predictor of job satisfaction than was procedural justice. Distributive justice, however, is a better predictor of personal outcomes such as pay satisfaction. However, this does not seem to fit the two-factor theory argument that procedural justice predicts system-referenced outcomes, whereas distributive justice predicts person-referenced outcomes. In addition, Masterson, Lewis, Goldman & Taylor (2000) showed procedural justice to be a stronger predictor of job satisfaction than interactional justice, although both had significant independent effects. Organizational commitment represents a global, systemic reaction that people have to the company for which they work. Perceived organizational justice is an important predictor of job satisfaction as well as organization commitment. One reason for this could be that use of fair procedures in decision making provides evidence of a genuine caring and concern on the part of the organization for the well being of employees (Lind & Tyler, 1988). This in turn motivates the employees to continue their association with their current organization. Thus in this research it is hypothesized that if the employees perceive both distributive justice and procedural justice to be high, they would be more motivated to continue their association with their current organizations and would show higher job satisfaction level.

Hypothesis 1: Distributive justice positively relates to job satisfaction.

Hypothesis 2: Procedural justice positively relates to job satisfaction.

Hypothesis 3: Distributive justice positively relates to organizational commitment.

Hypothesis 4: Procedural justice positively relates to organizational commitment.

Methodology

Sample

Sample for the present study consisted of 128 employees working in a medical college in Jammu (India). A 67.36% response rate (128 out of 190 possible respondents) was obtained. The gender composition of the sample was 61.71% male (N = 79) and 38.28% female (N = 49). The average age of the respondents was 30.40 years (SD = 3.25). On average, respondents had worked in their present jobs for 32.05 months (SD = 25.31).

Variables:

Control variable: Age, Gender and Job Tenure

Predictor Variable: Distributive Justice and Procedural Justice

Criterion Variable: Job Satisfaction and Organizational Commitment

Measurements

Distributive Justice Index

Perceptions of distributive justice were measured with the Distributive Justice Index developed by Price and Mueller (1986). A sample item states “My supervisor has fairly rewarded me when I consider the responsibilities I have”. All reliabilities reported have been above .90, and the scale has shown discriminate validity in relation to job satisfaction and organizational commitment (Moorman, 1991).

Procedural Justice Scale

Perceptions of procedural justice were measured using 15 item scale developed by Niehoff and Moorman (1993). A sample item states “Job decisions are made by my supervisor in an unbiased manner”. Moorman (1999) has reported reliability above .90.

Job satisfaction

Job satisfaction was measured using job satisfaction scale developed by Singh and Sharma (1999). The scale consisted of thirty items and each item has five alternatives and the respondent has to choose one option which candidly expresses his response. The mean score of all the items represent the job satisfaction level of the individual employee. A sample item states “With regard to post retirement benefits, like pension, gratuity, etc., I rate my job as” The test-retest reliability of the scale is reported to be 0.978 with N=52 and a gap of 25 days.

Organizational commitment

Organizational commitment was measured by the nine-item short version of the Organizational Commitment Questionnaire (OCQ) developed by Porter et al., (1974). There is a seven-point response dimension. A sample item states “I talk up this organization to my friends as a great organization to work for”. Item scores are summed and the mean is taken. Thus, there is a possible range of scores from one to seven, and the higher the score the more organizationally committed an individual is judged to be. Reliability and validity evidence has been provided by

Porter et al., (1974), Steers (1977), Steers and Spencer (1977), and Stone and Porter (1975). The coefficient alpha is consistently high in the studies, ranging from 0.82 to 0.93 with a median of 0.90.

Results

Table 1 lists the means, standard deviations, inter-correlations, and reliabilities for the variables. The correlations among some of the study variables provided initial support for our hypotheses. In support of Hypothesis 1, distributive justice was positively correlated with job satisfaction ($r = .61, p < .01$). In addition, procedural justice was positively correlated with job satisfaction ($r = .59, p < .01$), providing support for Hypothesis 2. Distributive justice was also positively correlated with organization commitment ($r = .91, p < .01$), providing support for Hypothesis 3. Finally, procedural justice was positively correlated with organization commitment ($r = .60, p < .01$), supporting Hypothesis 4.

To test our hypotheses, we performed a hierarchical regression analysis for each of the outcome variable i.e. job satisfaction and organization commitment. Our goal was to determine if the hypothesized variables added a unique contribution in the prediction of the criterion above and beyond the control variables. As such, we first entered the control variables. Second, we entered the distributive justice and procedural justice. To control potential demographic effects, we included age, gender and job tenure as control variables. In the description below of our results, all reported coefficients are standardized and adjusted R^2 s are reported.

R^2 is the measure of how much of the variability in the outcome variable is accounted for by the predictors. For the model 1 its value is 0.436 which means that control variables (age, gender and job tenure) accounts for 43.6% of the variation in job satisfaction. However for the final model (model 2) this value increases to 0.557 or 55.7% of the variation in job satisfaction. Table 2 shows that, as a set of predictors, distributive justice and procedural justice explained an additional 12% of variance in the criterion over and above the control variables ($\Delta F = 16.52, p < .01$). Specifically, as shown in table 3 distributive justice significantly related to job satisfaction ($\beta = .32, p < .01$) supporting Hypothesis 1. Table 3 also shows that procedural justice was not found to relate to job satisfaction ($\beta = .11, p > .1$), providing no support for Hypothesis 2.

As shown in Table 4, R^2 for the model is 0.935 which means that control variables (age, gender and job tenure) accounts for 93.5% of the variation in organizational commitment. However for the final model (model 2) this value increases to 0.953 or 95.3% of the variation in job satisfaction. Thus, as a set of predictors, distributive justice and procedural justice explained an additional 1.7% of variance in the criterion over and above the control variables ($\Delta F = 21.95, p < .01$). Specifically, as shown in table 5 distributive justice significantly related to organization commitment ($\beta = .42, p < .01$) supporting Hypothesis 3. It also shows that procedural justice was found to relate to organization commitment ($\beta = .10, p < .01$), providing support for Hypothesis 4.

Discussion

The present study attempted to link perceived organizational justice with job satisfaction and organization commitment. Distributive justice was found to be positively related to both job satisfaction and organization commitment. Consistent with this prediction, McFarlin and

Sweeney (1992) found that distributive justice was a more important predictor of what they termed two "personal outcomes" (pay satisfaction and job satisfaction) and that procedural justice was a more important predictor of two "organizational outcomes" (organizational commitment and subordinate's evaluation of supervisor). Other studies have shown high correlations between procedural justice and job satisfaction (e.g., Mossholder, Bennett, & Martin, 1998; Wesolowski & Mossholder, 1997). In addition, Masterson, Lewis, Goldman and Tylor (2000) showed procedural justice to be a stronger predictor of job satisfaction than interactional justice, although both had significant independent effects.

In addition procedural justice was not found to be related to job satisfaction but it was significantly related to organization commitment. Prior work by Tyler (e.g., Tyler, 1990) argues that procedural justice has stronger relationships with support for institutions than does distributive justice. However, we should note that several studies have instead supported the distributive dominance model. For example, Lowe and Vodanovich (1995) found a stronger relationship for distributive justice and organizational commitment than for procedural justice, as did Greenberg (1994).

Theoretical and practical implications

The present study attempts to explore the relationship between perceived organizational justice, job satisfaction and organization commitment. Theoretically, the current results suggest that organizational justice perception plays an important role in the development of organizational commitment and job satisfaction. Perceived organizational justice was expected to correlate significantly with both job satisfaction and organizational commitment. Those who perceive justice in their organization are more likely to feel satisfied with their job and feel less likely to leave and feel more committed to their job. The current study will provide the administrators and policy makers with insights into the relationship between perceived organizational justice and work attitudes and the formations of employees' justice perceptions, and with insights into how to manage employees using organizational justice perspective to draw positive attitudinal and behavioural reactions from employees. The present study will help them better understand how to retain valuable employees, increase employees' commitment to and satisfaction with their work, reduce employee turnover, and improve the performance of the employees.

Limitations

Like all researches, there are limitations to this study that must be taken into consideration. First, the data were cross-sectional in nature and this restriction prevented the inference of causality. At a minimum, a longitudinal design is required to infer any causality that may exist among these variables. Second, the results may have been affected by common method variance because all of our data were collected from self-report measures. Because measures come from same source, any defect in that source contaminates measures, presumably in the same fashion and in the same direction. A primary concern of common method variance is that the relationships observed between variables may be due to the measurement method rather than the hypothesized relationships between constructs (Podsakoff & Organ, 1986). However, Saalancik and Pfeffer (1977) have suggested that one possible technique that could be used to reduce common method variance is to reorder the items on the questionnaire such that dependent or criterion variable follows, rather than precedes, the independent variable. This method was followed in the design of our questionnaire. Finally, the effect sizes for the relationships of

interest were relatively small. This suggests the possibility of unknown moderator or mediator variables on the perceived organization justice-commitment and job satisfaction relationship. Organizational variables such as job characteristics, rewards, and other contextual variables may be of particular relevance because each of these variables is a potential antecedent of organization commitment and job satisfaction. Unfortunately, data were not collected in regard to possible moderators or mediators because such hypotheses were beyond the scope of this study.

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Table 1

Means, standard deviations, inter-correlations, and coefficient alphas of study variables

Variables	Mean	SD	1	2	3	4
Age	30.40	3.25				
Gender	.61	.48				
J T	32.05	25.31				
1. DJ	23.37	4.38	(.82)			
2. PJ	61.85	7.18	.66*	(.86)		
3. JS	74.16	8.82	.61**	.59**	(.83)	
4. OC	33.29	8.29	.91**	.60**	.51**	(.89)

Note: JT- Job Tenure (in months completed); DJ- Distributive Justice; PJ- Procedural Justice; JS- Job Satisfaction; OC- Organizational Commitment.

Note: N = 128.

* $p < .05$.

** $p < .01$ (two-tailed).

Table 2

Hierarchical Regression for job satisfaction, control variables and perceived Organizational Justice (Distributive and Procedural)

Model	R	R Square	Adjusted R Square	R Square Change
1	.661 ^a	.436	.423	.436**
2	.746 ^b	.557	.538	.120**

Note: N = 128

** $p < .01$.

a. Predictors: (Constant), Gender, Age, Job tenure

b. Predictors: (Constant), Gender, Age, Job tenure, Procedural justice, Distributive Justice

c. Job satisfaction

Table 3

Model	b	SE b	β
Step 1			
Constant	-16.03	10.47	
Gender	9.10	2.13	.50**
Age	2.82	0.32	.04**
Job Tenure	-0.03	0.03	-0.10
Step 2			
Constant	14.77	10.80	
Gender	11.92	2.29	.67**
Age	-0.62	0.67	-0.23
Job Tenure	-0.02	0.03	-.06
Distributive Justice	2.69	0.51	.32**
Procedural Justice	0.14	0.12	0.11

Note: N = 128

** $p < .01$.

Table 4

Hierarchical Regression for Organization commitment, control variables and perceived Organizational Justice (Distributive and Procedural)

Model	R	R Square	Adjusted R Square	R Square Change
1	.967 ^a	.935	.934	.935**
2	.976 ^b	.953	.951	.017**

Note: N = 128

** $p < .01$.

- a. Predictors: (Constant), Gender, Age, Job tenure
- b. Predictors: (Constant), Gender, Age, Job tenure, Procedural justice, Distributive Justice
- c. Organization commitment

Table 5

Model	b	SE b	β
Step 1			
Constant	-40.54	3.32	
Gender	-0.03	0.68	-0.002
Age	2.42	0.10	0.95**
Job Tenure	0.008	0.10	0.03
Step 2			
Constant	-51.08	3.32	
Gender	0.25	0.70	-0.02
Age	3.62	0.21	.42**
Job Tenure	0.002	0.009	0.006
Distributive Justice	-0.782	0.156	0.42**
Procedural Justice	-0.12	0.04	0.10**

Note: N = 128

** p < .01.

Making Knowledge a Strategic Corporate Resource

Deepankar Chakrabarti*

Abstract

The shift in the strategic role that knowledge plays in business is forcing business managers to actively participate in, if not lead, knowledge management for decision-making. Unfortunately there are not enough generic models or even guidelines for incorporating the management of knowledge into business and especially business strategy formulation. This leads to business managers considering knowledge management as being separate from business, which is reflected in their inability to align knowledge management goals with corporate goals. The purpose of this article is therefore to investigate the interdependency between knowledge, knowledge management and business from a managerial/strategic perspective.

Keywords: Knowledge, Knowledge Management, Strategy

Introduction

‘Knowledge is universally recognized as the most important asset an organization has’ (Henczel 2000). It would seem that the ability to reason with knowledge is becoming the distinguishing factor between being recognized as a leader or being considered a follower. Though knowledge is becoming freely available, it is seldom there when you need it most. This is because knowledge in itself is normally not tangible, resides in the head of the knower, and in a managerial sense can be internal as well as external to the firm (Zack 1999).

But why is it that a concept [knowledge] so powerful has not delivered what it was supposed to? In the absence of substantial proof that knowledge adds value to organizations, the importance and sufficient commitment to embark on knowledge and its management will continue to be underplayed (Kazimi, Dasgupta and Natarajan, 2004).

The value of knowledge ‘results from the way in which it is used in the firm’s processes in the production of products and services. Firms gain advantage from using the capabilities that arise from knowledge assets in ways which are difficult for others to imitate or replicate, as well as the intellectual property associated with the assets’. In essence, knowledge contains a non-quantifiable value to an organization (Armistead and Meakins, 2002). According to Laudon and Laudon (2010), this non-quantifiable value of knowledge refers to an ability to positively affect the efficiency and effectiveness of other resources. However, they emphasize that ‘as knowledge becomes a central productive and strategic asset, organizational success increasingly ‘also’ depends on the ability to produce, gather, store, and disseminate knowledge’. It is therefore the ability to manage knowledge successfully and not *per se* ‘only knowledge’ that drives the efficiency and effectiveness of other resources.

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In order to manage intangible assets, Davenport (1998) contends that managers need to have a sound understanding of the underlying principles, policies and strategies that guide the successful institutionalization of knowledge management. But, as Zack (1999) and Earl (2001) maintain, even though organizations accept that knowledge enhances performance; managers often do not know how and where to start dealing with knowledge management endeavours, especially in the domain of decision making and strategy formulation. A sound understanding of business strategy formulation is crucial in the foundation of an efficient and effective knowledge management strategy, and vice versa. According to Papp (1996), such an alignment will enable a firm to maximize its investments and to achieve harmony with the business strategies and plans. This, in turn, will equate to an increased profitability and competitive advantage.

In this article, the focus is on a discussion on the decisive role that knowledge plays as a strategic corporate resource and the success it achieves. In order to sensitize the reader to the major impact that knowledge has on corporate strategy and organizational success, a managerial perspective on the reasoning is followed covering issues like complexity of knowledge, strategic importance of knowledge and the instrumentality of knowledge in the formulation of strategies.

Complexity of knowledge

In an organizational sense, the problem with aligning knowledge and strategy is not only rooted in the complexity of knowledge, but also in the sharing of knowledge. Early research by Polanyi (1966) on the concept of sharing knowledge concluded that the problem with knowledge sharing is that 'we know more than we can tell'. Gertler (2003), also struggling with the idea that the dimension of knowledge exists in the background of our consciousness, argues in similar vein that 'when the skilled performer attempts to describe or explain their performance to an unskilled pupil, they must first try to develop their own awareness of all of the key components of success before they can attempt to communicate these to their student'. Tiwana (2000) is of the opinion that this uniqueness, this inability to share knowledge, makes it one of the most difficult and most precious assets business has to manage.

In addition, Henczel (2000) state that when the data-to-information transfer process is combined with the execution of a task, this leads to a further transformation process, a process of creating new information, a process of creating both explicit and tacit knowledge. To study a concept as complex and elusive as knowledge is therefore not an easy task.

As Davenport and Prusak (1998) stress: 'knowledge is a fluid mix of framed experience' and according to Snyman and Kruger (2004), knowledge means different things to different people; knowledge is extremely complex; and although it can be shared, the manner in which it is internalized and applied (managed) will be different for every person, situation and enterprise.

In a business sense, even if knowledge in the head of the knower has perceived value, it means nothing - for knowledge to have real value, it must be shared, it must be applied, and it must influence and change something, e.g. knowledge must lead to an innovative idea. However, as has been stated, knowledge is complex, requires a number of managerial processes to institutionalize and/or apply it, is called different things by different people, and probably does not have the same effect under all conditions. In this context, authors such as Von Krogh,

Nonaka and Aben (2001), state that the key resource for achieving sustainable competitive advantage and superior profitability is not knowledge in all its complexity, but more specifically some application of knowledge.

According to Darroch and McNaughton (2002), due to ambiguity and the uniqueness of firms, knowledge dissemination and responsiveness have the most impact on the creation of a sustainable competitive advantage, especially with regard to the importance of knowledge dissemination practice for innovation. Although it can be argued that in the quest to be *au fait* with knowledge in all its complexity, it is imperative that thorough appreciations be done to determine which knowledge management process (or processes) leads to growth and profitability. Although knowledge is complex and means different things to different people, it is important at this stage not to get trapped in an in-depth discussion of what specifically constitutes knowledge. The focus should rather be on determining whether there is any evidence to support the notion that knowledge (in all its complexity), is truly of strategic importance.

Strategic importance of knowledge

Owing to the uniqueness of knowledge it is extremely difficult if not impossible to imitate knowledge, especially context-specific tacit knowledge (Zack 1999). In agreement with this, Teece (1998) argues that the ability to build, utilize and protect knowledge assets that are difficult to imitate, is one way of sustaining competitive advantage. Zack (1999) goes on to argue that 'to acquire similar knowledge, competitors have to engage in similar experiences. However, acquiring knowledge through experience takes time, and competitors are limited in how much they can accelerate their learning merely through greater investment'. Zack (1999) is therefore of the opinion that: 'by having superior intellectual resources, an organization can understand how to exploit and develop their traditional resources better than competitors', and continues: 'therefore, knowledge can be considered the most important strategic resource'.

It is important that we determine how the business works – its chains of activity – and we need to also determine the exact points at which knowledge, skills and information inject their value' (Bater 1999). What Bater (1999) is proposing is that in assessing the strategic value of knowledge, strategists must look at business from a holistic perspective. Strategists not only need to look at the environment in which the organization competes, the chain of events that take place to transform input into output, the organization's culture, norms, values, structure and even politics, but also where and how specifically knowledge, skills and information inject value in the effort to sustain survival, the quest to achieve growth, profitability and sustainability. In the attempt to determine whether or not knowledge is of strategic importance, strategists need to focus on the very incision point in business management where knowledgeable reasoning really counts - the managerial point where the business' most important decisions are made, where resources (even those needed to manage knowledge) are allocated. In accordance with this, Carneiro (2000) maintains that 'a deepening of the analysis of manager's interest in knowledge is critical to understand how knowledge management can contribute to improve strategies formulation'. Therefore, in assessing the way strategy is formulated, strategists should not only assess the role knowledge plays in strategy formulation, but also the filtering role strategy plays in the allocation of resources needed to manage knowledge effectively. Quoting the words of Tiwana (2000): 'Knowledge must drive strategy, and strategy in turn must drive knowledge management'.

Role knowledge plays in the formulation of strategy

In assessing the role knowledge plays in strategy formulation, it is imperative to start off by looking at strategy from a holistic business perspective.

Snyman and Kruger (2004) argue that all strategy formulation is in essence the quest to achieve superior (economic) results, by means of the manipulation of sound business principles. This entails organizations structuring their core capabilities and competencies in such a way as to produce (transform input into output) more cheaply; to create new needs; to succeed in setting up efficient and effective barriers to entry; to kill off all competition; or at the very least be able to act on lucrative opportunities speedily, e.g. be able to transform quickly (Pearce and Robinson 2005).

Pearce and Robinson (2005) pose that in order to survive, organizations constantly need to analyze their internal strengths and weaknesses (strong points, weak points), be on the lookout for new opportunities and threats, outperform their competitors, grow internally, within an industry, or even beyond the borders of their competitive environment. According to these authors, this can only be achieved if strategy is based on the mustering/exploitation of core competencies and capabilities.

Business managers can turn to the distinguishing attribute that made man the crown of all creation - knowledgeable reasoning. Taking into account Bate's (1999) contention that strategists need to determine the exact points at which knowledge, skills and information inject most value into the managerial process, the point where knowledge is supposed to be brought into perspective with innovation should also be the point (of incision) where knowledge entry into the managerial process will yield the highest gain to the organization. As argued, this point of incision resides within business strategy.

The distinguishing factor between winning and losing, survival and extinction, profit and loss, in an ever-changing environment where time is of the essence, is knowledgeable reasoning. In order for businesses to evolve, innovation is an indispensable ingredient. However, in order to survive, grow and be profitable – especially in a rapidly changing environment, in order to be distinguished as a capable competitor - innovation needs to be brought into relation with knowledgeable reasoning. Only when this is done can innovation act as an efficient and effective agent of change, but it may be argued that strategy is the incision point where innovative plans are made, plans to enable the organization to grow and/or be profitable, the very point on the managerial agenda where innovation is supposed to be brought into relation with knowledgeable reasoning. Strategy is thus nothing more than a hypothetical moment of truth, a moment when all knowledge is supposed to come together. Therefore, knowledge must first be consolidated in a hypothetical moment of truth; it must lead to plans to speed up the business evolutionary process; it must then be filtered by and render strategy possible before it can be related to any form of innovation, for strategy is the filter for all knowledgeable reasoning. Pearce and Robinson (2005), therefore assert that in future knowledge will only gain in stature, and strategy will become a managerial process taking place at all levels of the organization, not only employed by strategic (top) managers.

It is only now that knowledge is becoming freely available that strategists are realizing its potential as an enabler, an agent of change enabling managers to drastically speed up the business evolutionary process. Strategy based on knowledgeable reasoning is undoubtedly changing the competitive environment, rewriting the rules, and enabling organizations to evolve and draw new types of synthesis. Bate (1999) maintains that 'it's knowledge and information that feed the business; the technology is important, certainly, but it remains merely the vehicle for delivery. No amount of IT will make a difference to business success unless it is geared to supporting an organization's knowledge and information needs'.

Knowledge as a strategic catalyst (in the past a scarce commodity) is becoming available to more and more takers. However, just as adding more catalyst can accelerate a chemical reaction, more knowledge can also accelerate the strategic management process. In an organizational context, it is knowledge management and not knowledge *per se* that drives innovation. Darroch and McNaughton, (2002), are of the opinion that knowledge management, as a managerial entity, is emerging as the antecedent of strategy and innovation.

In order to prove the interdependency between Strategic Management and Knowledge Management, Snyman and Kruger (2004) find that: 'the different strategy formulation methodologies differ primarily with regard to the way they perceive the interaction between the organization's profile, and the competitive environment in which the organization functions'. Snyman and Kruger (2004) also state that: 'although all the different strategy formulation methodologies differ with regard to their interaction with knowledge as a strategic resource, they are all in agreement that one needs to know what your organization's key resources are, and what your core competencies/capabilities should look like to sustain competitiveness in future'. Snyman and Kruger (2004) go on to say that: 'the key to developing a model capable of synthesizing strategic management and strategic knowledge management lies in the foundation of knowledge, and especially knowledge of the area of excellence'. Finally these authors come to the conclusion that 'strategy should dictate how information and knowledge should be used. At the same time, knowledge should make new strategies and new ways of competing possible'. Tiwana (2000), in trying to establish the interdependency between the two strategies (business strategy and knowledge management strategy) states clearly and concisely that: 'It's your company's business strategy that drives its knowledge management strategy, and not the other way around' but adjusts this statement later to say that: 'Knowledge management and business strategy must drive each other. This is possible only if the two are in perfect alignment'.

In effect the above-mentioned authors are trying to say that the formulation of winning strategies is built upon the foundation of knowledge, and especially knowledge of the area of excellence. Snyman and Kruger (2004) write that all strategy formulation models are based on the foundation of knowledge. Three ingredients are critical to the success of a strategy. Firstly, the strategy must be consistent with the conditions in the competitive environment. Specifically, it must take advantage of existing or projected opportunities and minimize the impact of major threats. This is only possible with a sound knowledge of one's competitive environment (opportunities, threats). Secondly, the strategy must be based on the exploitation of core capabilities, i.e. strategy must place realistic requirements on the firm's internal capabilities (strong points, weak points). Knowledge of one's capabilities, core competencies and areas of excellence is thus of paramount importance. Thirdly, in order to execute the strategies

successfully, knowledge and understanding of the strategy should be communicated throughout the organization. In corroboration of this perspective, the learning model not only emphasizes flexibility but also the fact that organizations should become learning, thus knowledgeable organizations, building strategies around core competencies (areas of excellence)'. Snyman and Kruger (2004) continue with this line of reasoning and argue that the critical essence of the learning perspective on strategy formulation is to learn faster than the competition rather than to outwit them. Finally, Snyman and Kruger (2004) come to the conclusion that even this critical essence of the transformational perspective on strategy formulation is based on the leverage of internal as well as external knowledge. Knowledge has undoubtedly played a crucial role in the evolution of strategy and will continue to do so.

In order to be successful, strategists still need to know more about their own capabilities and competencies, and the external forces they face, than their competition does. Even though it remains an open-ended question as to what specifically strategy will comprise of in future, strategy will continue to be built upon knowledgeable reasoning. Possibly this can be attributed to knowledge being the only strategic resource that cannot be consumed by the strategy formulation process. As Zack (1999) argues: 'Unlike traditional physical goods that are consumed as they are used, providing decreasing returns over time, knowledge provides increased returns as it is used. The more knowledge is used the more valuable it becomes, creating a self-reinforcing cycle'. As the environment changes and business evolves, knowledge will continue to affect and/or even alter the way strategy is perceived. In agreement with this statement, Leibold, Probst and Gibbert (2005) argue that 'in the global knowledge economy, the concept of competitive advantage is now being seen differently: the firm's potential relative to the overall processes and resources in business ecosystems and organizational networks, with a balancing of competitive advantage and collaborative co-evolution'.

Conclusion

Knowledge has played, and will continue to play, a crucial and enabling role in the formulation of strategies. The evolution of strategy should continue to progress along the line of descent through the history of the field, not by replacing previous notions, but rather by building knowledgeably upon them. As a result of advances in information and communications technology, information is becoming freely available, enabling organizations to speed up the data-to-information cycle. This phenomenon is causing the barriers between external and internal organizational spheres to become blurred and/or even collapse, compelling organizations to create new ways to formulate strategy, whether of a structured, unstructured or even chaotic nature.

In conclusion, it is proposed that the changing environment is catapulting knowledge management into a strategic dimension. The merger between strategic management and knowledge management is in itself becoming a strategic imperative.

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Book Review

**Capitalizing on Global Economic Crisis:
Opportunities for Asian Countries**

A Resilient Asia Amidst Global Financial Crisis:
From Crisis Management to Global Leadership
Editors: Harinder S Kohli & Ashok Sharma
Pages xxxvii + 417 Rs. 995/-
Asian Development Bank/ Sage, New Delhi

The book under review provides an incisive view on the impact and long-term implications of the global financial crisis on economies of Asia. Contributors of the volume enthusiastically build a case for strengthening recovery efforts so as to capitalize on the global economic crisis. They advocate inclusive growth and open regionalism as well as greater regional cooperation to bounce back and assume global leadership in economic resurgence.

The book is suitably organized in eleven chapters focusing on genesis and global response to financial crisis, impact on developing Asia and policy responses of China, Indonesia, Philippines, Thailand, India, Bangladesh, Sri Lanka, Bhutan, Maldives, Pakistan, Afghanistan, Mongolia etc. Social impact of the crisis on emerging markets vis-à-vis social protection and informal employment has also been dealt with meticulously. Long term implications of reinforcing resilience have been discussed in the backdrop of the need of reconsidering the growth model prevalent in Asia. Regional coordination and cooperation have been emphasized in order to take maximum mileage while the world is fast recovering from the financial crisis.

Although the book does not propose any uniform policy as scenario is diverse in different countries of Asia, it certainly sets the general agenda for strengthening recovery efforts, ensuring inclusive growth, and greater regional cooperation. Discussions in the book have been enriched by a panel of distinguished contributors comprising Suman Bery, Manu Bhaskaran, Colin Davis, Ritwick Ghosh, Harinder S Kohli, Hauhiko Kuroda, Pradeep K Mitra, Rajat M Nag, Corazon de la Paz-Bernardo, Andrew Sheng, and Hiroshi Watanabe.

The book has tremendous value for economists, policy makers, key functionaries of international financial institutions, academics and researchers.

–Srirang Jha