

The Potential of Derivatives Market in Bangladesh

Statistical Economic and Social Research
and Training Centre for Islamic Countries
(SESRIC)

ISSN 1308 – 7800

Volume 32, No. 4, December 2011

J o u r n a l o f E c o n o m i c C o o p e r a t i o n & D e v e l o p m e n t



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EDITORIAL NOTE

Five papers make up this issue. The first one, titled **Why Join a Monetary Union? Theoretical Answers for Policy Makers in the West African Monetary Zone (WAMZ)** by *Tamsir Cham*, examines the importance of currency union using a modified Barro-Gordon model. The model assumes that monetary unions follow a rule-based while individual central banks follow discretionary monetary policy rule. This paper finds that monetary union serves as a disciplinary mechanism and enhances commitment for member countries. The results also strengthen other findings that monetary unions can lower inflation and government spending.

The second paper, titled **Assessing Macroeconomic Performance of OIC Member Countries Using Data Envelopment Analysis, DEA** by *Nordin Haji Mohamad* and *Fatimah Binti Said*, uses a mathematical programming based technique in productivity management, known as data envelopment analysis, DEA to estimate how well the nations of the Organization of the Islamic Conference, OIC utilize their resources. A high growth rate (as indicated by the change in gross domestic product), a low rate of inflation, a low rate of unemployment and a favorable trade balance are four main targets or objectives of a nation's macroeconomic policy makers. Based on selected macroeconomic input and output indicators, this paper applies three versions of an output-oriented DEA model under the assumption of variable returns to scale to assess the relative macroeconomic performance of 54 member countries for the year 2007. The three versions produce consistent results. Three fuel-exporting countries and four least-developed countries top the performance list with Iran and Yemen at the bottom. Of a subset of 33 fuel-exporting and medium-developed countries, nine (seven and two respectively) top the list. This paper also analyzes the results to identify the possible merits of efficiency and sources of inefficiency.

The third paper, titled **Dutch Disease Investigated: Empirical Evidence from Selected South-East Asian Economies** by *Shahid Hussain Javaid*, investigates Dutch Disease hypothesis analyzing the impact of foreign inflows on appreciating real exchange rate. The paper also studies contraction in the tradable sector in selected South East Asian countries over 1981-2007. Using static and dynamic panel data techniques, the study first estimates real exchange rate appreciation due to surge in foreign inflows and then estimates contraction in the tradable

and expansion in the non-tradable sector. On the basis of empirical evidence the study confirms the Dutch Disease hypothesis in the countries studied.

The fourth paper, titled **Linkages between Foreign Direct Investment, Domestic Investment and Economic Growth in Malaysia** by *Hooi Hooi Lean* and *Bee Wah Tan*, examines the linkages between foreign direct investment (FDI), domestic investment and economic growth in Malaysia for the period of 1970-2009. Specifically, it attempts to determine the impact of FDI and domestic investment on economic growth respectively and whether FDI crowds in or crowds out domestic investment. It is expected that the empirical analysis and findings would show some insightful implications to the policy makers and market players. Furthermore, the recently announced Tenth Malaysia Plan attaches an important mission of leading the country towards a high-income nation. The private sector is in a critical position to drive this new growth aspiration. The question of how to attract investment is foreseen to become a “hot” debate topic once again despite numerous previous studies on the subject.

The last and fifth paper, titled **The Potential of Derivatives Market in Bangladesh** by *Saif Rahman* and *M. Kabir Hassan*, provides clear examples of how derivative securities can strengthen capital market of Bangladesh, both in terms of risk mitigation and creating alternative investment vehicles as well as reduce burden on our major import and export sectors. Furthermore, this paper also looks into the prerequisite of setting up a derivative markets in Bangladesh and provides a clear roadmap. In view of recent turmoil in the equity markets, a standardized exchange traded derivative market with phase-by-phase introduction of product has been recommended.

Why Join a Monetary Union? Theoretical Answers for Policy Makers in the West African Monetary Zone (WAMZ)

Tamsir Cham

In light of the increase in regional monetary unions, this paper examines the importance of currency union using a modified Barro-Gordon model. The model assumes that monetary unions follow a rule-based while individual central banks follow discretionary monetary policy rule. We find that monetary union serves as a disciplinary mechanism and enhances commitment for member countries. Our results also strengthen other findings that monetary unions can lower inflation and government spending.

1. Introduction and Framework

The adoption of the euro by the European Monetary Union (EMU) and its successful launching in January 1999 has stimulated interest in the formation of currency union arrangements around the globe. Prior to the euro, other currency unions have been in existence, including the Central Africa Economic Monetary Union (CAEMU), the West African Economic Monetary Union (WAEMU), the Eastern Caribbean Currency Union (ECCU), and the Common Monetary Authority (CMA). Recently, five West African countries proposed to enter into a monetary union called the West African Monetary Zone (WAMZ¹).

Since trade is the engine for growth and that currency union enhances growth via trade and the fact that the zone has not progressed much with growth, entering into monetary union could serve as a stimulus to economic growth. One of the potential benefits associated with monetary union is its effect in enhancing trade. The implication is that trade will increase as countries join the monetary union. This paper, however, differs from previous research in two folds: first it examined

¹ WAMZ members are The Gambia, Ghana, Guinea, Nigeria, and Sierra Leone

the benefit of currency union via fiscal discipline and credibility in macroeconomic policy. Second, we attached equal weights to output and inflation. The motivation for the study is the prone developing countries have particularly the WAMZ zone with high inflation rate, fiscal indiscipline, and credibility issues. This paper is organized as follows: In section 2 the literature on time inconsistency is examined; Section 3, contains the model; Section 4 contains the monetary union scenarios, Section 5 contains common monetary union rule. Concluding remarks are found in section 6.

II. Literature Review

The debate on rule versus discretion was pioneered by Kydland and Prescott (1977). Since its inception, the time inconsistency problem has received a great deal of attention from researchers and policymakers. In their paper, Kydland and Prescott outlined the fact that even with unanimous fixed social objective function and policymakers know the timing and magnitude of the effects of their actions, discretionary policy is a decision that is best given the current situation does not necessarily maximize social objective. The reasoned they outlined is that economic planning is a game against economic agents and not a game against nature. Consequently, there is no way control theory will deliver well in a game of economic planning where expectations are rational. In such setting, optimality and time consistency are mutually exclusive². The economic planners are tempted to deviate from an announced policy for its own benefit, and economic agents acted based on information announced by planners in the previous year. Once agents comprehend the action of the planners, they too incorporate it in their future expectations. Consequently, the solution attained by policymakers is suboptimal, that is second-best. The first-best is unattainable so long as policy makers go by discretionary policy. The first-best can only be attained when there is an enforcement of the planner's policy announcement. This kind of situation is known in the literature as rule-based regime for macroeconomic planning.

The work of Kydland and Prescott surged research on time-inconsistency and optimality in economic planning. Many studies on

² In this kind of framework, a policy cannot be optimal and time- consistent at the same time.

monetary policy have referred to their work. Barro and Gordon (1983a) extended the Kydland and Prescott's unemployment and inflation model and used rational expectation to illustrate a discretionary monetary regime. In this framework with the given society's preferences, the optimal solution for the monetary policy with zero inflation is not time-consistent. With a discretionary monetary regime, monetary authority will desire to have some positive inflation. The private agents know the potential desire of the authority and they too include such information in their expectation formation. Given that expectations are always greater than zero and that in a rational expectation equilibrium setting, expected inflation rate equals actual inflation, it implies that actual inflation will always be greater than zero. The outcome is second-best since the first-best is unattainable. Considering the long run time horizon where unemployment rate equals the natural rate, the inflation rate will remain high. Barro and Gordon (1983b) proceeded further but included reputation. In a short-time frame game, a rule-regime provides better outcome as compared to a discretionary regime. A rule-regime and political pressure are incompatible when monetary policy is needed to overcome unexpected economic disturbances. However, with a reputationable regime in an infinite time frame alleviate the time inconsistency problem discussed earlier. Recurring interactions may lead to reputational enforcement through trigger-strategy equilibrium. The interaction between private agents and policymakers and in order to build reputation and credibility, the policymakers abide by the rule. Consequently, policymakers forgo a short term benefits from inflation shock in order to secure the gain from low average inflation. A scenario of this kind, there must be an outcome that is superior to the second-best under a discretionary regime in the game. A repeated game of this kind do not last long since the agents know that the monetary authority will eventually deviate in the final period and the trigger-strategy equilibrium loosen through a process of backward induction.

Rogoff (1985) offers a solution to this difficulty. The solution is demonstrated in his article entitled *the optimal degree of commitment to an intermediate monetary target*. He showed with a high inflation in the final period, it is still possible to sustain inflation rates close to zero. Despite the level of uncertainty, there is still some room for improvement in a discretionary regime. Rogoff further argued that having an agent to head the central bank reduces the time-consistent rate of inflation; it suboptimally raises the variance of employment when

supply shocks are large. In his model, time-inconsistency problem arises as a result of labor market distortion that the monetary authority attempt to correct which can only be done with complete information at hand. Apparently, the first-best solution is attained if the labor-market distortion is completely removed. Removing the distortion at a low social cost, it would be possible to raise employment and lower inflation. A second-best solution would legally impose a complete state-contingent monetary rule. He argued that if the first and second best solutions are too costly or unattainable, then an appointment of a conservative central banker or monetary targeting such as price level, money supply, and interest rate, nominal GDP targeting should be used as a third best solution. He, however, pointed out that appointing conservative central banker or by providing the central banker with incentives to hit an intermediate monetary target, it is possible to induce less inflationary wage bargains. This outcome comes at a cost because the central banker cannot systematically raise employment; monetary policy can still be effective to stabilize inflation and employment around their mean market determined levels. Consequently, rigid targeting is only necessary on certain rare occasions. Rogoff (1985b) extends the analysis in his article *can International monetary policy cooperative be counterproductive?* Employing the framework used by his predecessors, he illustrated the potential danger with inter-central bank cooperation in that it exacerbates the credibility problem of the central bank and the private sectors. In this setting, domestic inflation is not only affected by domestic prices but also by foreign prices through the exchange rate mechanism. Moreover, each central bank may be tempted to inflate with pretext that the other will inflate. As a result, the real exchange rate discipline is lost. Monetary policy cooperation is mutually beneficial only in an institutional framework which eliminate or improve the central banks credibility problem vis-à-vis the private sector. In summary, monetary cooperation streamlined the two central banks' objective functions to a single problem. Hence Rogoff, extended the analysis of time-inconsistency problem in a multicountry framework. Using the above discussions as a framework, the time-inconsistency problem of a monetary policy is model in the following section.

III. Model

The model is a reduce form model of the Barro-Gordon (1983) type which is extended to included fiscal and monetary policy such as

government expenditure and monetary expansion. I followed previous researchers by assuming the model is of a finite one with three period time horizon; The central bank chooses the inflation level; The government defines her fiscal policy namely taxes and expenditure. The private sector makes their expectation of future inflation (π^e). The timing of the game is as follows first, the monetary policy authority- the central bank sets the inflation level that dependent on shock. In a discretionary central bank, the setting of inflation is delayed and therefore this stage will not occur. Second, wage setters form their expectation of the inflation level (π^e) and set their wages to incorporate future inflation. Third, a shock occurs in the following period just after wage setters formed their expectation. Fourth, the government chooses a level of expenditure to neutralize the shock. The government finances the expenses incurred in the previous period by either monetizing or through tax or both. The game ends after the government chooses the level of expenditure to compensate for the shock. The private sector is at a disadvantage compared to the government in that they make their decision before the shock. The government, however, has an idea about the nature of the shock before taking any decision. Using an extension of Barro-Gordon (1983) the reduce form; we followed Hallerberg (2002) et al and solve the model by applying backward induction process. The government authority in the country wants to minimize the loss function which is given by

$$L = \frac{1}{2} \beta [y^* - y_1]^2 + \frac{1}{2} \beta [y^* - y_2]^2 + \frac{1}{2} \alpha \pi^2 \text{-----} (1)$$

We assumed that the government attached equal weights on output and inflation. From the equation 1, y_1 and y_2 are output for period one and two respectively; y^* is the government target level of output and π is inflation level which is equivalent to price difference between period one and two. The coefficients β and α are the weights government attached on output and inflation respectively. Output in periods one and two respectively is given by

$$y_1 = \bar{y} + X - \varepsilon$$

and----- (2)

$$y_2 = \bar{y} + (\pi - \pi^e) - T$$

In the above equations in period one and two, $\bar{y}$ is the natural rate of output for the country. In the model the shock ε with mean zero occurred after the private sector made their expectation and before government expenditure X . Taxes T are levied, and/or monetized deficits πM are occurred thereafter.

As mentioned earlier, wages are determined by wage setters at the initial period and assuming that wages remain constant through out the periods under consideration. Wage setters set wages base on expected inflation by incorporating shocks. Wages, therefore, will be equal to the expected price in the following year when the shock occurred given as

$$w = E_{p1}[p_2]$$

And the expected inflation is

$$\pi^e = E_{\varepsilon}[\pi(\varepsilon)] \equiv \int \pi(\varepsilon) \text{-----} (3)$$

This is equivalent to

$$\pi^e = E_{\varepsilon}[\pi(\varepsilon)] \equiv \int \pi(\varepsilon) = w - p_1$$

Substituting equation 3 into equation 2 and rearranging we get

$$y_2 = \bar{y} + (\pi - \pi^e) - T \text{-----} (4)$$

Inflation in this setting can be represented as a function of monetary growth, money demand³, government expenditure, and taxes. Hence inflation is given as

$$\pi = \frac{X - T - \Phi}{M}$$

³ The relationship between money demand and inflation and the derivation of the relationship with other variables is given in the Appendix.

Where $\Phi = rB - \frac{dB}{dt}$; M is a multiple of the money supply in the first period.

The tax function can be represented as a function of government expenditure, money supply, and money demand given as

$$T = X - \pi M - \Phi \text{-----} (5)$$

From the above, tax is an increasing function of government expenditure. Substituting equation 5 into equation 4 and then the result into the loss equation 1 and then simplify we get

$$L = \frac{1}{2} \{ \beta [y^* - \bar{y} + X - \varepsilon]^2 + \beta [y^* - \bar{y} - \pi - \pi^e - T]^2 + \alpha \pi^2 \} \text{-----} (6)$$

As discussed, when a shock is realized, the government takes action and compensates for the shock. The budget used to compensate for the shock was planned to be used for the succeeding period⁴. In other words government borrowed and therefore need to pay back the loan. This kind of transfer from one period to another leads to *time-inconsistency problem* because the government is tempted to monetized the deficit to finance the deficit. In order to find the optimal inflation and government expenditure, backward induction is applied. First, we begin to find the optimal inflation level taking government expenditure (X) as given. Denoting the differences between output target and natural level of output by k , That is $k = y^* - \bar{y}$, then the loss function can written as

$$L = \frac{1}{2} \beta [k + \varepsilon - X]^2 + \frac{1}{2} \beta [k - \pi - \pi^e + X - \pi M - \Phi]^2 + \frac{1}{2} \alpha \pi^2 \text{-----} (7)$$

As period two begins, government expenditure X and expected inflation π^e are known. Subsequently, the government chooses inflation level as a function of government expenditure in the previous period. To minimize the loss function- equation 7 taking government expenditure as given, the optimal inflation level is given as

⁴ Government use next year budget to compensate for the shock

$$\pi^*(X) = \frac{\beta[1+M]}{\beta[1+M]^2 + \alpha} [k + X - (\pi^e + \Phi)]$$

When $k + X > \pi^e + \Phi$, then optimal inflation can be written as

$$\pi^*(X) = \frac{\beta[1+M]}{\beta[1+M]^2 + \alpha} [k + X - (\pi^e + \Phi)] > 0 \text{-----} (8)$$

The implication is that the optimal inflation will always be greater than zero (unless $k + X = \pi^e + \Phi$) which results to time-inconsistency problem where zero inflation is unattainable.

Given the optimal inflation rate, expected inflation, and shock realized in the first period, we calculate optimal government expenditure. To proceed, we first rewrite the loss function, (equation 7), where inflation is expressed as an explicit function of government expenditure. The loose function is now given as

$$L = \frac{1}{2} \beta [k + \varepsilon - X]^2 + \frac{1}{2} \beta [k - \pi(X) - \pi^e + X - \pi(X)M - \Phi]^2 + \frac{1}{2} \alpha \pi(X)^2$$

Using the loose function where inflation is expressed as an explicit function of government expenditure, we compute the optimal government expenditure. To determine the optimal government expenditure, we minimized the loose function and obtained

$$X^* = \left[\frac{1}{W+1} \right] \{k + \varepsilon - \pi^e [\beta(1-W) + W^2] + k[\beta(1-W) - W^2]\} \text{-----} (9)$$

$$\text{Where, } W = \frac{\beta[1+M]}{\beta[1+M]^2 + \beta}$$

The optimal government expenditure is a function of shock and expected inflation. There is a negative relationship between government expenditure and expected inflation. To evaluate the optimal inflation as function of expected inflation, we substitute equation 9 into equation 8 to obtain an expression for inflation as a function of expected inflation

$$\pi^*(\pi^e) = W\{k + [\frac{1}{1+W}][k + \varepsilon + \beta(1-W)(k - \pi^e) - W^2(k + \pi^e)] - \pi^e\} \quad (10)$$

Equilibrium inflation is obtained with the assumption that expectation about inflation is consistent. Hence the expected inflation is

$$\pi^e = E_1[\pi] \equiv \int \pi$$

Assuming rational expectation and stochastic shock with mean zero, the expected inflation equilibrium is

$$\pi^e = \pi^* = \frac{W\{k + [\frac{1}{W+1}][k + k\beta(1-W) - W^2k]\}}{1 + W[\frac{1}{1+W}]\{\beta(1-W) - W^2 + 1\}} \quad (11)$$

Given $\beta(1-W) - W^2 > 0$, it implies that the expected inflation in equilibrium will always be positive given as

$$\pi^e = \pi^* = \frac{W\{k + [\frac{1}{W+1}][k + k\beta(1-W) - W^2k]\}}{1 + W[\frac{1}{1+W}]\{\beta(1-W) - W^2 + 1\}} > 0$$

The first best response outcome is attained when inflation is set equal to zero. From equation 11, such outcome can occur if and only if $W = 0$.

Expected inflation equilibrium is an increasing function of the weight government attached on output but a decreasing function of the weight government attached on inflation. On the one hand, the higher the output government desires, the higher the expected inflation equilibrium. On the other hand, the greater government concerns about inflation, the lower the expected inflation equilibrium.

Given, $T = X - \pi M - \Phi$, where $\Phi = rB - \frac{dB}{dt}$

If the government could commit to zero inflation, then government spending may not necessarily be equal to tax revenue unless Φ is zero; that is there is no debt servicing.

IV. Monetary union

Since the first-best solution is unattainable, ways of improving on second-best has received a lot of attention. Improving on the second-best is a problem that WAMZ member countries face since they gained political independence. A sound macroeconomic economic framework with policy credibility would open to foreign markets for zone's exports and reduce barriers to foreign investment. Government, however, should control their fiscal spending when shocks asymmetric. Controlling government spending minimizes the adversity of large exogenous shock that confront the economy. High government spending serves as an incentive to increase inflation which is equivalent to devaluation of the country's currency relative to foreign currency. This therefore leads to loss in credibility of the domestic currency. When countries enter into monetary union they become committed and have higher chance of minimizing potential problems. Using the same model outlined above with some modifications, we model the monetary union case where the loss function for each country within the zone is given as

$$L^j = \frac{1}{2} \beta [y^* - y_1^j]^2 + \frac{1}{2} \beta [y^* - y_2^j]^2 + \frac{1}{2} \alpha \pi^2 \text{-----} (12)$$

Where, $y_1^j = \bar{y} + X^j - \varepsilon^j$ and $y_2^j = \bar{y} + (\pi - \pi^e) - T^j$ is the output for country j in period one and period two respectively.

Assuming that countries are similar in nature, that is, they have the same natural level of output target. However, they face different shocks and they maintain their level of government spending and tax level. By entering into monetary union, individual countries have no control on money supply. The money supply and monetary policy is undertaken and controlled by one main supranational central bank. Individual country in the union has no control over monetary policy. This is one of the main costs of entering into a monetary union. Following the same time sequencing as applied in a one country case in the previous section, where private individual form their expectation and wages are

contracted. In the following period, shock are realized, individual government compensate for the shock by choosing spending level and the main central bank determine the inflation rate for the union. To obtain the union inflation rate, we sum all the loss functions of the entire zone. This is obtained by adding the loss functions for all countries in the zone. Hence the loss function for the monetary union is

$$L = \sum_{j=1}^5 \left\{ \frac{1}{2} \beta [y^* - y_1^j]^2 + \frac{1}{2} \beta [y^* - y_2^j]^2 + \frac{1}{2} \alpha \pi^2 \right\} \text{-----} (13)$$

Where individual countries range from 1 to n, (n= 5) reflecting the number of countries in the monetary union. The optimal average inflation is given as a function of government spending in the monetary union is

$$\pi^*(X) = \frac{1}{n} \frac{\beta[1+M]}{\beta[1+M]^2 + \alpha} \sum_{j=1}^n [k + X^j - (\pi^e + \Phi^j)] \text{-----} (14)$$

$$\text{Where } \Phi = rB - \frac{dB}{dt}$$

Assuming that there exist no interest payment on individual government debt and no budget deficit financing by issuing debt, that is ($\Phi = 0$), then the optimal inflation for the union is

$$\pi^* = \frac{1}{n} \frac{\beta[1+M]}{\beta[1+M]^2 + \alpha} \sum_{j=1}^n [k + X^j - \pi^e] \text{-----} (15)$$

Which is the same as

$$\pi^* = \frac{\beta[1+M]}{\beta[1+M]^2 + \alpha} [k + \bar{X} - \pi^e] \text{ Where } \bar{X} = \frac{1}{n} \sum_{j=1}^n X^j \text{-----} (16)$$

Assuming the average government spending for the union is given as $\bar{X}$. The optimal union inflation rate is similar to the individual country's average inflation rate. The main difference is that individual countries optimal inflation rates is a function of only their own government

spending. In a monetary union, however, optimal inflation rate is a function of the overall average of the union government spending $\bar{X}$ ⁵. Consequently, each government within the union will minimize her loss function to determine her government spending taking expected inflation as a function of her expenditure.

$$L^j = \frac{1}{2} \{ \beta[k + \varepsilon^j - X^j]^2 + \beta[k - \pi - \pi^e + X^j - \pi M - \Phi]^2 + \alpha \pi^2 \} \text{-- (17)}$$

The optimal government is found by minimizing the above loss function.

V. Common Monetary Union Rule

The supranational central bank of the monetary union has to come up with a common inflation rate. If central bank's inflation rate is different from the previous average member countries' inflation rate, then there is an improvement. Such an outcome is one of the main reasons behind one rule the central bank employ that forces the members to adopt the minimum preferred inflation among all countries. The minimum inflation rate that the central bank can implement depends on the level of individual countries government spending.

$$\pi^{CB*}(X) = \frac{\beta[1+M]}{\beta[1+M]^2 + \alpha} [k + \bar{X}^L - \pi^e] \text{----- (18)}$$

Where $\bar{X}^L$ denoted the minimum average government spending by member countries. Subsequently, inflation rate will not be exclusively determined by one member country government spending. In other words, inflation rate is taken as given that is inflation rate π is fixed. Similarly, member countries take expected inflation as given after observing the exogenous shock; it implies that no member country in the union can monetize government debt. Consequently, optimal government spending is limited and is given by

⁵ Assuming the union used average inflation rate to determine the inflation rate for the entire monetary union.

$$X^{Uj*} = \frac{1}{2} [\pi(1+M) + \varepsilon^j + \pi^e] \text{-----} (19)$$

The government with the lowest shock, however, chooses its individually optimal spending given as follows:

$$X^{L\varepsilon*} = \left[\frac{1}{W+1} \right] \{k + \varepsilon^L - \pi^e [\beta(1-W) + W^2] + k[\beta(1-W) - W^2]\} \text{--} (20)$$

The implication is that if $\varepsilon^L < \varepsilon^j$, then $X^{L\varepsilon*} < X^{Uj*}$. That is if a member of the union faces less than the average shock that confronts the union as a whole, the optimal government spending of the country (with less than average union shock) will be less than the average union government spending. This highlights one of the benefits of common monetary rule which enforces fiscal discipline to zone members. This arises because individual countries do not have the ability to monetize debt. For the wage setters, it encourages commitment. Wage setters do not need to worry much about inflation. Consequently, their expectations on inflation rate remain low which further lowers government spending.

VI. Conclusion

We revisit the time-inconsistency problem that confronts monetary policy. Here, we examined monetary policy conducted by discretionary central banker and monetary policy under one supranational central bank. We followed other researchers by employing a theoretical game model. The model highlights the gains that can derive from joining a monetary union. This approach provides some insights pertaining to the advantages that member countries can derive as they enter into a monetary union. First, as countries enter into monetary union, the inflation rate in the zone is lower. Second, monetary union serves as a disciplinary mechanism since individual countries cannot monetize their debt. Furthermore individual country's optimal government spending may likely be lower than union government spending. It also encourages commitment among wage setters. Hence there is greater trust between private agent and government. Third, the low government spending lowers expected inflation. This subsequently lowers inflation rate. Finally, it encourages commitment among wage setters and increase trust between private agent and government.

Appendix

Equilibrium in the money market occurred where real money supply equals money demand. Using the above concept to formulate a demand for real money balances, and in equilibrium we have

$$\frac{M^s}{P} = \frac{M^d}{P}$$

$$\ln\left[\frac{M_1}{P_1}\right] = -\rho E_1[p_2 - p_1]$$

$$m_1 - p_1 = \rho E_1[p_1 - p_2]$$

$$m_2 - p_2 = 0$$

$$m_1 - p_1 = -\rho E_1[p_2] + \rho E_1[p_1]$$

$$m_1 + \rho E_1[p_2] = p_1 + \rho E_1[p_1]$$

$$m_1 + \rho p_2 = p_1[1 + \rho]$$

$$p_1 = \frac{m_1}{[1 + \rho]} + \frac{\rho}{1 + \rho} [p_2]$$

$$p_1 = \frac{m_1}{1 + \rho} + \frac{\rho}{1 + \rho} [m_2]$$

$$\pi \equiv p_2 - p_1 = m_2 - \left[\frac{m_1}{1 + \rho} + \frac{\rho E(m_2)}{1 + \rho} \right]$$

$$m_2 = [1 + \rho]\pi + m_1$$

$$M_2 = X - T + rB - \frac{dB}{dt} + M_1$$

But

$$\pi = \frac{1}{1 + \rho} \ln\left[\frac{X - T + rB - \frac{dB}{dt} - M_1}{M_1} \right]$$

$$\pi = \frac{X - T + rB - \frac{dB}{dt}}{M}$$

$$\pi = \frac{X - T + \Phi}{M}$$

Where, $\Phi = rB - \frac{dB}{dt}$, and $M = [1 + \rho]M_1$, and $T = X - \pi M + \Phi$

It is also standard in this type of model to treat inflation as the central bank's policy instrument. With money growth rate of m , the inflation rate is given by:

$$\pi = m + v - \gamma\varepsilon$$

This implies that money growth is given by:

$$m = \pi + \gamma\varepsilon - v$$

Where m is money growth rate, v Is the control error or velocity shock, and $\gamma\varepsilon$ Is the aggregate supply shock.

The government budget constraint is given as:

$$X - T + rB = \frac{dB}{dt} + \frac{dM}{dt}$$

Where, X Government level of spending excluding interest payment on government debt, T Tax revenue, r Interest rate on government debt, $\frac{dB}{dt}$ Deficit that is finance by issuing debt, and $\frac{dM}{dt}$ Deficit that is finance by monetizing debt.

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Assessing Macroeconomic Performance of OIC Member Countries Using Data Envelopment Analysis, DEA

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In this study, a mathematical programming based technique in productivity management, known as data envelopment analysis, DEA is used to estimate how well the nations of the *Organization of the Islamic Conference*, *OIC* utilize their resources. A high growth rate (as indicated by the change in gross domestic product), a low rate of inflation, a low rate of unemployment and a favorable trade balance are four main targets or objectives of a nation's macroeconomic policy makers. Based on selected macroeconomic input and output indicators, we apply three versions of an output-oriented DEA model under the assumption of variable returns to scale to assess the relative macroeconomic performance of 54 member countries for the year 2007. The three versions produced consistent results. Three fuel-exporting countries and four least-developed countries top the performance list with Iran and Yemen at the bottom. Of a subset of 33 fuel-exporting and medium-developed countries, nine (seven and two respectively) top the list. The results were analyzed to identify the possible merits of efficiency and sources of inefficiency.

1 Introduction

Managing an economy is no easy task. A high growth rate (as indicated by the change in gross domestic product, GDP), a low rate of inflation

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(as depicted by the change in consumer price index, CPI), a favorable trade balance and a high rate of employment are main targets or mission of a nation's macroeconomic policy maker. The sum of inflation rate and unemployment rate is associated with the undesirable Okun's *misery index* [11] which is literally a nightmare to policy makers and provides a pessimistic measure of the macroeconomic performance of a nation. Thus the performance of a nation needs to be assessed and evaluated periodically so that any shortcoming or underachievement can be identified, analyzed and appropriate steps taken to remedy it.

Many studies on macroeconomic and development performance of regions, cities and nations have been conducted and reported in the literature. Charnes, Cooper and Li [4] used DEA to evaluate the economic performance of 28 selected Chinese cities following the government's program of economic development. Sueyoshi [16] extended the study to measuring and evaluating the industrial performance which also explored the returns to scale of these cities. The macroeconomic performance of ten Asian economies with special attention to Taiwan was studied and summarized by Lovell [10] in terms of the four main output indicators. Despotis [7] extended the applicability of the DEA model with variable returns to scale to estimate the relative efficiency of countries in Asia and the Pacific in converting incomes to human development. Other regional studies utilizing DEA include [9], [12] and [13]. In most of these regional studies, the units under evaluation such as nations, cities and regions are nearly homogeneous in terms of their socio-economic background and geographical location.

This study seeks to assess the macroeconomic performance of 54 (out of the 57) selected member countries of the Organization of the Islamic Conference, OIC for the year 2007, by utilizing the output-oriented DEA model under the assumption of variable returns to scale, VRS. The complexity of OIC as the second largest inter-governmental organization after the United Nations motivates us to undertake this study. The 57 member countries are dispersed over a large geographical region spanning over four continents. As a group, the OIC countries account for one-sixth (or 16.67%) of the world's area, extending from Albania (Europe) in the North to Mozambique (Africa) in the South, and from Guyana (Latin America) in the West to Indonesia (Asia) in the East. Some of the member countries such as Benin, Burkina Faso, Djibouti, Gabon and Suriname (to name just a few) are less known (at

least to the authors), and this triggers us further interest to embark on this study. OIC community also exhibits high level of income divergence with huge gap between the rich and the poor countries. Based on 2007 statistics, the average GDP per capita for OIC as a group is US\$2595, ranging from a low US\$206 (for Guinea-Bissau) to a high US\$72849 (for Qatar) [15]. This reflects a difference of 354 times between the richest and the poorest. Thus a study of an organization with such high level of heterogeneity is likely to produce interesting (and probably contradicting) findings.

The rest of the paper is organized as follows. The next section provides a brief overview of the OIC member countries and their macroeconomic performance in comparison with the world, developing and developed countries. This is followed by the DEA methodology related to the three versions employed in the study – the extended multiplier form, the helmsman model of Lovell [10] and the *generic* input-output model of Ramanathan [14]. Section 4 focuses on the macroeconomic data utilizes for the study while section 5 presents the results, interpretations and policy implications. The final section concludes with highlights for future research.

2 Overview of OIC

The OIC is an international inter-governmental organization with a permanent delegation to the United Nations. It was established on 25 September 1969, following the loss of Muslim holy sites in Jerusalem. According to its charter, the OIC aims to preserve Islamic social and economic values; promote solidarity amongst member states; increase cooperation in social, economic, cultural, scientific, and political areas; uphold international peace and security; and advance education, particularly in the fields of science and technology. Over the last forty years, the membership has grown from its founding members of 25 to 57 countries.

Table 1 lists the 57 member countries (which for reference purposes are denoted as DMU01, DMU02,..., DMU57) according to their economic attributes and regional locations. Of the fifteen fuel-exporting countries (OIC-FEC), ten are from Middle East and North Africa (MENA) region. Twenty medium-developed countries (OIC-MDC) are scattered on the four continents while the remaining twenty-two are grouped under least-developed countries (OIC-LDC), of which seventeen belong to Sub-

Saharan Africa region with low income per capita. In terms of gross domestic product (GDP) per capita, only seven nations are categorized as high income group. Except for Brunei (from East Asia and Pacific), all countries in the high income group are OIC-FEC from MENA. The upper and lower-middle income group is dispersed over a larger region, while the majority of lower-income group is concentrated in the Sub-Saharan Africa region. In view of this non-homogeneity, results produced by any performance assessment on these groups should be handled with caution.

Table 1. OIC member countries according to categories and locations.

DMU ^a	Country	Group ^b	Income ^c	Region ^d
DMU01	Afghanistan	LDC	Low	South Asia
DMU02	Albania	MDC	Lower-Middle	Europe & Central Asia
DMU03	Algeria	FEC	Lower-Middle	MENA
DMU04	Azerbaijan	FEC	Lower-Middle	Europe & Central Asia
DMU05	Bahrain	FEC	High	MENA
DMU06	Bangladesh	LDC	Low	South Asia
DMU07	Benin	LDC	Low	Sub-Saharan Africa
DMU08	Brunei	FEC	High	East Asia & Pacific
DMU09	Burkina Faso	LDC	Low	Sub-Saharan Africa
DMU10	Cameroon	MDC	Lower-Middle	Sub-Saharan Africa
DMU11	Chad	LDC	Low	Sub-Saharan Africa
DMU12	Comoros	LDC	Low	Sub-Saharan Africa
DMU13	Cote d'Ivoire	MDC	Low	Sub-Saharan Africa
DMU14	Djibouti	LDC	Lower-Middle	MENA
DMU15	Egypt	MDC	Lower-Middle	MENA
DMU16	Gabon	FEC	Upper-Middle	Sub-Saharan Africa
DMU17	Gambia	LDC	Low	Sub-Saharan Africa
DMU18	Guinea	LDC	Low	Sub-Saharan Africa
DMU19	Guinea-Bissau	LDC	Low	Sub-Saharan Africa
DMU20	Guyana	MDC	Lower-Middle	Latin A & Caribbean
DMU21	Indonesia	MDC	Lower-Middle	East Asia & Pacific
DMU22	Iran	FEC	Lower-Middle	MENA
DMU23	Iraq	FEC	Lower-Middle	MENA
DMU24	Jordan	MDC	Lower-Middle	MENA
DMU25	Kazakhstan	MDC	Upper-Middle	Europe & Central Asia
DMU26	Kuwait	FEC	High	MENA
DMU27	Kyrgyzstan	MDC	Low	Europe & Central Asia
DMU28	Lebanon	MDC	Upper-Middle	MENA
DMU29	Libya	FEC	Upper-Middle	MENA
DMU30	Malaysia	MDC	Upper-Middle	East Asia & Pacific
DMU31	Maldives	LDC	Lower-Middle	South Asia
DMU32	Mali	LDC	Low	Sub-Saharan Africa
DMU33	Mauritania	LDC	Low	Sub-Saharan Africa
DMU34	Morocco	MDC	Lower-Middle	MENA
DMU35	Mozambique	LDC	Low	Sub-Saharan Africa
DMU36	Niger	LDC	Low	Sub-Saharan Africa
DMU37	Nigeria	FEC	Low	Sub-Saharan Africa
DMU38	Oman	FEC	High	MENA
DMU39	Pakistan	MDC	Low	South Asia
DMU40	Palestine	MDC	Lower-Middle	MENA
DMU41	Qatar	FEC	High	MENA
DMU42	Saudi Arabia	FEC	High	MENA
DMU43	Senegal	LDC	Low	Sub-Saharan Africa
DMU44	Sierra Leone	LDC	Low	Sub-Saharan Africa

Table 1. (Continue)

DMU*	Country	Group¹	Income²	Region³
DMU45	Somalia	LDC	Low	Sub-Sahara Africa
DMU46	Sudan	LDC	Lower-Middle	Sub-Sahara Africa
DMU47	Suriname	MDC	Upper-Middle	Latin A & Caribbean
DMU48	Syria	MDC	Lower-Middle	MENA
DMU49	Tajikistan	MDC	Low	Europe & Central Asia
DMU50	Togo	LDC	Low	Sub-Sahara Africa
DMU51	Tunisia	MDC	Lower-Middle	MENA
DMU52	Turkey	MDC	Upper-Middle	Europe & Central Asia
DMU53	Turkmenistan	FEC	Lower-Middle	Europe & Central Asia
DMU54	Uganda	LDC	Low	Sub-Sahara Africa
DMU55	United Arab	FEC	High	MENA
DMU56	Emirates	MDC	Low	Europe & Central Asia
DMU57	Uzbekistan	LDC	Low	MENA
	Yemen			

Notes:

- 1) FEC: Fuel-exporting country , LDC : Least-developed country MDC: Medium-developed country.
- 2) Low income (GDP per capita < US\$650) , Lower-middle income (GDP per capita US\$2000) ,Upper-middle income (GDP per capita < US\$9999), High income
- 3) (GDP per capita > US\$10000).
- 4) MENA : Middle East and North Africa countries.

* DMU refers to *decision making unit*.

Source: *Annual Economic Report on The OIC Countries*, 2008. Statistical, Economic and Social Research Training Centre for Islamic Countries (SESRIC).

Table 2 provides basic facts on selected economic indicators for OIC in comparison with the world, developed countries and developing countries for the year 2007. With a total population of 1422.8 million, OIC accounts for about 21.89% of the world population. This is equivalent to about a quarter of the total population of the developing countries but exceeds the total population of the developed countries by about 1.45 times. The largest contribution is Indonesia with 224.9 million while the least populated is the oil-rich Brunei with 0.4 million.

Table 2. Basic facts on OIC, the world, developed and developing countries, 2007.

Indicators	OIC	World	Developed countries	Developing countries
1. Population (millions)	1422.8	6500.5	983.9	5516.6
2. GDP (US\$, billions)	3692.6	54311.6	39131.1	15180.6
3. GDP per capita (US\$)	2595.0	8355.0	39772.0	2752.0
4. Export (US\$ billions)	1356.5	13812.8	7593.4	6219.4
5. Import (US\$ billions)	1206.7	14356.4	8398.8	5957.6
6. Change in GDP (%)	5.8	4.9	2.7	7.9
7. Change in GDP per capita (%)	3.7	3.7	2.0	6.5
8. Inflation (%)	7.4	3.9	2.2	6.3

Source: Annual Economic Report on The OIC Countries, 2008. Statistical, Economic and Social Research Training Centre for Islamic Countries (SESRIC).

A country's economic output is measured by its gross domestic product, GDP. The OIC total output in 2007 was US\$3692.6 billion, equivalent to only 6.8% of the world's GDP. It is also lower than that of the developed and developing countries (equivalent to 9.4% and 24.3% respectively). The top 10 OIC producing countries are Turkey, Indonesia, Saudi Arabia, Iran, United Arab Emirates, Malaysia, Nigeria, Pakistan, Algeria and Egypt. Together they account for 58 percent of group population but producing more than 73 percent of the group output [15]. The top producer is Turkey with US\$663.4 billion (18.0 percent of the group total) while the least contributor is Guinea-Bissau with US\$0.3 billion. The average growth rate of the group for the year was 5.8%, higher than recorded by the world and the developed countries but lower than that exhibited by the developing countries.

The richness of a nation is normally linked to its GDP per capita. The average GDP per capita for OIC countries in 2007 was US\$2595 (at current prices) which was 5.7% lower than that of developing countries (at US\$2752) and 68.9% lower than the world average of US\$8355. Its growth rate of 3.7% per annum was similar to the rest of the world, higher than the group of developed countries but lower than the group of developing countries. Azerbaijan reported the highest growth of 22.4% while Comoros experienced the lowest growth rate of -3.0% [15]. However, the richest OIC nation, Qatar with GDP per capita of US\$72849, exceeding the developed countries average, reported a growth rate of 2.9% which is lower than the group average. The poorest

OIC country was Guinea-Bissau with GDP per capita of US\$206 (less than US\$1 per day) and decreasing at a rate of 0.4% per year [15]. In fact, [5] ranks Qatar as the world's second richest nation in terms of GDP per capita while Guinea-Bissau is ranked 223rd from the group of 227 countries selected.

Another macroeconomic component is foreign trade. The merchandise exports of the OIC countries in 2007 amounted to US\$1356,5 billion which accounted for only 9.8% of the world total merchandise exports but more than one-fifth of the total exports of the developing countries. A similar pattern is observed for the import performance. The total merchandise imports of the OIC countries in 2007 accounted for 8.4% (or US\$1206.7 billion) of the world total merchandise imports and a modest 20.3% of the developing countries. The top ten exporting (importing) OIC countries accounted for 74.6% (70.3%) of the total merchandise exports (imports) of OIC countries. The top ten OIC exporting countries are Saudi Arabia, Malaysia, United Arab Emirates, Indonesia, Turkey, Iran, Nigeria, Algeria, Kuwait and Libya while the top ten OIC importing countries are Turkey, Malaysia, United Arab Emirates, Saudi Arabia, Indonesia, Iran, Egypt, Pakistan, Nigeria and Kazakhstan. On comparing the trade balance (the difference between the total merchandise exports and imports) the developing countries performed relatively better than the OIC countries, while the group of developed countries and the world experienced trade deficit during the year under consideration. Despite having the highest GDP per capita, Qatar is not listed as one of the top ten producing, exporting or importing countries.

Inflation is one of the indicators of macroeconomic stability. A low inflation rate is associated with a stable economy. The average inflation rate for OIC countries as a group in 2007 was considered higher than the world average and the averages associated with the groups of developed and developing countries. However, some OIC countries recorded negative inflation rate, particularly Chad (at -8.8%) and Burkina Faso (at -0.2%). The highest recorded was 22.9% by Guinea. Despite being rich, Qatar and United Arab Emirates also recorded a relatively high inflation rate of 13.8% and 11.0% in 2007.

As with most economies, the major economic activities of the OIC countries are services, industry and agriculture. The service sector dominates and provides the most important source of income in many

OIC countries, accounting on average 49.7% of the total GDP for the period 2002-2007 [15]. The share varies from 25.2% in Nigeria to 87.2% in Djibouti. The next major activity in the OIC countries is industry with a contribution of 38.4% average share in GDP. The share varies from 3.2% in Somalia to 69.1% in Brunei. The average share of industry in GDP exceeded 40% in 14 of OIC countries during the period 2002-2007. A clearer picture of industrialization is reflected by the performance of the manufacturing sector which contributed on average 15.2% of the GDP. However, manufacturing in member countries such as Turkmenistan, Malaysia, Indonesia, Tajikistan, Turkey and Uzbekistan is gaining importance, contributing 20-35% of their GDP. The third economic activity, agriculture is widely assumed to play a major role in most developing countries. But in OIC countries, agriculture contributed on average 11.2% of the total GDP during the period 2002-2007. The agriculture sector dominates in only five countries, all of which are least-developed countries (LDCs). The highest share of 60.1% was recorded by Somalia while the lowest share of less than 1% was recorded by Qatar [15].

From the above overview we can see that OIC is a relatively complex inter-governmental organization when viewed as an economic entity. It includes one of the richest nations of the world as well as one of the poorest. More than 70.0% of the country production, exports and imports are dominated by the top ten members. However, none of these top ten members includes the richest nation.

3 The DEA Methodology

DEA is a well-known non-parametric linear programming based technique used for computing technical efficiency score for a set of decision making units, DMUs. Its mathematical formulation has been treated in [3]. We stated below the output oriented DEA model employed in the study.

Suppose there are S decision making units (DMUs) to be investigated, each utilizes m inputs to produce n outputs. Further, let DMU_k , $(1 \leq k \leq S)$ uses a combination of m inputs, denoted by $X_k = \{X_{k1}, X_{k2}, \dots, X_{km}\}$ to produce n outputs, denoted by $Y_k = \{Y_{k1}, Y_{k2}, \dots, Y_{kn}\}$. The output oriented DEA for DMU_0 under the assumption of constant return to scale, CRS is given by

$$\text{maximize } \Omega_0 \quad (1)$$

$$\text{subject to } -X_{0i} + \sum_{k=1}^S X_{ki} \lambda_k \leq 0, \quad i = 1, 2, \dots, n, \quad (2)$$

$$-Y_{0j} \Omega_0 + \sum_{k=1}^S Y_{kj} \lambda_k \geq 0, \quad j = 1, 2, \dots, m, \quad (3)$$

$$\lambda_k \geq 0, \quad k = 1, 2, \dots, S, \quad (4)$$

DMU₀ is technically efficient if $\theta_0 = 1/\Omega_0 = 1$ and all the slacks are zero for all $i=1,2,\dots,n$ and $j=1,2,\dots,m$. For evaluation under the assumption of variable return to scale, VRS an additional convexity constraint is imposed on λ_k , such that

$$\sum_{k=1}^S \lambda_k = 1. \quad (5)$$

This results in the formation of a convex hull of intersecting planes which envelope the data points more tightly than the CRS conical hull and thus provides technical efficiency scores which are greater than or equal to those obtained under the assumption of CRS. The difference in the technical efficiency scores under the two assumptions of returns to scale is mainly attributable to scale inefficiency. The output-oriented model exhibits some special features:

- The technical efficiency score, $\theta_0 = 1/\Omega_0$, such that $1 \leq \Omega_0 < \infty$ since $0 \leq \theta_0 \leq 1$.
- Proportional improvement in outputs for inefficient DMUs is given by $\Omega_0 - 1$.
- The number of peers among efficient DMUs for an inefficient DMU under evaluation is not more than the number of constraints which corresponds to the total number of inputs and outputs. These peers can be identified from the non-zero λ_k values.

- Each constraint is associated with an input (or output). This provides ease of selecting combinations of input-output mix by enabling/disabling the relevant constraint(s).

The objective here is to seek maximum Ω_0 that increases Y_{0j} proportionally to $\Omega_0 Y_{0j}$, $\forall j$, while retaining the input level of DMU₀ no greater than X_{0i} , $\forall i$. Improvement or movement towards efficient frontier by inefficient DMUs can be identified by inspecting the system of equations (2) and (3). Define the slacks t_i^-, t_j^+ , $\forall i, j$ by

$$\sum_{k=1}^S X_{ki} \lambda_k + t_i^- = X_{0i}, \quad i = 1, 2, \dots, n, \quad (6)$$

$$\text{and} \quad \sum_{k=1}^S Y_{kj} \lambda_k - t_j^+ = Y_{0j} \Omega_0, \quad j = 1, 2, \dots, m. \quad (7)$$

For an inefficient DMU₀, say, the projected output on the efficient frontier is as dictated by its peers (identified from $\lambda_k \neq 0, \forall k$) and given

by $\sum_{k=1}^S Y_{kj} \lambda_k$, $j = 1, 2, \dots, m$. This can be achieved by proportional

improvements of $(\Omega_0 - 1)$ in all outputs plus additional amount (termed as slack movements) of t_j^+ in output Y_{0j} whenever $t_j^+ \neq 0$. On the input side, equation (6) suggests that the level of input X_{0i} , $\forall i$ can further be reduced by an amount of t_i^- whenever $t_i^- \neq 0$ to those dictated by the

peers, i.e. $\sum_{k=1}^S X_{ki} \lambda_k$. Thus, $(\Omega_0 - 1)Y_{0j} + t_j^+$ is a measure of *under-achievement* of output Y_{0j} , $j = 1, 2, \dots, m$, experienced by DMU₀, while t_i^- reflects the *over-utilization* of input X_{0i} , $\forall i$. The projected position on (and the movement to) the efficient frontier can be expressed as

$$X_{0i}^\wedge = \sum_{k=1}^S X_{ki} \lambda_k^* = X_{0i} - t_i^{-*}, \quad i = 1, 2, \dots, n, \quad (8)$$

$$\text{and} \quad Y_{0j}^\wedge = \sum_{k=1}^S Y_{kj} \lambda_k^* = Y_{0j} \Omega_0^* + t_j^{+*}, \quad j = 1, 2, \dots, m. \quad (9)$$

where $(X_{0i}^{\wedge}, Y_{0j}^{\wedge}, \forall i, j)$ is the position of the composite virtual efficient DMU on the frontier, and $(\Omega_0^*, t_i^{-*}, t_j^{+*}, \lambda_k^*)$ is the optimal solution of (1)-(4) for the decision making unit under evaluation, DMU_0 .

In this study, we employed three versions of (1)-(4) under the assumption of VRS in assessing the macroeconomic performance of the selected 54 member countries of OIC.

Model 1. This corresponds to the actual version of (1)-(4) with suitable set of selected input and output indicators,

$$\begin{aligned}
 & \text{maximize } \Omega_0 \\
 & \text{subject to} \\
 & -X_{0i} + \sum_{k=1}^S X_{ki} \lambda_k \leq 0, \quad i = 1, 2, \dots, n, \\
 & -Y_{0j} \Omega_0 + \sum_{k=1}^S Y_{kj} \lambda_k \geq 0, \quad j = 1, 2, \dots, m, \\
 & \sum_{k=1}^S \lambda_k = 1. \\
 & \lambda_k \geq 0, \quad k = 1, 2, \dots, S,
 \end{aligned} \tag{10}$$

Model 2. Following Lovell [10] and Lovell *et al.* [11], in the production of outputs each country uses only one input, its macroeconomic decision-making apparatus, a bureaucracy collectively referred to as *helmsman*. And each country uses exactly one helmsman. Thus $X_k = 1$, for all

$k = 1, 2, \dots, S$. The equivalent model is thus

$$\begin{aligned}
 & \text{maximize } \Omega_0 \\
 & \text{subject to} \\
 & -Y_{0j} \Omega_0 + \sum_{k=1}^S Y_{kj} \lambda_k \geq 0, \quad j = 1, 2, \dots, m, \\
 & \sum_{k=1}^S \lambda_k = 1 \\
 & \lambda_k \geq 0, \quad k = 1, 2, \dots, S,
 \end{aligned} \tag{11}$$

In this version, the input constraint $-X_{0i} + \sum_{k=1}^S X_{ki} \lambda_k \leq 0, \quad i = 1, 2, \dots$

, n , becomes $-X_0 + \sum_{k=1}^S X_k \lambda_k \leq 0$, since $n = 1$, and reduces to

$$\sum_{k=1}^S \lambda_k \leq 1, \text{ which is redundant since under VRS, } \sum_{k=1}^S \lambda_k = 1.$$

Model 3. Following the methodology adopted in [14] terms like “inputs” and “outputs” are largely generic. Performance of undesirable attributes (such as inflation) is considered inputs and performance of desirable attributes (such as economic growth) is considered outputs. Thus, the input and output variables in model 3 represent undesirable and desirable attributes respectively.

4 Selection of DMUs and indicators

We apply the three versions of the model discussed above to the OIC member countries for the year 2007. We choose the year 2007 since it is the latest year where all the data are available. The macroeconomic performance of a country can be measured by the growth rate of its GDP, the level of employment, the movement of consumer price index (CPI) and its trade balance, amongst others. The government can use fiscal and monetary policies to achieve these macroeconomic objectives. Fiscal policy involves the use of government spending, taxation and borrowing to influence both the pattern of economic activity and also the level and growth of aggregate demand, output and employment. Monetary policy, on the other hand involves the use of interest rates to control the level and rate of growth of aggregate demand in the economy. However, data availability is a problem. Thus, for the purpose of our study one input and four output indicators are chosen to characterize and reflect the macroeconomic structure of the 54 OIC member countries. These indicators are defined as follows,

- Input (X): Total government consumption expenditure as a percentage of GDP which in some studies acts as control instrument. We employ this input indicator only for the multiplier model 1.
- Output 1 (Y_1): The annual rate of growth of GDP, expressed in percentage.

- Output 2 (Y2): The ratio of merchandise exported to merchandise imported as a proxy for balance of trade.
- Output 3 (Y3): The rate of inflation as indicated by the rate of change of the CPI.
- Output 4 (Y4): The total labour participation rate (measured as percentage of total population ages 15 – 64 years) which refers to *the total population ages 15 – 64 years old that is economically active and supplying labour for the production of goods and services during a specified period* [15]. This indicator is chosen due to incomplete availability of data on the rate of employment.

The selected macroeconomic indicators for the year 2007 are depicted in Table 3 together with their data summary statistics. The main source of reference is the SESRIC database at <http://www.sesric.org/databases-index.php>. Except for the balance of trade, all other indicators exhibit relatively high standard deviations, especially the labour participation rate. The percentage of GDP allocated to government final consumption expenditure varies from a low 4.52% (Lebanon) to a high 30.61% (Chad) with an average of 14.72%. Twenty-five nations (about 43.9%) record final consumption expenditure above average. Except Azerbaijan, all OIC-FEC's final consumption expenditures exceeded 10% of their incomes (the highest being Brunei at 25.57% as compared to Azerbaijan's 6.53%).

Table 3 Selected macroeconomic statistics, OIC member countries, 2007

DMU	Country	X1	Y1	Y2	Y3	Y4
DMU01	Afghanistan	10.12	12.43	0.37	13.03	59.6
DMU02	Albania	12.36	6.01	0.51	2.94	60.3
DMU03	Algeria	23.39	4.60	1.94	3.56	57.3
DMU04	Azerbaijan	6.53	23.40	2.39	16.60	65.2
DMU05	Bahrain	18.24	6.64	1.42	3.39	63.7
DMU06	Bangladesh	5.11	5.61	0.76	9.11	71.2
DMU07	Benin	9.45	4.22	0.74	1.26	72.1
DMU08	Brunei	25.57	0.38	2.50	0.30	66.8
DMU09	Burkina Faso	18.69	4.23	0.48	-0.25	83.3
DMU10	Cameroon	12.09	3.30	0.96	0.91	63.8
DMU11	Chad	30.61	0.65	2.05	-8.81	74.1
DMU12	Comoros	12.24	-1.11	0.32	4.49	73.1
DMU13	Cote d'Ivoire	22.57	1.64	1.08	1.91	62.5
DMU14	Djibouti	26.21	5.21	0.74	4.97	67.3
DMU15	Egypt	8.17	7.13	0.83	10.95	47.3
DMU16	Gabon	17.58	5.56	1.94	5.03	70.9
DMU17	Gambia	8.53	7.08	0.66	5.37	76.9
DMU18	Guinea	5.40	1.51	0.74	22.86	84.1
DMU19	Guinea-Bissau	17.00	2.52	0.73	4.62	71.4
DMU20	Guyana	18.67	5.35	0.80	12.20	65.6
DMU21	Indonesia	6.68	6.32	1.16	6.17	67.7
DMU22	Iran	10.34	5.84	1.21	18.40	53.3
DMU23	Iraq	14.81	2.77	1.49	n.a	41.8
DMU24	Jordan	15.10	5.80	0.62	5.39	44.4
DMU25	Kazakhstan	7.12	8.69	1.16	10.77	69.4
DMU26	Kuwait	12.29	4.58	2.06	5.47	66.9
DMU27	Kyrgyzstan	12.10	8.28	0.50	10.20	63.8
DMU28	Lebanon	4.52	4.01	0.50	4.06	50.1
DMU29	Libya	13.10	6.80	3.39	6.20	52.7
DMU30	Malaysia	14.49	6.35	1.23	2.03	62.7
DMU31	Maldives	29.27	6.67	1.01	7.40	65.5
DMU32	Mali	19.11	2.48	0.81	2.50	50.1
DMU33	Mauritania	20.06	0.88	0.84	7.26	70.1
DMU34	Morocco	18.26	2.20	0.79	2.04	51.4
DMU35	Mozambique	13.68	7.00	0.64	8.16	82.9
DMU36	Niger	12.77	3.13	0.56	0.06	62.5
DMU37	Nigeria	26.06	6.40	2.06	5.47	54.5
DMU38	Oman	30.16	6.41	1.43	5.89	55.2
DMU39	Pakistan	12.70	6.40	0.66	7.77	53.8
DMU40	Palestine	16.11	0.00	0.17	n.a	40.8
DMU41	Qatar	19.50	14.23	1.89	13.76	77.2
DMU42	Saudi Arabia	26.36	4.14	1.65	4.11	54.3
DMU43	Senegal	10.38	5.03	0.63	5.87	73.3
DMU44	Sierra Leone	16.87	6.82	0.47	11.65	66.1

Table 3 (Continue)

DMU	Country	X1	Y1	Y2	Y3	Y4
DMU45	Somalia	9.96	2.68	0.18	n.a	71.1
DMU46	Sudan	13.72	10.52	0.81	7.98	51.5
DMU47	Suriname	4.67	5.53	0.87	6.43	51.1
DMU48	Syria	11.21	3.88	1.12	4.68	49.8
DMU49	Tajikistan	8.63	7.78	0.76	13.17	61.5
DMU50	Togo	10.53	2.07	0.58	0.96	68.9
DMU51	Tunisia	14.91	6.33	0.97	3.15	48.3
DMU52	Turkey	10.31	5.07	0.80	8.76	47.5
DMU53	Turkmenistan	13.36	11.61	1.16	6.26	64.8
DMU54	Uganda	9.26	6.49	0.33	6.80	85.9
DMU55	United Arab Emirates	10.55	7.67	1.39	11.13	77.7
DMU56	Uzbekistan	17.12	9.50	1.26	12.28	64.2
DMU57	Yemen	14.28	3.08	0.86	12.48	43.9
Data summary statistics	Mean :	14.72	5.59	1.05	6.65	62.7
	Standard deviation:	6.61	3.84	0.64	5.27	11.3
	Minimum :	4.52	-1.11	0.17	-8.81	40.8
	Maximum :	30.61	23.40	3.39	22.86	85.9

Notes:

X1: Final total government consumption expenditure (% of GDP)

Y1: Growth rate of real GDP (%)

Y2: Balance of trade (=Value of export/Value of import)

Y3: Rate of inflation (change in CPI, %)

Y4: Labour participation rate (ages 15 – 64 years, %).

Source: *Annual Economic Report on The OIC Countries, 2008*. Statistical Economic and Social Research Training Centre for Islamic Countries (SESRTC).

The highest economic growth is lead by Azerbaijan (23.40%) while Comoros recorded a negative growth of -1.11%. The average economic growth for OIC is 5.59% with a standard deviation of 3.84%. Only four countries recorded two-digit percentage growth rate. However, these four high-growth countries do not contribute to the ten OIC high-producing countries which accounted for 73% of the total OIC output in 2007 [15]. As a group, OIC countries recorded a small trade balance surplus in 2007. Five members of OIC-FEC exhibited a significant trade balance (of more than 2.0). These are Azerbaijan, Brunei, Kuwait, Libya and Nigeria. Libya recorded the highest trade balance of 3.39 while Palestine recorded the lowest at 0.17, followed by Somalia (0.18),

Uganda (0.33) and Afghanistan (0.37). These poor trade performers are also considered as politically unstable entities.

The average rate of inflation for the OIC countries in 2007 was about 6.65% which was considerably higher than the world's average of 3.90% and the average recorded by the developed and developing countries (2.20% and 6.30% respectively). The worst hit was Guinea (22.86%), followed by Qatar (13.76%), Tajikistan (13.17%) and Afghanistan (13.03%) while two OIC-LDC, Burkina Faso and Chad recorded a negative rate of -0.25% and -8.81% respectively. No data was available for three countries (Iraq, Palestine and Somalia). In fact, in Somalia it was reported that businesses print their own money, so inflation rate cannot be easily determined ([http://www.indexmundi.com/somalia/inflation_rate\(consumer_price\).html](http://www.indexmundi.com/somalia/inflation_rate(consumer_price).html)). The last indicator is total labour participation rate (ages 15 – 64 years old). The highest is 85.9% as recorded by Uganda, followed by Guinea (84.1%), Burkina Faso (83.3%) and Mozambique (82.9%). These are OIC-LDC from Sub-Saharan Africa region. Eight nations recorded a labour participation rate of less than 50%, the two lowest being Palestine (40.8%) and Iraq (41.8%). However, as a group, on average 62.72% of the total population in age group 15 – 64 years is economically active and contributing to the labour market.

Due to the non-availability of data on the rate of inflation for Iraq, Palestine and Somalia, we focus our study on the remaining 54 member countries. The indicators of input, balance of trade and labour participation rate take a strictly positive value for all observations. The rate of economic growth and inflation indicators take on negative value for some observations, and DEA is not capable of handling negative values. Thus, for consistency all indicators were normalized on a scale of [1, 10] such that the followings hold [13].

- For indicators whose large positive values are desirable (Y1, Y2 and Y4), we adopt the transformation

$$X_{nor} = \frac{9(X_{act} - X_{min})}{X_{max} - X_{min}} + 1 \quad (12)$$

where X_{nor} is the value of the normalized indicator,

X_{act} is the actual value of the indicator,

X_{max} is the maximum value of the indicator,

X_{min} is the minimum value of the indicator.

This transformation ensures that $X_{nor} \in [1, 10]$.

- For indicators whose small values are preferable (such as $Y3$), we adopt the transformation

$$X_{nor} = \frac{9(X_{max}-X_{act})}{X_{max}-X_{min}} + 1 \quad (13)$$

where X_{nor} is the value of the normalized indicator,

X_{act} is the actual value of the indicator,

X_{max} is the maximum value of the indicator,

X_{min} is the minimum value of the indicator.

This transformation ensures that $X_{nor} \in [1, 10]$.

5 DEA Results and Interpretations

We used linear programming software, LINDO to solve the DEA model under the assumption of VRS for the three models. This amounts to running the program 162 times. The relative technical efficiency scores (which act as performance indicators for each nation) are presented in Table 4. The results obtained are consistent for the three models with model 1 producing a relatively higher score, followed by model 2 and model 3. The mean absolute deviations, MAD between each model is less than 0.5% with an average score of 0.8864, 0.8288 and 0.7325 respectively. Model 1 suggested 14 nations were technically efficient in converting the input to outputs. However, in the absence of the input indicator, both model 2 and model 3 shortlisted seven nations as being technically efficient.

Table 4 Technical efficiency results for OIC member countries, 2007

DMU	Country	Model 1	Model 2	Model 3	$TE_{average}$
DMU01	Afghanistan	0.8109	0.7822	0.7064	0.7665
DMU02	Albania	0.9571	0.8567	0.6808	0.8315
DMU03	Algeria	0.8084	0.8021	0.8021	0.8042
DMU04	Azerbaijan	1.0000	1.0000	1.0000	1.0000
DMU05	Bahrain	0.8995	0.8616	0.7562	0.8391
DMU06	Bangladesh	1.0000	0.7923	0.7695	0.8539
DMU07	Benin	1.0000	0.8897	0.8145	0.9014
DMU08	Brunei	0.9966	0.9966	0.9966	0.9966
DMU09	Burkina Faso	1.0000	1.0000	1.0000	1.0000
DMU10	Cameroon	0.9750	0.8327	0.6788	0.8288
DMU11	Chad	1.0000	1.0000	1.0000	1.0000
DMU12	Comoros	0.8875	0.7993	0.7648	0.8172
DMU13	Cote d'Ivoire	0.7982	0.7596	0.5680	0.7086
DMU14	Djibouti	0.8109	0.8109	0.7192	0.7803
DMU15	Egypt	0.7711	0.6877	0.4904	0.6497
DMU16	Gabon	0.9715	0.9289	0.9286	0.9430
DMU17	Gambia	1.0000	0.9217	0.8641	0.9286
DMU18	Guinea	1.0000	1.0000	1.0000	1.0000
DMU19	Guinea-Bissau	0.8224	0.7935	0.7760	0.7973
DMU20	Guyana	0.6920	0.6920	0.6661	0.6834
DMU21	Indonesia	1.0000	0.8173	0.7596	0.8589
DMU22	Iran	0.5654	0.5439	0.5430	0.5508
DMU23	Iraq	...	...	...	...
DMU24	Jordan	0.8482	0.7865	0.5512	0.7286
DMU25	Kazakhstan	0.9300	0.8179	0.7813	0.8431
DMU26	Kuwait	0.9993	0.9011	0.9006	0.9337
DMU27	Kyrgyzstan	0.7901	0.7603	0.6876	0.7460
DMU28	Lebanon	1.0000	0.7724	0.4852	0.7525
DMU29	Libya	1.0000	1.0000	1.0000	1.0000
DMU30	Malaysia	0.9703	0.8876	0.7427	0.8669
DMU31	Maldives	0.7858	0.7859	0.7123	0.7613
DMU32	Mali	0.8293	0.7704	0.4297	0.6765
DMU33	Mauritania	0.7677	0.7677	0.7601	0.7652
DMU34	Morocco	0.8434	0.7736	0.4367	0.6845
DMU35	Mozambique	0.9769	0.9769	0.9763	0.9767
DMU36	Niger	0.9854	0.8508	0.6728	0.8363
DMU37	Nigeria	0.8458	0.8458	0.7490	0.8135
DMU38	Oman	0.7939	0.7939	0.6246	0.7374
DMU39	Pakistan	0.8134	0.7472	0.5366	0.6991
DMU40	Palestine	...	...	...	...
DMU41	Qatar	1.0000	1.0000	1.0000	1.0000
DMU42	Saudi Arabia	0.7785	0.7785	0.6493	0.7354
DMU43	Senegal	0.9066	0.8413	0.8074	0.8517
DMU44	Sierra Leone	0.7253	0.7253	0.6846	0.7118

Table 4 (Continue)

DMU	Country	Model 1	Model 2	Model 3	<i>TE_{average}</i>
DMU45	Somalia				
DMU46	Sudan	0.8920	0.8560	0.7333	0.8271
DMU47	Suriname	1.0000	0.7557	0.5125	0.7561
DMU48	Syria	0.8855	0.7552	0.5016	0.7141
DMU49	Tajikistan	0.7210	0.6822	0.6309	0.6780
DMU50	Togo	0.9911	0.8232	0.7188	0.8443
DMU51	Tunisia	0.9319	0.8595	0.6648	0.8187
DMU52	Turkey	0.7699	0.6833	0.4336	0.6289
DMU53	Turkmenistan	0.9741	0.9301	0.8664	0.9235
DMU54	Uganda	1.0000	1.0000	1.0000	1.0000
DMU55	United Arab Emirates	1.0000	0.9589	0.9578	0.9722
DMU56	Uzbekistan	0.7615	0.7615	0.7179	0.7470
DMU57	Yemen	0.5846	0.5372	0.3472	0.4897
	Mean :	0.8864	0.8288	0.7325	0.8159
	Minimum :	0.5654	0.5372	0.3472	0.4897

These seven nations comprised of three OIC-FEC and four OIC-LDC, each exhibiting superiority in one or more indicators or combinations of indicators. Azerbaijan (DMU04) recorded the highest rate of growth of GDP of 23.39% in 2007 (20.95% and 13.25% in 2006 and 2005 respectively) while maintaining a low level of total government consumption expenditure at 6.53% of GDP. It also experienced a favorable trade balance with export of merchandise and services more than double the import of merchandise and services. However, its rate of inflation of 16.6% was above the group's average of 6.65%. Libya (DMU29) is another top performer, mainly due to its superiority in balance of trade where the values of its exports more than triple the values of its imports. Its GDP growth rate of 6.8% was above the group's average of 5.59%. However, its labour participation rate of 52.7% was below the group's average of 62.72%. Qatar is another OIC-FEC performer shortlisted as relatively technically efficient despite exhibiting a relatively high rate of inflation (13.76%) and total government consumption expenditure (19.50%). These drawbacks were outweighed by the combination of the other three indicators – a high GDP growth rate of 14.2%, a favorable trade balance of 1.89 and an above average labour participation rate of 77.2%.

Four members of OIC-LDC (Burkina Faso, Chad, Guinea and Uganda) were jointly classified as top performers. Burkina Faso and Chad were the only two OIC member countries experiencing negative rate of inflation in 2007. Both also recorded relatively high labour participation rate. Guinea, however, recorded the highest rate of inflation of 22.86%. But, its score for the fourth indicator of 84.1% is second highest in the group, behind Uganda who lead the group with 85.9%. Three members of OIC-MDC (Indonesia, Lebanon and Suriname) were found to be technically efficient under Model 1 but not under Model 2 or Model 3. This is strongly attributable to their favorably low input values of 6.68%, 4.52% and 4.67% respectively, which were much lower than the group's average of 14.72%. Thus, it appears that superiority in one or more indicators can outweigh other shortcomings or nonperforming attributes when employing DEA methodology with no weight restriction.

Table 5 lists the weights associated with the indicators as given by the dual values of Model 2. Two countries, namely Azerbaijan and Qatar had the contributions from all four indicators; two countries, namely Guinea and Uganda had contributions from three contributors; two countries, namely Burkina Faso and Chad had contributions from two indicators while one country, namely Libya had contribution from one indicator only. The contributions of technical efficiency for Azerbaijan and Qatar came from the growth rates and the labour participation rate, amounting to more than 68.8%. A low normalized inflation rate only contributed 10.2% and 13.8% to the technical efficiency. Guinea and Uganda capitalized on labour participation rate giving it a contributing factor of 89.9% and 91.1% respectively. The normalized inflation rate only accounted for 0.3% and 3.3% to the technical efficiency scores respectively. The technical efficiency score for Burkina Faso came from two sources, a high normalized inflation rate (37.6%) and a relatively high labour participation rate (62.4%). No contribution was made by growth rate and balance of trade. Having the highest normalized inflation rate contributed 58.2% to Chad's technical efficiency score. The other 41.8% came from balance of trade. No contribution was made by growth rate and labour participation rate. Libya monopolized on the balance of trade, making it sole contributor to technical efficiency score. Thus, with the exception of Libya, all other efficient DMUs take account of rate of inflation but at a manageable level.

Table 5 Sources of efficiency

DMUs	Weights	Normalized indicators	Actual contributions
DMU04 Azerbaijan	$\alpha_1 = 0.0436$	10.00	0.436
	$\alpha_2 = 0.0160$	7.20	0.115
	$\alpha_3 = 0.0385$	2.78	0.107
	$\alpha_4 = 0.0581$	5.87	0.342
			----- 1.000
DMU09 Burkina Faso	$\alpha_1 = 0.0000$	2.90	0.000
	$\alpha_2 = 0.0000$	1.86	0.000
	$\alpha_3 = 0.0496$	7.57	0.376
	$\alpha_4 = 0.0658$	9.48	0.624
			----- 1.000
DMU11 Chad	$\alpha_1 = 0.0000$	1.59	0.000
	$\alpha_2 = 0.0666$	6.27	0.418
	$\alpha_3 = 0.0582$	10.00	0.582
	$\alpha_4 = 0.0000$	7.65	0.000
			----- 1.000
DMU18 Guinea	$\alpha_1 = 0.0000$	1.92	0.000
	$\alpha_2 = 0.0382$	2.60	0.099
	$\alpha_3 = 0.0031$	1.00	0.003
	$\alpha_4 = 0.0932$	9.64	0.898
			----- 1.000
DMU29 Libya	$\alpha_1 = 0.0000$	3.88	0.000
	$\alpha_2 = 0.1000$	10.00	1.000
	$\alpha_3 = 0.0000$	5.73	0.000
	$\alpha_4 = 0.0000$	3.37	0.000
			----- 1.000
DMU41 Qatar	$\alpha_1 = 0.0436$	6.61	0.288
	$\alpha_2 = 0.0161$	5.81	0.094
	$\alpha_3 = 0.0385$	3.59	0.138
	$\alpha_4 = 0.0581$	8.26	0.480
			----- 1.000
DMU54 Uganda	$\alpha_1 = 0.0000$	3.77	0.000
	$\alpha_2 = 0.0390$	1.45	0.056
	$\alpha_3 = 0.0059$	5.56	0.033
	$\alpha_4 = 0.0911$	10.00	0.911
			----- 1.000

Next, we look at the relatively poor performers and try to identify the sources of their inefficiencies. Based on the average of the three efficiency scores, the bottom four were Egypt (0.6497), Turkey (0.6289), Iran (0.5508) and Yemen (0.4897). Despite achieving a reasonable growth rate, all four nations performed badly in two of the output indicators, Y3 and Y4. The rates of inflation recorded (10.95% for Egypt, 18.4% for Iran, 8.76% for Turkey and 12.48% for Yemen) exceeded the group's average of 6.65%, while the labour participation rate of 47.3%, 53.5%, 47.5% and 43.9% respectively, were among the lowest. With the exception of Iran, the other three countries also recorded unfavorable trade balance of less than unity. The main peers for these poor performers were DMU04 (Azerbaijan) and DMU11 (Chad) which exhibited superiority in Y1 and Y3 respectively.

For a more homogenous comparison, we omitted the twenty-one OIC-LDC, and used Model 2 to assess the remaining 33 countries belonging to the OIC-FEC and OIC-MDC subgroups. Results are presented in Table 6 which also includes the peers for the inefficient DMUs. The efficient DMUs are ranked according to the peer counts, the number of times a DMU appears as a peer for the inefficient DMUs, while the inefficient DMUs are ranked according to their efficiency scores.

Seven OIC-FEC and two OIC-MDC top the performance list, with DMU30 (Malaysia) ranked first due to its high peer counts of 15. This is followed by five OIC-FEC members (Turkmenistan, Azerbaijan, Brunei, Gabon and Qatar). Another OIC-MDC top performer is Cameroon which is ranked seventh, followed by Libya and United Arab Emirates. On average, the OIC-FEC group recorded a relatively higher technical efficiency score of 0.9053 than the OIC-MDC group (of 0.8795). Although the bottom performer is from OIC-FEC (Iran at 0.5452), the next twelve bottom performers are from OIC-MDC group.

5.1 Identifying the sources of inefficiency

In addition to providing the relative technical efficiency scores, DEA also identifies sources of inefficiency inherent in the inefficient DMUs and projects targets or levels to be adopted by these DMUs if they are to be on the efficient frontier. To illustrate the computation involved, we will consider two selected inefficient DMUs (DMU05 Bahrain and DMU51 Tunisia). Their respective results are given in Table 7.

DMUs with zero slacks

For these DMUs, their projected values are fully dictated by their peers and given by the systems of equations (8) and (9) with $t_i^- = 0$, $t_j^+ = 0$, $\forall i, j$. Thus, for DMU05 (Bahrain), for example, we have $\Omega_5^* = 1.00519$, giving

$$\begin{aligned} X_{51}^\wedge &= X_{51} = 1, \\ Y_{5j}^\wedge &= 1.00519Y_{5j} = Y_{5j} + 0.00519Y_{5j}, \quad j = 1, 2, 3, 4.. \end{aligned}$$

This means all outputs are to be proportionally increased by 0.519% in all directions. These incremental values are associated with the radial movements and are given under the fourth column in Table 7. The projected values are the sum of the original values and their respective radial movements. These are recorded under the seventh column and represent the position of an *efficient virtual composite DMU (of peers)* on the efficient frontier which benchmarks the position of the inefficient DMU.

Table 6 Technical efficiency scores of OIC-FEC and OIC-MDC countries, 2007

Rank	DMU	Country	TE	Peer DMUs	Group
1	DMU30	Malaysia	1.0000	[30]	MDC
2	DMU53	Turkmenistan	1.0000	[53]	FEC
3	DMU04	Azerbaijan	1.0000	[04]	FEC
3	DMU08	Brunei	1.0000	[08]	FEC
3	DMU16	Gabon	1.0000	[16]	FEC
6	DMU41	Qatar	1.0000	[41]	FEC
7	DMU10	Cameroon	1.0000	[10]	MDC
8	DMU29	Libya	1.0000	[29]	FEC
9	DMU55	United Arab	1.0000	[55]	FEC
10	DMU05	Emirates	0.9948	[04,08,30,53]	FEC
11	DMU51	Bahrain	0.9651	[30, 53]	MDC
12	DMU02	Tunisia	0.9643	[30, 53]	MDC
13	DMU21	Albania	0.9509	[16, 30, 53]	MDC
14	DMU34	Indonesia	0.9497	[08, 10]	MDC
15	DMU13	Morocco	0.9490	[08, 10]	MDC
16	DMU37	Cote d'Ivoire	0.9442	[04, 29, 30]	FEC
17	DMU26	Nigeria	0.9421	[04,08,16,53]	FEC
18	DMU03	Kuwait	0.9224	[10, 30]	FEC
19	DMU42	Algeria	0.9153	[08, 29, 30]	FEC
20	DMU38	Saudi Arabia	0.8998	[04, 29, 30]	FEC
21	DMU25	Oman	0.8982	[16, 41, 53]	MDC
22	DMU28	Kazakhstan	0.8965	[10, 30]	MDC
23	DMU24	Lebanon	0.8807	[30, 53]	MDC
24	DMU48	Jordan	0.8759	[08, 10, 30]	MDC
25	DMU27	Syria	0.8472	[16, 41, 53]	MDC
26	DMU47	Kyrgyzstan	0.8445	[30, 53]	MDC
27	DMU56	Suriname	0.8255	[04,16,41,53]	MDC
28	DMU39	Uzbekistan	0.8251	[30, 53]	MDC
29	DMU20	Pakistan	0.7845	[16, 41, 55]	MDC
30	DMU52	Guyana	0.7599	[30, 53]	MDC
31	DMU49	Turkey	0.7489	[16, 41, 55]	MDC
32	DMU15	Tajikistan	0.7437	[04, 30, 53]	MDC
33	DMU22	Egypt	0.5452	[04,08,29,41]	FEC
		Iran			

Average: 0.9053 (All), 0.9403 (OIC-FEC), 0.8794 (OIC-MDC)

Table 7 Results for selected inefficient DMUs (2007)

DMUs	Variable	Normalized value	Radial movement	Slack value	Normalized projected value	Projected value	Original value	Percentage change
DMU05	Y1	3.80	0.0197	0.00	3.8197	6.64	6.60	0.6
Bahrain	Y2	4.76	0.0247	0.00	4.7847	1.43	1.42	0.7
$\Omega_5 = 1.00519$	Y3	6.53	0.0339	0.00	6.5639	3.28	3.39	-3.4
$TE = 0.9948$	Y4	5.57	0.0289	0.00	5.5989	63.84	63.70	0.2
DMU51	Y1	3.69	0.1333	0.00	3.8233	6.65	6.30	5.6
Tunisia	Y2	3.23	0.1167	0.5818	3.9285	1.21	0.97	25
$\Omega_{51} = 1.03612$	Y3	6.60	0.2384	0.00	6.8384	2.32	3.15	-26
$TE = 0.9651$	Y4	2.50	0.0903	2.8083	5.3986	62.84	48.30	30

DMUs with non-zero slacks

Next, we turn to DMU51 (Tunisia). The result indicates the presence of a non-zero variable slack, $t_2^+ = 0.5818$ and $t_4^+ = 2.8083$ associated with outputs Y_2 and Y_4 respectively. The position on the frontier is achieved by a radial movement of 3.612% of all outputs, followed by additional axial movements of 0.5818 and 2.8083 for outputs Y_2 and Y_4 respectively. A movement in all outputs alone is not sufficient to project the DMU51 onto the efficient frontier. Additional slack movements for outputs Y_2 and Y_4 are required for the DMU51 to match their virtual composite DMUs on the frontier. We can represent the results of normalized indicators for DMU51 in terms of equations (8) and (9) as follows,

$$\begin{cases} X_{51(1)}^{\wedge} = X_{51(1)} - t_1^- = 1 - 0 = 1, \\ Y_{51(1)}^{\wedge} = 1.036121Y_{51(1)} - t_1^+ = (3.69 + 0.1333) + 0.00 = 3.8233, \\ Y_{51(2)}^{\wedge} = 1.036121Y_{51(2)} + t_2^+ = (3.23 + 0.1167) + 0.58177 = 3.9284, \\ Y_{51(3)}^{\wedge} = 1.036121Y_{51(3)} + t_3^+ = (6.60 + 0.2384) + 0.00 = 6.8384, \\ Y_{51(4)}^{\wedge} = 1.036121Y_{51(4)} + t_4^+ = (2.50 + 0.0903) + 2.80826 = 5.3986. \end{cases}$$

A similar analysis can be conducted for all other inefficient DMUs (nations) in order to identify their sources of inefficiencies and the position of the composite efficient unit they are compared with.

5.2 Policy implication

On average, the technical efficiency scores for the OIC countries for the year 2007 are relatively high, averaging 0.8159 for all fifty-four countries and 0.9053 for OIC-FEC-MDC countries. However, some policy measures with the aim of strengthening economic cooperation amongst member countries is needed.

Most of the non-fuel producer are agriculture based economies. As demand for food is likely to continue to increase more rapidly, policies that have the potential to improve supply over time are mostly needed. Poor agricultural technology is the main factor that hinders agricultural output. Availability of water is a vital factor in maintaining and

increasing agricultural production. Thus, policy measures to improve facilities and land utilization are critical. Policy measures to improve such infrastructure could generate a considerable expansion in supply over time. Therefore, more efforts should be exerted in order to improve the infrastructure in agricultural sector through more investments, both public and private, and to create a favorable environment for foreign investment, including from the fuel-exporting members, in agricultural sector.

The high share of industry in the total output of many OIC countries, particularly in the fuel-exporting countries, does not reflect the high level of industrialization in the countries, since the production of oil and gas are classified as industrial activity. The low share of manufacturing in total output of many OIC countries is a clear indicator of the low level of industrialization in the countries. Improving the manufacturing facilities in these countries is utmost importance. The diversification of their production base would enable them to increase the value-added and quality of their products, helping them become less dependent on manufacturing imports and thereby increasing their trade balance. In addition, investments in agro-industry are another policy action in addressing agricultural and industrial development and unemployment challenges.

Inflationary pressures are on the rise. It has the potential effect of distorting macroeconomic and financial stability in many countries, including the OIC members. Thus, a prudent monetary policy becomes necessary in order to control inflation in the medium term.

The continued internal conflicts in some member countries, particularly in Africa, have undoubtedly serious negative impact on all aspects of life. It has impeded any efforts towards furthering the potential for economic development. It is hoped that such a conflict will come to an end. It is the role of member countries to try and find a solution acceptable to all parties. Thus, actions by governments, NGOs and international organizations are required to implement appropriate policies or programs to support the economic development in the OIC member countries.

6 Conclusions

In this study we utilized the DEA methodology and illustrated its applicability in measuring, assessing and analyzing the macroeconomic performance of OIC member countries for the year 2007. The three versions of the output-oriented model produced consistent results. Three nations were not included in the sample due to the absence of data on rate of inflation. When assessing the 54 member countries, the top performers were dominated by member of sub-groups OIC-FEC and OIC-LDC, attributable mainly to the superiority in one or more indicators considered in the assessment. For an alternative homogenous assessment the sample was reduced to include only members of sub-groups OIC-FEC and OIC-MDC. Seven members of OIC-FEC and two members of OIC-MDC were classified as best performers with Malaysia heading the list.

The paper also highlights how DEA can be used to estimate and identify inefficiencies and their sources. For inefficient units, DEA also identifies the associated efficient virtual composite units on the frontier comprising of relevant group of peers of efficient units and the directions to these projected composite units. This information is important and can aid the policy-makers in allocating resources more efficiently and identifying directions for improvement.

The study is by no means complete. Due to limited space and time, many important aspects of DEA have not been addressed. A revised DEA model with additional explanatory variables capturing essential features of the country's economic, fiscal, monetary, social and environmental aspects might produce valuable information in identifying the variations and shortcomings inherent in the macroeconomic performance. Others include the multiplier or weight restrictions such as the imposition of assurance regions (AR), issues of congestion, the restriction of integer-value variables, general multiple criteria decision making such as GoDEA and integrated analytic hierarchy process (AHP), dynamic changes in efficiency over time involving technological change and frontier shift (a study in Malmquist's total factor productivity), and random variable data chance constrained programming for the formulation of probability-based stochastic DEA model. These topics are receiving significant attention in literatures and provide directions and avenues for future research.

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Dutch Disease Investigated: Empirical Evidence from Selected South-East Asian Economies

Shahid Hussain Javaid

This paper investigates Dutch Disease hypothesis analyzing the impact of foreign inflows on appreciating real exchange rate. The paper also studies contraction in the tradable sector in selected South East Asian countries over 1981-2007. Using static and dynamic panel data techniques, the study first estimates real exchange rate appreciation due to surge in foreign inflows and then estimates contraction in the tradable and expansion in the non-tradable sector. On the basis of empirical evidence the study confirms the Dutch Disease hypothesis in the countries studied.

Introduction

Dutch Disease explains the relationship between exploitation of natural resources and decline in the manufacturing sector. The theory asserts that increase in revenues from natural resources will de-industrialize a nation's economy by appreciating the real exchange rate, which makes the tradable sector less competitive. The idea of "Dutch Disease" is not well-debated in the literature. Corden and Neary (1982) modeled this idea and explained 'Dutch Disease' as "adverse effect on non-booming sector due to booming sector". In their model, there are non-traded (services sector, e.g. transport, financial services, etc.) sector and two traded goods sectors (booming and non-booming sectors). The booming sector means the natural resource (mining sector) whereas non-booming sector is agriculture and manufacturing sectors. Studying occurrence of Dutch Disease it is necessary to accomplish the relationship between increase in natural resource revenues, the real-exchange rate appreciation, and a decline in the tradable sector. Appreciation in the real exchange rate results in contracting the tradable sector in most of the developing countries. Several factors cause appreciation in the real exchange rate. The study explores those factors.

Financial crisis in the last two decades of twentieth century especially the Asian financial and currency crisis¹ questioned the importance of foreign inflows. On the one hand, many economists thought foreign inflows caused this crisis. On the other hand, some argued that foreign inflows boost economic development. This generated a greater interest in valuing the contribution of foreign inflows in economic development.² Sudden increase in foreign inflows to developing countries is likely to raise consumption and investment, increase real money balances, boost foreign exchange reserves, appreciate real exchange rate (RER), and widen current account deficit. All this demands to empirically investigate the phenomenon of “Dutch Disease³”. The transmission mechanism of Dutch Disease may clarify the intensity of relation between foreign inflows and real exchange rate. The explanation of this mechanism is twofold: 1) First, the resource booms (increase in foreign inflows) tend to increase household income and rise in the demand for labor in the booming sector which decreases labor supply in the manufacturing sector. Second, this may cause higher production cost and contraction in the non-booming (manufacturing) sector which is known as resource movement effect. 2) The spending effect exists as a consequence of the extra revenue (e.g. foreign inflows). This leads to higher disposable income which signals an expansion in aggregate demand causing increase in domestic prices and increase in imports. This leads to real exchange rate appreciation and contraction in the tradable sector. The central point of the theory on foreign inflows and the real exchange rate has been the impact on the relative prices of non-tradable goods.

The literature on the subject identifies the difference between the effect of foreign inflows on real exchange rate and Dutch Disease phenomenon. The ‘Salter-Swan-Corden-Dornbusch model⁴’ is used to analyze the impact of foreign inflows on the real exchange rate (RER) in emerging economy. The mechanism explains the process of an increase

¹See Athukorala and Warr (2002).

² Soto (2000)

³ The term was originally used to explain the troubles faced by manufacturing sector in the Netherlands coming after the development of natural gas on a large scale that resulted in appreciation of the real exchange rate. It has since been used to refer to any situation in which a natural resource boom, or large foreign aid or capital inflows, cause real appreciation that jeopardizes the prospects of manufacturing (Williamson, 1995).

⁴See Lartey 2008.

in foreign capital inflows causing an appreciation in the real exchange rate. This increase in different foreign inflows e.g., an increase in foreign direct investment (FDI), remittances (REM) and official development assistance (ODA) induces appreciation in the RER. Several studies (Athukorala and Rjapatirana 2003; Larney 2007) were dedicated to assessing the impact of FDI on the RER. Others (White and Wignaraja 1992; Berg et al 2007; Adenauer and Vagassky 1998; Larney 2008) assessed the impact of aid on RER. The impact of remittances on real exchange rate was studied by Chami et al 2005; Jongwanich 2007; Ouattara and Strobl 2003; Bourdet and Falk 2003; Izquierdo and Montero 2006; Dorantes and Pozo 2004 and Rajan and Subramanian 2005. The empirical evidence on the “Dutch Disease” effect of foreign aid appears to be rather mixed. There is no broad unanimity in written work on the existence of Dutch Disease.

However, the standard trade theory models analyzing this phenomenon indicate that a resource boom may lead to a resource movement from tradable to non-tradable sector. This leads to the whole deterioration of the tradable sector (Corden & Neary 1982; Edwards et al 1982; Agenor 1998; Acosta et al 2007; Neary & Winjbergen 1986). In a panel study of 62 developing countries by Elbadawi (1999) and in a country analysis by Oomes and Kalcheva (2007) for Russia, Larney (2008) for Philippines found Dutch Disease effects. By contrast, Ogun (1995) for Nigeria, Nyoni (1998) for Tanzania, Sackey (2001) for Ghana and Ouattara and Strobl (2003) for a panel of CFA countries, found that aid flows were associated with real depreciation and found no Dutch Disease effects.

This paper uses panel series data to explore the evidence for Dutch Disease effects from increased foreign inflows in six small open economies in the South-East Asia. The countries including Pakistan, Bangladesh, India, Indonesia, Philippines and Malaysia, display a substantial degree of economic heterogeneity, and a corresponding level of heterogeneity in their response to foreign inflows can also be seen. The paper is organized as follows: section 2 presents some stylized facts, section 3 illustrates methodology and model specification, section 4 discusses empirical results and conclusions are given in section 5.

Some Stylized Fact

The countries of analysis are located in the southern and eastern corner of the continent of Asia. The key economic indicators of these economies show an increase in the GDP, GDP per capita and trade volume in the 1990s and 2000s. The average annual GDP growth is about 5.1% during 1981-2007. These economies are divided into tradable (agriculture, industry) and non-tradable (services) sectors. In terms of foreign inflows, these economies were relatively low in 1980s. The average yearly receipts were \$5.1 billion during the period of analysis. The real exchange rates have also been appreciated in the years of concern. The annual growth rate of tradable sector on average remained at 4.4% whereas non-tradable sector achieved 5.8% during the period of analysis. The employment share in the tradable sector has been reduced from 84% to 55% and employment in the services sector has been increased from 16% to 55%. It is important to note that aggregate foreign inflows are insignificant in estimating Dutch Disease effects so we disaggregate foreign inflows into three main categories (FDI, REM, and ODA). Before describing the econometric model, we briefly review historical trend of foreign inflows and real exchange rate of selected countries. These facts are discussed in detail below and figures are given in the appendix:

A) Historical Trend of Foreign Capital Inflows

Developing countries have always been welcoming foreign inflows. Foreign direct investment (FDI) has been the most important part of foreign capital⁵, since its inception, however the success has not been great as for six selected countries in South-East Asian history. The amount of FDI has been meager, roughly receiving \$264.4 billion during last 27 years. In total it has grown but it had never been more than 1% of real GDP during the period of analysis among Pakistan, India, Bangladesh and Indonesia. Needless to say, one of the most important sources of external capital for the countries of analysis is foreign remittances. Figure 1 establishes the importance of remittances. In early 1950s foreign inflows were mainly in the form of foreign official loans and grants; the major providers of official funding included World Bank,

⁵ For details Agenor (1998).

USAID, ADB, IMF and several other countries. World Bank has been one of the major sources of funding. During 1981-2007, Pakistan in total has received around \$118.8 billion, India \$351.2 billion, Bangladesh \$87.8 billion, Indonesia \$94 billion, Philippine \$188.6 billion and Malaysia received \$108.1 billion from different sources including remittances, foreign direct investment and official development assistance & grants (World Development Indicators 2008). India (\$351.2 billion) stood first amongst rest of the countries in receiving foreign inflows whereas Bangladesh (\$87.8 billion) remained at the bottom during 1981-2007. It is important to note that the volume of remittances was highest during the same period.

The selected countries have been receiving foreign inflows from the last so many years in different forms. In last 27 years⁶ (starting from 1981) they have received a total of \$948.4 billion foreign inflows in different forms and shape, figure displays foreign inflow receipts as a percent of GDP. The average yearly receipts have been \$5.9 billion. While during the same period real GDP grew at an average annual rate of 5.1% (GDP per capita was only at US\$581 million on average except Malaysia). The figure 1 shows trend of foreign inflows coming into Pakistan, Bangladesh, India, Indonesia, Philippine and Malaysia over the years. Foreign capital inflows have been volatile during the length of the time in which it is analyzed, the standard deviation (\$6.3 billion) of this series is 108% that of the mean, while Real GDP on the other hand has also been very volatile, and its standard deviation has been 110% of the mean value.

B) Historical Trend of Real Exchange Rate

The determinants of real exchange rate can be categorized into internal and external parts. The internal factors (import tariff, export tax, exchange controls, taxes and subsidies composition of government expenditure, technological progress) and external factors (terms of trade, foreign inflows, world real interest rate) are important in bringing exchange rate stable. The appreciation in real exchange rate means increase in domestic cost of producing tradable goods which causes

⁶ The reason for using these years is to avoid different exchange rate regimes. In early 1980s, countries of analysis almost followed managed floating system except Malaysia.

competitiveness of export problem. The real exchange rate measured⁷ here as the ratio of price index of trading partner countries expressed in US \$ to the domestic price index multiplied by the period average nominal exchange rate in domestic currency per US \$ (Sackey, 2001). The real exchange rate changed over time depending on whether inflation was more or less rapid in South-East Asian countries than in the economies of selected countries major trading partners. Keeping the base year value (2000=100), on average real exchange rate indexes declined from 1981 to 2007 (i.e., appreciated), and generally followed a downward trend. It is worth noting to say that Pakistan, India Indonesia and Philippine showed continuous appreciation in the real exchange rate during the period of analysis.

C) Historical Output-Employment Trend of Tradable and Non-tradable Sectors

The Industrial output and Services sector of the countries expressed as a percent share of GDP to capture the resource movement effects. This sectoral share changed over time in South-East Asian countries; share of Industrial sector declined from 1981 to 2007, and share of service sector followed an upward trend. Actually, there was an expansion in the services sector and a decline in the production of industrial goods as a share of GDP among the countries of analysis during the peak inflow period after 2001. Figure 3 clearly show contraction in the tradable sector. The sectoral share of employment also changed over time in the countries of analysis. The employment share in the non-tradable sector increased significantly whereas the employment in the tradable sector decreased during the period of analysis. Figure 4 identifies the trend of increase in the employment in the non-tradable sector.

Data & Methodology

1) Data Sources

Panel data set comprising six countries is applied for the period 1981-2007. The data come from various sources; International Financial Statistics (IFS) 2007, the World Development Indicators (WDI) 2007.

⁷ See Maxwell Opoku-Afari (2004)

The real exchange rate (RER) is the price of traded goods relative to the price of non-traded goods. Due to non-existence of indices of tradable and non-tradable prices, the real exchange rate has been proxied by available domestic and world price indices and nominal exchange rates. RER is defined as the measure of nominal exchange rates adjusted for price differentials between the home country and its trading partners. This is also referred to, in the literature, as the multilateral real exchange rate. This is different from the bilateral real exchange rate between a home country and a specific trading partner. The RER index has been calculated using geometric mean and total trade share of trading partners as weights. It is important to note that Nominal exchange rate index is defined as the index of nominal exchange rate (period average rates) in units of domestic currency per unit of foreign currency (US\$) for home country. An increase (decrease) in the value of RER represents depreciation (appreciation). Remittances (REM), foreign direct investment (net inflows) and official development assistance & grants (ODA) obtained from the World Development Indicators, trade openness (TROP) of the economy, calculated as $100 * (\text{imports} + \text{exports}) / \text{GDP}$. Imports and exports data come from the IFS 2008. Government final consumption expenditure (FCE) as percentage of GDP and terms of trade (TOT) obtained from World Development Indicators (online version 2008). The series for excess money growth (EXMGR) is constructed as the difference between growth rate of M2 and GDP, both of which are derived from WDI database. The variable excess money growth is used for future inflation to observe the macroeconomic consistency among the countries of analysis.

2) Methodology and Model Specification

The static as well as dynamic panel models for fixed effects of the real exchange rate using panel data for six selected Asian countries are examined. The static analysis refers to some kind of movement in which speed is constantly maintained i.e. studies focused on particular period of time. It is similar to taking a photo when you press the button for a shot then the photo is just at a particular point of time. Does that situation will remain there for long? Is there any force that can push the movement towards equilibrium or disequilibrium one? This question cannot be answer by static analysis. In dynamic economic the study of time path of variable is to see whether the variable will converge to a point which we call stable or steady state or will it diverge. Dynamic

analysis allows us to see the path of variable how the variables change with time. It helps us to see whether the equilibrium will be reached or not.

Different techniques have been used to estimate equation for different forms of foreign inflows which influence the real exchange rate. The objective is to analyze the “Dutch Disease” effects. The econometric analysis suggest various problems while using Static panel model fixed effects (within) estimator and dynamic panel using generalized method of moments (GMM) estimator to analyze the impact of foreign inflows on real exchange rate as a first step. Endogeneity and hetroskedasticity and identification are important in this regard. The problem of endogeneity occurs when the independent variable is correlated with the error term in a regression model. This implies that the regression coefficient in an OLS regression is biased. It is more worthy to mention that GMM and Two stages least squares (TSLS) are better techniques in the presence of endogeneity. This implies that the regression coefficient in an OLS regression is biased. There are many methods of overcoming this, including instrumental variable regression and Heckman selection correction. Hetroskedasticity is in fact about differing variances; its presence does not lead to inconsistency problems. Standard instrumental variable may be preferable in the presence of hetroskedasticity (Baum et al 2002).An identification problem may arise if some of the explanatory variables are correlated with the error term. For example, in the presence of risk-sharing strategies among distant family members, a drought will affect agriculture output while at the same time increase remittances from international migrants.

The static panel model is given by

$$Y_{it} = \alpha + \beta x_{it} + \eta_{it} + \varepsilon_{it} \quad (1)$$

Where x_{it} a vector of explanatory variables is, η_{it} is a country specific effect which is unobserved, and ε_{it} is an error term. The dependent variable is the real exchange rate, and the explanatory variables are remittances, foreign direct investment (FDI, net inflows), official development assistance (ODA), final government expenditure (FCE), excess money growth (EXMG), terms of trade (TOT) and trade openness (TROP).

The dynamic equation is given by

$$Y_{it} = \alpha Y_{it-1} + \beta(L) x_{it} + \eta_i + \varepsilon_{it} \quad (2)$$

The dynamic model for the level of Y_{it} , where Y_{it-1} is the one lag period of Y_{it} , x_{it} is a vector of other explanatory variables, and $\beta(L)$ is a vector of associated polynomial in the lag operator. Estimating the fixed effect estimator to equation (2) produce biased and inconsistent estimate of the coefficient on the lagged dependent variable, country specific transformation is eliminated and it destroys the correlation between the lagged dependent variable with the error term. To eliminate the country specific effect; the first difference of equation is as

$$Y_{it} - Y_{it-1} = \alpha (Y_{it-1} - Y_{it-2}) + \beta (x_{it} - x_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \quad (3)$$

This shows the lagged difference in the real exchange rate that may be correlated with the error term. This necessitates the use of instruments to deal with the endogeneity. The GMM difference estimator uses the lagged level of explanatory variable as instruments. Blundell and Bond (1998) show that persistence in the explanatory variables may have adverse effects on small sample. The GMM system estimator combines the difference estimator with an estimator in levels, to minimize the potential bias. The equation in levels uses the lagged differences of explanatory variables as instruments under two conditions: (a) there is no serial correlation in the error term, (b) the differences of explanatory variables and the errors are uncorrelated. The validity of the instruments determines whether the GMM estimator is consistent or not. Hall-Rudebusch-Wilcox (HRW), test is applied to check for validity of instruments⁸. Instrumental variable (2SLS) is not used since Breusch Pagan test identifies problem of heteroskedasticity⁹. This confirms the joint significance of independent variables and justifies application of GMM technique in estimating dynamic panel data. As a second step contraction in tradable sector and expansion in the services sector is calculated using GMM.

The variables used in the study account for different foreign inflows, trade openness as external factors and excess money growth and

⁸ The eigen value is 0.18 which is greater than the critical value i.e. 0.13

⁹ The F-stat is 4.5

government final consumption expenditure as internal factors in determining the real exchange rate. It is important to note that the expected theoretical impacts of the respective variables are as follows:

- Foreign inflows bear negative sign tends to cause real appreciation by changing the composition of the demand for traded and non-traded goods, according to the “Dutch disease” theory of foreign inflows.
- The sign of Government expenditure depends on the composition of expenditure. Consumption expenditure of non-tradable tends to appreciate the REER, while that of tradable leads to real depreciation.
- The sign of trade openness would cause real depreciation (appreciation) if it reduces (increases) the demand for non-tradable.
- Excess money growth captures negative sign, since changes in the money supply would tend to raise the general price level and hence leading to appreciation of the REER.
- Terms of trade sign depends on whether income (substitution) effect dominates then deterioration of TOT leads to real depreciation (appreciation).

Justification of including these variables can be explained by analyzing internal and external determinants of real exchange rate. The main focus of the study is to measure the impact of appreciating real exchange rate in contracting the tradable sector.

Estimation and Results:

A) Descriptive statistics

Conventionally, real exchange rate model connects the real exchange rate to foreign inflow variables (remittances, foreign direct investment and official development assistance), trade openness and policy variables like government expenditure. In this study, the real exchange rate index has been taken as dependent variable and remittances, foreign direct investment, official development assistance, trade openness, final consumption expenditure and excess money growth as explanatory variables.

Table 1. Correlation Matrix

Variables	ODA	REM	FDI	EXMGR	FCE	TROP	TOT	REER
ODA	1							
REM	0.20	1						
FDI	-0.21	-0.10	1					
EXMGR	0.10	-0.09	-0.11	1				
FCE	0.34	0.60	-0.50	0.07	1			
TROP	-0.25	-0.09	0.73	-0.17	-0.68	1		
TOT	-0.61	-0.24	0.16	-0.07	-0.56	0.34	1	
REER	0.31	-0.21	-0.26	0.26	-0.01	-0.24	-0.11	1

Table1 presents the correlation matrix for the variables. Two categories of foreign inflows are negatively correlated with the real exchange rate, whereas official development assistance (ODA) is positively correlated with the real exchange rate in contrast to expectation. Trade openness is negatively correlated with the real exchange rate, while the coefficient representing the correlation between the real exchange rate and excess money growth rate bears a sign that is contrary to expectation. Government final consumption expenditure is negatively correlated with the real exchange rate. Table 2 introduces some descriptive statistics on the variables.

Table 2. Descriptive Statistics

Variables (ratio of GDP)	Obs	Mean	Std.Dev	Min	Max
FCE	162	77.64	10.02	51	94
TROP	162	64.01	5434.38	12	229
TOT	160	0.7	0.34	0.01	1.19
EXMGR	162	11.68	11.62	-53	76
REER(2000=100)	162	165.86	110.58	58.68	592.12
ODA	162	0.92	0.93	-0.45	3.76
REM	162	3.05	3.07	0.01	13.74
FDI	162	1.34	1.81	-2.76	8.76

Note: estimates are based on annual data for the six countries over the period 1981-2007

B) Empirical estimations

The results obtained from estimating equations (1) and (2) are analyzed. Table 3 represents results from the static panel regressions using panel least square method (OLS). The coefficient estimates show that excess money growth, remittances, government expenditure and foreign direct investment are significant with a negative sign but ODA is significant with opposite sign. OLS country fixed-effects could be biased if any explanatory variable is correlated with other determinants of real exchange rate. Durbin Watson stat is very low in the specification effects. Dynamic panel is estimated using generalized method of moments (GMM) to sort out specification issues. GMM-Difference estimator is applied. In table 4, ODA, REM, FCE, TROP, TOT has both statistically significant coefficients with expected signs but FDI and EXMGR are statistically significant with unexpected signs. The results reveal that increase in ODA, REM and TROP lead to real exchange rate appreciation. Since the real exchange rate acts as a summary indicator of the outcome of macroeconomic adjustments that occur following an increase in foreign inflows, the results are implicative of the existence of Dutch Disease effects caused by increase in ODA, REM and TROP inflows.

Table 3.Static Panel Regressions: Fixed Effects

Dependent Variable: REER

Variables	Coefficient	Std. Error	T-stat	Prob
C	11.3	2.67	4.2	0
Log(TROP)	-0.24	0.18	-1.33	0.18
Log(EXMGR)	0.09	0.04	2.01	0.04
Log(FCE)	-1.3	0.55	-2.3	0.02
Log(TOT)	-0.003	0.11	-0.03	0.97
Log(FDI)	-0.11	0.03	-4.32	0
Log(REM)	-0.20	0.04	-4.27	0
Log(ODA)	0.12	0.05	2.38	0.02
R-squared: 0.69				
Durbin-Watson stat: 0.43				
JB: 10.31				0.15

Table 4. Dynamic Panel Regressions: Using GMM/DPD

Dependent Variable: REER

Variables	Coefficient	Std. Error	T-stat	Prob
Log(REER(-1))	0.93	0.04	21.62	0
Log(TROP)	-0.02	0.04	-0.54	0.59
Log(EXMGR)	0.01	0.01	-1.57	0.11
Log(FCE)	-0.15	0.10	-1.60	0.11
Log(TOT)	-0.04	-0.03	-1.7	0.09
Log(FDI)	0.01	0.004	2.29	0.02
Log(REM)	-0.06	0.03	-1.95	0.05
Log(ODA)	-0.01	0.003	-2.69	0.00
S.E. Regression: 0.06				
J-stat: 65.12				

The results further show that the substitution effect of trade liberalization does not dominate the income effect; therefore, as the degree of openness of a country increases, the real exchange rate tends towards appreciation. The estimates also indicate that a fiscal expansion leads to appreciation of the real exchange rate, consistent with the claim that government expenditure are generally allocated towards non-tradable goods. The statistically significant EXMGR suggest that excess credit creation due to foreign exchange market interventions have no repercussions in terms of fuelling inflation in face of high foreign inflows. It confirms the fact that lagged impact of changes in the explanatory variables on the real exchange rate is significant. The terms of trade explains that positive shock to the price of exports relative to imports results in REER appreciation.

The robustness of the results can be analyzed by deleting single country one by one. It is interesting to note that FDI are significant with expected signs causing real exchange rate to appreciate except Philippines. As for as the official development assistance is concerned, without Indonesia, Pakistan and Philippines, real exchange rate appreciation is found. Whereas without India and Bangladesh ODA is significant but not with expected sign, causing real exchange rate to depreciate. Needless to say, ODA is not significant in Malaysia. Without Malaysia, Pakistan and Indonesia, the Remittances are insignificant with unexpected sign but excluding Philippine, Bangladesh and India provide significant results.

Table 5. Dutch Disease Effects: Using GMM/DPD
Effects on Tradable

Variable	Coefficient	Std. Error	T-stat	Prob
Log(TD(-1))	0.12	0.10	1.24	0.21
Log(FDI)	-0.005	0.002	-2.4	0.01
Log(REM)	-0.0004	0.004	-0.09	0.92
Log(ODA)	0.002	0.002	0.79	0.43
Log(REER)	0.03	0.02	1.63	0.1
Log(TROP)	0.01	0.02	0.63	0.52

S.E.Regression: 0.02

J-stat: 118.56

Effects on Non-Tradable

Variable	Coefficient	Std. Error	T-stat	Prob
Log(NTD(-1))	0.41	0.08	4.97	0
Log(FDI)	0.007	0.002	3.7	0
Log(REM)	0.005	0.005	0.95	0.34
Log(ODA)	-0.02	0.005	-3.84	0
Log(TROP)	-0.07	0.03	-2.5	0.01
Log(FCE)	0.21	0.07	2.8	0

S.E.Regression: 0.02

J-stat: 44.19

In the second crucial step for investigating Dutch Disease effects of foreign inflows over the tradable and non-tradable sectors. The results in table 5 show that due to foreign inflows tradable sector contracts because the coefficients of different inflows are statistically and positively significant except ODA which may be used by the government for development activities. On the other side, the non-tradable sector going to expand due to inflows as shown in the results, the coefficients of REM and FDI are positively significant. This means that increase in REM and FDI support to increase the non-tradable sector. However, increase in ODA lead to contraction in non-tradable sector which may be the cause of its concentration in productive sector by the government.

Concluding Remarks

The paper investigated the impact of foreign inflows on the real exchange rate in six selected South-East Asian countries with a focus on Dutch Disease effects. The main objective was to see whether increase in foreign inflows, particularly REM, FDI (net inflows) and ODA, results in real exchange appreciation (a case of Dutch disease). The estimated real exchange rate model specifying three different kinds of foreign inflows, i.e. FDI, REM, and ODA showed that increase in inflows lead to a real appreciation. Second, FDI and REM cause spending effect whereas REM and FDI show resource movement effect. Thus, the study concludes that increase in the inflow of FDI and REM cause Dutch disease effects in the region. The main policy recommendation drawn from this study can be that as REM, FDI and ODA are associated with appreciation of the real exchange rate; these economies may continue to receive aid with focus on increase in tradable sector. This suggests that foreign inflows may be used to supply sides improvements which would maintain higher export volumes. According to the empirical analysis different kinds of foreign inflows seem to locate Dutch Disease. The study will also help measure RER misalignment. Needless to say such a small sample size for such analysis may create normality of residual problem using GMM.

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APPENDIX (A): Variables defined

Measurement of real exchange rate

The real exchange rate (*RER*) is the price of traded goods relative to the price of non-traded (domestic) goods. In the absence of readily available indices of tradable and non-tradable prices, the real exchange rate has to be proxied by available domestic and world price indices and nominal exchange rates. There is no unique way of constructing a proxy measure, but all commonly used measures compute the ratio,

$$\frac{(NER)P^w}{p^D}$$

Where *NER* denotes the nominal exchange rate (measured as domestic currency per foreign currency), *PW* is an index of foreign prices and *PD* is an index of domestic prices. *NER* and *PW* are weighted averages computed across trading partner countries. The country weights are based on export shares, import shares or, most commonly, shares based on the sum of exports and imports taken from IMF original weights¹⁰. The countries included are Canada, Japan, United Kingdom, United States, Belgium, France, Germany, Italy, Netherlands, India, Korea, Singapore and Malaysia. The ratio of an index of a country's period average exchange rate to a weighted geometric average of exchange rates for the currencies of selected countries, weighted by each country's trade, and adjusted for relative changes in consumer prices. Base year = 2000. It is important to note that the selected trading partner of concerned countries account for almost 70% of total trade.

The particular measure used differs according to the measures used for *PW* and *PD*. Preferred proxy measure makes use of foreign producer (wholesale) prices for *PW* and domestic CPI for *PD*. Country weights based on export shares are used in the construction of *NER* and *PW* series. The index may thus serve as a rough proxy for the theoretical concept of the real exchange rate – the relative prices of tradable to non-tradable goods. A convenient alternative to GDP deflator as the domestic price measure in constructing the index is the consumer price index (CPI) (Edwards 1989, Athukorala and Warr 2002). Most of the

¹⁰ IMF

previous studies have typically used either of two other indicators, although the theoretical reasoning behind the particular measurement choice is seldom made explicit. One, which is perhaps the most widely used, particularly in publications of the IMF and the World Bank, uses a trade-weighted index of consumer prices in trading partner countries for *PW* and an index of consumer prices in the given country for *PD*. The use of this indicator as a proxy for the theoretical concept of a real exchange rate for developing countries is usually justified on the premise that under the low inflation conditions that prevail in developed countries (which are generally the major trading partners), producer prices and consumer prices tend to move together (Edwards 1989).

Industry (value added % of GDP) comprises value added in mining, manufacturing, construction, electricity, water and gas.

Agriculture (value added % of GDP) consists of forestry, hunting, fishing, cultivation of crop livestock production.

Services (value added % of GDP) include hotels and restaurants, transport, financial professional, personal services such as health, education and real estate services.

ODA is the net disbursement of loans and grants on concessional terms by official agencies of Development Assistance Committee (DAC) and centre Arab countries to promote economic development and welfare.

Workers' remittances (REM) are current transfers by migrants who are employed or intend to remain employed for more than a year in another economy in which they are considered residents. Some developing countries classify workers' remittances as a factor income receipt (and thus as a component of GNP). The World Bank adheres to international guidelines in defining GNP, and its classification of workers' remittances may therefore differ from national practices. This item shows receipts by the reporting country. Data are in current U.S. dollars.

Foreign direct investment (FDI) is net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments.

Money and Quasi Money Growth is the average annual growth rate in money and quasi money. Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. The change in the money supply is measured as the difference in end of year totals relative to the level of M2 in the preceding year.

GDP Growth is the annual percentage growth rate of GDP at market prices based on constant 1987 local currency. Aggregates are based on constant 1987 U.S. dollars. GDP measures the total output of goods and services for final use occurring within the domestic territory of a given country, regardless of the allocation to domestic and foreign claims. Gross domestic product at purchaser values (market prices) is the sum of gross value added by all resident and nonresident producers in the economy plus any taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

Excess Money Growth (EXMGR) is estimated as the difference between money growth and GDP growth.

Trade openness (TROP) is calculated as the ratio, sum of exports and imports to GDP.

Government final consumption expenditure (FCE) is the sum of household final consumption expenditure and general government expenditure.

Appendix (B)

Figure 1: Different Foreign inflows

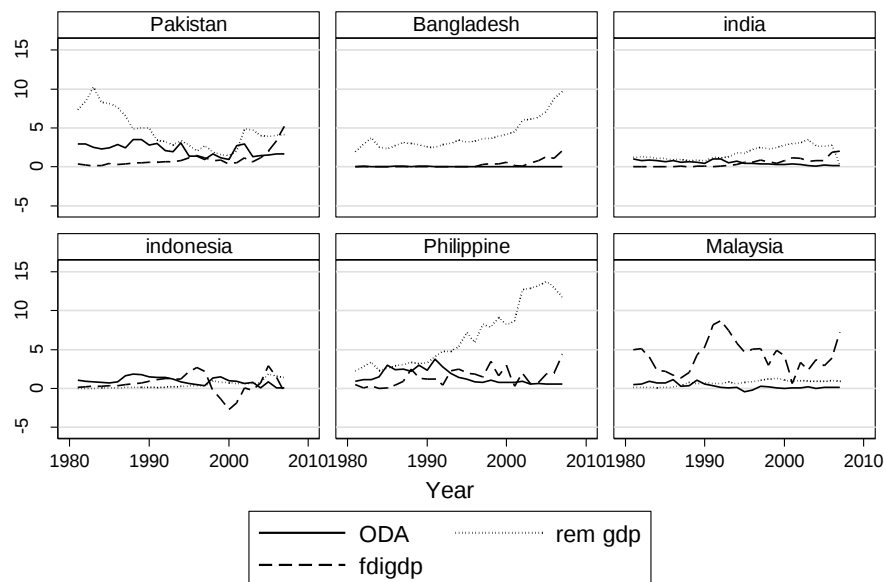


Figure 2: Trend of Real Exchange Rate

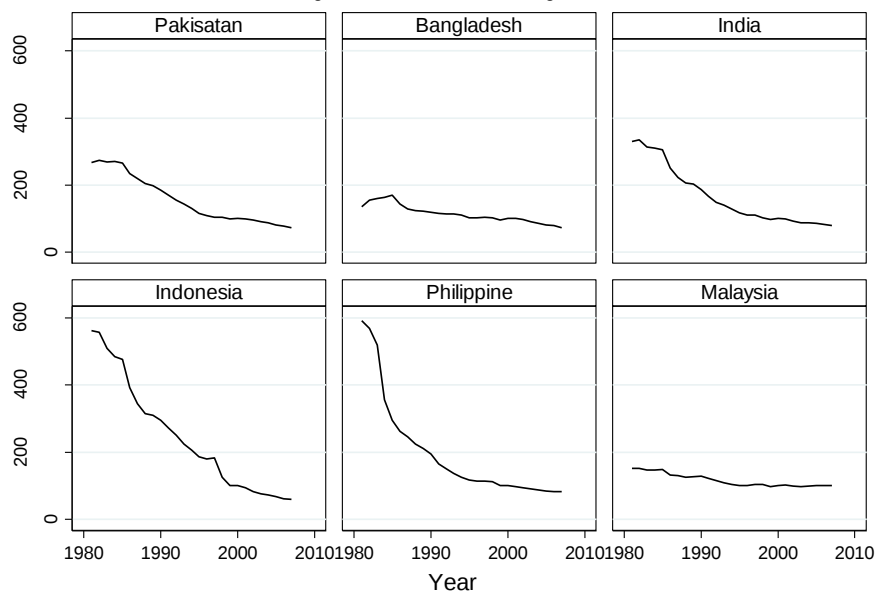


Figure 3: Percentage Share of Tradable and Non-Tradable

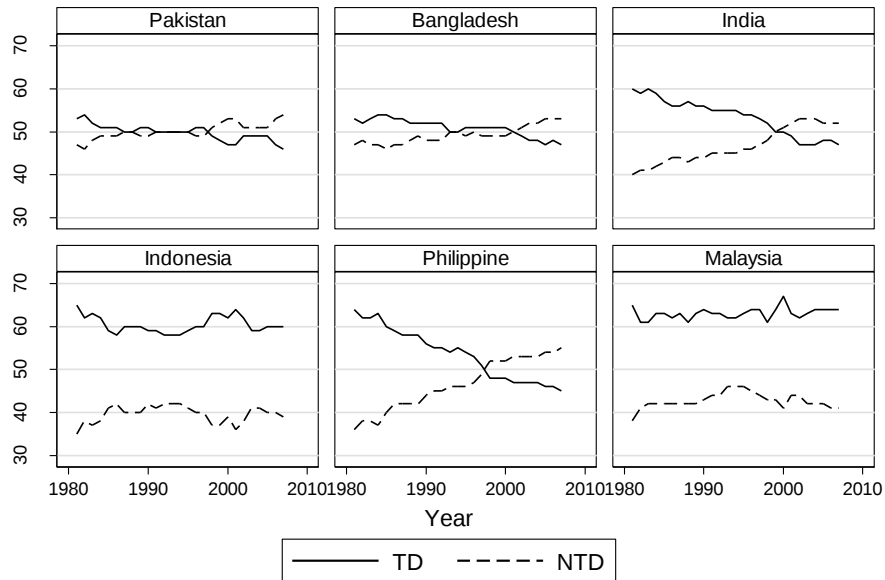
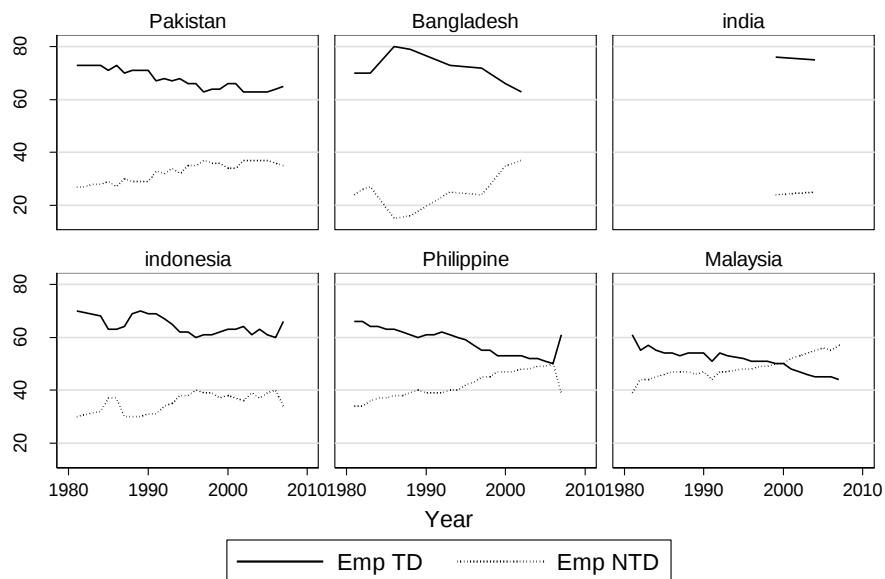


Figure 4: Percentage change in Employment



Linkages between Foreign Direct Investment, Domestic Investment and Economic Growth in Malaysia

Hooi Hooi Lean¹ and Bee Wah Tan

This paper examines the linkages between foreign direct investment (FDI), domestic investment and economic growth in Malaysia for the period of 1970-2009. Specifically, it attempts to determine the impact of FDI and domestic investment on economic growth respectively and whether FDI crowds in or crowds out domestic investment. It is expected that the empirical analysis and findings would show some insightful implications to the policy makers and market players. Furthermore, the recently announced Tenth Malaysia Plan attaches an important mission of leading the country towards a high-income nation. The private sector is in a critical position to drive this new growth aspiration. The question of how to attract investment is foreseen to become a “hot” debate topic once again despite numerous previous studies on the subject.

Introduction

For more than a century, foreign direct investment (FDI) has contributed significantly to the economic growth of Malaysia. Debate on the relationship between FDI and economic growth is ample and not new in the literature (see, for example, Jackman, 1982; de Mello, 1997; de Mello, 1999; Feridun, 2004; Duasa, 2007; Pradhan, 2009). Many studies found that FDI and economic growth are closely related. However, Wong and Jomo (2005) argued that the role of FDI in stimulating a host country's economic growth is not consistent in the aftermath of the Asian financial crisis. Nevertheless, Duasa (2007) and Pradhan (2009)

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supported the view that there was no strong relationship between FDI and economic growth in Malaysia. They also suggested that the inflow of FDI contributes to less volatility of economic growth. Hence, it is noted that the existing empirical studies focused on analyzing the broad relationship between FDI and economic growth in the case of Malaysia.

On the other hand, the empirical studies relating domestic investment (DI) and economic growth are restricted for the case of Malaysia. DI is claimed to be the most important source of economic growth and also an effective instrument in creating jobs for an economy. Firebaugh (1992) added that DI is more likely to build relationship within the domestic industries. Apart from that, DI plays a dual role in the economy as part of aggregate demand and enlarges a nation's stock of productive assets. Thus, it is believed that DI is an important factor in accounting for business cycles and the policy makers would now consider DI when reforming their policies on investment sources.

For this reason, the revitalize research's attention is shifted to empirically analyze the dynamic linkages between FDI and DI in influencing the economic growth, both separately and together (see, for example, Choe, 2003; Razin, 2003; Kim and Seo, 2003; Hecht et al., 2004; Apergis et al., 2006; Tang et al., 2008; Adams, 2009; Merican, 2009). The studies found the existence of the long run relationship among FDI, DI and economic growth but the direction of causality among the variables remains vague. For example, Choe (2003), Kim and Seo (2003), Hecht et al. (2004) and Apergis et al. (2006) found bilateral causal relationship between FDI and economic growth. In contrast, Tang et al. (2008) determined that there is only one way causality from FDI to DI and FDI to GDP in China, while the causal link between DI and economic growth is bilateral.

Furthermore, the linkage between FDI and DI raises a question: does FDI crowd in or crowd out DI? Agosin and Machado (2005) claimed that if FDI crowds out DI, the increase in total investment is smaller than the increase in FDI. If there is a crowding in, the increase in total investment will be more than the increase in FDI. Interestingly, Kim and Seo (2003) showed that an expansion in FDI neither crowds in nor crowds out the DI in South Korea. However, Wang (2010) found that

contemporaneous FDI crowds out DI in the developing countries. Empirical findings of FDI crowds in and/or crowds out DI from previous studies suggest that the effects are not on the scale and need further analysis to prove the complementary and substitution effects between FDI and DI.

This paper seeks to contribute on country-specific study for the dynamic linkages among FDI, DI and economic growth in Malaysia. Most of the studies in the literature (see, for example, Choe, 2003; Hetch et al., 2004; Apergis et al., 2006; Adams, 2009; Wang, 2010) employed cross-sectional or panel data to investigate the relationship between FDI, DI and economic growth that are likely to suffer from the problem of data comparability and heterogeneity. Adams (2009) used panel data analysis to conduct a study on FDI and DI in 42 Sub-Saharan Africa countries. The study found that FDI did not have positive impact on economic growth due to the low level of development in sub-Saharan Africa but DI was shown to have positive and significant correlation with economic growth. The study also revealed a net crowd out effect of FDI on DI as FDI is negatively correlated with DI. On the other hand, Hecht et al. (2004) explored that most of the DI has significant impact on FDI, while the impact of FDI inflow towards DI is weaker among the 64 estimation countries. In addition, Choe (2003) found that the causal relationship is bilateral between FDI and economic growth; while only a unilateral causal relationship runs from economic growth to DI in the 80 observed countries. Nonetheless, the results show that the causal relationship between FDI and DI remains controversial.

In the case of Malaysia, studies that focus on analyzing the effect of FDI and DI to economic growth are limited (see, for example, Ang, 2009; Merican, 2009). Ang (2009) examined the long-run relationship between private DI, public investment and FDI in Malaysia for the period of 1960-2003. The results show that public investment, private DI and FDI are cointegrated in the long run. Moreover, both FDI and public investment are statistically significant and positively related to the private DI. Merican (2009) examined the linkages between FDI, DI and economic growth in four ASEAN members namely, Indonesia, Malaysia, Thailand and Philippines over the period of 1970-2001. Focusing on Malaysia, the study found that FDI was better than DI in promoting

economic growth in Malaysia. Nevertheless, both of these studies did not test the causality between the variables which are contradicted to the earlier studies that assumed at least a unilateral causal relationship between FDI and economic growth (see, for example, Zhang, 2001; Feridun, 2004; Pradhan, 2009) or from DI and economic growth (see, for example, Liwan and Lau, 2007; Balcioglu and Vural, 2009). Obviously, the causal relationship between FDI, DI and economic growth remains as an ambiguous question. Against this backdrop, the causal relationship among the variables for a country specific analysis is very important for policy makers to design the appropriate investment policy.

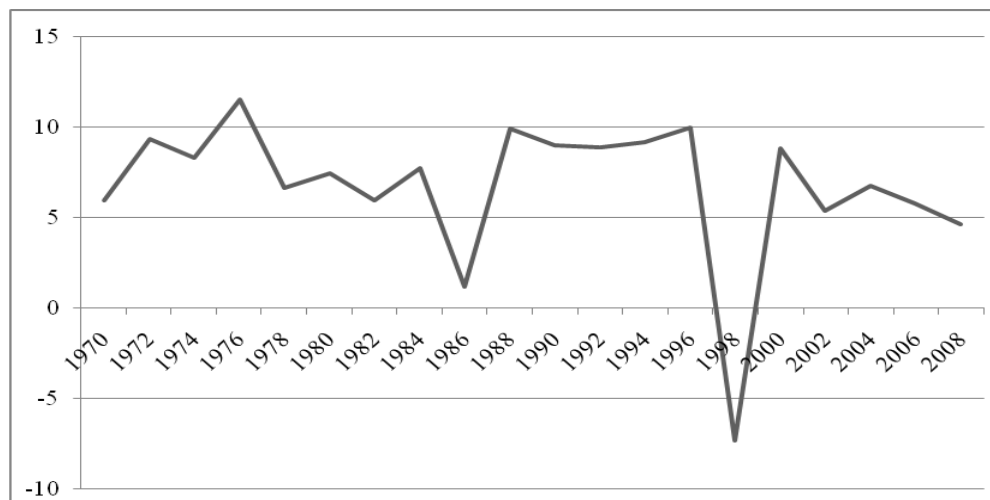
This study attempts to generate a better understanding of the dynamic linkages between FDI, DI and economic growth in Malaysia over the period of 1970 to 2009. Specifically, it aims to determine the impact of FDI and DI on economic growth respectively. Furthermore, this study intends to find out the effect of FDI on DI in order to examine whether FDI crowds in or crowds out DI. The objectives of this study can be achieved through the following analyses. First, we employ the conventional Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests to check the stationarity of each series. Second, the Johansen and Juselius (1990) multivariate cointegration test will be used to detect the potential long-run relationship among the variables. Third, we normalize the cointegrating vector by DI to discover the crowding effect of FDI to DI. Finally, the Granger causality test will be implemented to examine the causal relationship between FDI, DI and economic growth.

The rest of this paper is organized as follows. Section 2 gives an overview of the relationship between the FDI, DI and economic growth in Malaysia. Section 3 discusses data, model specification and methodology used in this study. The empirical findings are reported in Section 4. Lastly, the conclusion and policy recommendations are presented in Section 5.

Overview of Malaysia's FDI, DI and Economic Growth

Since achieving independence in 1957, Malaysia experienced solid economic performance with annual average GDP growth rate of 6 per cent during the period of 1970 to 1980. However, the GDP growth recorded nearly 0 per cent during the economic depression in the middle of 1980s. The country recovered from the crisis in the mid-1980s and achieved an average GDP growth rate of at least 9 per cent during 1990 to 1996. However, the GDP growth rate declined to -7 per cent during the Asian financial crisis. Since then, the economic growth showed a slower process of recovery. It took about four years for the economy to return to its normal growth path. However, the impact of the terrorist attack in the US in 2001 had slowed the economic growth again with an annual growth rate of 5 per cent from 2002 to 2008. Figure 1 presents the plotted time series data of the real GDP growth rate in Malaysia for the period from 1970 to 2009.

Figure 1: Annual growth rates of GDP



DI accounted for about 30 per cent of GDP from 1970s to 1980s in average. The share declined to 26.39 per cent before picking up again in the 1990s. In general, the share of DI to GDP contributed more than the share of FDI to GDP for more than half a century in Malaysia. However, FDI inflow is also a dominant factor to spur the economic growth of Malaysia as it maintains an open policy toward investment and trade

since 1980. According to the inward FDI Potential Index² (UNCTAD, 2004) and Ang (2009), Malaysia was ranked the first among the Asian developing countries for receiving FDI in 2003. Thus, the importance of FDI to economic development is therefore undeniable. However, UNCTAD (2010) reported that the FDI in Malaysia plunged 81 per cent from US\$7.32 trillion in 2008 to US\$1.38 billion in 2009 with the rank of 22nd among the Asian nations. In terms of the global competitive landscape, Malaysia faces greater competition than ever (Tenth Malaysia Plan³) due to the country's crash in FDI. China has the largest FDI with their popular free trade zones. In addition, China is also competing actively for cheap labor by offering low wages and the largest population thereby attracting export-oriented multinational firms (Zhang, 2005). Nonetheless, the Malaysian government's procurement process is a big problem for foreign investors as there is too much bureaucracy and the transaction process is slow as a consequence. Thus, suitable and effective policy enhancement is needed for the government to stabilize FDI and enhance DI in order to drive the economic growth.

A number of investment policies have been introduced to carrying on the investment path in Malaysia. The most primitive investment legislation created is the Investment Incentives Act 1968. The Act provides variety incentives to induce greater and more rapid flow of investment. Furthermore, the established of Malaysian Industrial Development Authority (MIDA) to promote and coordinate industrial development activities such as screening the investors, enhancing investors' confident by giving tax exemption and financial assistant have contributed to the investment growth in Malaysia. Therefore, the growth of DI and FDI and thus the economic growth are greatly influenced by these investment policies.

² The inward FDI Potential Index is shown for three-year period to offset annual fluctuations in the data. The index covers 141 economies for as much of the period as the data permit. However, some economies in transition could not be ranked in the early years for lack of data or because they did not exist as a separate country. The index excludes tax havens, which for tax rather than productive reasons tend to have massive FDI inflows in relation to their economic size.

³ Malaysia government allocated RM230 billion for development expenditure under the Tenth Malaysia Plan. Economic sector received 55% of the total allocation. To achieve the goal of 6 per cent per annum growth rate, the Malaysian Investment Development Authority has been corporatized and rebranded to leap the investment activities.

The DI and FDI are expressed as the ratio of GDP with five years average in Table 1. In 1970 to 1974, the shares of DI and FDI to GDP were 21.24 per cent and 2.99 per cent respectively. The number surged to 37.03 per cent and 7.18 per cent in 1990 to 1994, making it the highest throughout the sample period. On average, the DI and FDI contributed 27.72 per cent and 3.85 per cent respectively to GDP over the whole sample period. On the other hand, the proportion of FDI to DI recorded a 13.99 per cent share from the earlier 1970s and slumped down into a lower portion of 8.65 per cent in 1985-1989⁴. However, the contribution of shares of FDI to DI increased dramatically to 19.41 per cent in the following five years. Overall, the average ratio of FDI to DI is 13.75 per cent from 1970 to 2009.

Table 1: Average ratio of DI to GDP, FDI to GDP and FDI to DI (in percentage)

Year	DI/GDP	FDI/GDP	FDI/ DI
1970-1974	21.24	2.99	13.99
1975-1979	24.28	3.21	13.33
1980-1984	34.25	4.12	11.95
1985-1989	26.39	2.33	8.65
1990-1994	37.03	7.18	19.41
1995-1999	35.59	4.95	14.52
2000-2004	22.37	2.75	12.39
2005-2009	20.60	3.26	15.76
1970-2009	27.72	3.85	13.75

Methodology

Data and Model Specification

The data set consists of yearly time series data over a forty year period from 1970 to 2009, which is obtained from International Financial Statistics (IFS) published by the International Monetary Fund and World Development Indicators (WDI) published by the World Bank. Economic

⁴ This aggressive trend became incoherent due to the economic downturn in 1980s.

growth is measured by real GDP at year 2000 constant price, DI is proxied by real gross fixed capital formation (GFCF)⁵, and FDI is estimated using net FDI inflows. All variables are measured in Ringgit Malaysia (RM) in million.

All the variables are transformed into natural logarithmic form for allowing a better regression treatment as most economic time series data are characteristically exponential with respect to time, and a log transformation changes the vertical scale to linear. Furthermore, log transformation makes elasticity calculation easier, as the estimated coefficients are approximate to the percentage changes in the variables.⁶ Thus, the estimated model can be expressed in equation (1) below.

$$\ln Y_t = \beta_0 + \beta_1 \ln FDI_t + \beta_2 \ln DI_t + \varepsilon_t \quad (1)$$

where $\ln Y_t$ is real GDP, $\ln FDI_t$ is net FDI inflows and $\ln DI_t$ is the DI, β_0 is the constant parameter and ε_t is the error terms.

Estimation Method

We begin with employing the augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1981) and Phillips-Perron (PP) (Phillips and Perron, 1988) unit root tests to check the stationarity properties of each variable in order to avoid any spurious regression. Then, the long-run equilibrium relationship between the three variables is tested by Johansen's multivariate cointegration procedure (Johansen, 1988; Johansen and Juselius, 1990). In order to examine the Johansen's cointegration approach, the vector autoregressive (VAR) model is estimated:

$$\Delta Y_t = \pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + u_t \quad (2)$$

⁵ GFCF is used as proxy for domestic investment in many previous studies (see, for example, Braunerhjelm et al., 2005; Olubanjo et al., 2010; Almsafir et al., 2011; Bakare, 2011). GFCF includes land improvements, plant, machinery and equipment purchases; and the construction of roads, railway, private residential dwellings, commercial and industrial buildings etc but exclude all kinds of financial assets.

⁶ See Gujarati and Porter (2009), *Basic Econometrics*, 5th Edition for details.

where Δ is the first difference operator, Y_t is a vector of the three endogenous variables $(\ln Y_t, \ln FDI_t, \ln DI_t)$. Γ is a matrix of VAR parameters for lag i and π is a coefficient matrix which contain information about the long run relationship between variables in the vector. If the variables are cointegrated, the cointegrating rank, r , is given as $\pi = \alpha\beta'$, where α is the matrix of parameters denoting the speed of convergence to the long-run equilibrium and β represents the matrix of parameters of the cointegrating vector. Johansen-Juselius derived trace test (λ_{trace}) and maximum eigenvalues test (λ_{max}) for testing the numbers of cointegrating rank in the system.

If the variables are cointegrated, an error correction term should be included into the vector error correction model (VECM)⁷ below to examine the causality between the variables:

$$\Delta \ln Y_t = \alpha_1 + \sum_{i=1}^k \delta_{1i} \Delta \ln Y_{t-i} + \sum_{i=1}^k \delta_{2i} \Delta \ln FDI_{t-i} + \sum_{i=1}^k \delta_{3i} \Delta \ln DI_{t-i} + \beta_1 EC_{t-1} + \varepsilon_{1t} \quad (3)$$

$$\Delta \ln FDI_t = \alpha_2 + \sum_{i=1}^k \delta_{1i} \Delta \ln Y_{t-i} + \sum_{i=1}^k \delta_{2i} \Delta \ln FDI_{t-i} + \sum_{i=1}^k \delta_{3i} \Delta \ln DI_{t-i} + \beta_2 EC_{t-1} + \varepsilon_{2t} \quad (4)$$

$$\Delta \ln DI_t = \alpha_3 + \sum_{i=1}^k \delta_{1i} \Delta \ln Y_{t-i} + \sum_{i=1}^k \delta_{2i} \Delta \ln FDI_{t-i} + \sum_{i=1}^k \delta_{3i} \Delta \ln DI_{t-i} + \beta_3 EC_{t-1} + \varepsilon_{3t} \quad (5)$$

From the equations above, Δ is the first difference operator and the residuals ε_{it} are assumed to be normally distributed and white noise.

EC_{t-1} is the one period lagged error correction term derives from the cointegrating equation⁸. The error correction term will delay the speed of short-run adjustment toward the long-run equilibrium. The significance of the EC_{t-1} term represents the long-run causality, while the joint F-tests on the differenced explanatory variables depict the short-run causality.

⁷ According to Engle and Granger (1987), if the variables are cointegrated, Granger causality test within the first difference VAR model will be misleading. Therefore, an error correction term should be included into the VECM model.

⁸ This term must be included to avoid misspecification and omission of important constraints and will be excluded if the variables are not cointegrated.

Empirical Findings

The results of ADF and PP unit root tests are tabulated in Table 2. At the 5 per cent significant level, both ADF and PP tests cannot reject the null hypothesis of unit root for FDI, DI and GDP at level, but all variables are stationary after first differencing. Hence, we conclude that all variables are $I(1)$ ⁹. Given that the variables are $I(1)$, we proceed to test the long-run equilibrium relationship with the multivariate Johansen-Juselius cointegration test. In order to specify the model, the Akaike's information criterion (AIC) statistic suggests that three year is the optimal lag length in this VAR system. Table 3 Panel A summarizes the results of likelihood ratio tests for cointegration. Surprisingly, both the trace and maximum eigenvalues statistics indicate that the null hypothesis of zero cointegration is rejected at the 1 per cent significant level. Hence, we conclude the existence of at least one cointegration relationship among the variables.

Table 2: The results of unit root tests

Variables	Test statistics	
	ADF	PP
$\ln Y_t$	-2.086 (0)	-2.091 (1)
$\Delta \ln Y_t$	-5.056 (0)***	-5.062 (1)***
$\ln FDI_t$	-1.715 (0)	-1.630 (1)
$\Delta \ln FDI_t$	-8.186 (0)***	-8.184 (1)***
$\ln DI_t$	-1.776 (1)	-2.726 (1)*
$\Delta \ln DI_t$	-4.181 (0)***	-4.222 (1)***

Note: The asterisks ***, ** and * denote the significance at 1, 5 and 10 per cent levels respectively. ADF is the augmented Dickey-Fuller test and PP is the Phillips-Perron test. $\ln$ denotes as natural logarithm and Δ is the first different operator. Figure in the parentheses indicate the optimal lag length for ADF test and bandwidth for PP test. The optimal lag length and bandwidth are selected by Akaike's information criterion (AIC) and Newey-West Bartlett kernel. The critical values are obtained from MacKinnon (1996).

⁹ Nelson and Plosser (1982) indicated that most of the macroeconomic variables are not stationary at level but it will stationary after the first differencing.

Table 3: The result of Johansen-Juselius cointegration test

Panel A: Multivariate cointegration test				
Series: $\ln Y_t \ln FDI_t \ln DI_t$		LR tests statistics	Critical values [#]	
Hypotheses			1 per cent	5 per cent
H_0	H_1			
$LR(\lambda_{\text{trace}})$				
$r = 0$	$r \geq 1$	59.872 ^{***}	34.99	41.07
$r \leq 1$	$r \geq 2$	14.469	19.96	24.60
$r \leq 2$	$r \geq 3$	4.725	9.24	12.97
$LR(\lambda_{\text{max}})$				
$r = 0$	$r = 1$	45.403 ^{***}	22.00	26.81
$r \leq 1$	$r = 2$	9.744	15.67	20.20
$r \leq 2$	$r = 3$	4.725	9.24	12.97
Panel B: Normalized long run coefficients				
$\ln Y_t$	$\ln FDI_t$	$\ln DI_t$	<i>Intercept</i>	
1.000	4.796 ^{***}	-4.520 ^{***}	21.456 ^{***}	

Note: *** denotes the significant level at 1 per cent. # represent that the critical values were obtained from Osterwald-Lenum (1992). The Akaike's Information Criterion (AIC) is used to select the optimal lag order.

As the variables are cointegrated and the interest of this study is to evaluate the response of real output on FDI and DI respectively, we normalized the coefficient of $\ln Y_t$ to 1 to obtain the long-run coefficients of $\ln Y_t$ with respect to FDI and DI. The long-run coefficients are reported in Table 2 Panel B. It is shown that $\ln FDI_t$ is positively related to $\ln Y_t$ but $\ln DI_t$ is in a reverse direction. Conversely, the coefficients of both variables are statistically significant at the 1 per cent level. This result infers that the real output will increase in the long-run if FDI increases. As documented in Moran et al. (2005), FDI may contribute to the economic growth through its impact on capital stock,

market competition and technology transfer to the local firms in Malaysia.

In contrast, increase of DI will depreciate GDP growth. This result although contradicts with Tang et al. (2008) and Merican (2009) but it is consistent with Elboiashi et al. (2009). The contradiction may be due to different framework and sample period used for the investigation. According to Elboiashi et al. (2009), there may be an offsetting effect between FDI and DI in the country. Both local and foreign firms are competing for the human capital and scarce production factors. Foreign firms which are more productive and efficient will be the winner. Nevertheless, by normalizing the coefficient of DI to 1, we find that FDI is positively significant at 1 per cent level with the coefficient of 1.0612. In other words, a 1 per cent increase in FDI will lead to 1.06 per cent increase in DI. Therefore, we can verify that FDI crowds in DI in Malaysia. This finding is consistent with Ang (2009) that FDI has a complementary role to DI.

Table 4: The results of Granger causality tests based on VECM

Dependent variable	χ^2 statistics [p-values] $\frac{\sum \Delta \ln Y_t \sum \Delta \ln FDI_t \sum \Delta \ln DI_t}{ECT_{t-1}}$ [t-statistics]			
$\Delta \ln Y_t$	—	2.2761 [0.5171]	1.3662 [0.7135]	-0.0044 [-0.0581]
$\Delta \ln FDI_t$	11.2346* [0.0105]	—	8.7705** [0.0325]	-0.6021*** [-3.5820]
$\Delta \ln DI_t$	0.5644 [0.9045]	1.3254 [0.7231]	—	-0.0362 [-0.2375]

Note: ***, ** and * denote the significant level at 1, 5 and 10 per cent levels respectively.

In view of the fact that the series are cointegrated, we proceed to determine the direction of causality within the VECM framework. The results of both long-run and short-run Granger causality tests are

presented in Table 4. For the long-run Granger causality, we find that the one period lagged error correction term has a negative sign but it is only statistically significant when FDI as the dependent variable. This infers that FDI has significant causality relationship with DI and economic growth in the long-run. For the short-run causality analysis, we find that only unilateral Granger causality running from GDP to FDI and from DI to FDI. The results are consistent with Zhang (2001) but contradicted with Balcioglu and Vurul (2009) and Pradhan (2009). The contradiction may be due to different methods of analysis and sample used in their studies. Nevertheless, our result implies that the foreign investors are concerned about the economic growth and the local investment sentiment to make their investment decision in Malaysia. In other words, the growth-enhancing effect of FDI differs depending on host country characteristics, including the quality of institutions, the extend of trade openness, the level of technological sophistication and the stock of human capital (see, for example, North, 1991; Borensztein et al., 1998; Rodrik, 1999; Xu, 2000; Fortarnier, 2007).

Conclusion and Policy Recommendations

This paper analyzes the dynamic linkages between FDI, DI and economic growth in Malaysia from 1970 to 2009. The empirical results of this study can be summarized as follows. First, the FDI, DI and economic growth are cointegrated in the long run. Second, FDI has positive impact on the economic growth, while DI is negatively affecting the economic growth in the long run. Third, an increase of FDI will bring positive impact to the DI. In other words, FDI crowds in DI and there appears complementary effect from FDI to DI. Forth, there is a one way causal relationship from DI to FDI and from economic growth to FDI in the short run.

We support the view that high economic growth will attract FDI inflow in Malaysia. DI is also an important factor in attracting FDI in the short run. With the crowd in effect of FDI on DI, the expansion in FDI inflows may be associated with an incredible boost in DI, and both FDI and DI can collaborate together for the development of the country. Therefore, the government may encourage foreign investors to invest in the high risk areas where the DI is lack of the technology and

experiences. At the same time, domestic firms may learn from the foreign firms by collaborating with them in the supply chain where there will be a greater tendency that the foreign firm will transfer the management, production and technology know-how to their local suppliers, enhancing the transfer of technology and skills. As reported in Singapore's 2011 Budget, the government focuses on providing improved financial opportunities in the areas of education and employment as well as continuing the productivity measures commenced that promotes skills development and innovation. More recently, under the Tenth Malaysian Plan, the government upgrades the early childhood education right through to up skilling the existing adult workforce. Malaysia is then in the process of nurturing top talent to meet industry's requirement and drive productivity improvements to move up the value chain. Nevertheless, small and medium enterprises (SMEs) are targeted to be the growth drives of private domestic investment. Thus, policies to ensure adequate access and availability of financing for SME are of great importance. For this reason, the Malaysian government must continue to give the higher financial priority to SMEs such as *SME Bank Business Financing Scheme*, *Co-operative Financing Fund* and *Rural Economy Funding Scheme*. Eventually, domestic promotions and attractive packages such as taxes incentives, finance and credit facilities, reduction of the transaction costs and improvement of the delivery system by cutting down on bureaucracy and corruption can be launched.

The Ministry of International Trade and Industry has targeted that DI to make up 40 per cent of the country's aggregate investment in year 2010. On the other hand, Malaysia is en route to improving the quality of retaining and attracting FDI inflows in order to woo the economic growth after the recent global financial/economic crisis. As proposed in the Tenth Malaysia Plan, initiatives such as benchmarking Malaysia's attractiveness, empowering Malaysian Investment Development Authority to attract investment and investing in talent recruitment can be undertaken.

The exact types of DI and inward FDI that will contribute most to the output growth is beyond the scope of this paper. This might be an interesting issue for future research. Moreover, the proxy variable of DI

and the decomposition of DI to private and public funds may give a clearer picture of its impact in the country.

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The Potential of Derivatives Market in Bangladesh

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The derivatives market has attained the highest growth of all financial market segments in recent years and has become the central contributor to the stability of the financial world. In recent years, derivative markets have grown by leaps and bounds in emerging economics and given the high level of economic and financial risks faced by market participants and investors in emerging countries, derivatives contribute to a country's economic development by making these risks manageable. Due to the recent catastrophic fall of capital market, rapidly declining FDI and scarcity of investment opportunities in an equity centric economy, investors of Bangladesh is crying out for an innovative and versatile financial product such as derivative securities for hedging and market expansion. In our paper, we have provided clear examples of how derivative securities can strengthen capital market of Bangladesh, both in terms of risk mitigation and creating alternative investment vehicles as well as reduce burden on our major import and export sectors. Furthermore, we have also looked into the prerequisite of setting up a derivative markets in Bangladesh and provided a clear roadmap. In view of recent turmoil in the equity markets, we need to be circumspect and foresighted in our approach; a standardized exchange traded derivative market with phase-by-phase introduction of product has been recommended.

1. Introduction

Derivative securities are one of the most actively traded financial instrument for ensuring efficiency and depth of capital market. These

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securities have no intrinsic value; their returns are linked to, or derived from, some other product or underlying asset. The derivatives market has attained the highest growth of all financial market segments in recent years and has become the central contributor to the stability of the financial world. Its size has increased by around 24 percent per year in terms of notional amount outstanding, far outpacing other financial instruments such as equities (11 percent) and bonds (9 percent)³. With a global reach and involvement of players with varied objective (hedging, speculation or arbitrage), derivatives offer various types of risk protection and innovative investment strategies.

The market for derivatives is the largest single segment of the financial market and as of June 2007, the global derivatives market amounted to €457 trillion in terms of notional amount outstanding⁴. From the data available through Bank International Settlement (BIS) in 2008, the derivatives market is more than four times larger than the combined global equity and bond markets measured by market capitalization.

Derivatives can be traded Over-the-counter (OTC) or on exchanges. OTC derivatives are created (and privately negotiated) by an agreement between two individual counterparties. Most of these contracts are held to maturity by the original counterparties, but some are altered during their life or offset before termination. Products such as swaps, forward rate agreements, and exotic options are almost always traded in this way.

Exchange-traded derivatives (ETD), on the other hand, are fully standardized and their contract terms are designed by derivatives exchanges. A derivatives exchange acts as an intermediary to all transactions, and takes Initial margin from both sides of the trade to act as a guarantee.

Of recent, the derivatives market has attracted more attention against the backdrop of the financial crisis, fraudulent actions and the near failure of some market participants. However, structured credit-linked securities which were responsible for the financial crisis, are not derivatives in the

³ See BIS 2008 and BIS statistics (www.bis.org/statistics/derstats.htm).

⁴ See BIS 2008; the notional amount of a derivatives contract refers to the value or nominal amount of the underlying to the derivatives contract; outstanding refers to open derivatives contracts that are held by market participants.

first place and so could not tarnish the impact and growth of derivative securities in modern finance.

For decades North America reigned supreme in derivative market. However, the emerging markets in Asia-Pacific has overtaken North America as the world's biggest derivatives market amid increasing demand for futures and options contracts in the region's fast-growing economies. According to Washington-based Futures Industry Association (FIA), Derivatives contracts traded in Asia-Pacific accounted for 38 percent of the global total in the six months to June 2010, while North America stands at 33 percent. This incessant growth has been fueled by creation of derivative markets in Brazil, Korea, Singapore, Malaysia, India, and after decade long stagnation in China. The derivative markets have added strength, variety and most importantly better risk management in afore mentioned emerging economies.

Bangladesh economy has been strong in recent years with GDP growth remained within range of 5-6 percent for last 8 years and real GDP has shown strong growth in recent years, averaging over 6 percent p.a. in 2006-09. The equity centric capital market i.e. Dhaka Stock Exchange (DSE), has been in the top three best performing markets in the world over the last three years (2008-10). However, these rapidly growing but fundamentally feeble capital markets experienced a staggering collapse in early December 2010 and from December 2010 till February of 2011 the index fell from a high of around 8,900 points to 5,200 points, a drop of almost 42 percent in just three months. The volatility in share markets has become a matter of concern in recent months for investors, regulators and policy makers and the debacle of the capital market has brutally exposed the lack of vehicles for risk minimization and alternative investment in the capital market of Bangladesh.

Hassan (2001) explains that capital market allows investors to accept greater risk in return for the chance of greater returns. In a good capital market risk must be accepted; the purpose of the regulatory regime is not to block the passage of the commercial risk to the investor but it is to keep the participants in the market from cheating. At present there is a lot of confusion over this. Capital market in Bangladesh is still at a nascent stage of development. Broadening and diversification of the

capital market is necessary to deepen the financial sector. This may be achieved by increase in financial assets in relation to non-financial ones and diversification of financial instrument. An efficient capital market is in help at both micro and macro level of the economy. At the micro level, an efficient capital market benefits investors by providing a range of investment outlets for their savings. On the other hand, firms may raise its funds whenever they face their financial needs. At the macro level, government is benefited by effective allocation of national savings to both public and private enterprises. Besides, by successfully mobilizing finance from local sources, the government can also reduce its dependency on foreign funds to finance its growth. However, to implement the above needful an efficient market is a prerequisite. Many have come forward with suggestions in order to develop the capital market of Bangladesh to make it a twenty-first century compatible. As the major stakeholders in Bangladesh is currently exploring new and pragmatic means for strengthening and stimulating the capital markets, the possibility of developing a structured derivative market alike flourishing emerging economies of India, China, Malaysia and so on, need to be judiciously analysed.

This paper aims to contribute an objective and fact-based foundation for exploring the possibility of introducing derivative securities for strengthening the feeble capital market of Bangladesh. We have provided fact, figures and analysis, and suggested a pragmatic roadmap for creating a derivative market in Bangladesh.

The rest of this paper is organized in five main sections. Section 2 takes a close look at the growth of emerging derivative markets and lessons learned from markets like India and China.

Section 3 discusses the prerequisites of creating a stable derivative markets and a brief literature overview outlining the building blocks. The rationale for creating a derivative market in Bangladesh is provided in Section 4 and section 5 outlines some of the major recommendations. Finally, section 6 briefly summarizes the facts and recommendations and provides concluding remarks.

2. Emerging Derivative Markets

2.1 Recent growth in Asia-Pacific

The Asia-Pacific has overtaken North America as the world's biggest derivatives market amid increasing demand for futures and options contracts in the region's fast-growing economies. According to Washington-based Futures Industry Association (FIA), Derivatives contracts traded in Asia-Pacific accounted for 38 percent of the global total in the six months to June 2010, while North America stands at 33 percent⁵.

Derivatives contracts traded in the Asia-Pacific region climbed 52 percent to 4.2 billion contracts in the six months to June in year 2010 from a year earlier, while those that changed hands in North America increased 16 percent to 3.7 billion, the association's data showed. The world's largest derivatives exchange (by number of transactions) is the Korea Exchange (which lists KOSPI Index Futures & Options) which accounted for 42 percent of derivatives traded across the Asia-Pacific region in the first half of 2010, while Indian derivative exchanges accounted for 32 percent and China's exchanges made up 16 percent. The rapid growth in demand for commodity futures contracts both in China and India have made analysts predict that both of this booming derivative markets to eventually overtake Korea as the region's top derivative exchange. According to FIA data, contracts traded on the four Indian derivatives exchanges more than doubled to 1.36 billion in the first half of 2010, compared with 542.4 million a year earlier; In China, contracts that changed hands on three exchanges climbed 60 percent to 672 million in the same period. This incessant demand for derivatives in Asia is due to the region's economic growth and a maturing market which has created a demand for new innovative derivative tools from Asian corporate and financial institutions to hedge their risks.

Exhibit 1 shows global derivative volume by region and percentage change for first six month of both year 2009 and 2010 and Asia Pacific region now the largest in terms of volume.

⁵ Burgos, J. (2010, October 15). Asia Tops North America as Biggest Derivatives Market for the First Time. Bloomberg

Exhibit 1: Global Listed Derivatives Volume by Region
Based on the number of contracts traded and/or cleared at 76 exchanges worldwide (in millions USD)

	Jan-Jun 2009	Jan-Jun 2010	% Change	% of Total
Asia Pacific	2,767.70	4,206.87	52.0%	37.5%
North America	3,170.86	3,666.78	15.6%	32.7%
Europe	1937.76	2,407.33	24.2%	21.5%
Latin America	476.13	776.53	63.1%	6.9%
Other	165.33	163.98	-0.8%	1.5%
Global Total	8,517.79	11,221.48	31.7%	100.0%

Source: Bank for International Settlements⁶

2.2 The size and structure of derivatives markets in EMEs

According to BIS Quarterly Review (Dec 2010), daily turnover in derivatives in of Emerging Market Economics (EME) has expanded four times over the past decade, to over 6% of emerging market GDP⁷. The derivatives in emerging markets are traded in almost equal proportions over the counter and on exchanges and unlike in advanced economies, Foreign Exchange derivatives are still the most traded derivatives in EMEs (50% of total turnover), while interest rate derivatives remain underdeveloped (probably due to pegged interest rates).

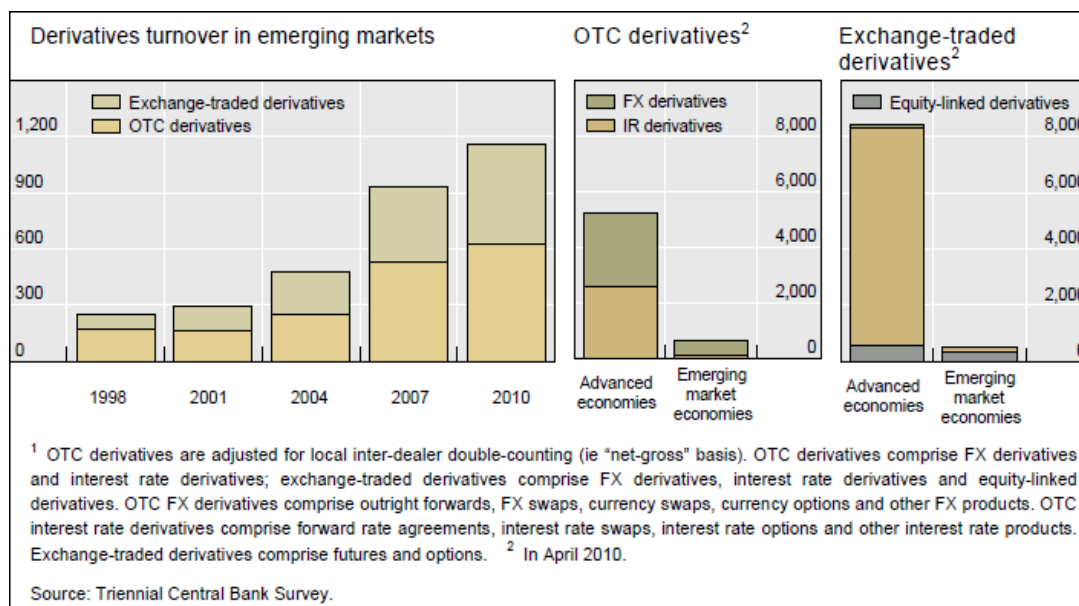
Average daily turnover of derivatives in EMEs was \$1.2 trillion in April 2010 (6.2% of those economies' GDP), compared to \$13.8 trillion (36% of GDP) in advanced economies. However, the small derivatives markets in EMEs have expanded rapidly with an average daily turnover increase of 300% since 2001, and 25% over the past three years, despite the crisis in 2008–09 (Exhibit 2, left-hand panel)⁸. This was higher than the growth of turnover in advanced economies (250% since 2001, and 22% since 2007).

⁶ See Bank for International Settlements for Derivatives volume in 2009-10

⁷ Mihaljek, D., & Packer F. (Dec 2010). Derivatives in emerging markets. BIS Quarterly Review, p.43-44

⁸ Triennial Central Bank Survey (2010)

Exhibit 2: Derivatives daily turnover in advanced and emerging markets¹ (in billions USD)



2.3 Driving factors for growth of derivative market (Globally and in Asia)

Firstly, an intrinsic characteristic of derivatives instruments is that they are designed to transfer risk, whereas equity or fixed income securities are designed to be an explicit claim on the stream of cash flows generated from the ownership of a financial asset in a certain jurisdiction. Traders trading in derivatives markets form expectations about underlying asset prices and are better placed to manage the risks associated with price changes.

Many fund managers of pension or hedge funds in North America have increasingly taken a global view of asset diversification and risk management, and have increasingly sought to create synthetic exposures to asset classes not readily available in domestic market. This characteristic makes derivatives more amenable to borderless trading, making OTC derivatives markets, in particular, more global in nature than, say, largely nationalistic equity markets.

The second driver is the rate of development of financial innovations and new derivatives instruments. Advances in information technology, coupled with financial institutions' drive to enhance returns and expand their global reach, have facilitated the financial intermediaries (and, to some extent, their clients, particularly hedge funds) to continuously introduce and/or embrace new derivatives instruments and advances in risk-management techniques.

The main driving factors for derivative markets in various economies of Asia have been the immense benefits from risk sharing in more complete capital markets, corporate demand for hedging tools, institutional needs for enhanced liquidity in an environment of large cross-border flows and trade integration, as well as rapidly declining transaction costs in electronic trading. At present, most of the derivative markets in Asia offer multiple products for different user requirement (Exhibit 3)

Exhibit 3: Derivative products and turnover across Asia

	Australia	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Singapore	Thailand
INDEX										
Futures	√	x	√	√	√	√	√	√	√	√
Options	√	x	√	√	x	√	√	√	√	√
Options on futures	√	x	x	x	x	√	x	x	x	x
STOCK										
Futures	√	x	√	√	x	x	x	x	x	√
Options	√	x	√	√	x	√	√	x	√	x
CURRENCY										
Futures	√	x	x	x	√	√	√	x	√	x
Options	x	x	x	x	x	x	√	x	√	x
INTEREST RATE										
Futures	√	x	√	√	x	√	√	√	√	√
Options on futures	√	x	x	x	x	√	x	x	x	x
BONDS										
Futures	√	x	√	x	x	√	√	√	√	x
Options on futures	√	x	x	x	x	√	√	x	√	x
COMMODITIES										
Futures	√	√	x	√	√	√	√	√	√	√ (gold)
Options on futures	√	x	x	x	x	x	x	x	x	x
# of products traded	12	1	6	6	3	10	9	5	9	5

Sources: Websites of regional exchanges, WFE, Futures Industry Association

Finally, equity derivatives have usually reduced volatility and strengthened liquidity in equity markets, enhanced returns to institutional investors such as mutual or pension funds, and reduced the cost of equity listings for firms.

2.4 Indian derivative markets – a roadmap for future derivative emerging markets

India over the years has developed a robust derivatives market. In the year 2000, National Stock Exchange (NSE) started its operation in derivatives contracts and introduced futures contracts on the Nifty and Sensex index. This was followed by Options contracts on Nifty and Sensex (European Style), Option contracts on stocks (American style) and Futures contracts on stocks in June, July and November 2001, respectively. The number of underlying stocks and indexes has increased over the years (Exhibit 4)

Exhibit 4: Future and Option contracts traded in NSE and BSE (Source: NSE and BSE)

Financial Year	NSE - Stocks	BSE - Stocks	NSE – Index(es)	BSE – Index(es)
2001-02	31	31	1	1
2002-03	41	38	1	1
2003-04	53	42	2	1
2004-05	52	46	2	1
2005-06	117	76	3	7
2006-07	155	89	3	7
2007-08	265	126	7	7

Since its inception, the derivative markets in India (Both NSE and BSE) have experienced steady growth in Turnover. During 2001-02, turnover on NSE was Rs. 1019,250 million and during 2007-08 it was Rs. 130,904,780 million. Likewise, during 2001-02, turnover on BSE was Rs. 19,170 million and during 2007-08 it was Rs. 2423,080 million (Exhibit 5).

Exhibit 5: Total Derivatives turnover since inception (in Rs. Millions)

Period	NSE	BSE	Total
2001-02	1,019,250	19,170	1,038,420
2002-03	4,398,650	24,750	4,423,400
2003-04	21,304,470	120,740	21,425,210
2004-05	25,470,530	161,120	25,631,650
2005-06	48,242,450	90	48,242,540
2006-07	73,562,710	590,070	74,152,780
2007-08	130,904,780	2,423,080	133,327,860
04/2008 to 09/2008	59,638,940	114,910	59,753,850

Source: BSE and NSE (excluding currency derivatives)

The story has not been without its share of hurdles. On path of creating a vibrant derivatives market, Indian government and regulators embarked on meticulous planning and feasibility analysis which can act as a roadmap for an emerging economy such as Bangladesh. We will have a brief look at some of these initiatives.

Initiation of feasibility analysis and policy amendment

The Securities and Exchange Board of India (SEBI) set up a 24-member Committee in November 1996 under the Chairmanship of Dr. L.C. Gupta in order to create an appropriate regulatory framework for derivatives trading in India. The Committee submitted its report in March 1998 expressing overwhelming support for introducing derivatives as a prudent tool of hedging market risk and also prescribing necessary preconditions for the introduction of derivatives trading in India⁹. SEBI also set up a separate committee in June 1998 under the Chairmanship of Prof. J. R.Varma to recommend measures for risk containment in derivatives market in India. While major recommendations of Gupta Committee dealt with the legal and

⁹ <http://www.sebi.gov.in/commreport/lcgupta.html>

regulatory issues and infrastructural changes; Varma report, which was submitted in October 1998, worked out the operational details of a margin system, a methodology for charging initial margins, broker net worth, deposit requirement and real-time monitoring requirements. The separate mandate of these two committees allowed them to analyze and provide recommendations in an unbiased manner.

Understanding investor objective

The LC Gupta Committee conducted a wide market survey with several entities relevant to derivatives trading like brokers, mutual funds, banks/FIs, FIIs and merchant banks. Of the 112 respondents to the questionnaire sent to brokers and financial institutions, about 67 percent favoured the introduction of stock index futures as the first step towards introduction of financial derivatives trading in India, and stock index options came a distant second with 39 percent support. Another major reason of these market surveys was to gauge the major necessity of introducing derivative securities. Although majority was in favour of hedging, a significant portion also felt the use of derivatives for speculative purposes. Such insight allowed the regulators and policy makers to go back to the drawing board and draw-out infrastructural and policy changes which not only accommodate hedging but also allowed speculation activities in moderation.

Need for building skill set and customized training

The L. C. Gupta Committee during its extensive market research recognized the lack of in-depth understanding of derivative products both of Indian trading community and the probable end-users. The committee suggested all broker-members, sales persons/dealers should compulsorily undergo training prior to the initiation of trading in such instruments, and should pass a SEBI-approved certification program recommended. The National Stock Exchange (NSE) acted upon the recommendation by launching a formal certification programme, called the National Certification for Financial Markets (NCFM), a web based on-line objective type test to build a band of future traders and investors who will have the necessary skills and knowledge to deal in derivatives.

Phase-by-phase entry

The L. C. Gupta committee had also recommended that there should be phased introduction of derivatives products. To start with, index futures to be introduced, which should be followed by options on index and

later options on stocks. Such gradual entry would allow investors to get acquainted with the functionalities of simple derivative instruments and be better adept to deal with other complex derivatives later. SEBI followed this prescribed order which allowed participants to learn gradually about more sophisticated products and in less than a decade develop one of the most robust derivative markets in India.

Our further study of the policy reforms, infrastructure modifications and operational mechanisms of the successful Indian derivative market played an integral role in developing the recommendations for introducing derivative securities in Bangladesh.

2.5 Failure of derivative market – Lessons from China

China experienced major obstacles in the early 1990s and closed out 27 of its 30 exchanges, and currently only allows commodity future trading which is expanding rapidly. During early 1990s, the Shanghai Stock Exchange and Shenzhen Stock Exchanges traded bond futures in very high volumes. Unfortunately, risk management procedures were not very adequate – margins were as little as one per cent of contract price in early 1995. This situation became acute when a scandal involving chaotic trading of bond futures contracts in the Shanghai Stock Exchange. One of largest securities firms incurred huge losses when its short-selling strategy went disastrously wrong, to the point of threatening the stability of the entire financial system (refer to Box 1 in Appendix)¹⁰. Shortly thereafter, the government shut down the bond futures markets and scaled back trading in commodity futures. Since then Chinese government has been very apprehensive on the reopening of any trading in financial futures contracts. The Shanghai derivatives failure has been a lesson for exchanges. In order to develop a strong derivative market there has to be a strong and liquid money market where the volatility of a well designed derivative is within acceptable limits. There has to be transparent legal and regulatory structures which must guide market participants and well established clearing house mechanism to ensure negligible counter party risk. Finally, if market elements are not market determined then derivative markets can create

¹⁰ Fratzscher, O., Emerging Derivative Markets in Asia (March 2006). The World Bank, p.10-12

systematic risk. If macro factors of any economy are artificially restricted, derivative markets will not flourish.

3. Building blocks for a Well-Functioning Derivatives Market

The derivatives market is very dynamic and has rapidly developed into the most important segment of the financial market. Whether access to derivative market is through a specific exchange or over-the-counter, derivative markets add substantial value to institutional or retail investors or corporate stakeholders. Due to this rapid growth of derivative markets, there has been consistent research by academics and policy makers in determining a set of prerequisites for developing new market for derivative securities.

3.1 Economic rationale of a derivative market

Derivatives accomplish a critical economic need by facilitating risk management, and enabling price discovery. Price discovery occurs when an asset is traded and new information about its value is incorporated into its price. Academic research has shown that trading in derivatives markets enable market participants form expectations about underlying asset prices and to manage the risks associated with price changes.

The economic benefits that organized derivatives exchanges provide in developed countries are well documented. In one such significant article, Peck (1985) demonstrates both theoretically and empirically the direct impact futures markets have on commodity prices, and their indirect impact on production, consumption and storage decisions. She also provides empirical evidence that seasonal and annual commodity prices are more stable in economies with futures markets. Her results demonstrate that futures markets fulfill an economic role by decreasing price volatility. Silber (1985) provides a sound explanation for the economic contribution of financial futures and indicates that increased liquidity and risk reduction facilities available to portfolio managers and other investors reduce the cost of capital to businesses, which ultimately translates into greater capital formation for the economy as a whole. Baluch and Ariff (2007) studied 11 countries, including 5 developed and 6 emerging markets, and their derivative exchanges to empirically test the economic contribution of derivative markets in the development process of countries, both developed and emerging. Although, the

results of the study did not provide conclusive evidence of direct economic contribution, it did provide some insight into the relationship between derivative markets development and economic growth as well as the dependence of the derivative markets as a risk-reducing agent for the spot markets/economy. The study recommended that emerging markets should follow the Supply-Leading pattern of development, launching derivative products on their most liquid spot market financial products; with prior and proper set-up of financial infrastructure and institution and legal arrangements.

3.2 Reason for concern

However, derivatives have its fair share of criticism. Some analysts have even called derivative as “Destructive”. Recent subprime mortgage crisis is an example how over exposure in security and derivative market without substantial collateral can lead to a chain of global havoc. Concerns arise especially in the areas of accounting and transparency and in presence of appetite for higher leverage and speculation, lack of corporate governance, as well as on counterparty and potential systemic risks in unregulated markets. These concerns are valid but can be successfully eradicated with an appropriate legal and regulatory environment and a sound market infrastructure.

3.3 Prerequisite of a derivative market

Research pertaining to launching derivatives exchanges in emerging markets consists primarily of country specific feasibility reports or study conducted by using different emerging markets as model. Such studies have been performed on countries such as Korea, India, Pakistan, Malaysia and Turkey. However, a limited number of empirical studies, which generally focus on one specific derivatives contract, exist. Bricheux, Savre and Tachon (1992) describe the important factors for developing a successful futures contract and future market:

- (i) Conditions for creating a futures market (legal, regulatory, political and economic).
- (ii) Conditions for creating a futures contract (price volatility, underlying asset's risk, large cash market, maturity of the spot market, and existence as well as involvement of dealer community).
- (iii)

Conditions for futures contract success (futures market environment, well-designed contract, and exchange perseverance).

Ersen and Karagozoglu (2003) analyzed the readiness of emerging markets for the establishment of derivatives trading. They mentioned that between 1989 and 2000, 183 derivatives contracts were introduced by 10 derivatives exchanges in emerging countries; which were mostly futures contracts on financial (equity, exchange rate and interest rate) assets. They indicated that 45 percent of the contracts launched by emerging country exchanges failed on average after 2.75 years and were no longer offered for trading. According to their paper the successful derivatives, equity, interest rate and exchange rate contracts attain the highest volume of trade, respectively. Ersen and Karagozoglu (2003) developed a model based on macroeconomic, financial, risk and market size variables to explain the trading in derivatives contracts in emerging markets.

Fratzscher (2006) identified three critical policy issues that need to be carefully considered before derivatives markets can be successfully developed: (i) a deep liquid cash markets supported by market determined prices, (ii) how much regulation is needed in OTC and ETD derivative markets; and (iii) what infrastructure is necessary. Market participants, policy makers and regulators should support each-other to ensure these prerequisites are satisfied.

In order to support a vibrant derivative market, a liquid, efficient, and integrated cash market is imperative. Most exchange-traded derivatives and standard OTC derivatives, such as foreign exchange forwards and interest rate swaps, are very liquid. Market participants can expect to find a counter party to trade at a fair price. On the contrary, artificial policy mechanisms such as pegged interest rates, segmented fixed income markets, and capital controls impede foreign exchange derivative markets development and they might develop underground markets. In addition, some of the major derivatives markets are settled in kind (rather than cash) and hence require a sizeable amount of underlying securities for settlement. Many examples in developed markets have illustrated that large derivative positions can be abused to “squeeze” the cash markets, unless large and liquid benchmark securities have been established.

The next major requirement for a sound derivative market is stringent regulation to monitor and ensure the credibility and efficiency of derivative markets. There must be sound risk management mechanisms in place to ensure depositors are protected in financial distress and integrity of the payment systems need to be secured to ensure transparency and efficient transaction processing. Hedging is a pivotal practice in derivatives market, it at its core deals with risk minimization to attract investments which has played a vital role in the recent popularity of derivatives in financial markets, emerging economies promote derivatives and the risk free side of it to create stability in their markets and enable it to grow.

However, use of derivatives may create some unwanted risks. The different risks that market participants face such as counter party, operational, legal and liquidity can ultimately lead to systemic risk, that is, default of one counterparty may have adverse effects on other market participants, potentially destabilizing the entire financial market. A primary concern of all stakeholders, including regulators and policy makers, is to limit systemic risk to the greatest extent possible and a strong set of administrative regulations can certainly reduce these unwanted risks. The progressive regulators argue that the existing institutional supervision of banks does not require any additional functional regulation of derivatives markets. Instead, markets are encouraged to develop self-regulatory organizations (SROs) to maintain the integrity of the derivatives market. This approach appears to be consistent with the existing market structure in the US and the UK where OTC derivatives trading is dominant and the market is highly concentrated among banks.

However in a country like Bangladesh dominated by naïve investors with limited knowledge of global investment products, along with improving governance of market participants and for self regulation of the exchanges, there must be vigilant regulatory oversight over derivatives to maintain financial stability.

Fratzscher (2006) emphasized on three additional considerations that regulators have to weigh in order to establish an even playing field for derivative markets: First, an adequate legal framework for enforcement and the adoption of IFRS accounting rules (incl. IAS 39) are critical

prerequisites for sound derivative markets. Second, capital rules for banks operating in OTC derivative markets need to be aligned with margin rules that are effective in ETD derivative markets. International Swaps and Derivatives Association (ISDA) has worked diligently over the years to make over-the-counter (OTC) derivatives markets safe and efficient. ISDA has clear guidelines for global derivative markets-developed or emerging economies alike in reducing counterparty credit risk, increasing transparency, and improving the industry's operational infrastructure. Such guidelines should be adjusted for local market requirement and implemented carefully. Third, taxes need to be harmonized for all derivatives and related cash products, because transaction costs are an important driver of liquidity that can shift and even destabilize markets. Indian derivative market has suffered due to lack of liquidity over the years and one of the major reasons is different tax treatment for different financial market.

Finally, the single most important risk management tool for derivative markets is to reduce exposure through close-out netting arrangements, ideally with a central counterparty (CCP). The most common means of mitigating counterparty risk are netting and collateralization of counterparty risk exposures. In the OTC segment, these lead to the theoretic regulatory capital required being reduced by around 70 percent¹¹.

A derivative exchange with a Central Counterparty (CCP) provide multilateral netting across all trading parties and creates confidence in investors and regulators by offering several lines of defense against their counterparty risk exposure. As a consequence, the use of CCPs reduces the trading parties' regulatory capital for credit risk from derivatives transactions to zero – irrespective of whether the transaction is OTC or on exchange. However, major financial institutions have been vocal against multilateral netting through a CCP because that would require them to post margins and hence increase transaction costs. The highly successful Indian derivative exchanges have struggled to gain active participation of major banks due to similar concerns. This presents an intricate situation for policy makers to balance the need for financial innovation and low transaction costs on one hand, while on the other hand trying to reduce risks that may undermine financial stability.

¹¹ see BIS 2007b

Based on information of major exchanges of Asia, Fratzscher (2006) determined an index of major infrastructure requirements for a derivative market (Exhibit 6). Surprisingly, there appears to be a strong correlation between existing derivatives products in Asia we found-out in Exhibit 3 as markets with adequate infrastructure have experienced higher growth in turnover and product line

Exhibit 6: Derivatives market infrastructure across Asia¹²

	Australia	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Thailand
Liquidity											
Fixed income benchmarks	✓	()	()	✓	()	✓	✓	✓	X	✓	✓
Fixed income liquidity	✓	()	✓	()	X	✓	✓	()	()	✓	()
Equity market liquidity	✓	✓	✓	✓	()	✓	✓	✓	X	✓	()
Regulation											
Derivatives law	✓	X	✓	✓	X	()	()	()	X	()	()
Securities lending	✓	()	✓	✓	()	✓	✓	X	X	✓	()
Accounting standards	✓	()	✓	()	✓	()	()	✓	X	✓	()
Exchanges											
Clearing and settlement CCP	✓	X	✓	✓	X	()	✓	()	X	✓	()
ISDA netting opinion	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓
Demutualized exchange	✓	X	✓	✓	X	()	✓	()	X	✓	()
Taxes											
Tax harmonization	✓	X	()	✓	✓	()	✓	()	X	✓	X
Transaction costs and IT	✓	()	✓	✓	X	✓	✓	✓	()	✓	()
Investor base and NBFI	✓	()	✓	✓	X	()	✓	()	X	✓	()
# best practice components	12	1	10	10	3	7	10	5	1	11	2

Notes: ✓ denotes best practice ; () denotes progress on existing deficiencies ; and X denotes major problems.

4. Justification for Derivatives in Bangladesh

4.1 Why Bangladesh needs a derivative market

(a) Increased volatility in capital market needs attention

A good number of academic papers investigated the nature and performance of Bangladesh stock Market. For example, Hassan and Chowdhury (2008), using monthly data for market index and 46 actively traded individual firms from January 1991 through May 2003, examine the efficiency of stock market of an emerging market. We employ a

¹² Fratzscher, O., Emerging Derivative Markets in Asia (March 2006). The World Bank, p.8

battery of tests including variance ratio tests to examine the efficiency issue of Bangladesh stock market. Portfolio results suggest that the DSE is weak-form efficient, but the individual firm returns suggest that DSE is weak-form inefficient. We suggest that individual firm returns are influenced by non-synchronous trading and firm-specific and market micro-structure effects.

Basher, Hassan and Islam (2007) examines the time-varying risk return relationship and the impact of institutional factors such as circuit breaker on volatility for the emerging equity market of Bangladesh using daily and weekly stock returns. The Dhaka Stock Exchange (DSE) equity returns show negative skewness, excess kurtosis and deviation from normality. The returns display significant serial correlation suggesting stock market inefficiency. The results also show a significant relationship between conditional volatility and stock returns, but the risk-return parameter is found to be sensitive to choice of samples and frequencies of data. Overall, the coefficient of the risk-return parameter is negative and statistically significant. While this result is not consistent with the portfolio theory, it is possible theoretically in emerging markets as investors may not demand higher risk premia if they are better able to bear risk at times of particular volatility. While lock-in did not have any overall impact on stock volatility, the imposition of a circuit breaker has contributed significantly to the volatility of realized returns. As a policy to improve the operation of capital market timely disclosure and dissemination of information to the shareholders and investors on the performance of listed companies should be emphasized.

Chowdhury, Hassan and Kabir (2007) investigate whether or not there is any contrarian profit (return reversal) in the Bangladesh capital market due to investor overreaction. They consider 1-, 3-, 6-, 12-, and 18-month portfolio formation and evaluation period to detect any pattern in the difference between the returns of the loser and winner portfolios for the period from June 1991 through May 2003. They have found that there is no long-term overreaction in stock prices. Even there is negligible overreaction when intermediate-term like 3- and 9-month investment strategy is considered. But, there is a tendency for the market to overreact when short-term such as monthly strategy is used. This phenomenon gives the indication that DSE may suffer from more severe short-term overreaction. However, it can only be found if data of higher frequency like daily and weekly are taken into account. Finally, it is

premature to comment whether or not the market is at least efficient in the weak form since there has been little research accomplished so far to detect overreaction or underreaction in the Bangladesh market.

Hassan and Maroney (2004) observes that capital market in Bangladesh is still at a nascent stage of development. This paper examines efficiency of Dhaka Stock Exchange (DSE) by taking into consideration the problems of non-linearity, thin trading and structural change. Their results show that parameter uncertainty is a major consideration when developing any successful trading strategy in Bangladesh stock market. Even though they do find non-linearity after correcting for thin- trading in some of the years under study, the ability to execute profitable trading strategies is confounded by parameter instability. Even if these statistics indicate dependence in returns data, the ability to make trading profits may be limited.

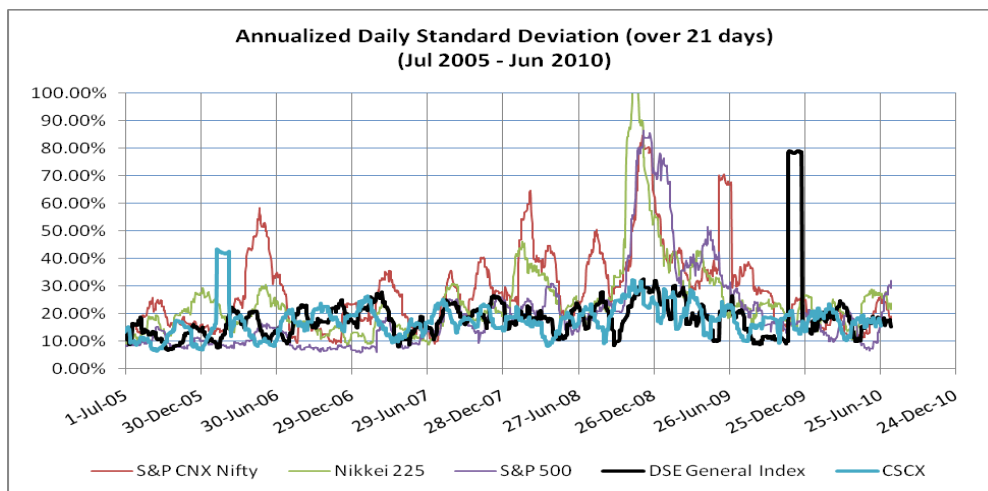
We have calculated volatility of the two capital markets of Bangladesh: Dhaka Stock Exchange and Chittagong Stock Exchange. There are a few reasons behind taking only the equity markets into account. Firstly, derivatives on the equity securities (stocks and index) have always accounted the greater portion of the global derivatives market. As of 2008, 69% of all the derivative contracts traded were the equity derivatives despite the growth rate had declined comparing to the previous years¹³. The second reason is the commodity markets still lacks infrastructural strength and the interest rates being strictly controlled by the central bank of the country (not conducive for derivatives). However, the impediments and the low yield of the other investment alternatives and the rapid growth¹⁴ in the capital market have turned a lot of investors to our share markets with an expectation of high return within a much shorter time lag. So, while introducing derivatives in Bangladesh, the capital market is the very first sector to be demanding attention. The potential or scopes in other sectors like foreign exchange or commodity markets or petroleum import are discussed in later.

¹³ World Federation of Exchanges [WFE], 2009, p. 11

¹⁴ Approximately 24%, 44% and 42% growth in the three consecutive 6 months period during the Jan '09 – June '10 timeline. Detailed data is shown in Figure 1 (in Appendix).

While comparing the annualized volatility¹⁵ of DSEGEN and CSE Selective Category Index (CSCX) to some stock indices around the world the S&P 500, S&P CNX Nifty and Nikkei 225 index were taken into account. According to WFE (2009), these are underlying indices of the most actively traded index options in the world (p. 25). Now, Exhibit 7 shows that both DSEGEN and CSCX show a moderate volatility level over the period under consideration in contrast to other three indices. However, Telecom giant Grameenphone Ltd. entered the market on November 16, 2009 collecting BDT 4.49 billion worth of capital from the public in form of equity which caused record breaking volatility in the Nov-Dec period in 2009. Other than this particular event the fluctuation of both the national indices is observed to be at a decent level.

Exhibit 7: Comparison of volatility (DSEGEN, CSCX, S&P 500, Nikkei 225 and S&P CNX Nifty)



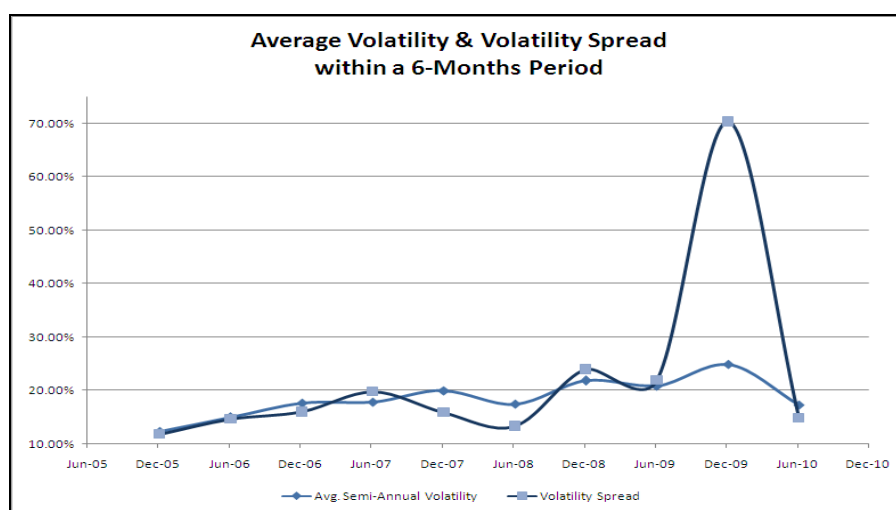
As the exhibit shows, volatility of the three reference stock indices is quite high, especially at the end of the year 2008 and beginning of 2009; while the two local indices could hardly reach that particular level of fluctuation. However, having a closer look at the price movements of DSEGEN in Exhibit 8, it can be noticed that the average standard deviation¹⁶ is increasing throughout the timeline. Having ignored the

¹⁵ Volatility is defined as 21-day standard deviation of daily returns times $\sqrt{252}$ (assuming 21 trading days in a month and 252 trading days in a year).

¹⁶ Mean of the annualized standard deviation for a 6-months period (Jan-Jun and Jul-Dec).

massive upward rise of the volatility spread curve¹⁷ in the late 2009, the spread has also widened with the increase of average fluctuation.

Exhibit 8: Average volatility for a 6-months period and the volatility spread (for DSE General Index)



Though earlier discussion reveals that the volatility level of the local markets has not yet reached a level of being threatened of possible market collapse, the increasing rate of uncertainty and the spread signals a possible alarming situation in the future. Basically the greater attention is demanded by the volatility spread as it illustrates the maximum amount of deviation the market had shown. No matter for how long this level of instability had to be sustained by the market, risk of an overall meltdown remains high. In this regard, the great collapse of Shanghai Stock Exchange could be again brought into the discussion. On February 23, 1995, the market incurred a \$10 billion loss in eight minutes due to price manipulation and the subsequent affects (Fratzscher, 2006, p. 14). So, it is a matter of high concern to control the volatility level more closely by the authority. The fluctuation level might grow gradually with the growth of market capitalization and other factors, but the deviation reaching an abnormal ceiling within a very short time limit must be impeded.

¹⁷ Volatility spread is defined as the difference between the maximum and minimum standard deviation during a 6-months period.

The growth of the index and the market getting more volatile are basically results of more and more investors entering the market with fresh capital to grab greater return within a shorter time period. As a result, one of the major reasons behind the increasing volatility trend is the discrepancy between the amount of the large investor pool attracted towards the market with fresh fund and the amount of the capital being capitalized by the companies.

Exhibit 9: Growth rate comparison- Market Capitalization (MC) and Issued Capital (IC) in DSE¹⁸.

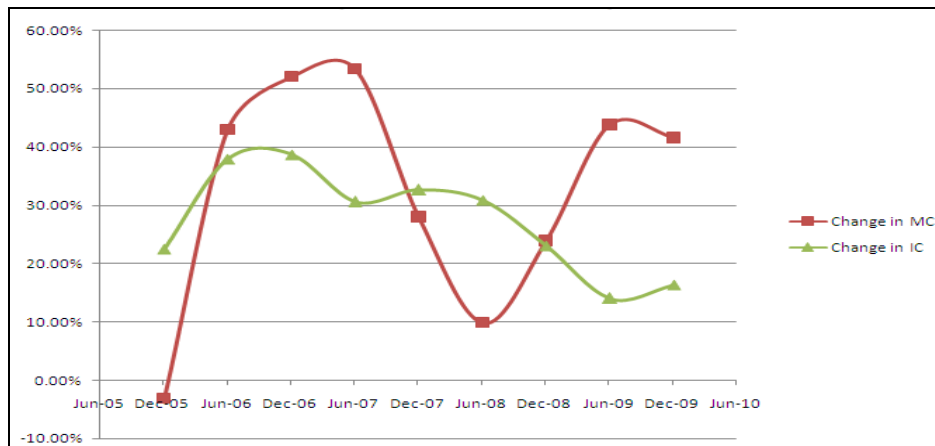


Exhibit 9 shows how the growth in the issued capital is sloping downward over the last five years and how market capitalization has grown at a far higher rate than that of the issued capital. From Figure 2, it can be observed that the amount of issued capital in DSE had grown at the rate of 14.01% and 16.31% during the latter half of 2009 and the first half of 2010, comparing to the 43.76% and 41.53% growth in market capitalization respectively. Such a high difference resulted into a drastic price hike of all the securities traded and also in the increase in volatility spread. If this trend prevails for a long duration, the current efficiency level of the entire market is anticipated to decline largely and also the low supply and high demand of securities is likely to raise the volatility ceiling to a precarious extent. A strong derivative market can be a remedy in such volatile scenario.

¹⁸ Detailed data shown in Figure 2.

(b) Defense against abnormal growth in capital market

We have demonstrated the need for derivatives in our capital market due to abnormal rise in volatility. Like volatility abnormal growth in return may also be matter of grave concern.

In the latter half of the year 2009, the main gauge¹⁹ of Dhaka Stock Exchange started showing a drastic upward rise as the largest IPO in the country's history was executed. However, the rising streak hasn't stopped since it reached its peak on December 5, 2010 at 8918.51 points through breaking all-time-high records almost every week. Exactly a year before the index stood at 4383.31 and within a year it grew at an amazing rate of 103.47% with a growth of around BDT 1.82 trillion in market capitalization. Whether this is due overall performance of the market being apparently on the rise or does it indicate the investors' becoming more and more confident about their choices of investment or it is just a price bubble that has been given birth by the huge gap of supply and demand of securities and more and fresh capital being injected in the market- remains the question. The investors, policy makers and the market experts have shared different reasoning or theories to explain this abnormality in the market's growth, nevertheless all of them have expressed fear about this price bubble exploding in near future wiping away a large sum of money from the investors and institutions.

However, SEC has been striving for slowing down this seemingly unsustainable growth of the bourses by playing with the regulations and policies of the capital market as well as ensuring strict monitoring of the trading and transactions in the last two years consistently. Needless to say, all its endeavors failed to slowdown market and fear of massive market correction prevailed.

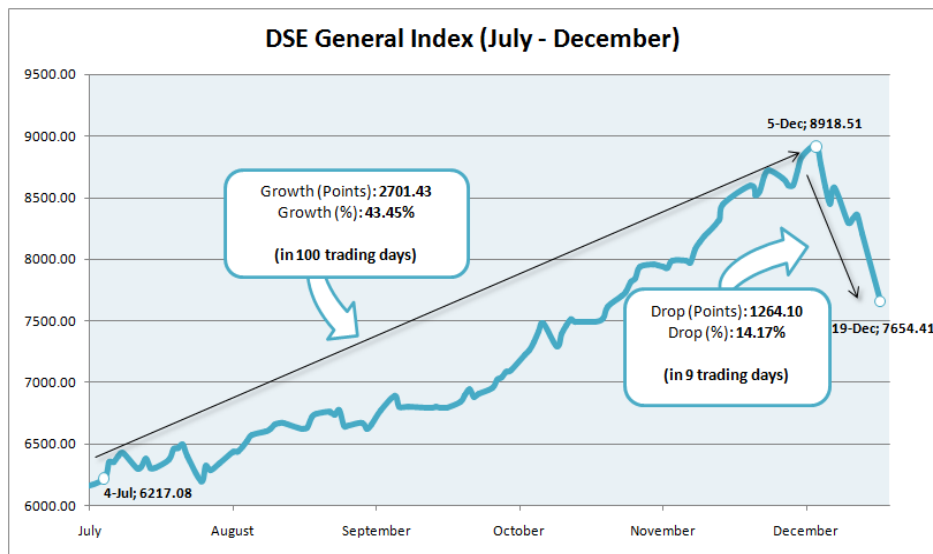
The Collapse of the Market

On December 6, 2010, the DSE General index started to prove the pessimist analyzers correct by starting a dire falling trend initiated by losing approximately 147, 185 and 134 index points during three consecutive sessions. However, the market had seen its deepest fall on

¹⁹ Dhaka Stock Exchange General Index (Considers all securities except the ones from Z-category)

December 19 losing 551 points and summing up to a loss of 1264.10 points in only 9 trading days²⁰.

Exhibit 10: DSEGEN Index: Rise and Fall



This fall has been designated as a “natural price correction” by the authority, while a number of investors have lost their investment due to this bizarre collapse of the market.

Protection against the Correction

Now, whether the market has faced a natural correction or an artificial one, the fact is that the investors have lost their valuable investment. When the institutional investors have either drawn their investments out of the bourse or retain the capacity of sustaining such losses, the individual investors in some cases have to lose everything as their portfolios failed as a whole with the dip in the market. For these instances, different means are needed in order to hedge against the possible losses. Derivatives could have played a very important role in this particular scenario by offering protection to the investors by hedging their investments.

²⁰ From Dec 6, 2010 to Dec 19, 2010

A simulated scenario is elaborated in the following sections showing how a particular investor could have hedged his investment with the help of a “put option”. The industries facing the greatest fall during the recent market disaster include the banking industry as a major contributor. So the stock the investor invested in is assumed to be the stocks of Mutual Trust Bank Ltd.²¹ (trading code: MTBL). For simplicity, the each put option contract is assumed to stand for the right to sell one share and the price of the options is assumed to be their intrinsic price²². However, it should be noted that the more the investors become insecure about the price, the more the price of the put options deviates upwards from the intrinsic value due to high demand. So, the real prices will be more than the ones used in the simulation.

The Investor & the Scenario

An investor is assumed to be interested in the stocks of Mutual Trust bank Ltd. (MTBL) as the bank has a pretty good financial performance (consistent dividends etc.) and the stock prices have shown a fairly long upward trend in the month of October. So he buys 10,000 shares of MTBL, BDT 622.75 each at a total cost of BDT 6,227,500.

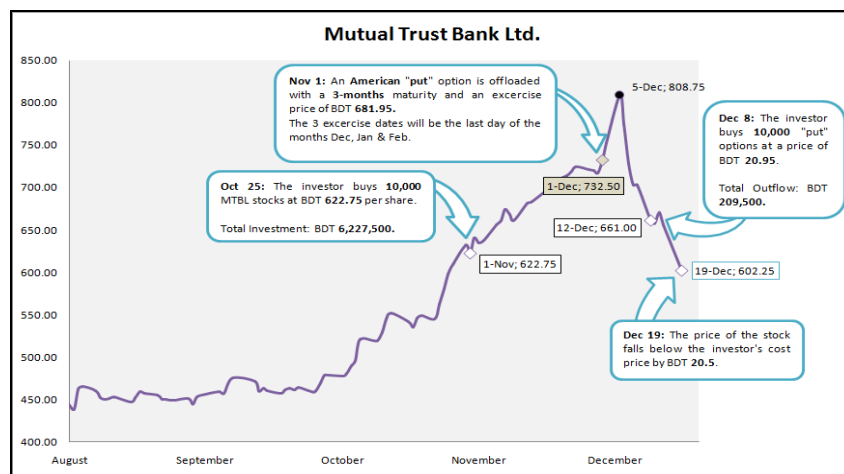
Now, observing the abnormal upward trend of the market a put option is launched on the first trading day of December with the following features:

- Type: American option
- Maturity: 3 months
- Exercise dates: Last trading days of December, January and February
- Exercise price: BDT 681.95²³

²¹ MTBL is one of the banks that have moved with the index; meaning their price rose as the index went up and on the day the index dipped, these companies' shares also came down.

²² Intrinsic price of put option (premium) = Exercise price – Spot price

²³ Exercise price has been stipulated by taking the average of the closing prices during the month of the previous month (November)

Exhibit 11: MTBL: Simulated scenario over the real time price trend

After December 5, the investor starts apprehending possible loss he could make in his investment in MTBL. On December 12, he confirms himself about the long falling streak and takes long position (buys) in 10,000 put options spending BDT 209,500 (BDT 20.95 each option).

Exhibit 12: Illustration of the transactions and the portfolio values

Date	Security	Transaction	Price (BDT)	Volume	Value	Portfolio Value
1-Nov-10	Stock	Buy	622.75	10,000	6,227,500	6,227,500
	Options	-	-	-	-	
12-Dec-10	Stock	Held	661.00	10,000	6,610,000	6,819,500
	Options	Buy	20.95	10,000	209,500	
19-Dec-10	Stock	Held	602.25	10,000	6,022,500	6,819,500
	Options	Held	79.70	10,000	797,000	
* Cost of the portfolio = BDT 6,437,000 (Cost of stocks + Cost of options)						
** Price per share for exercising the options <= BDT 643.70						

The exhibit shows that with the stated transactions at the real time market price of the shares and the assumed price²⁴ of the options, the total value of the portfolio is never less than the cost price.

²⁴ The real time price is supposed to be higher than the stated ones due to the expected high demand.

However, if the price of the stocks remains below or equal to BDT 643.70 on the exercise dates, the investor can exercise the option and makes no loss at least²⁵. If the price is above this ceiling, the investor doesn't exercise the options as the value of the portfolio remains above the cost.

Hence, in presence of properly designed and adequate types of derivatives tools in the market, the investors could hedge their investment against the possible collapses like the recent one.

(c) Protection in major export sector (Case study: RMG Sector)

As one of the major industries and the largest export sector, Readymade Garments (RMG) has the highest exposure to the exchange rate risk with regard to their overseas financial transactions. To mitigate this particular risk, RMG exporting companies historically have been using two tools like selling the rights of the Letter of Credit (LC) and forward contract over the exchange rate.

Existing Tools

The transfer of LC has its own disadvantage of high processing fees that can amount from 3% to 5% of the total LC amount. Again, forward contract on the foreign exchange often becomes hassling due to the rigidity of the regulation of the central bank. On one side, the central bank of Bangladesh doesn't allow derivative tools on any asset except for the cases with special permission. On the other hand, if a forward contract is permitted by Bangladesh Bank, the financial institution acting as the processor of the entire contract has to close the accounts right on the maturity dates. It has been observed that due to any unavoidable circumstances it is likely for the LCs to have a deferred arrival and in such cases the customers are compelled to execute the contract at a the forward or worse rate²⁶.

²⁵ If the price is below the stated price, the difference will serve as the profit per share for the investor.

²⁶ "HSBC transacts first ever Bangladesh Taka Onshore FX Option Trade", The Financial Express, December 9, 2009.

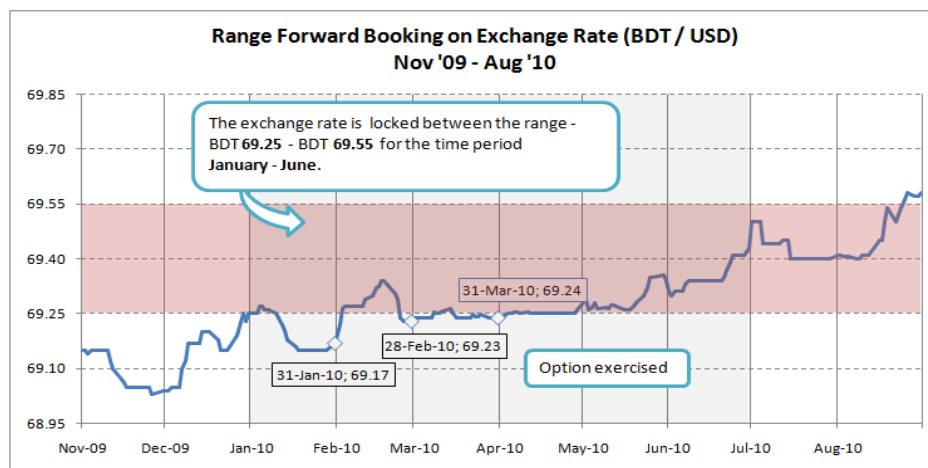
Range Forward Booking

In December 2009, HSBC introduced a customized option derivative contract for Viyelle Ltd- a local RMG exporter and Coats Bangladesh- a UK based supplier of yarn and other raw materials. The contract involved an upfront fee as premium, a volume limit of USD 0.5 million and a maturity period of six months. The difference of this particular option with the regular ones is that it features a range of exercise rate. Typically the floor (lower range) happens to be the spot rate of the contract being formed and the ceiling (upper range) is BDT 0.30 or 0.40 above the floor. The mechanism allows the supplier to exercise the contract if the exchange rate falls below the floor and if the rate goes above the ceiling the supplier can enjoy a limited profit as the difference is absorbed by the intermediary.

The Simulation

Assuming a Range Forward Booking processed in order to hedge the exchange rate risk during the period January to June in 2010 for an amount of USD 0.5 million. The amount is a limit and design of the contract allows exercising the right of converting certain amount of US dollar at the floor rate on exercise dates as long as the cumulative amount doesn't exceed USD 0.5 million.

Exhibit 13: Mechanism of Range Forward Booking on BDT/USD



For simplicity, in the illustration we assume that supplier needs to convert a total of USD 0.5 million into Bangladeshi currency at five

episodes amounting USD 100,000 each transaction. So they undergo a processing of a Range Forward Booking contract designed as mentioned earlier. The first three exercise dates are utilized as spot rates remain below floor of the specified range.

From the Exhibit 14, it can be shown that the option contract enables the company to avoid a possible loss of BDT 11,000, which could have been much higher depending on the intensity of exchange rate volatility. However, there is an upfront premium charged by the financial intermediary. Even if the charge is more than the avoided loss amount, the option enables the company to minimize loss to certain extent.

Exhibit 14: Transaction Summary

Date	USD Volume	Spot Rate (SR)	Exercised Rate (XR)	BDT @ SR	BDT @ XR	Actual Inflow
31-Jan-10	100,000	69.17	69.25	6,917,000	6,925,000	6,925,000
28-Feb-10	100,000	69.23	69.25	6,923,000	6,925,000	6,925,000
31-Mar-10	100,000	69.24	69.25	6,924,000	6,925,000	6,925,000
29-Apr-10	100,000	69.26	69.25	6,926,000	6,925,000	6,926,000
31-May-10	100,000	69.34	69.25	6,934,000	6,925,000	6,934,000
			Total	34,624,000	Total	34,635,000
				Amount of loss avoided		11,000

Hence, derivatives can act as a protection in any major swing exchange rates which has negative impact on our export transactions.

(d) Protection in major import sector (Import of Petroleum)

Being a country with higher import needs than the capacity of exporting, Bangladesh has been experiencing growing negative balance in its current account²⁷. Especially in 2008, the trade deficit took a leap from

²⁷ Refer to Figure 3 in Appendix for graphical representation of Export, Import and Balance of Trade condition.

around BDT 268 billion to BDT 511 billion, almost twice as it used to be in the preceding fiscal years²⁸. This unusual doubling of trade deficit was apparently caused by the increase in the import volume in taka in some major commodities like rice, wheat, fertilizer, cotton, staple fiber and most importantly the edible oil²⁹. The global political unrest and the financial crisis in 2007-08 contributed a great deal to the boost in price in the international market, especially the price of the edible oil and the petroleum products³⁰ (both crude and refined form). Hence, the government must take actions and look into modern financial tools to mitigate the risks due to the price instability and volatility in the exchange rate against major currencies.

Petroleum Products in National Import

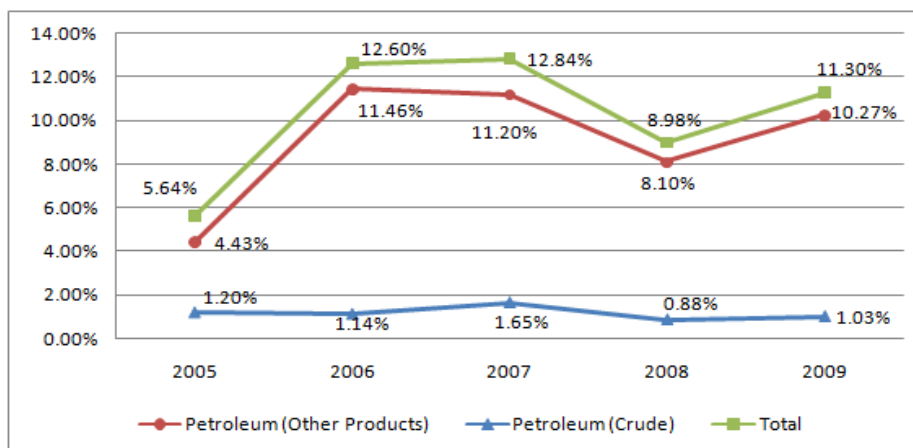
Petroleum is a principal commodity for Bangladesh, the national demand of which is met entirely by import (National Accounting Wing, BBS, 2010, p. 24). Bangladesh's petroleum imports mainly consist of the refined oil products and comparatively a very little crude oil is imported as the country doesn't have an established industry of oil refining (Islam, 2006). Considering the entire national import of any given year, the petroleum products as well as the machinery and equipments are the highest contributors in the whole import amount. Exhibit 16 provides a year-by-year contribution of petroleum and petroleum related products on the total import of Bangladesh. The petroleum import is entirely dealt by the government and afterwards supplied throughout the country and distributed among different sectors, private and public. The total import volume for petroleum in BDT has increased from 43.41 billion to 178.66 billion in 2009, in just 5 years.

²⁸ Approximately BDT 237, 270 and 268 billion during the years 2005, 06 and 07 respectively.

²⁹ Edible oil import jumped from BDT 76.28 to BDT 132.61 billion, mostly because of price increasing by 68.53%.

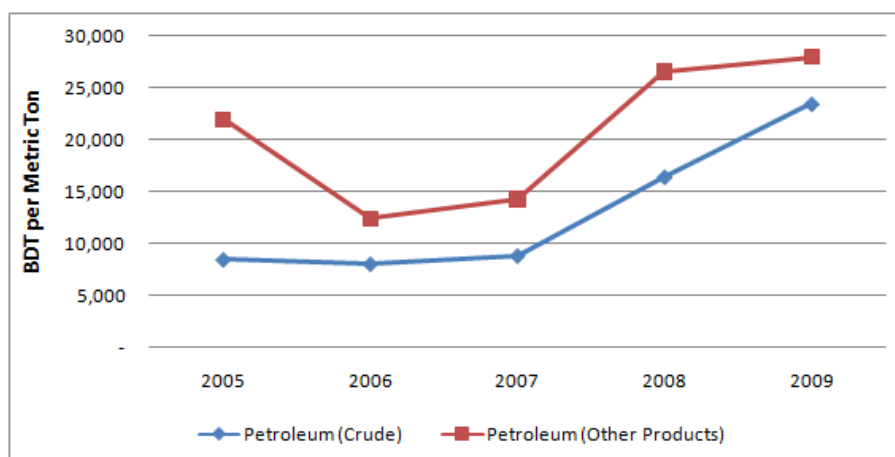
³⁰ Detailed numbers are shown in Figure 4 in the Appendix.

Exhibit 15: Trend of contribution of Petroleum products (crude & refined) in import



But interestingly enough, the total import quantity has come down from 10.24 million metric ton to 6.51 million metric ton during these years excluding the year 2005³¹ and the price paid for petroleum and related product has grown to staggering level (Exhibit 16).

Exhibit 16: Trend of unit price (BDT per Metric Ton) of crude oil and other petroleum products



³¹ Refer to Figure 4 in Appendix for the breakdown of the imported quantity of petroleum products.

Such hike in the price of the major import commodity is not a really good thing for a country, especially for the ones that are running in trade deficit such as Bangladesh. We buy most of the crude oil from the Middle Eastern and a few Asian countries and the refined oil products from the global oil companies like Shell, KPC etc (Islam, 2006). The government directly acts as the buyer. It is really important that the government protects itself from the exposure of the price risk posed by the current political unrest in the Middle East, otherwise widening of trade deficit cannot be controlled and non judicial use of the country's foreign reserve will create a negative impact on our economy. Energy derivatives, particularly on petroleum sector, can be a long-term solution for Bangladesh's over dependence on import of petroleum.

Use of derivatives in Petroleum Import

Petroleum commodities are highly price inelastic and the supply-demand paradigm doesn't usually intervene to force back the price towards the equilibrium in this particular market. This inherent volatility results in rapid price swings of petroleum products without being fueled by almost any global macro-economic change.

Exhibit 17: Average of 20-day Historical Volatility in Percent³²

Asset	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Crude Oil	32.89	19.26	23.22	28.99	19.85	38.17	29.11	43.15	35.70	38.40
Heating Oil	37.10	24.03	21.19	29.63	19.75	37.32	28.26	33.21	34.53	41.72
T-Bill	13.76	18.57	12.63	19.03	10.50	10.98	11.7	17.81	13.28	13.37
S&P 500	13.45	10.01	8.46	9.55	7.58	9.38	17.24	18.41	18.19	19.63
USD/DM	12.43	12.94	10.18	8.91	11.62	6.46	9.69	8.58	8.87	9.88
Gold	10.87	8.07	12.23	9.14	7.15	6.13	11.87	14.00	12.85	12.69

The above comparison shows how petroleum products have been historically showing a volatile movement than any other major assets in terms of price. However, after 2000 this volatility has increased even more with the prices breaking free from the resistance line and soaring due to the international wars and worsening political relations.

³² Source: (Semptra Commodities); details in the References section.

As previously mentioned, to hedge against such a risky trend in petroleum prices globally futures, options and swap contracts are used and the two major exchanges dealing with energy derivatives are the New York Mercantile Exchange and London's International Petroleum Exchange (Walsh, 2009). For Bangladesh, entering into customized swap contracts is much more feasible than to enter the overseas energy futures or options market. The bureaucracy prevailing in the administration and lack of technical know-how of derivative market would not allow the government to efficiently operate in the formal overseas options and futures markets. Besides, in the case of long-term forward contracts, the exposure to default and credit risks may be substantial. Hence, it is prudent for Bangladesh first to get accustomed to the concept of trading in energy derivatives via swaps, build-up credibility in international market as a strong counter party and in 5-10 years time participate in neighboring Shanghai Futures Exchange (SHFE) dealing with crude or fuel oil future contracts. One of our leading financial institution Standard Chartered Bank had already executed two successful swap contracts for importing cotton (Rahman, 2010) and more recently copper (The Financial Express, 2010).

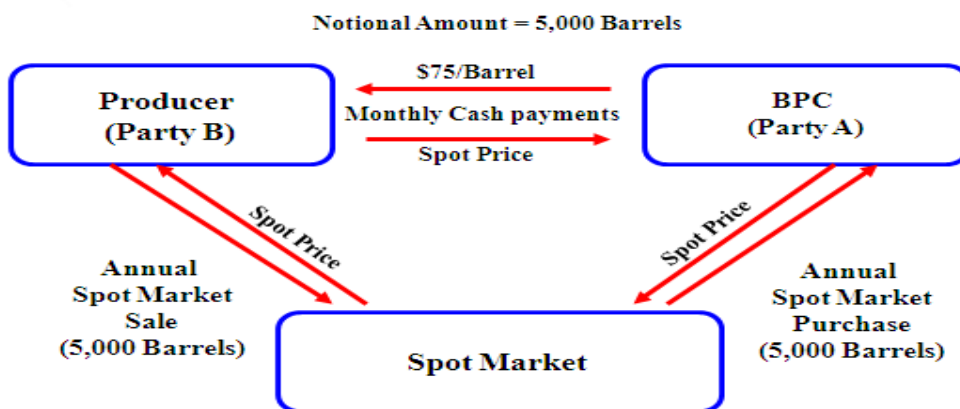
The possible use of a swap contract to minimize risk in petroleum purchasing is shown by the simplest form of fixed for floating swap contract. Firstly the fixed for floating swap contract enables oil end users to fix the purchase price of future oil consumption and thus minimizes any exposure to rising prices. By locking in prices, end users gain greater control over the variable revenues and costs inherent in their businesses. Because swaps do not involve the actual transfer of any assets or principal amounts, a base must be established in order to determine the amounts that will periodically be swapped. This principal base is known as the "notional amount" of the contract.

Example of Swap contract for petroleum:

The following example will give a clear idea how a swap derivative contract can work in purchasing/importing petroleum by Bangladesh. Exhibit 18 illustrates an example of a standard fuel oil swap. In the example, Bangladesh Petroleum Corporation (BPC) and an oil producer agree to enter into a 5-year fuel oil swap with a monthly exchange of payments. BPC (Party A) agrees to pay the producer (Party B) a fixed price of \$75 per barrel, and the producer agrees to pay BPC the

settlement price of a futures contract for Shanghai Futures Exchange (SHFE) fuel oil on the final day of trading for the contract. The notional amount of the contract is 5,000 barrels. Under this contract the payments are netted, so that the party owing the larger payment for the month makes a net payment to the party owing the lesser amount. If the SHFE settlement price on the final day of trading is \$71 per barrel, Party A will make a payment of \$4 per barrel times 5,000, or \$20,000, to Party B. If the SHFE price is \$80 per barrel, Party B will make a payment of \$25,000 to Party A. The 10-year swap effectively creates a package of 60 cash-settled forward contracts, one maturing each month for 5 years.

Exhibit 18: Example of a swap transaction between Fuel Oil Producer and Purchaser (BPC)



So long as both parties in this arrangement are able to buy and sell fuel oil at the variable SHFE settlement price, the swap guarantees a fixed price of \$75 per barrel, because the producer and BPC can combine their financial swap with physical sales and purchases in the spot market in quantities that match the nominal contract size. As a result, the purchases and sales shown in the inner loop cancel each other out and what remain are the fixed payment of money to the producer and BPC's purchase of crude oil. The producer never actually delivers fuel oil to the client BPC, nor does BPC directly buy fuel oil from the producer. All their physical purchases and sales are in the spot market, at the SHFE price.

(e) Demand for alternative source of investments

In light of our scrutiny of the volatility and the return vs. risk assessment of the two capital markets of Bangladesh, we can confer that moderate volatility level of the markets does not pose any threat of market collapse while ensuring that there is enough fluctuation to serve the purpose of hedging. As the investors are being offered by the market a fair return against the risk, the market capitalization is increasing at a bull rate being much higher than the supply of securities. This eventually poses potential threat of the market losing its efficiency and also the volatility increasing in the long run. In order to make sure that the market doesn't face the above mentioned dilemma, the regulatory authority must ensure a boost in the supply of new and good-quality securities. Now, derivatives securities can play a vital role in this regard besides the new stocks and bonds. An important aspect for capital market is reflection of fair value of scrips. This is not adequately present in the current scenario, and due to this reason the market is not receiving the attention of an important segment of investors, both foreign and local. Although DSE experienced impressive growth in liquidity in recent years with Average Daily Turnover increased from US\$ 24mm in 2007 to US\$ 75mm in 2009, FDI has actually declined by 36 percent between 2008 and 2009. In an equity centric market and in absence of a solid bond market, investors are looking for an alternative class of instruments and derivative can be the ideal solution to this problem as coming-up with innovative derivatives will be much easier than to issue fundamentally strong new company's IPO.

5. Recommendation for Introducing Derivatives in Bangladesh

The value of derivative securities is undeniable for a financial market. The capital market of Bangladesh has recently witnessed extra-ordinary volatility and the recent periodic crashes at Dhaka Stock Exchange (DSE) has illustrated our lack of knowledge and tools to combat this aggravating market volatility.

One of the major reasons for such high volatility of our capital market is the lack of hedging instruments that could protect the investors, both individuals as well as institutions. For last two decades, emerging markets namely Korea, Malaysia, Brazil and India have innovatively and judiciously used a vibrant derivative market for risk mitigation and

also yielded substantial benefits in terms of market expansion and overall economic growth. In view of the overwhelmingly positive outcome in similar markets of the world, the introduction of derivatives market in Bangladesh should have a salient effect on the country's capital market and the overall economy. The following set of recommendations will address both the preparatory evaluation need and also relevant building blocks of creating an efficient derivative exchange.

Recommendation 1: Establishing an Advisory Committee

First and foremost, the Security and Exchange Commission should form an advisory committee for preparing a comprehensive report on the feasibility of introducing exchange traded derivatives market in Bangladesh.

Our policy makers and regulators can take cue from India's Dr. L.C. Gupta led highly successful feasibility committee and create an advisory committee comprising of representatives of regulatory institution (SEC, Bangladesh Bank), DSE, CSE, financial institutions (ex: private bank, merchant bank, investment bank, brokerage, credit rating agency), academics, legal experts, consultants (local and/or international with relevant experience in derivatives) and ministry of finance. The committee should be headed by a senior official of local and international pedigree. The mandate of the committee can be as follows-

(i) Study and recommend whether trading of exchange-traded derivatives is suitable for the capital market in Bangladesh in its present form. The research should address (but not confined to) aspects concerning market infrastructure, systems, risks, transparency, investor interest and education, users of the derivatives products.

(ii) Specify the probable and likely benefits for the capital market of Bangladesh by introducing or trading of exchange-traded derivative products (based on the progress achieved by the emerging and developed markets after the introduction of exchange-traded derivatives).

(iii) Prepare a list of legal amendments and regulatory reform required for derivatives.

(iv) Prepare a comprehensive roadmap (if required) for successful introduction of exchange-traded derivatives for the capital market of Bangladesh.

Recommendation 2: Build-up public awareness and deduce stakeholder's opinion

The concept and usage of derivatives is still quite vague to our major stakeholders such as regulators, financial institutions and export/import entities. Such limited understanding of derivatives trading on the part of major players can become a hindrance to the development of the market. Hence, the initial process of creating a derivative market should involve sending customized leaflets and questionnaire to major stakeholders to educate them on the various derivatives available in global markets and also ascertain their requirement of derivative instruments. Such comprehensive market survey can be an interactive method of sharing ideas, concerns and suggestions for going forward.

Recommendation 3: Implementing stringent training and licensing mechanism

Derivative products by nature are complex and success of a derivative market is coherent with the knowledge and expertise of the participants. The recent stock market probe clearly identified the lack of basic understanding of risk and dynamics of a capital market of many of the representative of financial institutions and investors and oversight of the regulators as a key contributory factor of collapse of the exchanges³³. Given the high level of economic and financial risks faced by market participants and investors in emerging countries, such inadequacy in knowledge and skill set may lead to substantial increase in systematic risk of the market. The pricing of derivatives products and management risk models require brokers/dealers, regulators and end-users to have sufficient educational training in finance and quantitative methods used

³³ Khaled, K.I. (March 2011). Stock Market Probe Committee Report. Ministry of Finance, Bangladesh.

for asset pricing. Thus, it is essential professionals attend specialized courses in financial management and derivatives. SEC in consultation with domestic/international experts, Bangladesh Bank, Ministry of Finance and market players should introduce a compulsory training and certification program. The National Certification for Financial Markets (NCFM) of India can be an ideal guideline for preparing the content and means of offering such training.

Access by intermediaries to the market should be governed by adequate licensing to ensure that intermediaries understand characteristics of derivative market particular electronic exchange. They must understand the importance of due diligence for their clients and follow the best practice governance and accounting standards and offer sufficient collateral for their respective risk positions. Although this licensing will be responsibility of the exchange, it should be subject to stringent monitoring of SEC.

Recommendation 4: Derivative Exchange is the way to go, not over-the-counter market

Derivatives, introduced both via exchanges and OTC have enjoyed global recognition and appreciation primarily as effective instrument for hedging. They ensure depth and liquidity to the capital markets and hence encourage trading. However, choice of exchange versus OTC depends on the sophistication and prudence of capital market. The recent stock market manipulation in Bangladesh has severely questioned the integrity and effectiveness of the regulatory bodies and also demonstrated the facile manner syndicates can eat into the core fundamentals of the market. Under the circumstances, an OTC market which by nature is not strongly regulated will create havoc in already feeble governance framework. There is strong recommendation in stock market probe report for restricting the main regulatory body SEC and demutualization of the main exchanges DSE and CSE. If government is sincere in its effort to revamp our financial market and regulatory structure, such actions can also indirectly create an environment where derivative exchange market can flourish. Besides it would be easier for traders, investors and brokers to move up the learning curve by trading standardized products of exchange derivative market, rather than exotic derivative of OTC which usually combines attributes of several derivatives instruments and are, therefore, more complex than their exchange traded counterparts. Such initial standardization is not only

beneficial from the trader's perspective but also from the perspective of the regulators who need to understand the dynamics and magnitude of the risks associated with the products before being able to design sustainable measures to alleviate systematic risk. Therefore, introduction of Exchange-Traded Derivatives in Bangladesh will be pragmatic and efficient.

Initially, a cautious approach of development of a two track framework for derivatives trading, where SEC sets the rules and regulations pertaining to trading, eligibility, membership, clearing, settlement, margin maintenance, reporting and the electronic exchange (to begin with DSE) ensures stringent monitoring and ethical and efficient function, is suggested. However, in the long run, a self-regulatory organization (SRO) i.e. a separate demutualized exchange needs to be established to maintain the integrity of the derivatives market.

In view of recent turmoil in the equity markets, it is recommended that simpler derivative products be launched first followed by more sophisticated products as our markets evolve. Phased introduction of derivatives, with index futures (short-term) followed by options on index and individual assets should be in mid-term horizon. Once the exchange has gained some expertise by trading in index futures, we should also introduce limited kinds of commodity futures such as rice and grain. Considering Bangladesh's dependence on agricultural production, commodity futures can allow our producers some protection against drop of price due to unforeseen events or seasonality factors. Keeping in mind our need for risk minimization in export-import sectors (ex- RMG, Petroleum), longtime plan should include introducing currency swap derivative and commodity future contracts. It needs to be noted, in the presence of administered (pegged) interest rates, interest rate exchange derivatives won't be effective. Considering interest rate in Bangladesh is more or less steady, we are not recommending introduction of interest swaps in near future.

Recommendation 5: Development of existing infrastructure and new system

Once the advisory committee has successfully completed its feasibility analysis and provided a regulatory framework, focus should shift on upgrading infrastructure to accommodate derivative trading. A deep and

liquid market for the underlying (initially only DSE and CSE traded stocks) is necessary for the development of an efficient derivative market. The easy movement of capital between different markets and currencies is essential to eliminate pricing discrepancies and efficient functioning of the markets. The stock market probe report highlighted the crying need of restructuring main regulatory body SEC and also strengthening of key institutions such as Central Depository Bangladesh Ltd. (CDBL) and clearing house. Such actions should be taken on a priority basis, both for improving our stock market and creating a platform for a derivative exchange. In order to increase investor confidence, derivative exchange must set-up on-line screen-based systems for all trades in financial derivatives, and an independent and automated, real-time market surveillance systems to identify market abuses.

A specific sub-group of the advisory committee comprised of mathematicians, analysts and derivative exchange consultants should be in charge of preparing all rules pertaining to trading, clearing, settlement, margin maintenance and membership eligibility criteria.

Recommendation 6: Establish a Central Counterparty (CCP)

In order to maintain the efficiency and transparency of derivative security exchange, clearing and settlement of derivatives products should be executed through a central counterparty (CCP) with multilateral multi-product close-out netting arrangements.

Clearinghouses can be organized in a wide variety of forms: some are organized as departments of their affiliated exchanges (vertically integrated) while others are independent legal entities.

In present scenario, all transactions are settled by clearing house which is part of DSE and settlement is based on category of shares (Such as A, B, N, G, Z category). The settlement classifications are: T+0 (Day settlement), T+3 (Normal settlement) and T+9 (Prohibitory settlement). Central Depository Bangladesh Ltd. (CDBL), on the other hand, acts as a record keeper by electronically recording and maintaining securities accounts and registering transfer of securities. However modern concept of clearing house for a derivative exchange is much more vivid. A CCP acts as a buyer to all sellers and a seller to all buyers and assumes the responsibility of guarantor to both parties. The CCP establishes different

tools for conducting its monitoring activities, such as, daily compensation of losses (and gains), liquidation of open positions when a trading party is in default, collateralization of maximum expected daily losses, a clearing fund, support from a highly rated guarantor and finally the clearing house's equity capital. Bangladesh should establish an independent clearing corporation/clearing house for proposed derivative exchange, which should become counter party for all trades or alternatively guarantee the settlement of all trades.

6. Concluding Remarks

In summary, financial derivatives provide risk management tools as well as alternative investment opportunities to market participants. Emerging economies in which index futures and options have been introduced have experienced significant gains in both stock market capitalization and trading volume. There is no denying of the fact that our existing institutional set up and regulatory framework might not be adequate for sophisticated instruments like derivatives. However, the recent catastrophic fall of our stock market, rapidly declining FDI and scarcity of investment opportunities in an equity centric economy, is crying out for an innovative and versatile financial product for hedging and market expansion. The importance of the development of institutional infrastructure and human capital cannot and should not be overlooked; however if the capital market of Bangladesh want to be competitive with other emerging economies of India, China, Malaysia or Singapore, the process of progressive policy making cannot wait indefinitely for our market players to catch up with their counterparts in more developed financial markets. Hence, our policy makers and regulators must initiate a process for introducing derivative securities in Bangladesh within 3-5 years.

In view of recent turmoil in the equity markets, we need to be circumspect and foresighted in our approach; a standardized exchange traded derivative market with phase-by-phase introduction of product has been recommended. We are confident, adequate legal and regulatory reform, and governance infrastructure and oversight will pave the way for successful introduction of derivative securities in Bangladesh and provide the perfect fillip to our stagnant investment climate.

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