# Monetary policy and inflation targeting in a small open-economy

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20 May 2009

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**Abstract**

This paper investigates the transmission mechanism of monetary policy and inflation targeting in a small open-economy by using backward-looking of aggregate supply (AS) and aggregate demand (AD) framework. Since September 1998 until July 2005, Malaysia has implemented a currency pegged to the U.S dollar in responding to the Asian financial crisis. However, since the $21^{st}$ of July 2005 until at present, the Central Bank of Malaysia (CBM) has eliminated pegging with the U.S dollar and moved to the floating exchange rate with basket currencies framework. This new regime has an essential role to be a primary objective of policy in stabilizing exchange rate against its major trading partners, particularly the regional countries. Nevertheless, maintaining the soundness of interest rate is also important to perceive inflation targeting in increasing economic growth. Therefore, by using a quarterly data from 1991:1 to 2006:1, this study has adopted a traditional structural econometrics model (SEM) to examine the role of inflation targeting in monetary policy transmission in a small-open economy, i.e. Malaysia. The findings indicated that output gap is an important variable in forecasting a domestic inflation rate and interest-rates policy is statistically significant in influencing the output gap. Therefore, the choosing of interest-rates as a policy target is vital in controlling the domestic inflation rate.

## 1.  Introduction

This paper aims to examine the implementation of monetary policy under inflation targeting in a small open-economy, i.e. Malaysia. The focal point is given in modelling the effect of domestic, foreign and monetary policy disturbances on domestic inflation and output gap. To achieve this objective, this study has used the

structural econometric modelling framework in estimating the backward-looking aggregate supply (AS) and aggregate demand (AD).

The motivation of this study is connected with the issues of monetary policy implementation in inflation rate targeting through controlling interest rates. This is due to the fact that the main objective of controlling monetary instruments is to achieve the ultimate target such as maintaining price stability and sustainability of economic growth. However, how does the change in monetary policy is significant to stabilize the economic growth and price level? Many countries especially in Asian countries have changed their monetary policy in order to consistently manage their economy. Malaysia especially, has experienced three transition of changing their monetary framework in terms of exchange rate, interest rates policy and monetary aggregate.

Every country has to consistently adapt a new changing in a financial market to ensure the soundness of economic growth and price level as well. Therefore, what is the most efficient policy that should be implemented to the economy to achieve the final target? Most central banks used short-term interest rates as their main instruments of monetary policy. Indeed, it likely influences the investment and saving decisions of households, firms and foreigners as the rate charges by banking and financial institutions.

In the case of small open economy, the changing in exchange rate regime also can influence the demand and supply in basket of goods and services. It relatively affects domestic currency prices of imported final goods, as well of equity transactions. More importantly, the real exchange rate will affect the relative price between domestic and foreign goods, which in turn will affect both domestic and foreign demand for domestic goods, and hence contribute to the aggregate demand

channel for the transmission of monetary policy in Svensson (2000). In addition, domestic and foreign interest rates also play an important role in influencing the pattern of aggregate demand for domestic goods and services. This, directly affect the level of price and relatively amount of goods and services can be used by households and firms.

The findings of this paper indicated that output gap is statistically significant in influencing the inflation rate. However, the role of foreign inflation and purchasing power parity are insignificantly in influencing the inflation rate. In addition, a monetary policy variable that is three months interest rates is statistically significant in influencing the output gap. Therefore, the Central Bank of Malaysia has a right path in stabilize the price level by controlling the interest rates.

The remainder of this paper is organized as follows. Section 2 briefly explains the background of monetary policy framework in Malaysia. Section 3 discusses some related literature on monetary policy and inflation targeting. Section 4 explains the methodologies, and finally Section 5 concludes.

## 2.      The Background of Monetary Policy in Malaysia

In 1995, Malaysia shifted the monetary strategy from monetary aggregates to interest rates as an intermediate target. Since then, Malaysia monetary policy is operated through short term interest rates in order to achieve its ultimate objective of price stability. The direction of interest rates is influenced by liquidity management and its signalling impact. A change in policy rate specifically would affect the whole range of market rates, which have a direct impact on lending rates or cost of funds in the financial system. The changes in policy rates will affect the private sector's financial assets and liabilities position, indeed affects asset prices. Therefore, this will likely

affect the decisions to consume, save, and invest, that involves domestic and external goods and services as well. Subsequently, these factors will influence aggregate demand and ultimately price level.

The stability of price is important to ensure the efficiency of resource allocation, improving investment sentiment, providing incentive to save, enhancing economic welfare and more importantly fostering sustainable long-term economic growth. However, the changes of interest rates rate regime can be classified into three times since 1995 that were the introduction of interbank rate in November 1995, followed by intervention rate in September 1998 and lastly overnight policy rate in April 2004. Under the interest rate framework in 1995, BLR was changed in order to promote greater efficiency among banking institutions and more essentially, to ensure the rapid transmission of changes in the direction of policy into the credit market. Besides, it enabled commercial banks and finance companies to quote the BLR below the ceiling BLR computed for the industry. However the computation of ceiling BLR was revised in September 1998 by substituting the weighted average interbank rate with the intervention rate. With this new framework the ceiling BLR can be computed and it allowed banking institutions to borrow from the BNM at times when the market is short of liquidity. Ultimately, in April 26 2004, BNM implemented new interest rates framework. Under this new framework, the overnight policy rate (OPR) replaced the three-month intervention rate. The OPR was set at the prevailing interbank overnight rate of 2.7% and allowed to fluctuate within a narrow range of plus or minus 25 basis points. It has given the most significant interest rate within that period until currently.

In terms of exchange rate regimes, Malaysia has implemented three regimes since the world war two. Initially, flexible exchange rate regime was introduced until the speculative attacks that have depreciated the currency to Ringgit Malaysia 4 in 1997. Therefore, in September 1998, capital control has been implemented that fixed the currency the US dollar that can reduce the risk of capital outflows and depreciation of currency. Nevertheless, in July 2005, BNM announced the shift of currency to managed floating as a result of stabilization and enhancement of economic growth within the years.

Government of Malaysia also tries to maintain price stability. It is essential to stabilize the price level at low level for creating a conducive environment for sustainable economic growth. Changes in either demand or supply conditions affect inflation rate which lead to persistent changes in prices level and give rise to a temporary increase in inflation, respectively. Monetary authorities should conduct monetary policy effectively which are able to accurately assess the sources of current and future movements in inflation. More importantly, they can distinguish whether an increase inflation rate is the result of supply shock, or demand conditions. Therefore, Bank Negara Malaysia has constructed indices of core inflation for inflation targeting to enhance the analysis of the underlying inflationary trend in the economy. The measures of core inflation have been used in Malaysia such as headline, excluding food, excluding price-volatile and controlled items, modified weights, trimmed-mean, weighted-median and principal component.

# 3. Literature Reviews

Basically, inflation targeting can be modelled as an instrument rule or a targeting rule Svensson (2002). What should be modelled in our sample? A number of researchers such as Haldane (1998), and further examined Haldane and Batini (1998), and Rudebusch and Svensson (2002) find instrument rule responds directly to deviations of the rule-consistent inflation forecast from the inflation target. A well known example of a simple instrument rule is a Taylor rule, Taylor (1993) that analysed the rule of federal funds rate responds to the inflation deviations and output deviations. The Taylor rule is an explicit instrument rule, if they are forward-looking in current period, indeed it is an implicit instrument, that is, an equilibrium condition. On the other hand, a targeting rule can minimize loss function, which central bank has perfect control over the goal variables and there is no intertemporal and intratemporal trade-off between the goal variables Svensson (1999).

As mentioned by Svensson (2002), inflation targeting can be defined as three characteristics that are a numerical inflation target, inflation forecast targeting, and a high degree of transparency and accountabilility. The first characteristic refers to a point target or a target range, which is referring to a specific price index. The primary objective of monetary policy is to achieve the inflation target. There is no other nominal anchor, like an exchange rate target or a money growth target. Secondly, a decision making process which the central bank's inflation forecast has a prominent rule and the instrument is set such that the inflation forecast conditional in the instrument setting is consistent with the target. Thirdly, the high degree of transparency and accountability, which is as in central bank is accountable for achieving the inflation target and provides transparent and explicit monetary-policy reports presenting its forecasts and explaining and motivating its policy.

Similarly in Svensson (1999), inflation targeting can be interpreted as the announcement and assignment of a relatively specific loss function to be minimized by the central bank. The operating procedure, inflation-forecast targeting, can be interpreted as a way of ensuring that first-order conditions for a minimum of the loss function are approximately fulfilled. The high degree of transparency and accountability, especially the published Inflation Reports, can be interpreted as a way for outside observers of verifying that the first-order conditions are fulfilled. As discussed in Faust and Svensson (1998), more transparency makes the central bank's reputation more sensitive to the bank's actions and increases the cost of deviation from the announced policy. Thus, the high degree of transparency increases the incentives for the central bank to minimize the assigned loss function.

Besides, strict and flexible inflation targeting is also important to be considered for allowing a variety of loss function for the central bank as discussed in Svensson  (2000). By examining inflation targeting in a small open economy with forward looking aggregate supply and demand with micro-foundations, and with stylized realistic lags in the different monetary-policy transmission channels, and his findings found that flexible CPI inflation targeting does not limit the variability of CPI inflation but also the variability of the output gap and the real exchange rate. Besides, negative productivity supply shocks and positive demand shocks similar effects on inflation and the output gap, and induce similar monetary policy responses.

Under the instrument rule Guender (2003) proposed a simple stochastic macroeconomic model and examines the optimal setting of the policy parameter under inflation targeting. The optimal value for the parameter in the instrument rule depends on the sources of uncertainty, the preferences of the policy maker, and also on the policy parameter. Policy parameter also depends positively with variance of IS shocks

relative to cost-push shocks, whereas negatively related with variability in the rate of inflation relative to output. In general, given finite values for the policymaker's preference parameter and the variances of the two disturbances, optimal value of instrument rule assumes a strictly positive and finite value.

Granville and Mallick (2006) investigate the relation between the interest rate, inflation rate, exchange rate, and money supply in Russia since 1992. The result showed that interest rate responded more to changes in the exchange rate than to inflation rate. Whereas, in the long-run inflation determined interest rates, they have shown that in the short-run, nominal interest rate has negatively reacted to inflation, whereas inflation reacts positively to interest rate. Using an error-correction mechanism they find that, similar to Mishkin (1992), the short-run adjustment of interest rates to inflation, exchange rate, and money growth is very slow, only at the rate of 6.8%. This suggests that the interest rate is not targeted by the central bank as a direct instrument of monetary control. This is not surprising in economies in transition and especially in Russia where the mechanisms of monetary transmission and financial intermediation took long periods to be put in place and are still in need of reform and regulation. He also suggested that Russia should adopt a pre-announced inflation target which would coordinate expectations and thus generate a more stable inflation scenario for the economy.

However, Wesche and Gerlach (2008) have found money growth is helpful in guarding against the development of inflation pressures and in setting monetary policy in Switzerland. They also found that the fluctuation in steady state inflation depends on low-frequency money growth and output gap. However, historically Switzerland has low and stable inflation in which money growth and velocity changes are

negatively correlated. Second, at higher frequencies the output gap Granger causes inflation

Exchange rate plays an important role in the discussion of inflation targeting, and it has several important consequences. Svensson (2000) explained that the exchange rate allows additional channels for the transmission of monetary policy. In an open economy, the real exchange rate will affect the relative price between domestic and foreign goods, which, in turn, will affect both domestic and foreign demand for domestic goods, and hence contribute to the aggregate-demand channel for the transmission of monetary policy. There is also a direct exchange rate channel for the transmission of monetary policy to inflation, in that the exchange rate affects domestic currency prices of imported final goods, which enter the consumer price index (CPI) and hence CPI inflation. Typically, the lag of this direct exchange rate channel is considered to be shorter than that of the aggregate demand channel. Hence, by inducing exchange rate movements, monetary policy can affect CPI inflation with a shorter lag. Finally, there is an additional exchange rate channel to inflation: The exchange rate will affect the domestic currency prices of imported intermediate inputs. Eventually, it will also affect nominal wages via the effect of the CPI on wage-setting. In both cases, it will affect the cost of domestically produced goods, and hence domestic inflation (inflation in the prices of domestically produced goods).

This paper only mentions two different measures of output gap. Firstly, there are theory-free univariate time series models, of which the Hodrick-Prescott (1997) filter is the most prominent example. Secondly, there are multivariate models built on well-known economic relationships, which make use of time series techniques as early referred to Harvey et al. (1986).

Mendez and Palenzuela (2003) estimated multivariate models built on well-known economic relationships, which make use of time series techniques. In their paper three criteria were adopted to assess the reliability of an output gap. Firstly, the estimation should have forecasting power over inflation. Secondly, the ex post statistical measures. Thirdly, the estimate of the output gap should be positively correlated with standard measures of capacity utilization. However, their findings show that under multivariate specification unobservable components type models of the output gap show temporal consistency between sequential and final estimates.

However, our research will be concentrated on the Hodrick-Prescott filter in estimating output gaps as proved by Razzak (1997) that has estimated the Hodrick-Prescott technique, and his findings showed that Hodrick-Prescott filter acts as a smoother over the sample and as a true filter at the end of the sample. By using these two different  concepts, the output gap resulting from the true filter is consistent with the policy maker's interpretation of the cyclical component of real output and provides better out-of-sample forecasts of inflation.

Besides, Mise et al. (2005) also applied Hodrick-Prescott filter to their research in applying to economic series as part of the study of business cycles. This technique is suitable for policy makers to make an assessment of whether, and how much, an economic variable is 'above trend'. Therefore if such an issue is important, they implemented adjustment to the filter is desirable. Similarly, the research constructed by Gerlach and Yiu (2004). Their findings also mentioned that Hodrick-Prescott filter is much preferable for constructing output gaps in applied econometrics since it contains much the same information for inflation and other variables that policy makers are interested in.

## 4.    Methodology

### 4.1    The Model

Specifically, our modelling is inspired by Svensson (2000). The model analyses the supply and demand shocks on the inflation and the output gap from the monetary policy responses. The main purpose of this paper is to extend the formal analysis of inflation targeting to a small open economy where the exchange rate and the fiscal impulse are important for conducting monetary policy. Another purpose is to incorporate recent advances in the modelling of backward-looking aggregate supply and demand.

Basically, this model has two structural equations as developed by Golinelli and Rovelli (2005) that can be shown as below:

$$\pi_t = \alpha_{10} + \alpha_{11}y_{t-1} + \alpha_{12}\pi_{t-1}^* + \alpha_{13}\left(e_{t-1} + p_{t-1}^* - p_{t-1}\right) + \varepsilon_{1t} \tag{1}$$

Equation 1 shows the aggregate supply (AS) equation, where domestic inflation $(\pi_t)$ is influenced by the long-run purchasing power parity condition $\left(e_{t-1} + p_{t-1}^* - p_{t-1}\right)$, $e_{t-1}$ is proxy by nominal exchange rate and $p_{t-1}$ and $p_{t-1}^*$ are the domestic and foreign log-levels of prices. Besides, domestic inflation also is driven by the output gap $(y_{t-1})$ and the foreign inflation rate $\pi_{t-1}^*$, whereas $t$ is a time or duration of the series. Since the model is developed by using backward-looking of aggregate supply, therefore the series are estimated by adding lagged of all predetermined variables (lagged endogenous and lagged exogenous variables)

$$y_t = \alpha_{20} + \alpha_{21}y_{t-3} + \alpha_{22}\pi_{t-1} + \alpha_{23}\left[e_{t-2} + p_{t-2}^* - p_{t-2}\right] + \alpha_{24}g_{t-2} + \alpha_{25}i_{t-1} + \varepsilon_{2t}$$

$$\tag{2}$$

Equation 2 shows the aggregate demand (AD) equation that imposed the link of output gap to the nominal interest rate, the real exchange rate, and the government expenditures. Lagged of all the predetermined variables are also added in the model to ensure the link of the variables in the long run. The explanation of the above variables is as follows;

$\pi_t$ is domestic inflation rate, $\pi_t^*$ is foreign inflation rate, $y_t$ is output gap (cyclical component in the HP filter), $e_t + p_t^* - p_t$ is purchasing power parity, $i_t$ is nominal interest rate and $g_t$ is government consumption.

## 4.2 Variables Justifications

Specifically, for estimation purposes the list of variables in this study as follows;

*i) domestic inflation rate ($\pi_t$)*

Domestic growth of price index has been chosen for defining of this variable. Consumer price index is a proxy for price index. The data has been collected from department of statistic in quarterly. Besides, the measure of inflation is using an annualized quarterly change of domestic inflation.

*ii) foreign inflation rate ($\pi^*$)*

US inflation rate has been using for estimating this variable. The reason is to see the relationship between domestic and foreign inflation rate whether it's the major factor that influences the domestic inflation rate. The measuring of the data is using an annualized quarterly change of foreign inflation.

*iii) output gap ($y$)*

Capacity utilization is proxy for output gap. We use the Hodrick-Prescott (HP) filter to construct trend output. The Hodrick-Prescott (1997) filter decomposes a time series into growth and cyclical components $(y_t = y_t^g + y_t^c)$, where $y_t$ is the natural

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logarithm of an observed time series and $y_t^g$ and $y_t^c$ are the growth and cyclical components respectively. The filter is given by:

$$\min_{y_t^g} = \sum_{t=1}^{T}\left(y_t - y_t^g\right)^2 + \lambda\sum_{t=1}^{T}\left[\left(y_{t+1}^g - y_t^g\right) - \left(y_t^g - y_{t-1}^g\right)^2\right]$$

(3)

Hodrick and Prescott (1997) minimize the variance of $y_t^c$ subject to a penalty for variations in the second difference of the growth term, where $\lambda$ controls the smoothness of $y_t^g$. The minimization of (3) provides a mapping from $y_t$ to $y_t^g$ with $y_t^c$ determined residually. The filter is computed by applying the HP technique with $\lambda$ equal 1600 to real GDP data, running it over a sample from 1991:Q1 to 2006:Q1. According to Hodrick and Prescott (1997) filter is to decompose a time series such as real GDP into a trend component that is for potential output and a cyclical component that is output gap. Therefore, cyclical component has been calculated from the HP filter as a proxy of output gap in this research.

*iv) purchasing power parity (PPP)*

PPP is a good indicator for measuring the ability of domestic citizen to buy goods and services in the country. Thus, nominal exchange rate that been added with the foreign price index and deducted with domestic price index. Therefore, this variable also can be identified as a real exchange rate.

*v) nominal interest rate* $(i_t)$

Three month interbank rate has been chosen as a policy instrument in the KLIBOR market. The three months interbank rate is also the best candidate for a monetary policy variable because the Central Bank of Malaysia (CBM) has directly influenced the interbank rate through its intervention in the money market.

*vi) government consumption* $(g_t)$

This variable measures the government consumption on currently final goods and services. It also as a good proxy of fiscal policy in influencing the aggregate demand.

### 4.3    Data

Therefore, in order to estimate the backward looking aggregate supply (AS) and aggregate demand (AD), this study have used the quarterly data from 1991:1 to 2006:1. All the variables are in logs, except nominal interest rate. The data set are collected from the Monthly Bulletin of the Central Bank of Malaysia, International Financial Statistics (IFS) and Department of Statistics Malaysia.

### 4.4    Estimation Method

A structural econometrics model (SEM) will be using, which simultaneously estimate the equations developed above. The reason for using a structural econometric model (SEM) it is well suited to analyze the transmission mechanism, although their data requirements are quite demanding and this makes them hard to implement for transition economies. According to Hsiao (1997a, 1997b) the structural equation approach for estimation and testing still valid even when some regressors are non-stationary, provided they are cointegrated. Therefore, a two-stage least squares approach (2SLS) is applied to estimate the model developed. Therefore simultaneity exists in this model because there is interdependence among the endogenous variables. Thus, $\pi_t$ affects $y_t$, and $y_t$ affects $\pi_t$.

For applying a 2SLS we have to involve two successive applications of OLS. The process is as follows; In stage 1, we need to get rid the correlation between $\pi_t$ and $\varepsilon_{2t}$. Firstly, we have to regress $\pi_t$ on all the predetermined variables (lagged

endogenous and lagged exogenous) in the whole system, and also $y_t$ on all the predetermined variables. This goal is accomplished by performing the reduced-form regression of $\pi_t$, and $y_t$ on all the predetermined variables (lagged endogenous and lagged exogenous) in the system (stage 1), obtaining the estimates $\hat{\pi}_t$, and $\hat{y}_t$, then replacing $\pi_t$, and $y_t$ in the original equation by the estimated $\hat{\pi}_t$, and $\hat{y}_t$, and then applying OLS to the equation thus transformed (stage 2).

To illustrate 2SLS further, let us modify the model above as follows:

$$\pi_t = \hat{\Pi}_{10} + \hat{\Pi}_{11}\pi_{t-1}^* + \hat{\Pi}_{12}\left(e_{t-1} + p_{t-1}^* - p_{t-1}\right) + \hat{\Pi}_{13}i_{t-1} + \hat{\Pi}_{14}g_{t-1} + \varepsilon_{1t} \tag{4}$$

$$y_t = \hat{\Pi}_{20} + \hat{\Pi}_{21}y_{t-3} + \hat{\Pi}_{22}\pi_{t-1}^* + \hat{\Pi}_{23}\left(e_{t-2} + p_{t-2}^* - p_{t-2}\right) + \hat{\Pi}_{24}i_{t-1} + \hat{\Pi}_{25}g_{t-2} + \varepsilon_{2t} \tag{5}$$

where $\varepsilon_t$'s are the usual OLS residuals. From equation (4) and (5) we obtain

$$\hat{\pi}_t = \hat{\Pi}_{10} + \hat{\Pi}_{11}\pi_{t-1}^* + \hat{\Pi}_{12}\left(e_{t-1} + p_{t-1}^* - p_{t-1}\right) + \hat{\Pi}_{13}i_{t-1} + \hat{\Pi}_{14}g_{t-1} \tag{6}$$

$$\hat{y}_t = \hat{\Pi}_{20} + \hat{\Pi}_{21}y_{t-3} + \hat{\Pi}_{22}\pi_{t-1}^* + \hat{\Pi}_{23}\left(e_{t-2} + p_{t-2}^* - p_{t-2}\right) + \hat{\Pi}_{24}i_{t-1} + \hat{\Pi}_{25}g_{t-2} \tag{7}$$

Where, $\pi_t$ is an estimated of the mean value of $\pi$ conditional upon the fixed predetermined variables. Equation (4) and (5) now can be expressed as;

$$\pi_t = \hat{\pi}_t + \hat{\varepsilon}_{1t} \tag{8}$$

$$y_t = \hat{y}_t + \hat{\varepsilon}_{2t} \tag{9}$$

Equation (8) and (9) shows that the stochastic $\pi$ and $y$ consist of two parts; $\pi_t$ and $y_t$, which is a linear combination of non stochastic predetermined variables, and a random components. Under classical OLS theory, $\hat{\pi}_t$ and $\varepsilon_{1t}$ and $\hat{y}_t$ and $\hat{\varepsilon}_{2t}$ are assumed to be uncorrelated.

Following are the process of stage 2. In this stage we replace $\pi_t$ and $y_t$ in the original (structural) equations by their estimated value from the preceding two regressions and then run the OLS regressions as follows:

$$\pi_t = \alpha_{10} + \alpha_{11}\hat{y}_{t-1} + \alpha_{12}\pi^*_{t\wedge 1} + \alpha_{13}(e_{t-1} + p^*_{t-1} - p_{t-1}) + \varepsilon^*_{1t} \tag{10}$$

$$y_t = \alpha_{20} + \alpha_{21}y_{t-3} + \alpha_{22}\pi_{t-1} + \alpha_{23}(e_{t-2} + p^*_{t-2} - p_{t-2}) + \alpha_{24}g_{t-2} + \alpha_{25}i_{t-1} + \varepsilon^*_{2t} \tag{11}$$

where $\varepsilon^*_{1t} = \varepsilon_{1t} + \alpha_{12}\varepsilon_{2t}$ and $\varepsilon^*_{2t} = \varepsilon_{2t} + \alpha_{21}\varepsilon_{1t}$. Thus, the estimations will be consistent.

## 5. Empirical Results

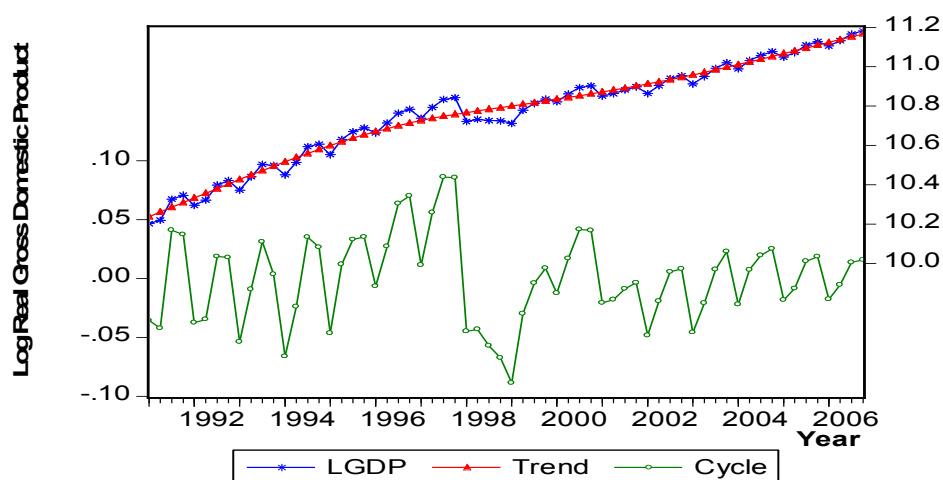**Figure 1: Hodrick-Prescott Filter Application.**



Figure 1 plot two output gap measures obtained from the Hodrick-Prescott filter and smoother with λ equal 1600 using quarterly data for Malaysia from 1991q1 to 2006q4. The HP application acts as a smoother of real GDP that known as a trend component for potential output, and as a true filter at the end of the sample as a cyclical component that for output gap. These two different concepts, the output gap resulting from the filter is consistent with the policy maker's interpretation of the

cyclical component of real output and provides better out-of-sample forecasts of inflation.

The output gap resulting from the filter is negative up to 2000, and ambiguous thereafter, while the output gap resulting from the smoother is positive for the whole period. The filter's measure of the output gap is more variable than that from the smoother. Gives there differences between the properties of the output gap resulting from the smoother and that from the filter, we should be concerned about the economic interpretation of these output gaps. If the policy maker is interested in the current output gap, then the smoother conveys misleading information about the output gap. However, it is shown that the filter or cyclical output outperforms the smoother or trend output by producing better out-of-sample inflation forecasts from Malaysia sample.

Below are the results of the two-stage least square (2SLS) test.

### Table 1 Aggregate Supply Result (Dependent: Domestic Inflation)

| Variable | Coefficient | t-Statistic | Prob. |
|:---:|:---:|:---:|:---:|
| C | 0.072627 | 0.057523 | 0.9545 |
| Output Gap(-1) | 7.682916 | 2.361546 | 0.0245** |
| Foreign Inflation(-1) | 0.881482 | 1.268684 | 0.2137 |
| PPP(-1) | -0.179483 | -0.153093 | 0.8793 |

Note: *,** and *** indicate significance at the 1%, 5% and 10% levels, respectively.

Table 1 shows the results of the aggregate supply by using the 2SLS method. The pressure on domestic inflation from output gap is well identified. To ensure that domestic inflation converges to the foreign inflation rate in the long run, therefore a homogeneity condition has been imposed. However, the restriction is not rejected for

Malaysia for its coefficient is at 0.881482 and p-value 0.2137. Similarly, we find no link between real exchange rate and domestic inflation.

Nevertheless, our result shows that output gap or capacity utilization is statistically significantly correlated with the domestic inflation at 5% critical value (p-value = 0.0354) in the long run which is 7.682916 coefficient value. This means that 1% increase in output gap in previous year would increase the domestic inflation in the current year at 7.68%. Indeed, there is no satisfying converges between the variables, but the link between the variables is positively correlated.

**Table 2 Aggregate Demand Result (Dependent: Output Gap)**

| Variable | Coefficient | t-Statistic | Prob. |
|---|---|---|---|
| C | 1.061863 | 1.546447 | 0.1346 |
| Output Gap(-3) | 0.419190 | 1.870005 | 0.0732*** |
| Domestic inflation(-1) | -0.005221 | -0.406594 | 0.6878 |
| PPP(-2) | -0.043747 | -0.434916 | 0.6674 |
| Government Consumption(-2) | -0.108876 | -1.196199 | 0.2428 |
| Three month interbank rate(-1) | -0.012209 | -2.272204 | 0.0319** |

Note: *,** and *** indicate significance at the 1%, 5% and 10% levels, respectively.

Table 2 shows the result of the aggregate demand equation 2. As can be seen from the table only nominal interest rate and lag 3 output gap are correlated and significant with the output gap in the long run at coefficient value -0.012209 and 0.419190 respectively. This imposes that in the long run the changes in the nominal interest rate would influence output gap which in turn stabilizes the inflation at a lower rate.

Nevertheless, other variables are failed to prove correlated with the output gap. For example, government consumption as a proxy of fiscal policy is not significant in influencing the output gap, similarly with the domestic inflation and real exchange rate that are highly unaffected the output gap.

## 6.    Summary and Conclusions

This paper investigates the implementation of monetary policy under inflation rate targeting in a small-open economy, i.e. Malaysia by estimating the backward-looking model of aggregate supply (AS) and aggregate demand (AD). Several aspects of the results discusses in this paper are worth emphasizing. First, output gap has been found to be correlated with the domestic inflation rate. Therefore, domestic inflation rate can be classified as endogenous variable since output gap is statistically significant influenced inflation. Otherwise, we failed to prove the opposite relationship between these two variables as can be shown in AD model. Secondly, foreign inflation is not significant in the AS model. Therefore, the change in domestic inflation is not influenced by the foreign disturbances.  Similarly, purchasing power parity also is not important in influencing domestic inflation rate in our model. Explanation to the above results conclude that monetary policy applied in Malaysia only consider the output gap to influence the level of domestic inflation rate which otherwise are not important in transmission mechanism of monetary policy in AS model.

However, in AD model nominal interest rate has been proved to have a significance relationship with output gap, otherwise for the other variables. This showed that fiscal policy and real exchange rate are not important in influencing the ratio of output gap in forecasting the domestic inflation rate. Indeed, it is essential for

policy makers maintaining the interest rate at certain level in order to achieve a target of low inflation rate.

Ultimately, our paper has proved the importance of output gap in predicting or achieving the domestic inflation rate which is controlled by instrumental variable such as interest rate as intermediate target. Therefore, inflation targeting in this case can be categorized as central bank's inflation forecast by setting the instrument in order to achieve the ultimate goal.

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