ANALISIS 5(1&2), 33-45 (1998)

THE APPLICABILITY OF THE P-STAR APPROACH OF MODELLING INFLATION IN A DEVELOPING COUNTRY: THE CASE OF MALAYSIA

MUZAFAR SHAH HABIBULLAH
Department of Economics
Universiti Putra Malaysia

ABSTRACT

The P-Star approach of modelling inflation proposed by Hallman et al. (1989) has been widely tested for the United States and other developed countries. However, the applicability of the P-Star model for the developing countries is yet to be determined. Thus, the main purpose of the present paper is to add to the current literature on the robustness of the P-Star approach by testing it with respect to a developing country—Malaysia. Using a sample period of 1981:1 to 1994:4, our results suggest that the monetary data for Malaysia do not support the P-Star model approach of modelling inflation.

ABSTRAK

Kaedah 'P-Star' yang dicadangkan oleh Hallman et al. (1989) untuk membentuk model inflasi telah meluas digunakan di Amerika Syarikat dan negara-negara membangun yang lain. Walau bagaimanapun, penggunaan model ini terhadap negara-negara sedang membangun amatlah kurang sekali. Justeru itu, tujuan utama kertas kerja ini adalah untuk menguji kesesuaian model 'P-Star' ini terhadap data-data negara sedang membangun seperti Malaysia. Menggunakan data siri masa suku tahunan daripada 1981:1 hingga 1994:4, keputusan kajian ini mencadangkan bahawa data-data kewangan tidak menyokong kaedah'P-Star' dalam pembentukan model inflasi di Malaysia.

INTRODUCTION

The purpose of this paper is twofold. The first is to investigate the relationship between money and the price level in Malaysia using the P-Star approach recently proposed by Hallman et al. (1989). Despite financial deregulation and innovations in the United States in the 1980s, using the P-Star model, Hallman et al. (1989) found out that 'P* ties together the level of money and prices very well, and the model was able to track inflation movements successfully. Since then there has been widespread application of the P-Star approach of modelling inflation to other developed countries. However, the applicability of the P-Star model approach for the developing countries has yet to be determined. The second purpose is to propose, construct and investigate the performance of the Divisia monetary aggregate as an alternative to the 'conventional' Simple-sum aggregate as an intermediate indicator in Malaysia. Recent developments in monetary economics suggest that the Divisia aggregate is the appropriate measure of money as it measures the monetary services for holding money, and empirical studies in developed countries indicate that Divisia money is superior to the 'conventional' Simple-sum aggregate.

The plan of the paper is as follows. Section 2 presents the derivation of the P-Star (p^*) model. In Section 3, we discuss the computation of p^*, followed by a discussion on the construction of the Divisia aggregate and sources of data used in the analysis. The empirical results are presented in Section 4. The last section contains the main conclusions.

THE P-STAR (P*) MODEL APPROACH

In recent times Hallman et al. (1989) have proposed a simpler model of inflation. In their model, the discrepancy between actual price level and the equilibrium price level is the key determinant of inflation. The equilibrium price level or the so-called P-Star (P^*) is determined by the level of money stock, the equilibrium velocity (V^*) and the potential output (Q^*). Using quarterly data covering the period 1970 to 1988 for the United States, Hallman et al. (1991, p. 857) concluded that: "P*, through its dependence on long-run values of velocity and output, can be used to indicate long-term price developments."

The P^* approach is based on the equation of exchange,

$$PQ = MV \tag{1}$$

where the product of the price level (P) and real GNP (Q) equals the stock of money (M), multiplied by its velocity (V). Taking logarithms (lower-case notation) for equation (1) gives,

$$p + q = m + v \tag{2}$$

From equation (2), the price level can be expressed as,

$$p = m + v - q \tag{3}$$

According to Hallman et al. (1991), the equilibrium price level (p^*) is written as,

$$p^* = m + v^* - q^* \tag{4}$$

where v^* is the equilibrium level of velocity and q^* is the real potential output. equation (4) says that the equilibrium price level, p^*, is defined as money stock per unit of real potential output and the long-run equilibrium level of the velocity of money. Substracting equation (4) from equation (3) gives the P-Star model derived by Hallman et al. (1989, 1991),

$$p - p^* = (v - v^*) + (q^* - q) \tag{5}$$

According to equation (5), the gap between the actual and equilibrium prices, p-p^*, is determined by a velocity gap, v-v^*, and an output gap, q^*-q. The P-Star model indicates inflationary pressure if there is a monetary overhang, that is when current velocity is below its long-run equilibrium level or current output is raised above its potential level or both.

Hallman et al. (1991) hypothesize that in the long-run, the discrepancy between actual and equilibrium prices, $p - p^*$, becomes zero as p adjusts to p^*. Assuming the long-run relationship between p and p^*, the short-run dynamic model of inflation was estimated from the following model,

$$\Delta\pi_\tau = \alpha(p_{t-1} - p^*_{t-1}) + \Sigma_{i=1}^{K} \beta_i \Delta\pi_{\tau-i} + \varepsilon_t \tag{6}$$

where π is the rate of inflation (equal to $p_t - p_{t-1}$) and α is the speed of adjustment of actual prices to p^* and should be negative.

A central issue in empirical testing of the P-Star modelling approach is how to measure potential output (q^*) and equilibrium velocity (v^*) since these two series are unobservable. In this study we used three methods of deriving equilibrium values for velocities and output. The three methods used are (i) the simple linear trend, (ii) the quadratic trend and (iii) the Hodrick-Prescott filter approach to determine potential output and equilibrium velocity. However, the latter method is a common procedure for estimating trends, particularly in the business cycle literature. In implementing the P-Star approach, Hoeller and Poret (1991) and Kool and Tatom (1994) applied the HP-filter to compute the potential output and equilibrium velocity. Hoeller and Poret (1991) and Razzak and Dennis (1996) have pointed out that the HP-filter is easy to implement (compared with the more complicated Kalman filter) and the trends it produces usually appear 'plausible'.

According to Hodrick and Prescott (1980), the filter is designed to produce a non-linear trend based on the variability of the series by minimising the following problem[1]:

$$\sum_{t=1}^{T} (y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \qquad (7)$$

where y is the time series, τ is the trend component series (τ_t, t = 1,...,T) and λ is a fixed parameter. The first term is the sum of the squared deviations between the contemporaneous trend values and the original series. The second term is a multiple, λ, of the sum of the squares of the trend component's second differences. Hodrick and Prescott claimed that λ can be interpreted as a measure of the relative differences of the trend component. If $\lambda = 0$, the growth component series coincides with the original series and the cyclical component is zero. If λ goes to infinity, the trend component approaches a linear deterministic time trend. Hodrick and Prescott proposed a value of $\lambda = 1600$ as reasonable for quarterly time series data and their recommendation has been widely followed in the literature applying the HP-filter[2].

Sources and Descriptions of Data Used

In this study, quarterly time series data for the period 1981:1 to 1994:4 have been used. For the purpose of this study, consumer price index has been employed as a measure of price level for Malaysia. Since there is no a priori evidence which measure of money should be used—narrow or broad money, both monetary aggregates M1 and M2 have been used for the construction of p*. Empirical studies have shown that different monetary aggregates used to construct p*, have different implications on the performance of the P-Star approach. For example, in the United States, Hallman et al. (1991) have indicated that M2 can be a good anchor for the price level, but Tatom (1990) on the other hand, suggests that money and price level are linked when M1 is used to construct p*. For France, Bordes et al. (1993) found out that, amongst the monetary aggregates M1, M2 and M3 used to calculate p*, their analysis suggest that a long-run relationship between money and the price level was established using M1 and M2. In contrast, Todter and Reimers (1994) found that amongst the three monetary aggregates (M1, M2 and M3), 'the best results were obtained when M3 is used to estimate the equilibrium price'. In this study, as an alternative to the above 'conventional' Simple-sum M1 and M2, 'weighted' monetary aggregates have been introduced, particularly Divisia M1 and M2 for Malaysia[3]. The reason for considering Divisia aggregate is that the traditional Simple-sum monetary aggregate is not a good measure of the monetary services of a country. According to Barnett (1980), the assumption made in constructing the Simple-sum aggregate, which is based on their components receiving equal weights of one, are contrary to the voluminous studies existing in the literature which indicate that each monetary asset has a certain degree of 'moneyness' associated with it. Therefore, according to the proponents of the Divisia approach, it is not which assets are to be included in the measure of money stock which is important, but rather how much of each monetary asset is to be included. This points to the conclusion that each component should be given a different weight when adding the various components of financial assets to arrive at the official monetary aggregates.

Following Barnett (1980), a Divisia monetary aggregate is constructed in the following manner: Let q_{it} and p_{it} represent the quantities and user costs of each asset to be included in the aggregate at time t. The expenditure share on the services of monetary asset i in period t is:

$$s_{it} = p_{it}q_{it} / \Sigma_j p_{jt} q_{jt}. \tag{8}$$

The user cost (see Barnett, 1978) of each asset is measured as:

$$p_{it} = (R_t - r_{i,j}) / (1 + R_t) \tag{9}$$

where R_t is the benchmark rate, the maximum r_j and r_i [i = 1, 2, ..., n). j = 1, 2, ..k. $i \neq j$]. The growth rate of a Divisia aggregate then can be written as,

$$G(Q_t) = \textstyle\sum_{i=1}^{n} S_{it}^{*} G(q_{it}) \tag{10}$$

where $s_{it}^* = 0.5(s_{it}+s_{it-1})$ and n is the number of assets in the aggregate. Single period changes, beginning with a base period, can be accumulated to determine the level of the Divisia aggregate in each succeeding period.

Details of the monetary components and their respective user costs in constructing the Divisia monetary aggregates are presented in Table 1. In Table 1, the rate of returns on currency is assumed to be zero since it is a perfectly liquid asset. On the other hand, although the explicit rate of return on demand deposits is also zero, Offenbacher (1980) and Barnett et al. (1981) strongly argue that an implicit rate of return must be imputed to demand deposits, if the substitutability between currency and demand deposits is to be estimable. Barnett (1982: 699) proposes that, "In some cases implicit rates of return must be used in computing the interest rates in the formula p_i especially when the own rate of return on an asset is subject to governmental rate regulation. An implicit imputation is also used in the measurement of R. The Divisia quantity index has been found to be robust to those imputations within the plausible ranges of error in the imputation".

Table 1
Information Used to Construct Divisia Aggregates

Money	Asset Components	Rate of Returns
M1	Currency in circulation	Zero
	Demand deposits	Implicit rate of return. Using Klein's (1974) method. The basic formula for computing Demand deposit rate of return (DDr) is as follows; DDr = r_L*(1-RRDD), where r_L is comercial bank's base lending rate (percent p.a.), and RRDD is reserve requirement on demand deposits.
M2	Saving deposits	Savings deposit rate (SDr) in percent p.a.
	Fixed deposits	Fixed deposit rate (FDr). FDR= max $[(r_i)]$, where i = 1,3, 6, 9 & 12 months maturity (percent p.a).
	Negotiable Certificate of Deposits	Rate on NCDs (NCDr). Proxied with the Interbank rates, r. NCDr= max$[(r_i)]$, where i = overnight, 7-days, 1 month & 3-months call money (percent p.a.).
	Repurchase agreement (Repos)	Repo rate (REPOr). Proxied with the call money rate at discount houses, r. REPOr=max$[(r_i)]$, where i=3, 6 & 12-months maturity (percent p.a.).
	Benchmark asset	*Maximum available rate. Max = {[DD_r, SDr_i, TDr_i, NCDr, REPOr,r_j] + 0.1], where i = rates at commercial banks and Finance companies; j= Treasury bill rates (3, 6 & 12-months) and yield on Govern ment securities (5 & 20 years).*

However, the proper implicit rate imputation to demand deposits remains an open issue. Following Offenbacher (1980), the approach taken in this study is to compute an implicit rate using Klein's (1974) methodology. The formula used for constructing the implicit rate on demand deposits (DDr) is given as follows:

$$DDr = r_L\,[1 - (BR/DD)] \tag{11}$$

where r_L is the rate of return on bank's earning assets and BR is bank reserves on demand deposits. As for the benchmark assets, as shown in Table 1, we follow the envelope approach, that is, a series of benchmark rates is formed by selecting that benchmark rate which is higher than the rate of return of each of the monetary asset components. This will ensure that $p_i \geq 0$ (see Mullineux, 1986). Furthermore, Binner (1990) proposes adding 0.10 points to the benchmark rate to ensure that this rate will be non-zero.

For output, total exports as proxy for nominal income have been used since gross national product for Malaysia is only available in annual form. The rationale for using exports as proxy for income in a developing country has been supported by numerous empirical studies, for example by Tyler (1981), Ram (1987), and Odedokun (1991). These studies have empirically detected positive and significant effects of export expansion on economic growth[4].Furthermore, recent findings by Dutt and Ghosh (1994, 1996) indicate that exports and economic growth are co-integrated in the majority of the developing countries investigated. This implies that exports are a good candidate to proxy for income in a developing country like Malaysia. To arrive at the output measures, the value of total exports is deflated by the consumer price index.

Data on the consumer price index, total exports, and monetary aggregates and their components were compiled from various issues of *SEACEN Financial Statistics-Money and Banking* published by the SEACEN Centre, and *International Financial Statistics* which is published by the International Monetary Fund.

DISCUSSION ON EMPIRICAL RESULTS

Table 2 reports the results from estimating equation (6) using all three methods of deriving v* and q*. For each method all four monetary aggregates used to construct p* have been estimated. In all equations estimated the constants have been excluded since they are not significantly different from zero. The number of lagged dependent variables used to obtain no serial correlation in the residuals varies between three and four-quarter periods.

The results in Table 2 suggest that the inflation equations can be explained satisfactorily by the lagged inflation in the first-difference as the main determinants for Malaysia. These results are consistent for all three methods used in deriving v*, and also for all four monetary aggregates used to construct p*. Although most of the price gap values correctly have a negative sign, they were insignificantly different from zero. In summary, the above results suggest that Malaysian monetary data do not support the Hallman et al. P-Star approach in modelling inflation in a developing country. The above results are in contradiction to the results obtained by Hoeller and Poret (1991) on the OECD countries. Hoeller and Poret employed the linear trend and the HP-filter to compute v* and q*, and both methods fit the model quite well with the latter further improving the fit of the equations.

Nevertheless, the validity of the P-Star approach has been questioned on fundamental grounds. For instance, Tatom (1992) and Kool and Tatom (1994) have pointed out that the non-stationarity of the price gap is sufficient to

Table 2
Regression Results: P-Star Model Using Different Measures of Equilibrium Velocity

Independent variables	Simple Linear Trend				Quadratic				Hodrick-Prescott Filter			
	Simple-sum M1	Simple-sum M2	Divisia M1	Divisia M2	Simple-sum M1	Simple-sum M2	Divisia M1	Divisia M2	Simple-sum M1	Simple-sun M2	Divisia M1	Divisia M2
$P_{t-1}-P^*_{t-1}$	0.0033	0.0072	0.0031	-0.0289	-0.0184	-0.0109	-0.0276	-0.0420	-0.0201	-0.0182	-0.0359	-0.0436
	(0.3385)	(0.3479)	(0.1930)	(1.0727)	(0.8882)	(0.3602)	(0.9685)	(1.5009)	(0.9212)	(0.4298)	(1.1086)	(1.3733)
$\Delta\pi_{t-1}$	-0.7937	-0.7931	-0.7913	-0.8391	-0.7876	-0.7886	-0.7919	-0.8544	-0.8315	-0.8228	-0.8325	-0.8481
	(5.6231)**	(5.6263)**	(5.6105)**	(5.9867)**	(5.6428)**	(5.6112)**	(5.6820)**	(6.1405)**	(5.9181)**	(5.8910)**	(5.9504)**	(6.0851)**
$\Delta\pi_{t-2}$	-0.3847	-0.3839	-0.3807	-0.5823	-0.3818	-0.3782	-0.3902	-0.6033	-0.5723	-0.5697	-0.5834	-0.5935
	(2.4603)**	(2.4606)**	(2.4426)**	(3.3400)**	(2.4387)**	(2.4387)**	(2.5292)**	(3.4817)**	(3.2761)**	(3.2352)**	(3.3484)**	(3.4228)**
$\Delta\pi_{t-3}$	-0.2307	-0.2298	-0.2277	-0.4574	-0.2200	-0.2234	-0.2236	-0.4702	-0.4485	-0.4475	-0.4549	0.4617
	(1.9510)*	(1.9503)*	(1.9296)*	(2.8607)**	(1.8922)*	(1.9090)*	(1.9278)*	(2.9717)**	(2.7901)**	(2.7397)**	(2.8473)**	(2.9100)
$\Delta\pi_{t-4}$				-0.1072				-0.1197	-0.1074	-0.1023	-0.1046	-0.1151
				(0.9208)				(1.0362)	(0.9191)	(0.8679)	(0.8994)	(0.9943)
R-squared	0.435	0.435	0.434	0.488	0.443	0.435	0.444	0.499	0.484	0.477	0.488	0.496
SER	0.007	0.007	0.007	0.006	0.007	0.007	0.007	0.006	0.006	0.006	0.006	0.006
D.W.	2.04	2.04	2.04	2.09	1.98	2.01	1.97	2.09	2.07	2.09	2.05	2.08
LM(4)	6.362	6.588	6.208	3.041	5.725	6.608	6.208	3.332	1.814	3.105	1.632	2.815
	[0.173]	[0.159]	[0.184]	[0.550]	[0.220]	[0.158]	[0.184]	[0.503]	[0.769]	[0.540]	[0.803]	[0.589]

Notes: SER and D.W. denote the standard error of regression and Durbin-Watson statistic respectively. LM(4) is the Breusch and Godfrey's Langrange Multiplier test for residual serial correlation of the fourth-order process. The LM Chi-square statistic for serial correlation with four lags, with four degrees of freedom at the 5 percent level is 9.48.
Number in parentheses (.) and [.] are respectively, t-statistics and p-values.
Asterisks (**) and (*) denote statistically significant at the five and ten percent level respectively.

invalidate the P-Star model approach. The non-stationarity of p-p* implies that the hypothesis that p tends to equal p* in the long-run is rejected. For further analysis, non-stationarity tests have been conducted on the price gap, p-p*, using the standard augmenting Dickey-Fuller (ADF) test (Said and Dickey, 1984), and the results are presented in Table 3. The results indicate that the null hypothesis of a unit root cannot be rejected for the majority of the monetary aggregates used to construct p* in Malaysia. Only in the case of Divisia M1 can the null hypothesis of unit root be rejected.

Table 3

Results of the ADF Unit Root Tests for the Price Gap Series

Price gap series	t_{ADF}	Lags	LM(4)
A. Simple linear trend			
Simple-sum M1	-1.58	4	7.88
Simple-sum M2	-1.30	0	2.58
Divisia M1	-2.41	7	7.21
Divisia M2	-2.12	4	5.17
B. Quadratic trend			
Simple-sum M1	-2.58	8	7.14
Simple-sum M2	-2.06	12	6.65
Divisia M1	-3.53*	5	4.03
Divisia M2	-2.70	4	4.85
C. Hodrick-Prescott filter			
Simple-sum M1	-2.51	8	7.53
Simple-sum M2	-3.38	4	5.77
Divisia M1	-3.79*	5	4.37
Divisia M2	-2.88	4	5.23

Notes: The relevant tests are derived from the OLS estimation of the following augmented Dickey-Fuller (ADF) regression:

$$\Delta y_t = a + bt + \beta y_{t-1} + \Sigma \quad d_i y_{t-i} + v_t$$

where Δ is the difference operator, t is a linear time trend and v is the disturbance term. The hypothesis that a series contains a unit root is tested by Ho : $\beta = 0$ while the hypothesis that the series is non-stationary with a stochastic trend rather than a deterministic time trend is tested by $H_0 : b = -\beta$. Rejection of the latter hypothesis suggests the existence of a deterministic trend. τ_τ is the t-statistics for testing the significance of β when a time trend is included in the above equation. In determining the lag length n, we started with one lagged regressor, and proceeded by adding an extra lagged term to the regression until the t-statistic on the last lagged term was greater than 1.6

(approximately the 10% critical critical bound) and the error was white noise. If the error was not white noise the process was repeated by adding another lagged term until the t-statistic on the last lagged coefficient was greater than 1.6 and the error was checked for white noise. LM(4) is the Breusch and Godfrey's Lagrange Multiplier test for residual serial correlation of the fourth-order process.
The calculated statistics are those computed in MacKinnon (1991). The critical value at 5 percent for T = 50 is -3.49 for τ_{τ}. The LM Chi-square statistics for serial correlation with four lags, with four degree of freedom at the 5 percent level is 9.48. Asterisk (*) denotes statistically significant at the five percent level.

CONCLUSION

Since the work of Hallman et al. (1989) on the use of the P-Star approach for modelling inflation for the United States, there has been widespread application of the P-Star model in other developed countries. Except for a study by Corker and Haas (1991) for South Korea, the applicability of the P-Star model approach for the developing countries has received less attention among researchers. Therefore, the objective of this paper has been to investigate the robustness of the P-Star model approach in determining inflation in a developing country, in this case, Malaysia.

In this study, the Divisia monetary aggregates (both narrow and broad measures) have been introduced as alternatives to the conventional Simple-sum aggregate in calculating p*. Furthermore, the simple linear trend, the quadratic trend and the Hodrick-Prescott filter approaches have been employed to derive the equilibrium velocity and potential output. Generally, the results suggest that Malaysia's monetary data do not support the P-Star model approach in modelling inflation.

The above results have at least two important implications on the study of inflation in Malaysia. First, inflation in Malaysia could be adequately modelled using more determinants than the one suggested by the P-Star approach. Government expenditure, interest rates, wages and salaries, imports, exchange rate and other factors could play important roles in affecting inflation in Malaysia. Incorporating the role of expectations in modelling inflation, however, could further complicate the issue. Second, the P-Star model approach is appropriate if the properties of the time series have been checked before proceeding to further analysis. This has been the approach taken by Corker and Haas (1991) who estimated a velocity function in testing the usefulness of the P-Star model for South Korea. The relationship between income velocity and interest rate was tested for co-integration and the residuals from the co-integrating regression were used as the velocity gap, v-v*, in the calculation of the price gap, p-p*. In this respect, the latter approach in modelling inflation for Malaysia is under investigation.

ENDNOTES

1. See also Kydland and Prescott (1990).
2. The HP-filter has been criticised on several grounds, which among others are (a) the computation of the trend component is sensitive to the choice of k, (b) the filter can alter the properties of the series, (c) the filter can lead to spurious cyclical behaviour and (d) the filter can generate business cycle dynamics even if none are present in the original series. See for example King and Rebelo (1993), Jaeger (1994) and Cogley and Nason (1995). Given these strictures, we emphasise that our use of the filter is purely for exploratory purposes.
3. Barnett (1980) stresses that Divisia monetary aggregates is an appropriate measure of monetary services. Barnett and Spindt (1982) have provided a 'Divisia Cookbook' index for the computation of a Divisia aggregate.
4. Furthermore, the use of export will minimise any spurious results that will arise when using income that had been generated using some interpolation technique. Nevertheless, one has to be cautious when interpreting the results.

REFERENCES

Barnett, W.A. (1978). The User Cost of Money, *Economics Letters*, **1**: 145-149.

Barnett, W.A. (1980). Economic Monetary Aggregates: An Application of Index Number and Aggregation Theory, *Journal of Econometrics*, **14**: 11-48.

Barnett, W.A. (1982). The Optimal Level of Monetary Aggregation, *Journal of Money, Credit and Banking*, **14**: 687-710.

Barnett, W.A., Offenbacher, E.K. & Spindt, P.A. (1981). New Concepts of Aggregated Money, *Journal of Finance*, **36**: 497-505.

Barnett, W.A. & Spindt, P.A. (1982). Divisia Monetary Aggregates: Their Compilation, Data and Historical Behavior, Federal Reserve Board Staff Study No. 116, Washington, D.C.: Federal Reserve Board.

Binner, J.M. (1990). The Construction, Interpretation and Analysis of Divisia Monetary Aggregates for the U.K. Unpublished PhD Thesis, The University of Leeds.

Bordes, C., Girardin, E. & Marimoutou, V. (1993). An Evaluation of the Performance of P-Star as an Indicator of Monetary Conditions in the Perspective of EMU: The Case of France, in P. Aretis (ed.), *Money and Banking: Issues for the Twenty-First Century*, Basingstoke and London: MacMillan.

Cogley, T. & Nason, J. (1995). Effects of the Hodrick-Prescott Filter on Trend and Difference Stationary Time Series: Implications for Business Cycles, *Journal of Economic Dynamics and Control*, **19**: 235-278.

Corker, R.J. & Haas, R.D. (1991). Price Pressure Gaps: An Application of P* Using Korean Data. IMF Working Paper WP/91/26, Washington, D.C.: International Monetary Fund.

Dutt, S.D. & Ghosh, D. (1994). An Empirical Investigation of the Export Growth-Economic Growth Relationship, *Applied Economics Letters*, **1**: 44-48.

Dutt, S.D. & Ghosh, D. (1996). The Export Growth-Economic Growth Nexus: A Causality Analysis, *The Journal of Developing Areas*, **30**: 167-182.

Hallman, J.J., Porter, R.D. & Small, D.H. (1989). M2 per Unit of Potential GNP as an Anchor for the Price Level. Staff Study No. 157, Washington, D.C: Board of Governors of the Federal Reserve System.

Hallman, J.J., Porter, R.D. & Small, D.H. (1991). Is the Price Level Tied to the M2 Monetary Aggregate in the Long Run?, *American Economic Review*, **81**(4): 841-858.

Hodrick, R.J. & Prescott, E.C. (1980). Postwar U.S. Business Cycles: An Empirical Investigation, Discussion Paper No. 451, Carnegie-Mellon University.

Hoeller, P. & Poret, P. (1991). Is P-Star a Good Indicator of Inflationary Pressure in OECD Countries?, *OECD Economic Studies*, 17, **Autumn**: 7-29.

International Monetary Fund, (Various issues). *International Financial Statistics*, Washington, D.C.: International Monetary Fund.

Jaeger, A. (1994). Mechanical Detrending by Hodrick-Prescott Filtering: A Note , *Empirical Economics*, **19** : 493-500.

King, R.G. & Rebelo, S.T. (1993). Low Frequency Filtering, and Real Business Cycles, *Journal of Economics Dynamics and Control*, **17** : 207-231.

Klein, B. (1974). Competitive Interest Payments on Bank Deposits and the Long-Run Demand for Money, *American Economic Review*, **64**: 931-949.

Kool, C.J.M. & Tatom, J.A. (1994). The P-Star Model in Five Small Economies, *Federal Reserve Bank of St. Louis Review*, **76(3):** 11-29.

Kydland, F.E. & Prescott, E.C. (1990). Business Cycles: Real Facts and a Monetary Myth, *Federal Reserve Bank of Minneapolis Quarterly Review*, **14** : 3-18.

Mullineux, A. (ed.) (1986). *Financial Innovation, Banking and Monetary Aggregates*, Cheltenham: Edward Elgar.

Odedokun, M.O. (1991). Differential Impacts of Export Expansion on Economic Growth in the LDCs: A Comparison of Evidences Across Regional Income Groups and Between the Decades of 1970s and 1980s, *Eastern Africa Economic Review*, **7**: 69-93.

Offenbacher, E.K. (1980). Economic Monetary Aggregates: Comment, *Journal of Econometrics*, **14**: 55-56.

Ram, R. (1987). Exports and Economic Growth in Developing Countries: Evidence from Time Series and Cross-Section Data, *Economic Development and Cultural Change*, **36**: 51-72.

Razzak, W. & Dennis, R. (1996). The Output Gap Using the Hodrick-Prescott filter with a Non-Constant Smoothing Parameter: An Application to New Zealand, Discussion Paper No. G95/8, Reserve Bank of New Zealand.

Said, S.E. & Dickey, D.A. (1984). Testing for Unit Roots in Autoregressive-Moving Average Models with Unknown Order, *Biometrika,* **71**: 599-607.
SEACEN Centre (Various issues). *SEACEN Financial Statistics-Money and Banking,* Kuala Lumpur: The South East Asian Central Bank (SEACEN) Research and Training Centre.
Tatom, J.A. (1990). The P-Star Approach to the Link Between Money and Prices, *Working Paper No. 90-008,* Federal Reserve Bank of St. Louis.
Tatom, J.A. (1992). The P* Model and Austrian Prices, *Empirica-Austrian Economic Papers,* **19**: *3-17.*
Todter, K.H. & Reimers, H.E. (1994). P-Star as a Link between Money and Prices in Germany, *Weltwirtschaftliches Archiv,* **130:** 273-289.
Tyler, W.G. (1981). Growth and Export Expansion in Developing Countries: Some Empirical Evidence, *Journal of Development Economics,* **15**: 349-363.