



Faculty of Economics and Business

**PREDICTIVE POWERS OF DIVISIA MONETARY
AGGREGATES AND SIMPLE SUM MONEY ON
INFLATION:
COMPARATIVE EVIDENCE FROM MALAYSIA**

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Statement of Originality

The work described in this Final Year Project, entitled
**“PREDICTIVE POWERS OF DIVISIA MONETARY AGGREGATES
AND SIMPLE SUM MONEY ON INFLATION:
COMPARATIVE EVIDENCE FROM MALAYSIA”**
is to the best of the author’s knowledge that of the author except
where due reference is made.

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ABSTRACT

PREDICTIVE POWERS OF DIVISIA MONETARY AGGREGATES AND SIMPLE SUM MONEY ON INFLATION: COMPARATIVE EVIDENCE FROM MALAYSIA

By

Lim Kok Shyong

The weaknesses of simple sum monetary aggregates in both aggregation theory and linkages to macroeconomic variables ultimately led to monetary targeting being replaced by other methods such as inflation targeting and interest rate targeting as monetary policy tools. However, innovation in monetary aggregation theory led to the introduction of Divisia monetary aggregates as an alternative to simple sum money. By using a P-Star model framework in the context of Malaysia, this study investigates the performance of Divisia monetary aggregates in predicting inflationary movements against their simple sum counterparts. The results showed that Divisia M1 is superior to other monetary aggregates used in this study to forecast future inflationary movements in Malaysia. In addition, the P-Star model of inflation is shown to be a valid empirical model to predict inflation for Malaysia.

ABSTRAK

KUASA RAMALAN AGREGAT KEWANGAN DIVISIA DAN WANG PENAMBAHAN MUDAH KE ATAS INFLASI: BUKTI PERBANDINGAN DARI MALAYSIA

Oleh

Lim Kok Shyong

Kelemahan agregat kewangan penambahan mudah dalam teori pengagregatan dan kemerosotan hubungannya dengan pembolehubah ekonomi mengakibatkan sasaran monetari digantikan dengan kaedah yang lain seperti sasaran inflasi dan sasaran kadar faedah sebagai alat polisi kewangan. Namun inovasi dalam kaedah pengagregatan wang telah membawa kemunculan agregat kewangan Divisia sebagai alternatif kepada agregat kewangan penambahan mudah. Dengan menggunakan kaedah P-Star, kajian ini membanding prestasi agregat kewangan Divisia dengan agregat kewangan penambahan mudah dalam meramal pergerakan inflasi di Malaysia. Hasil kajian menunjukkan bahawa Divisia M1 mempunyai prestasi yang terbaik dalam meramal inflasi untuk Malaysia berbanding agregat kewangan yang lain. Di samping itu, kaedah P-Star dibuktikan sebagai model empirikal yang sah bagi meramal inflasi untuk Malaysia.

CHAPTER ONE

INTRODUCTION

1.0. Introduction

The monetary concept that price level fluctuations are linked with the changes in the supply of money is one of the most reputable ideas ever proposed in economics. It is best remembered through the famous aphorism by Nobel Laureate, Milton Friedman who said “Inflation is always and everywhere a monetary phenomenon” (Friedman, 1963, pp. 17). However, it is also one of the most debated concepts that continue to provide opposing views over the decades. Money and macroeconomic activity has always been a subject of debates and literature published throughout the decades. Consequently, the link between the two subjects of money and macroeconomic activity has been scrutinized and studied with various new ideas and methodologies.

This debate is especially interesting considering the empirical analysis and research into the role and significance of money, as well as the methodology of aggregating the numerous components of money assets which make up the simple sum aggregate of money. Pre-1980’s literature and views showed that there was a significant link between monetary aggregates and macroeconomic indicators (Darrat *et al.*, 2005) and this thought was closely followed by most central banks which sought to control economic activities through the use of monetary targeting. Prior to the mid-1980s there was a strongly held view of a significant link between simple

sum or broad money and inflation. This notion, however, was discredited after the mid-1980s when the previously significant relationship between money and other indicators of macroeconomic activity, such as inflation, began to show instability and broke down (Friedman, 1996 and Binner *et al.*, 1999). Reasons for the instability between the relationship of broad money and economic indicators like inflation and nominal and real GDP were mainly focused on financial innovations that were introduced over time (Binner *et al.*, 1999) as well as flaws and weaknesses in the aggregation methods of money (Schunk, 2001). The weakening relationship between money and macro economic variables resulted in most developed countries abandoning their monetary targeting policies in the post-1980s period (Habibullah, 1999).

Before we continue further, it is appropriate that we revisit a simple explanation of the theory that binds money and inflation. Based on a simple explanation of the Quantity Theory of Money, it is stated that when the supply of money changes, there would be an overall adjustment of the price level to equate for the change in quantity of money demanded so that it would be in equilibrium with the quantity of money supplied. The quantity of money demanded at a given time is influenced by the price level, real income - which is measured by the real Gross Domestic Product (GDP) - and a multitude of other factors. The relationship can then be summed up as inflation being a situation that occurs when the quantity of money supplied exceeds the quantity of money demanded, brought about by the changes in real income and other factors. As the quantity of money supplied exceeds the quantity of money demanded, the price level will have to rise in order for the money supply and the money demand to reach an equilibrium point (Fitzgerald, 1999).

The traditional developments in the research on money and its relationship with macroeconomic indicators were mainly focused more on the various strengths, weaknesses and information content of money with regards to forecasting future movements of those indicators (see Estrella and Mishkin, 1997; Fitzgerald, 1999; Dwyer and Hafer, 1999; Budina *et al.*, 2006; Aksoy and Piskorski, 2006). However, ever since the late 1980s, there is an increasing amount of literature which has shown significant interest in both the monetary aggregation methods, and comparisons between the traditional simple sum money and new types of monetary aggregates. Indeed, in recent times there has been a mushrooming body of literature regarding the relative performances of Divisia monetary aggregates against the traditional simple sum money aggregates and a greater focus is given towards identifying the better monetary aggregate to be used as indicators (see Binner *et al.*, 1999; Binner *et al.*, 2005; Yue and Fluri, 1991; Schunk, 2001; Habibullah, 1999 and Darrat *et al.*, 2005). The renewed interest in monetary aggregates can be attributed towards the developments in the aggregation theory of money and the appearance of Divisia monetary aggregates index (see Barnett, 1980 and Anderson *et al.*, 1997a, 1997b, 1997c) which we will discuss later on in this study.

The main focus of this study will be on comparing the performance of Divisia monetary aggregates and traditional simple sum money aggregates in their capacity as indicators and providers of information content on future inflation movements. The idea of this study is to compare the two types of monetary aggregates using a P-Star model of inflation developed by Hallman *et al.* (1989) to predict the price level and work out which monetary aggregate is best suited to be used as a prediction tool. In addition, we will also examine the usefulness of monetary aggregates as information

content providers of future inflation movements, using the results from the analysis via the P-Star model. Before we move further on, the following parts of this chapter will be used to provide some background information regarding the monetary policy history of Malaysia and we will also briefly touch on the subjects of traditional simple sum money and Divisia monetary aggregates. We will also provide a brief introduction to the P-Star model of inflation as a prologue to a more detailed explanation of its construction in Chapter Three.

1.1. Monetary Policy and Financial Liberalization in Malaysia

Many countries in the 1990's abandoned monetary targeting as an intermediate targeting variable and switched to either interest rate targeting or inflation targeting. In Malaysia itself, monetary aggregates such as M1 and M3 had been major policy targets until the mid-1990s. However, Bank Negara Malaysia (BNM), the central bank of Malaysia, gradually shifted from monetary targeting to interest rate targeting from 1987 to the mid-1990s (Mohd Said and Janor, 2001). The progress of monetary policy in Malaysia for the past two decades can be briefly charted with a description of four periods. Prior to 1987, the central bank adopted a monetary targeting policy based on simple sum M1 as the monetary aggregation method of choice. However, as financial liberalization and innovation started to emerge at the end of the 1980s, BNM moved to a broader definition of money, M3, for monetary targeting purposes from the period between 1987 and the mid-1990s. As the relationship between money and macroeconomic variables began to weaken as a result of emerging developments in the financial system of the country, the central

bank finally discarded monetary targeting and adopted interest rate targeting after the mid-1990s using the 3-month Interbank Rate (IBR).

After the occurrence of the Asian Financial Crisis which struck most of Southeast Asia in 1997, the unstable short-term capital movements and volatile exchange rate of the ringgit resulted in BNM losing the ability to influence domestic interest rates based on local concerns. Hence, in response BNM imposed selective exchange control on 1 September 1998 and fixed the ringgit exchange rate against the US dollar. The central bank also introduced its 3-month Intervention Rate in early 1998 to provide a clearer signal of the direction of monetary policy (Bank Negara Malaysia, 1999, pp. 140-147). The BNM Intervention Rate was eventually replaced by the Overnight Policy Rate (OPR) on 26 April 2004 under the New Interest Rate Framework. It can be presumed, however, that monetary targeting may have largely been forgotten as a monetary policy tool to control inflation at this moment.

Financial reforms and liberalizations since the late 1970s in Malaysia may have also contributed to the situation where the simple sum money aggregation failed to perform adequately as an indicator of changes in the volume of money in circulation. Reforms to the financial sector began to take place as early as the 1970s, when the period saw the beginnings of financial sector reforms such as the deregulation of interest rates and removal of credit ceilings in the financial sector. These liberalizations to the rules and regulations then preceded the introductions of new money assets and derivatives such as negotiable certificates of deposits (NCDs) in 1979, repurchase agreements (REPOs), banker's acceptances (BAs) (Dahalan *et al.*, 2005) and the emergence of financial innovations such as Automated Teller Machines

(ATMs) which brought more liquidity to the market than previously possible. In view of the continuing financial sector reforms and anticipated financial innovations that would occur in the future from technological advancement or new financial developments, the potential of simple sum monetary aggregates may be eroded even more than it is now.

1.2. Monetary Aggregation Methods: Simple Sum and Divisia Monetary Aggregates

Traditional monetary aggregation methods used to construct monetary aggregates such as M1 and M2 are based on an arbitrary grouping of financial assets whereby the components of varied financial assets are summed up together to create a total value for the supply of money held in circulation. These measures of money were generally referred to as simple sum measures of money. The method of aggregating money with the traditional, simple sum method was intended to achieve aggregates that internalize substitution effects (Fisher and Fleissig, 1995) and all assets are entered in with the assumption that the components are with a weight equal to unity, implying the notion that components in each measure of money were perfectly substitutable with each other (Barnett, 1980). This meant that there would be no difference in the measure of substitution of one component for another component in the aggregate.

These traditional simple sum aggregation methods have received widespread criticism which can be divided into two focal points. On one side is the criticism of

the methodology of aggregation and the other would be the lessening significance of money towards macroeconomic activity ever since the rapid financial liberalization and innovations which emerged during the mid-1980s till present.

Barnett (1980) criticized the method of monetary aggregation in which the components of money were added up together without taking into consideration the weight of the components. The simple sum aggregation method was also criticized as having no relevance other than simple accounting meanings (Schunk, 2001). Some previous literature had also revealed that the financial assets, which made up components in the aggregation methods, were shown to be less than perfect substitutes for each other as argued by Moroney and Wilbratte (1976) and Boughton (1981). The traditional aggregation method or simple sum money continued to receive widespread criticism throughout the 1980s and early 1990s. The notion of perfect substitutability among the various components inside the money aggregate was deemed as a flaw in the aggregation method and an inappropriate way to measure financial assets to obtain a supply of money value (Fisher and Fleissig, 1995).

The method of regarding assets as perfectly substitutable was also deemed to be inconsistent with utility and index number theories (Darrat, *et al.* 2005). The perfect substitutability assumption was also noted to be inconsistent with microeconomic demand theories. As Anderson *et al.* (1997a, pp. 26) wrote, “according to microeconomic demand theory, if these assets were perfect substitutes, rational consumers would choose to hold only a single asset, unless all the assets had the same user cost”. Hence, the summation of dollar values of financial assets to create a monetary aggregate was generally inconsistent with the economic theory of

consumer decision making (Anderson *et al.*, 1997a). The simple sum money aggregation method was also criticized as having failed to account for the varying degree of “moneyness”, which is the degree of monetary services that financial assets provide to holders (Batten and Thornton, 1985).

The second focal point of criticism for the simple sum money aggregation regarded it as being weakened through the introduction of various financial developments and innovations. There is a widely held belief that the link between money and macroeconomic activity began to show signs of weaknesses as financial liberalizations began to take place throughout most of the developed world during the 1980s. This thought was held by analysts who believed that innovations and developments in the financial system have greatly distorted the relationship between money growth and macroeconomic variables (Batten and Thornton, 1985 and Habibullah, 1999). Habibullah (1999) noted that studies in major industrialized countries suggested the relationship between money and economic variables were distorted by financial deregulation and innovations.

Divisia monetary aggregate emerged as an alternative to the simple sum money aggregate through the pioneering works of Barnett (1980) who advocated the use of Divisia chain-linked index numbers to construct a weighted index number measure of money (Binner *et al.*, 1999). Both microeconomic aggregation theory and the theory of superlative index numbers developed by Diewert (1976) formed the basis of the Divisia monetary aggregates. The Divisia monetary aggregation method had the aim of measuring the flow of monetary services obtained from an assortment of monetary assets that could not be substituted perfectly with each other (Elger *et al.*,

2006). A recent, detailed explanation of the Divisia monetary aggregates can be found in the literature published by Anderson *et al.* (1997a, 1997b, 1997c) which sought to explain the concepts, theories behind the Divisia aggregates and its construction methodology.

Among the advantages of the Divisia monetary aggregates is that the weights assigned to individual monetary assets - which are used to formulate the Divisia aggregates - can vary over time in response to shifts in the yield curve of financial assets and to financial innovation (Binner *et al.*, 1999). The effects of financial innovation and shifts in the yield curve that distorts the opportunity costs of holding monetary assets and the degree of “moneyness” will be able to be overcome using the weights assigned to the individual monetary components of the aggregate. Another advantage is that the pure substitution effect that is sought when creating a monetary aggregate is also internalized. This is done through the assigning of weights for the components, depending upon its share of total expenditures of monetary services (Barnett and Offenbacher, 1980 and Barnett *et al.*, 1984). The Divisia aggregates also have an advantage in terms of its consistency with microeconomic theory (Anderson *et al.*, 1997a).

Though the advantages of Divisia aggregates over the simple sum aggregates are apparent in theoretical terms as stated above, empirical analysis regarding the matter were mixed, although the results tend to favour Divisia monetary aggregates in most cases. Empirical researches done by Binner *et al.* (1999), Habibullah (1998), Schunk (2001) and Darrat *et al.* (2005) have been in support of Divisia monetary aggregates in varying degrees. However, some literature works for example, Serletis

(1987) and Elger *et al.* (2006) have suggested that Divisia monetary aggregates did not perform better or at best, only marginally against simple sum money aggregates. The results sometimes vary depending on how broad the Divisia monetary aggregate is (see Schunk, 2001; Yue and Fluri, 1991; Binner *et al.*, 1999).

Hence, it is the main purpose of this study to compare the Divisia monetary aggregates' performance against the traditional simple sum monetary aggregates through empirical analysis.

1.3. Introduction to the P-Star Model of Inflation

The P-Star model of inflation was developed by Hallman *et al.* (1989) as an alternative method of modeling inflation based on the quantity theory of money approach in response to normally complicated inflation modeling methods. The main construct of the P-Star model is based on the level of money stock, the equilibrium velocity of money and the potential output of the economy, with the difference between the actual price level and the equilibrium price level determined from the P-Star model becoming the key indicator of inflationary movement (Habibullah, 2006). Hoeller and Poret (1991) explained that in equilibrium, the difference between the actual price level (p) and the equilibrium price level (p^*) in the model would be zero and any gap that appears ($p - p^*$) as a consequence of the price level deviating from the equilibrium would provide insight on future movements of inflation.

The P-Star model has been mentioned to be well suited to its purpose of predicting inflationary movement. For example, Hallman *et al.* (1991) found the P-Star model to be able to link the supply of money and inflation well. In addition, Todter (2002, pp. 16), after reviewing several literatures regarding the application of the P-Star model, noted that the model "...has a notable explanatory power for aggregate inflation development in the euro-area countries." The model, of course, has its share of criticism (for example, see Christiano, 1989; and Pecchenino and Rasche, 1990); however we believe that the P-Star model is suitable as a platform for our study as it is based on the quantity theory of money approach and has been shown to be applicable to Malaysia (see Habibullah, 1999), though from a much earlier time period. A more detailed explanation of the construct and methodology of the P-Star model will be provided in Chapter Three of this study.

1.4. Problem Statement

Price level stability has always been one of the main concerns of the central bank, Bank Negara Malaysia. Inflation has always been one of the most important macroeconomic indicators of a country as inflation causes a myriad of problems for a country, not only in terms of higher costs of living and lower standards of life for its people but also as a negative element to investments and growth of a country.

Before the mid-1980's the concern of maintaining price stability in Malaysia was addressed mainly by BNM through the monetary targeting policies, which sets the supply of money in circulation according to the demand for money. Hence, the

M1 and M3 money indicators were extremely significant in monetary policy formation. This, however, did not last as the introduction of financial innovations for the past two decades rendered unstable the relationship of simple sum money with macroeconomic indicators and resulted in the central bank dumping the monetary targeting policy in favour of interest-rate targeting measures. BNM moved to an interest rate targeting policy during the mid-1990s using the Interbank Rate (IBR) and subsequently followed by the introduction of the BNM's Intervention Rate in 1998 to replace the usage of the IBR as an interest rate targeting policy indicator (Bank Negara Malaysia, 1999). The intervention rate was then replaced with the Overnight Policy Rate (OPR) in April 2004.

Recent situations in Malaysia, such as the protracted increases in crude oil prices and subsequent increase in the prices of petroleum-based products and petrol in early 2006, resulted in strong inflationary pressures in the country. This prompted the central bank to increase interest rates several times in short intervals in order to control the inflationary pressures, as predicted according to the Fisher's Effect theory. However, frequent increases in interest rates do not bode well for growth and businesses in the country as frequent increases lead to uncertainties and also higher cost of borrowings for businesses. Therefore, a monetary policy that would be able to control the price level but also leads away from the Fisher's Effect may be suitable and attractive in times of strong inflationary pressures.

Hence, given the significant developments with monetary aggregation theory and inflationary problems faced by the country in recent times, it is now a suitable moment to revisit the possibilities of a return to monetary targeting and determine the

usefulness and suitability of Divisia monetary indices proposed by Barnett (1980) for the economy of Malaysia and its performance in comparison with the simple sum money counterpart.

1.5. Objectives of the Study

1.5.1. General Objective

The primary aim of this study is to compare the performance of Divisia M1 and M2 with simple sum M1 and M2, with regards to predicting the price level in Malaysia. It is hoped that this would provide further insight into that question of which monetary aggregate would be better as a monetary policy tool in predicting and providing information on future inflation movements of Malaysia, in case there is an intention to revert back to a policy of monetary targeting.

1.5.2. Specific Objectives

This study seeks to examine and verify the relationship of Divisia monetary aggregates with inflation, which is an important macroeconomic indicator of a country's economy. This would be useful in providing information regarding its suitability for adoption as a monetary policy tool by BNM. Specifically, the aims of this study are:

- i. To compare the relative performance of Divisia monetary aggregates against simple sum aggregates in forecasting inflation for Malaysia.
- ii. To examine the viability of Divisia monetary aggregates as information content providers of future inflation movements in Malaysia using a P-Star model framework.

1.6. Significance of the Study

The findings from this study may be able to provide useful information regarding the relative performance of Divisia monetary aggregates against traditional simple sum monetary aggregates for Malaysia. This would be able to contribute another step towards clearing the uncertainty and lack of information regarding performance of Divisia monetary aggregates when pitted against simple sum monetary aggregates.

Findings from this study may also provide more information regarding the relationship of Divisia monetary aggregates with the price level. This would hopefully contribute towards expanding the limited literature regarding this subject for middle-income developing countries.

The results of this empirical examination, if it indeed proves the worth of Divisia monetary aggregates, may be able to lend supportive argument that monetary

targeting should be reconsidered for adoption by the central bank, using Divisia monetary aggregates.

1.7. Scope of the Study

This study aims to compare the relative performance of Divisia monetary aggregates and simple sum money in forecasting inflation in Malaysia. The monetary aggregates chosen for this study are simple sum M1, simple sum M2, Divisia M1 and Divisia M2. The period chosen for this study encompasses the Malaysian economic scene from 1981:Q1 to 2003:Q4. A detailed description of the data set that will be used in the empirical analysis of this study will be discussed in Chapter Three.

The study is organized as follows. In Chapter Two, we will examine some literature regarding the relationship of money and inflation before proceeding to discuss some literature in the study of Divisia monetary aggregates and simple sum monetary aggregates on macroeconomic indicators such as inflation, money demand and income. In Chapter Three, we will discuss the data set and also the P-Star model of inflation that will be used to conduct the empirical analysis in this study. Chapter Four will consist of the result of the empirical analysis and the accompanying discussions regarding the nature of our findings. Finally, in Chapter Five, we will provide the conclusions and implications of the study.