The Importance of Transmission Mechanism on the Development of Credit Derivatives: A Monetary Aggregate Approach

Caner ÖZDURAK
107664008

İSTANBUL BİLGİ ÜNİVERSİTESİ
SOSYAL BİLİMLER ENSTİTÜSÜ
ULUSLARARASI FİNANS YÜKSEK LİSANS PROGRAMI

Yrd. Doç.Dr. Sadullah ÇELİK
2010

The Importance of Transmission Mechanism on the Development of Credit Derivatives: A Monetary Aggregate Approach

Kredi Türevlerinin Gelişiminde Transmisyon Süreçlerinin Önemi: Parasal Taban Yaklaşımı

Caner ÖZDURAK
107664008

Yrd. Doç.Dr. Sadullah ÇELİK : ....
Prof.Dr. Oral ERDOĞAN : ....
Doç.Dr. Erhan ASLANOĞLU : ....

Tezin Onaylandığı Tarih : 15 Temmuz 2010

Toplam Sayfa Sayısı: 86

Anahtar Kelimeler (Türkçe)	Anahtar Kelimeler (İngilizce)
1) Parasal Taban	1) Monetary Aggregate
2) Kredi Türevleri	2) Credit Derivatives
3) Divisia Endeksi	3) Divisia Index
4) Para Politikası	4) Monetary Policy
5) Zaman Serileri	5) Time Series

Abstract

The main purpose of the thesis is to test the empirical validity of enriching money demand function with credit derivatives using the new monetary aggregates. As a result it is concluded that monetary policy has lost some effectiveness after the invitation of derivative instruments to the financial markets. In the application part time series models are used for modeling money demand and supply.

Özet

Bu tezin amacı para talebi fonksiyonunu kredi türevleri ile genişleterek yeni parasal taban uygulamalarını test etmektir. Sonuç olarak para politikasının etkisi türev ürünlerin piyasalara tanıtılmasından sonra azalmıştır. Uygulama bölümünde para talebi ve arzını modellemek için zaman serileri modelleri kullanılmıştır.

To my deceased father

Acknowledgements

It gives me a great pleasure to thank my advisor Assistant Professor Sadullah Çelik of Marmara University for his helpful comments and suggestions throughout the study.

I have profoundly benefitted from discussions with my professor Feride Gönel of Yıldız Technical University. I thank Prof. Nuri Yıldırım, Associate Prof. Ensar Yılmaz, Associate Prof. Murat Donduran and Associate Prof. Hüseyin Taştan for their suggestions, discussions and comments which improved my understanding of the issues and the proper ways to cope with them. I also learned a lot from all my faculty members at İstanbul Bilgi University and I am thankful to them.

I am also grateful to my friends; R. Berra Özcaner, Gökhan Hepşen, Nurhayat Bul, Sermet Fulser, Tuna Demiralp, Senem Çağın, Duygu Korhan, Cem Emlek, Anıl Tanören, Serkan Çetin, Yener Yıldırım, Hakan Şengöz, Pelin Grit, Erdem Gül, Mustafa Yavuz, Nuray Piyade, İlkim Debrelioğlu, Associate Prof. Elgiz Yılmaz of Galatasaray University, Akın Toros, Tunç Coşkun and Alp Oğuz Baştuğ for their precious support and encouragement throughout my studies. I thank my father, mother and brother for their understanding and patience.

Last but not least, I thank my professor Oral Erdoğan of İstanbul Bilgi University for his encouragement and support.

TABLE OF CONTENTS

1. INTRODUCTION

"So you think that money is the root of evil?" said Francisco d'Anconia.

"Have you ever asked that what is the root of money? Money is a tool of exchange, which can't exist unless these are goods produced and men able to produce them. Money is the material shape of the principle that men who wish to deal with one another must deal by trade and give value for money. Money is not the tool of mockers, who claim your product by tears, or the looters, who take it from you by force. Money is made possible only by the men who produce. Is this what you consider evil?"[1]…

The modern theory on money demand incorporates the evolution of financial markets behavior, and then of households' allocation and preferences in different fashions; innovation in money demand can be considered as an increasing number of liquid assets between which to choose, considering money as a store of value and as a mean of payment; innovation modifies the utility of money holdings, through wealth and substitution effects. Liquidity has to be weighted with risk aversion and profitability to incorporate portfolio innovation properly (Oldani 2005).

The traditional approach to the transmission mechanism through which money affects aggregate demand has focused on the key role of interestrates. Monetary shocks upset money supply-money demand equilibrium causing changes in interest rates. However, an important gap in

---

[1] The meaning of Money, Speech of Francisco d'Anconia , Atlas Shrugged, Any Rand, (1957).

this analysis is that while it is generally acknowledged that movements in short-term interest rates like the Treasury Bill rate clear the money market, aggregate demand depends primarily on long-term interest rates (McCafferty). His paper represents an effort to link the traditional macroeconomic literature on the transmission mechanism of monetary shocks with the literature on the term structure of interest rates.

Cox, Ingersoll and Ross (1981) re-examines many of these traditional hypotheses while employing recent advances in the theory of valuation and contingent claims. They show how the Expectations Hypothesis and the Preferred Habitat Theory must be reformulated if they are to obtain in a continuous-time, rational-expectations equilibrium. They also modify the linear adaptive interest rate forecasting models, which are common to the macro-economic literature. The difference of this thesis is to represent an effort to link the traditional macroeconomic literature on the transmission mechanism of monetary aggregates with credit derivatives.

The main purpose of the thesis is to test the empirical validity of enriching money demand function with credit derivatives using the new monetary aggregates. Aftermath of Global Financial Crisis 2008 sparked off by subprime mortgage crisis, the effects of derivatives on financial markets and transmission mechanisms of economics should be revisited and questioned.

The name “new monetary aggregates” is attached to the Divisia monetary aggregates and the CE indices. The aim is to introduce the theoretical framework that the micro foundations approach to construct the new monetary aggregates and introduce financial innovations. This is useful for two reasons. First, the origins of the theoretical background are reviewed and second, the theoretical framework for the empirical part of the thesis is built. Then, a brief survey of monetary aggregation theory is given in section 2.1. In section 3 the methodology is reviewed while in section 4 empirical results are analyzed for the in order to indicate the importance of transmission mechanism on the development of credit derivatives. Empirical results showed that Currency Equivalent Index and Monetary Service Index are performing better than Simple Sum Monetary Aggregate.

The intensification of the global financial crisis, following the bankruptcy of Lehman Brothers in September 2008, has made the current economic and financial environment a very difficult time for the world economy, the global financial system and for central banks. The fall out of the current global financial crisis could be an epoch changing one for central banks and financial regulatory systems. It is, therefore, very important that we identify the causes of the current crisis accurately so that we can then find, first, appropriate immediate crisis resolution measures and mechanisms (Mohan 2009).

The widespread innovations in the financial markets have brought important changes in the way monetary policy is conducted, communicated and transmitted to the economy. The transmission mechanism is changing. While the effect of monetary policy on the availability and cost of bank credit is decreasing, monetary policy actions have prompter effects on a whole range of financial market yields and asset prices (Dragni, 2007).

2. LITERATURE SURVEY

This chapter is a brief survey of the monetary aggregation literature. The main purpose is to introduce the theoretical framework that the micro foundations approach uses to construct the new monetary aggregates.

Early attempts of weighted monetary aggregation studies are based on Hutt (1963), Chetty (1969) and Friedman and Schwartz (1963) after it was figured out that simple summation procedure have not been adequate enough to capture the time dynamics of the asset demand theory. Then, the concepts of the consumer's choice problem, weak separability and aggregator functions that explain the micro foundations of the new monetary aggregates are discussed.

The fundamental theoretical argument of simple sum monetary aggregates is that the owners of all monetary assets accept every asset as perfect substitutes. With such simple summation including the milestone studies of Diewert (1976) and Barnett (1978) divisia monetary aggregates and Currency Equivalent Indices became popular under the "Micro foundations approach" title. A weight of unity is attached to each monetary asset in simple summation. However these assets have different opportunity costs. As Barnett (1984) mentioned "one can add apples and apples, but not apples and oranges".

Inadequate performance of money demand functions using simple sum aggregates was questioned first by Goldfeld (1976). Once monetary assets began yielding interest, these assets became imperfect substitutes for each other. The missing money puzzle of Goldfeld (1976) was solved by Barnett (1978, 1980) with the derivation of the user cost formula of monetary services demanded. As a result, Barnett set the stage for introducing index number theory in to the monetary economics.

Briefly, the Divisia index is a weighted sum of its components' growth rates where the weight for each component is the expenditure on that component as a proportion of the total expenditure on the aggregate as a whole.

In many nations, monetary aggregates forms are expressed as *M1, M2, M3* and *L*. Before Barnett (1978, 1980) many studies discussed the aggregation of heterogeneous agents and also various goods a single agent purchases. However, these approaches did not include microeconomic aggregation theory and index number methods.

It is well known that the definition of the monetary aggregation affects the structure of money demand and the transmission mechanism of the economies. Hence, if the utility of monetary services is clearly comprehended, the characteristics of money demand can be explained with its' important role for the causality relationships in the transmission mechanism.

Therefore, this thesis will try to examine the importance of differences of using Divisia index and simple sum method as monetary aggregator for monetary policy and the transmission mechanism. In this sense, the main goal is to analyze transmission mechanism models through time series techniques. This will help to determine the nature of monetary policy needed to combat financial crisis based on money supply and demand dissonance during the subprime mortgage crisis period.

The rapid transmission of the U.S. subprime mortgage crisis to other financial markets in the United States and other countries during the second half of 2007 has raised some important questions. Frank *et al.* (2008) suggest that during the recent crisis period the interaction between market and funding liquidity sharply increased in U.S. markets

In contrast, these transmission mechanisms were largely absent before the onset of financial turbulences in July 2007. The introduction of the structural break in the long-run mean of the conditional correlations between the liquidity and other financial market variables is statistically significant and further strengthens these conclusions.

2.1. Consumer's Choice Problem under Budget Constraints of Monetary Assets

There have been consequences among economists. Economists agree on the important roles of monetary assets in macroeconomics. Aggregation methods should maintain the information contained in the elasticities of substitution of monetary assets as well as abandoning strong a priori assumptions about these elasticities of substitution. However, the widely used simple sum monetary aggregates disregard the importance of appropriate monetary aggregation methods as the ongoing discussion demonstrates. An emerging literature employs statistical index numbers to construct monetary aggregates that are consistent with microeconomic theory.

Economists have agreed for a long time ago that equilibrium between the demand for and supply of money is the most important long-run determinant of an economy's price level. Hence, it's not such an easy case to measure the aggregate quantity of money in the economy.

As simple summation method for monetary aggregates experienced flaws, The Federal Reserve of St. Louis' monetary services index project started to provide researchers and policy makers with an extended and more efficient database of new measures of monetary aggregates-the monetary services index (MSIs).

Consumers hold monetary assets in order to obtain utility from various types of monetary services. Some of these assets are more serviceable for exchange as they reduce shopping time, permit sudden purchase of bargain-priced goods and provide prevention against unanticipated expenses. The demand of consumers for monetary assets on such cases can be considered as a model of choices made by a representative consumer to maximize utility function that is subject to a budget constraint. This budget includes both stocks of real monetary assets and quantities of non-monetary goods and services in which monetary assets are treated as durable goods that provide a flow of monetary services.

In this context, Samuelson (1947) noted that;

… It is a fair question as to the relationship between the demand for money and the ordinal preference fields met in utility theory. In this connection, I have reference to none of the tenuous concept of money, as a numeraire commodity, or as a composite commodity, but to money proper, the distinguishing features of which are its indirect usefulness not for its own sake but for what it can buy, its conventional acceptability, its not being "used up" by use, etc.

Under these circumstances, for such a durable good its rental equivalent price should be considered as an opportunity cost which can be notified as the present value of the interest foregone by holding the monetary asset discounted to account for the payment of interest at the end of the period.

2.1.1. Optimization Problem of the Consumer

Every time the consumer makes a decision about monetary assets, he/she faces an optimization problem under the budget constraints. In economics, a central feature of consumer theory is about the choice that a consumer makes. Just like in the theory of firm in which a firm decides how to maximize costs, the consumer decision problem may be formalized by assuming that the consumer maximizes the utility function, $U(m_1,...,m_n,q_1,...q_m)$ subject to the budget constraint:

$$\sum_{i=1}^{n}\pi_i m_i + \sum_{j=1}^{m} p_j q_j = Y$$

where $m = (m_1,...m_n)$ is a vector of the stocks of real monetary assets $\pi = (\pi_1,...,\pi_n)$ is a vector of user costs of monetary assets, $q = (q_1,...,q_m)$ is a vector of quantities of non-monetary goods and services, $p = (p_1,..., p_m)$ is a vector of prices of non-monetary goods and services, and Y is the consumer's total current period expenditure on monetary assets and non-monetary goods and services.

All these decision problems have a feature in common. There is a set of alternatives Ω from which the consumer has to choose. In our case, different monetary assets define the set Ω for the consumer.

Briefly, a consumer in the theory of consumer behavior has a choice-set as does the firm in the theory of firm. In this context, the consumer must have some ranking over the different alternatives in the choice set. This ranking is expressed by a real-value function such as $f:\Omega \rightarrow \Re$ where higher value of an alternative implies that it has a higher rank than an alternative with a lower value.

In our model, these alternatives refer to monetary assets' yield provided to the consumer. In its abstract form an optimization problem consist of a set **Ω** and a function[2] $f:\Omega \rightarrow \Re$. The purpose is to select an alternative from the set **Ω** that maximizes or minimizes the value of the objective function *f*. That is the consumer either solves

i. Maximizes $f(w)$ subject to $w \in \Omega$ or

ii. Minimizes $f(w)$ subject to $w \in \Omega$.

As a result, the solution to the consumer's optimization problem yields demand function for real monetary assets and for quantities of non-monetary goods and services:

$m_i^* = f_i(\pi, p, Y)$ for $i = 1,...,n$ and

$q_j^* = g_j(\pi, p, Y)$ for $j = 1,...,m$

2 This function is termed as objective function.

2.1.2. Barnett's Approach over Consumer's Optimization Problem

The simple sum monetary aggregates announced by the Federal Reserve are calculated by summing dollar values of the stocks of the monetary assets related to each aggregate which is not generally consistent with the economic theory of the consumer's optimization problem.

In the presence of such inadequate monetary aggregates, Barnett (1980) developed a method which is quite consistent with the economic theory. Barnett accepted the quantities of monetary assets included to the decision maker's portfolio as weakly separable from the quantities of other goods and services.

In this context, the utility function $U(m_1,...,m_n,q_1,...,q_m)$ evaluated as $U[u(m_1,...,m_n),q_1,...q_m]$ where the function $u(m_1,...,m_n)$represented the amount of monetary services the consumer received from the holding portfolio of monetary assets.

As a result, under the assumption of weak separability, the marginal rate of substitution between monetary assets m_i and m_j can be represented in terms of the derivatives of $u(m_1,...,m_n)$ as;

$$\frac{\partial u(m_1,...,m_n)}{\partial m_i} \bigg/ \frac{\partial u(m_1,...,m_n)}{\partial m_j}$$

Barnett's approach allows us to discuss the representative consumer's choice problem as if it were solved in two stages. In the first stage, the consumer selects (1) the desired total outlay on real monetary services (but not the quantities of individual monetary assets), and (2) the quantities of all non-monetary individual goods and services. In the second stage, the consumer selects the quantities of the individual real monetary assets,$m_1,...,m_n$, conditional on the total outlay on monetary services selected in the first stage, that provide the largest possible quantity of monetary services.

This two-stage budgeting model of consumer behavior implies that the category subutility function, u $(m_1,...,m_n)$, is an aggregator function that measures the total amount of monetary services received from holding monetary assets. If we let $m^*_1... m^*_n$ denote the optimal quantities of monetary assets chosen by the consumer, we can regard the aggregator function as defining a monetary aggregate, *M*, via the relationship

$M = u(m^*_1,...,m^*_n)$. A major difficulty remains, however: The specific form of the aggregator function is usually unknown. Diewert (1976) and Barnett (1980) have established that, in this model, the aggregator function at the optimal quantities,

$M = u(m^*_1 \ldots m^*_n)$, may be approximated by a statistical index number. The monetary services indexes presented in this issue of the Review are superlative statistical index numbers, as defined by Diewert (1976).

Moreover, Serletis and Molik (2002) investigate the roles of traditional simple-sum aggregates and recently constructed Divisia and currency equivalent monetary aggregates in Canadian monetary policy to address disputes about the relative merits of different monetary aggregation procedures. They find that the choice of monetary aggregation procedure is crucial in evaluating the relationship between money and economic activity. In particular, using recent advances in the theory of integrated regressors, they find that Divisia M1 + + is the best leading indicator of real output. Furthermore, Divisia M1 + + causes real output in vector autoregressions that include interest rates, and innovations in Divisia M1 + + also explain a very high percentage of the forecast error variance of output, while innovations in interest rates explain a smaller percentage of that variance.

In their paper Fleissig and Serletis (2002), provide semi-non-parametric estimates of elasticities of substitution between Canadian monetary assets, based on a system of non-linear dynamic equations. The Morishima elasticities of substitution are calculated because the commonly used Allen-Uzawa measures are incorrect when there are more than two variables. Results show that monetary assets are substitutes in use for each other at all data points, both in the short run and in the long run.

2.2. Money Demand Theories Survey

Money demand is an economic theme, which has fascinated economists over the centuries and no unique result has been ever reached. As in the models Baumol (1952), Tobin (1956), Stockham (1981) and Jovanovic (1982), but in contrast to those of Grandmont and Younes (1973), and Helpman (1981), households are allowed to hold interest bearing capital in addition to barren money.

Moreover, money demand and money allocation in portfolio depend on the definition of money and wealth and on the possible combinations, depending on technology available and risk attitude. In particular there exist a large number of potential alternatives to money, the prices of which might reasonably be expected to influence the decision to hold money. Even so, linear single-equation estimates of money demand with only a few variables continue to be produced, in spite of serious doubts in the literature about their predictive performance.

Stephen Goldfeld (1976) brought wide attention to the poor predictive performance of the standard function. Another problem with this literature is that the studies of the demand for money are based on official monetary aggregates constructed by the simple-sum aggregation method.

Using very simple notation, we can synthesize the evolution of money demand specifications and start with the well know quantitative theory of money $(MV = PQ)$, moving to the Fisherian interpretation as $(MV(r) = PQ)$ and then consider the Keynesian liquidity preference $(M^d = (r, Y))$ where money holdings are not only function of income (or consumption), but also depend on the alternative investment opportunities (following the speculative motive to hold money) together with precautionary and transactions motives.

In this context, Tobin (1956) introduced the concept of average money holdings $M = \left(2bT/r \right)^{1/2}$ where b is the brokerage charge to convert bonds into money, r is the interest rate and T is the number of transactions.[3]

Money demand and its relationship with growth and inflation are central themes in modern monetary such as Barro and Santomero (1972) and Coenen and Vega (1999) who observe that a stable representation of the money demand should include alternative assets' return to explain portfolio shifts and wealth allocations in the short run.

The simple Keynesian money demand function $M_d = (r, Y)$ is enlarged with innovation (r^*) written implicitly as $M_d = (r, Y, r^*)$. Derivatives increase markets' liquidity and substitutability as well as increasing the speed of the transmission mechanism of monetary impulses. Although it is possible to shift individual risk at the macro level it cannot be cancelled.

3 This is the famous square-root law.

According to the credit view, the notion of imperfect substitutability between credit and bonds and the introduction of derivatives that are highly substitutable with bonds and credit, can dramatically alter the monetary policy actions and effects in a market economy.

Since different functional forms have different implications for the presence of the liquidity trap and effectiveness of the traditional monetary policy, the choice of functional form is an important issue. Bae and De Jong (2007), investigate two different functional forms for the US long-run money demand function by linear and nonlinear cointegration methods. They aim to combine the logarithmic specification, which models the liquidity trap better than a linear model, with the assumption that the interest rate itself is an integrated process. The proposed technique is robust to serial correlation in the errors. For the US, their new technique results in larger coefficient estimates than previous research suggested, and produce superior out-of-sample prediction.

Finally Barnett *et all.* (2008), provide an investigation of the relationship between macroeconomic variables and each of the Divisia first and second moments, based on Granger causality. They find abundant evidence that the Divisia monetary aggregates (or any Diewert superlative index) should be used by central banks instead of simple sum monetary aggregates. This paper provides evidence that Divisia second moments should also be used by monetary policy makers, because they contain information relevant to other macroeconomic variables.

2.2.1. Thales of Miletus, First Derivative: Lagged Application of an Original Idea

A derivative is a contract whose value depends on the price of underlying assets, but which does not require any investment of principal in those assets. (BIS 1995) Derivatives can be divided into 5 types of contracts: Swap, Forward, Future, Option and Repo. These are financial instruments widely used by all economic agents to invest, speculate and hedge in financial market (Hull, 2002)

Unlike common belief, derivative instruments are not recent inventions. The first account of an option trade contract is reported by Aristotle in his Politics. In book1, Chapter 11 of Politics, Aristotle tells the story of Thales (624-547 BC) who is said to have purchased the right to rent the olive presses at a future point in time for a determined price. The main idea of olive presses option was induced by the challenge of critics who had pointed out to Thales' poor material well being and mentioned that if the philosopher had anything of value to offer others than he should be able to get the respect he deserves. As Thales made a fortune of olive presses contracts which turned the philosopher's intellect to the creation of wealth.

Thales proved his cleverness but one point that needs to be mentioned is Thales being a monopoly as there were no other bidders for the olive presses. He actually purchased a call option and gave deposits for the use of olive presses at a very low price since there were no other bidders. Also Aristotle illustrates the story of Thales as an operation of the monopoly devise. Moreover, in their paper "What is the Fair Rent Thales Should Have Paid" Markopoulos and Markelious (2005) try to calculate the ratio of the option value to the market rental price of presses referring to Thales' option trade.

Likewise, in the 1600s in Amsterdam, both call and put options were written on tulip bulbs during the legendary tulip-bulb craze. In 12th century, sellers arranged contracts named "letters de faire" at fair grounds. These contracts indicated the seller would deliver the goods he had sold on the determined maturity. Commodities such as wheat and copper have been used as underlying assets for option contracts in Chicago Commodity Exchange since 1865. In 1900s, Bachelier began the mathematical modeling of stock price movements and formulates the principle that "the expectation of the speculator is zero" in his thesis Théorie de la Spéculation.

In this context, the origins of much of the mathematics in modern finance can be traced to Louis Bachelier's 1900 thesis on the theory of speculation, framed as an option-pricing problem. This work marks the twin births of both the continuous-time mathematics of stochastic processes and the continuous-time economics of derivative-security pricing.

Furthermore, the mean-variance formulation originally developed by Sharpe (1964) and Treynor (1961), and extended and clarified by Lintner (1965a; 1965b), Mossin (1966) and Fama (1968a; 1968b). In addition Treynor

(1965), Sharpe (1966) , and Jensen (1968; 1969) have developed portfolio evaluation models which are either based on this asset pricing model or bear a close relation to it. In the development of the asset pricing model it is assumed that (1) all investors are single period risk-averse utility of terminal wealth maximizers and can choose among portfolios solely on the basis of mean and variance, (2) there are no taxes or transactions costs, (3) all investors have homogeneous views regarding the parameters of the joint probability distribution of all security returns, and (4) all investors can borrow and lend at a given riskless rate of interest. The main result of the model is a statement of the relation between the expected risk premiums on individual assets and their "systematic risk.

Finally in 1997 Scholes and Merton won the Noble Prize in collaboration with the late Fischer Black who developed a pioneering formula for the valuation of stock options. It's obvious that Thales pulled the trigger against the notion "uncertainty" and inspired all other great minds for centuries in order to be able to find a way to beat risk.

According to the conventional wisdom, credit derivative contracts are a form of insurance. Henderson 2009 explores whether credit derivatives should be regulated as insurance and offers an alternative form of regulation for these financial instruments. The largely unregulated credit derivates market has been cited as a cause of the recent collapse of the housing market and resulting credit crunch. We regulate insurance companies with special rules for three reasons: (1) the inverted production cycle of insurance; (2) the unique governance problems inherent in a model in which the firm's creditors are policyholders; and (3) a view that state-based consumer protection is important to ensure a functioning market. This essay shows that none of these policy justifications obtain in credit derivative markets. The essay briefly discusses how a centralized clearinghouse or exchange can help improve the credit derivatives markets, as well as potential pitfalls with this solution.

2.2.2. Derivatives in the Money Demand Function

The introduction of derivatives in emerging capital markets increases international substitutability, attracting foreign investors (e.g. Tesobono swap in Mexico). The dynamics of short-run broad money demand adjusts to financial innovation, while the theory tells us that in the long-run money should be a stable function of income and interest rate.

Money demand should be modeled through the use of weighted monetary indexes such as Divisia Index, introduced in the literature. Divisia Index addresses directly the problem of un-perfect substitutability contrary to traditional money aggregates, which are simple sums of assets. The money demand function in the implicit form can be written as (m/p) = f (r, y, future), where (m/p) is real cash balance (money demand), and is a function of interest rate (r), income (y), and the financial innovation (future) representative of market and portfolios in terms of liquidity, and open interest.

Nonexistent risk-free rate causes a risky economy in which derivatives are by definition independent of their underlying assets and benefits from specific pricing rules. The property of futures' prices being correlated with the underlying is efficiency characteristic and is called price discovery effect[4].

Discovery price effect should not be confused with the independency. Generally speaking the introduction of exchange traded derivative products:

i. Increases information about the underlying,

ii. Does not seem to increase volatility and risks of and on the underlying market,

iii. Price discovery effect improves

iv. Bid-ask spread and the noise component of prices both decrease.

Although Reinhar *et all*. (1995), find that financial innovation plays an important role in determining money demand and its fluctuations, and that the importance of this role increases with the rate of inflation; Donmez and Yilmaz (1999) state that "a mature derivatives market on an organized exchange leads to a better risk management and better allocation of resources in the economy".

Central banks in certain circumstance use derivatives as a substitute of the channels of monetary policy; Tinsley (1998) and others explain which

---

[4] For further details see Hull (2002).

are the advantages for central banks in using derivatives to manage the exchange and interest rates.

3. ECONOMETRIC METHODOLOGY

Main purpose of this section is to review the econometric methodology used in the empirical analysis followed by the empirical assessment of the monetary aggregates for the developed countries.

The preferred empirical investigation procedure refers to time series, since across countries (i.e. cross section) the definition of main variables is not homogenous, leading to the complete lack of data and the impossibility of any reliable analysis.

Panel data estimates are undeveloped in this field, since money demand basically refers to non-stationary variables, and techniques and theory are not yet able to deal with them. Time series analysis can be started, after the check for the presence of unit roots. Macroeconomic variables are often non-stationary, and the demand function should be expressed using the same root order; i.e. if all variables are I(1) a function could be expressed in terms of the levels; if one variable is I(2), we should take its first difference, which is I(1), to estimate its parameter with other I(1) variables. Simple money demand estimates on levels with the OLS provide unstable results and super-consistent coefficients.

Money demand estimates, being over long or short periods, have improved fast after the Engle and Granger procedure evolved. Friedman and Schwartz (1963) were the first to observe the existence of a strong correlation between money supply and the business cycle, Tobin added that this causal relationship could be reversed, and the Granger Causality test, introduced in the field by Sims (1972), finally cleared the way. Barro, with many co-authors, improved the analysis over the '70s, by discerning the influence of real variables, shocks and un-anticipated components.

Modern money demand estimates can be split into short term analysis, which use the error correction approach (ECM), i.e. the Maximum Likelihood-ARCH estimator, and long term analysis, which use the Vector Auto Regression (VAR) or the Vector Error Correction Mechanism (VECM).

3.1. Unit Root Test

The common procedure in economics is to test for the presence of a unit root to detect non-stationary behavior in a time series. This thesis uses the conventional Augmented Dickey-Fuller (ADF) for unit root tests.

In the terminology of time series analysis, if a time series is stationary, it is said to be integrated of order zero, or I(0) for short. If a time series needs one difference operation to achieve stationarity, it is an I(1) series; and a time series is I (n) if it is to be differenced for n times to achieve stationarity. An I(0) time series has no roots on or inside the unit circle but an I(1) or higher order integrated time series contains roots on or inside the unit circle. So, examining stationarity is equivalent to testing for the existence of unit roots in the time series.

A pure random walk, with or without a drift, is the simplest non-stationary time series:

$$y_t = \mu + y_{t-1} + \varepsilon_t, \varepsilon_t \sim N(0, \sigma_\varepsilon^2) \qquad (1)$$

where μ is a constant or drift, which can be zero, in the random walk. It is non-stationary as $Var(y_t) = t\sigma_\varepsilon^2 \to \infty \; as \; t \to \infty$. It does not have a definite mean either. The difference of a pure random walk is the Gaussian white noise, or the white noise for short:

$$\Delta y_t = \mu + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2) \qquad (2)$$

The variance of Δy_t is σ_ε^2 and the mean is μ.The presence of a unit root can be illustrated as follows, using a first-order autoregressive process:

$$y_t = \mu + \rho y_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2) \qquad (3)$$

Equation (3) can be extended recursively, yielding:

$$\begin{aligned} y_t &= \mu + \rho y_{t-1} + \varepsilon_t \\ &= \mu + \rho\mu + \rho 2 y_{t-2} + \rho\varepsilon_{t-1} + \varepsilon_t \\ &. \\ &. \\ &. \\ &(1 + \rho + \ldots + \rho^{n-1})\mu + \rho^n y_{t-n} + (1 + \rho L. + \ldots + \rho^{n-1} L^{n-1})\varepsilon_t \end{aligned} \qquad (4)$$

where L is the lag operator. The variance of y_t can be easily worked out:

$$Var((y_t)) = \frac{1-\rho^n}{1-\rho}\sigma_\varepsilon^2 \tag{5}$$

It is clear that there is no finite variance for y_t if $\rho \geq 1$. The variance is $\sigma_\varepsilon^2/(1-\rho)$ when $\rho< 1$.

Alternatively, equation (3) can be expressed as:

$$y_t = \frac{\mu + \varepsilon_t}{(1-\rho L)} = \frac{\mu + \varepsilon_t}{\rho((1/\rho) - L)} \tag{6}$$

which has a root $r = 1/\rho$.Comparing equation (5) with (6), we can see that when y_t is non-stationary, it has a root on or inside the unit circle, that is, $r \geq 1$; while a stationary y_t has a root outside the unit circle, that is, $r< 1$. It is usually said that there exists a unit root under the circumstances where $r \geq 1$. Therefore, testing for stationarity is equivalent to examining whether there is a unit root in the time series. Having gained the above idea, commonly used unit root test procedures are introduced and discussed in the following.

3.1.1. Dickey and Fuller

The basic Dickey–Fuller (DF) test (Dickey and Fuller 1979, 1981) examines whether $\rho<1$ in equation (3), which, after subtracting yt−1 from both sides, can be written as:

$$\Delta y_t = \mu + (\rho - 1)y_{t-1} + \varepsilon_t = \mu + \theta y_{t-1} + \varepsilon_t \tag{7}$$

The null hypothesis is that there is a unit root in y_t, or $H_0 : \theta = 0$, against the alternative $H_1 : \theta < 0$, or there is no unit root in y_t . The DF test procedure emerged since under the null hypothesis the conventional t -distribution does not apply. So whether $\theta < 0$ or not cannot be confirmed by the conventional t -statistic for the θ estimate. Indeed, what the DF procedure gives us is a set of critical values developed to deal with the non-standard distribution issue, which are derived through simulation. Then, the interpretation of the test result is no more than that of a simple conventional regression. Equations (3) and (7) are the simplest case where the residual is white noise. In general, there is serial correlation in the residual and Δy_t can be represented as an autoregressive process:

$$\Delta y_t = \mu + \theta y_{t-1} + \sum_{i=1}^{\rho} \phi i \Delta y_{t-i} + \varepsilon_t \qquad (8)$$

Corresponding to equation (8), DF's procedure becomes the Augmented Dickey–Fuller (ADF) test. We can also include a deterministic trend in equation (8).Altogether; there are four test specifications with regard to the combinations of an intercept and a deterministic trend.

3.1.2. Kwiatkowski, Phillips, Schmidt and Shin

Recently, a procedure proposed by Kwiatkowski et al. (1992), known as the KPSS test named after these authors, has become a popular alternative to the ADF test. As the title of their paper, 'Testing the null hypothesis of stationarity against the alternative of a unit root', suggests, the test tends to accept stationarity, which is the null hypothesis, in a time series. In the ADF test on the other hand, the null hypothesis is the existence of a unit root, and stationarity is more likely to be rejected. Here in that the series y_t is assumed to be (trend-) stationary under the null. The KPSS statistic is based on the the residuals from the OLS regression of y_t on the exogenous variables x_t:

$$y_t = x_t^{'}\delta + u_t \tag{9}$$

The LM statistic is defined as:

$$LM = \sum_t S(t)^2 / \left(T^2 f_0\right) \tag{10}$$

where, f_0 is an estimator of the residual spectrum at frequency zero and where S(t) is a cumulative residual function:

$$S(t) = \sum_{r=1}^{t} \hat{u}_r \tag{11}$$

based on the residuals $\hat{u}_t = y_t - x_t^{'}\hat{\delta}(0)$. We point out that the estimator of δ used in this calculation differs from the estimator for δ used by GLS detrending since it is based on a regression involving the original data and not on the quasi-differenced data.

To specify the KPSS test, you must specify the a set of exogenous regressors x_t and method for estimating f_0.

Many empirical studies have employed the KPSS procedure to confirm stationarity in such economic and financial time series as the unemployment rate and the interest rate, which, arguably, must be stationary for economic theories, policies and practice to make sense. Others, such as tests for purchasing power parity (PPP), are less restricted by the theory.

Confirmation and rejection of PPP are both acceptable in empirical research using a particular set of time series data, though different test results give raise to rather different policy implications. It is understandable that, relative to the ADF test, the KPSS test is less likely to reject PPP.

3.1.3. Variance Decomposition

As returns may be volatile, we are interested in the sources of volatility. The expression for innovation in the total rate of return:

$$r_t - E_t\{r_t\} = E_{t+1}\left\{\sum_{\tau=o}^{\infty}(1-\lambda)^{\tau}\Delta d_{t+1+\tau}\right\} - E_t\left\{\sum_{\tau=0}^{\infty}(1-\lambda)^{\tau}\Delta d_{t+1+\tau}\right\}$$
$$-\left[E_{t+1}\left\{\sum_{\tau=1}^{\infty}(1-\lambda)^{\tau} r_{t+\tau}\right\} - E_t\left\{\sum_{\tau=1}^{\infty}(1-\lambda)\right\}^{\tau} r_{t+\tau}\right] \quad (12)$$

Equation (12) can be written in compact notations, with the left-hand side term being ν_t, the first term on the right-hand side $\eta_{d,\,t}$, and the second term on the right-hand side $\eta_{r,\,t}$:

$$v_t = \eta_{d,t} - \eta_{r,t} \quad (13)$$

where ν_t is the innovation or shock in total returns, $\eta_{d,t}$ represents the innovation due to changes in expectations about future income or dividends, and $\eta_{r,t}$ represents the innovation due to changes in expectations about future discount rates or returns. Again, we use VAR to express the above innovations. Vector z_t contains, first of all, the rate of total return or discount rate. Other variables included are relevant to forecast the rate of total return:

$$z_t = Az_{t-1} + \varepsilon_t \tag{14}$$

with the selecting vector e1 which picks out r_t from zt , we obtain:

$$v_t = r_t - E_t\{r_t\} = e1'\varepsilon_t \tag{15}$$

Bringing equations (14) and (15) into the second term on the right-hand side of equation (12) yields:

$$\eta_{r,t} = E_{t+1}\left\{\sum_{\tau=1}^{\infty}(1-\lambda)^{\tau} r_{t+\tau}\right\} - E_t\left\{\sum_{\tau=1}^{\infty}(1-\lambda)^{\tau} r_{t+\tau}\right\}$$

$$= e1'\sum_{\tau=1}^{\infty}(1-\lambda)^{\tau} A^{\tau}\varepsilon_t = e1'(1-\lambda)A[I-(1-\lambda)A]^{-1}\varepsilon_t \tag{16}$$

$\eta_{d,t}$ can be easily derived according to the relationship in equation (13) as follows:

$$\eta_{d,t} = v_t + \eta_{r,t} = e1'\{I + (1-\lambda)A[I-(1-\lambda)A]^{-1}\}\varepsilon_t \tag{17}$$

The variance of innovation in the rate of total return is the sum of the variance of $\eta_{r,t}$, innovation due to changes in expectations about future discount rates or returns, $\eta_{d,t}$, innovation due to changes in expectations about future income or dividends, and their covariance that is:

$$\sigma_v^2 = \sigma_{\eta,d}^2 + \sigma_{\eta,r}^2 - 2Cov(\eta_{d,t}, \eta_{r,t}) \tag{18}$$

3.2. Vector Autoregression

The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system.

The mathematical representation of a VAR is:

$$y_t = A_t y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t$$

where y_t is a k vector of endogenous variables, x_t is a d vector of exogenous variables, A_1,…., A_p and B are matrices of coefficients to be estimated, and is ε_t a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

Since only lagged values of the endogenous variables appear on the right-hand side of the equations, simultaneity is not an issue and OLS yields consistent estimates. Moreover, even though the innovations may be contemporaneously correlated, OLS is efficient and equivalent to GLS since all equations have identical regressors.

As an example, suppose that industrial production (IP) and money supply (M1) are jointly determined by a VAR and let a constant be the only exogenous variable. Assuming that the VAR contains two lagged values of the endogenous variables, it may be written as:

$$IP_t = a_{11}IP_{t-1} + a_{12}M1_{t-1} + b_{11}IP_{t-2} + b_{12}M1_{t-2} + c_1 + \varepsilon_{1t} \quad (19)$$

$$M1_t = a_{21}IP_{t-1} + a_{22}M1_{t-1} + b_{21}IP_{t-2} + b_{22}M1_{t-2} + c_2 + \varepsilon_{2t}$$

where, a_{ij},b_{ij} and c_i are the parameters to be estimated.

3.3. Cointegration Tests

The finding that many macro time series may contain a unit root has spurred the development of the theory of non-stationary time series analysis. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables.

For a pair of variables to be cointegrated, a necessary (but not a sufficient) condition is that they should be integrated of the same order. Assuming that both x_t and y_t are I(d), the OLS regression of one upon another will provide a set of residuals, u_t. If u_t is I(0) (stationary), then x_t and y_t are said to be cointegrated (Engle and Granger, 1987). If u_t is nonstationary, x_t and y_t will tend to drift apart without bound. Therefore, cointegration would mean that u_t will rarely drift apart from zero and will often cross the zero line. Thus, the cointegration of two variables is at least a necessary condition for them to have a stable long-run (linear) relationship.

The Engle-Granger cointegration technique is a two-stage residual based procedure. While quite useful, this technique suffers from a number of problems. The purpose of the cointegration test is to determine whether a group of non-stationary series is cointegrated or not. As explained below, the presence of a cointegrating relation forms the basis of the VEC specification. EViews implements VAR-based cointegration tests using the methodology developed in Johansen (1991, 1995a).

Consider a VAR of order p:

$$y_t = A_t y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t \qquad (20)$$

Where y_t is a k-vector of non-stationary I(1) variables, x_t is a d-vector of deterministic variables, and ε_t is a vector of innovations. We may rewrite this VAR as,

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + \varepsilon_t \qquad (21)$$

where

$$\Pi = \sum_{i=1}^{p} A_i - I_o \qquad \Gamma_i = -\sum_{j=i+1}^{p} A_j \qquad (22)$$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank $\Gamma < k$, then there exist $\Gamma \times k$ matrices α and β each with rank Γ such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I(0).

Γ is the number of cointegrating relations (the cointegrating rank) and each column of β is the cointegrating vector. As explained below, the elements of α are known as the adjustment parameters in the VEC model. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π.

3.4. Impulse Response Analysis and Variance Decomposition

Impulse response analysis is another way of inspecting and evaluating the impact of shocks cross-section. While persistence measures focus on the long-run properties of shocks, impulse response traces the evolutionary path of the impact overtime. Impulse response analysis, together with variance decomposition, forms innovation accounting for sources of information and information transmission in a multivariate dynamic system.

Considering the following vector autoregression (VAR) process:

$$y_t = A_0 A_1 y_{t-1} + A_2 y_{t-2} + K + A_k y_{t-k} + \mu_k \tag{23}$$

where y_t is an n × 1 vector of variables, A_0 is an n × 1 vector of intercept, A_τ (τ =1, …, k) are n×n matrices of coefficients, μ_t of white noise processes with $E(\mu_t) = 0$, $\Sigma_\mu = E(\mu_t \mu_t^{'})$ being non-singular for all *t* and, $E(\mu_t \mu_t^{'})$ for t≠s. Without losing generality, exogenous variables other than lagged y_t are omitted for simplicity. A stationary VAR process of equation (23) can be shown to have a MA representation of the following form:

$$y_t = C + \mu_t + \Phi_1 \mu_{t-1} + \Phi_2 \mu_{t-2} + K$$
$$= C + \sum_{\tau=0}^{\infty} \Phi_\tau \mu_{t-\tau} \qquad (24)$$

where $C = E(y_t) = (I - A_1 - ... - A_K)^{-1} A_0$ and Φ_τ can be computed from A_τ recursively

$\Phi_\tau = A_1\Phi_{\tau-1} + A_2\Phi_{\tau-2} + K + A_K\Phi_{\tau-K}$, τ =1, 2, Λ with Φ_0=I and Φ_τ for τ<0.

The MA coefficients in equation (24) can be used to examine the interaction between variables. For example, $a_{ij,k,}$ the *ij* th element of Φ_k, is interpreted as the reaction, or impulse response, of the *i* th variable to a shock τ periods ago in the *j* th variable, provided that the effect is isolated from the influence of other shocks in the system. So a seemingly crucial problem in the study of impulse response is to isolate the effect of a shock on a variable of interest from the influence of all other shocks, which is achieved mainly through orthogonalisation.

Orthogonalisation per se is straightforward and simple. The covariance matrix $\Sigma_\mu = E(\mu_t \mu_t^{'})$,), in general, has non-zero off-diagonal elements. Orthogonalisation is a transformation, which results in a set of new residuals or innovations $\mathbf{v}_t$ satisfying $E(v_t, v_t^{'}) = I$. The procedure is to choose any non-singular matrix **G** of transformation for $v_t = G^{-1}\mu_t$ so that $G^{-1}\Sigma_\mu G^{'-1} = I$. In the process of transformation or orthogonalisation, $\mathbf{\Phi_\tau}$ is replaced by $\mathbf{\Phi_\tau G}$ and $\boldsymbol{\mu}_t$ is replaced by $\mathbf{v}_t = G^{-1}\mu_t$, and equation (24) becomes:

$$y_t = C + \sum_{\tau=0}^{\infty} \Phi_\tau \mu_{t-\tau} = C + \sum_{\tau=0}^{\infty} \Phi_\tau G v_{t-\tau}, \qquad E(v_t v_t^{'}) = I \qquad (25)$$

Suppose that there is a unit shock to, for example, the *j* the variable at time 0 and there is no further shock afterwards, and there are no shocks to any other variables. Then after *k* periods, $\boldsymbol{y_t}$ will evolve to the level:

$$y_t = C + \left(\sum_{\tau=0}^{k} \Phi_\tau G\right) e(j) \qquad (26)$$

where **e(j)** is a selecting vector with its *j* the element being one and all other elements being zero. The accumulated impact is the summation of the coefficient matrices from time 0 to *k*. This is made possible because the covariance matrix of the transformed residuals is a unit matrix **I** with off-diagonal elements being zero. Impulse response is usually exhibited graphically based on equation (26). A shock to each of the *n* variables in the system results in *n* impulse response functions and graphs, so there are a total of *n*x*n* graphs showing these impulse response functions.

To achieve orthogonalisation, the Choleski factorisation, which decomposes the covariance matrix of residuals Σμ into GG' so that G is lower triangular with positive diagonal elements, is commonly used. However, this approach is not invariant to the ordering of the variables in the system. In choosing the ordering of the variables, one may consider their statistical characteristics. By construction of G, the first variable in the ordering explains all of its one-step forecast variance, so a variable which is least influenced by other variables, such as an exogenous variable, is consigned to the first in the ordering. Then the variable with least influence on other variables is chosen as the last variable in the ordering.

The other approach to orthogonalisation is based on the economic attributes of data, such as the Blanchard and Quah structural decomposition. It is assumed that there are two types of shocks, the supply shock and the demand shock. While the supply shock has permanent effect, the demand shock has only temporary or transitory effect. Restrictions are imposed accordingly to realize orthogonalisation in the residuals. Since the residuals have been orthogonalised, variance decomposition is straightforward. The k-period ahead forecast errors in equation (24) or (25) are:

$$\sum_{\tau=0}^{k-1} \Phi_\tau G v_{t-\tau+k-1} \qquad (27)$$

The covariance matrix of the *k*-period ahead forecast errors are:

$$\sum_{\tau=0}^{k-1} \Phi_\tau G G' \Phi_\tau' = \sum_{\tau=0}^{k-1} \Phi_\tau \Sigma_\mu \Phi_\tau' \qquad (28)$$

The right-hand side of equation (28) just reminds the reader that the outcome of variance decomposition will be the same irrespective of **G**. The choice or derivation of matrix **G** only matters when the impulse response function is concerned to isolate the effect from the influence from other sources. The variance of forecast errors attributed to a shock to the *j* the variable can be picked out by a selecting vector **e (j),** with the *j* the element being one and all other elements being zero:

$$Var(j,k) = \left(\sum_{\tau=0}^{k-1} \Phi_\tau Ge(j)e(j)'G'\Phi'_\tau \right) \tag{29}$$

Further, the effect on the i^{th} variable due to a shock to the j^{th} variable, or the contribution to the i^{th} variable's forecast error by a shock to the j^{th} variable, can be picked out by a second selecting vector e(i) with the ith element being one and all other elements being zero.

$$Var(ij,k) = e(i)'\left(\sum_{\tau=0}^{k-1} \Phi_\tau Ge(j)e(j)'G'\Phi'_\tau \right)e(i) \tag{30}$$

In relative terms, the contribution is expressed as a percentage of the total variance:

$$\frac{Var(ij,k)}{\sum_{j=1}^{n} Var(ij\,k)} \tag{31}$$

which sums up to 100 per cent.

3.5. Money Demand and Time Series Models

Non-stationarity of time series data, an important characteristic of time series, has been taken care of by the theory of cointegration. Whereas the question as to whether the estimated model is valid for statistical inference, forecasting and policy analysis or not is addressed by the theory of exogeneity.[5] It is strongly argued that the analysis of exogeneity of parameters of interest is required to derive policy implications from the cointegration analysis. The exogeneity of variables depends upon the parameters of interest and the purpose of the model. If the model is to be

[5] Among others see Engle, et al. (1983).

used only for statistical inference/analysis then we require the analysis of weak erogeneity. If the purpose of modeling is forecasting the future observations then we need to conduct the analysis of strong exogeneity.

Finally the concept of super-exogeneity is relevant if the objective of the study is that the money demand model to be used for policy analysis. Considering the importance of money demand in the macroeconomic analysis and exogeneity in statistical analysis, forecasting and policy simulation, this paper attempts to provide congruent money (M2) demand function by employing cointegration analysis, estimating dynamic error correction model and testing the super-exogeneity of the parameters of interest.

The error correction model has become a very popular specification for dynamics equation in applied economics, including applications to such mainstream problems as personal consumption, investment, and the demand for money. The statistical framework is attractive, in that it encompasses models in both levels and differences of variables and is compatible with long-run equilibrium behavior. The success of the error correction paradigm in applications has led to the development of theory justifying the form of such an estimating for purposes of interference (i.e. the concept of cointegration in economics time series-Granger and Engel (1988), and related literature), as well as discussion of the theoretical behavior of such models under so-called ‘growth equilibrium’.

With the introduction of derivatives, markets are more perfect thus influencing monetary policy actions (Vrolijk, 1997). Financial innovation influences the structure and behavior of the central banker, and the process of development of financial markets goes together with the process of changing of monetary theory and policy.

Financial innovation might influence the degree of substitution between financial assets in the portfolio of economic agents. We treat this property in a Tobin's framework (Savona, 2003). Given more perfect financial market, the substitutability between financial assets and liabilities increases, thus making the traditional demand for money function unstable in its parameters, which do not include innovation.

The introduction of derivatives on world markets decreases asymmetries, transaction and investment costs, thus contributing to increase the possibilities for portfolio diversification. The degree of substitution with traditional and new investments increases, making money aggregates less meaningful

In this context, the money demand function defined in the previous sections should be implemented according to the country specific conditions based on empirical investigation procedure that refers to the time series, since across countries the definition of main variables is not homogenous. This problem leads to the complete lack of data and the impossibility of any reliable analysis which clarifies why panel data estimates are un-developed in this field.

Time series analysis can be started after checking the presence of unit roots as macroeconomic variables are often un-stationary, and the demand function could be expressed using the same root order. If all variables are I(1) a function could be expressed in terms of the levels.

Old-fashioned theories remain influential, despite their lack of recent polishing by academic macro theorists, because they are indeed strongly supported by historical evidence. In this context, simple money demand estimates on levels with the OLS provide unstable results and super-consistent coefficients. Monetary aggregates tend to move in the same direction as aggregate economic activity. Simple co-movements could in principal easily be accounted for as passive response of money demand to changes in the level of activity not generated by monetary policy.

Friedman and Schwartz (1963) were the first to observe the existence of a strong correlation between money supply and business cycle. They paid special attention to the timing of movements in monetary aggregates and aggregate activity and tried to isolate periods when monetary policy variables moved for reasons that cannot be connected to any previous developments in the private sector. Moreover, Romer and Romer (1990) have done the same thing more systematically.

The historical ‘event studies’ using monetary aggregates and the study of impulse response lead to the result that when monetary aggregates increase unexpectedly nominal income subsequently rises. Responses to financial innovations generate timing patterns that are at least partly immune to the effects of differencing. The response of income to an innovation in money is invariant to differencing of the money data. When the responses show the extreme asymmetry of zero responses of money to income innovations, this condition-Granger casual priority of money-is invariant to differing of either income or money. Sims (1971) showed that money was Granger causally prior to nominal income in U.S. postwar data through 1960s and Tobin added that this causal relationship could be reversed, and the Granger Causality test, introduced in the field by Sims (1972). Furthermore this result still holds using data through the 80s verified by Sims (1989).

However, in larger multivariate time series models, including a nominal interest rate, money stock innovations become smaller, as interest rate innovations predict a considerable fraction of movement in the money stock. Further, the remaining money stock innovations have less predictive power for income.

In this context, Conte and Oldani (2006) investigated money demand estimates splitting in to two terms; short term analysis which uses the error correction model (ECM) and long term analysis, which uses the Vector

Auto Regression (VAR) or the Vector Error Correction Mechanism (VECM). Based on their findings, fractional cointegration was useful for underlying the role of future prices, i.e. financial innovation, in explaining instability in money demand. Futures help money demand function to come back to a stable long-run equilibrium path after instability periods. Traditional monetary literature paid attention to modified money markets and institution, but a stable money demand function needs to be identified in order to provide meaningful information about inflation pressures and financial order. The long-run equilibrium solution, i.e. money as a function of income and price, is confirmed by their results, but the inclusion of futures lets increase the descriptive power of the money demand function.

4. EMPIRICAL RESULTS

The main purpose of this chapter is to construct and test the empirical validity of the new monetary aggregates for USA. The reason for selecting USA is the availability of data. Our aim is to look at an empirical specification of money demand, which includes one of the most traded, liquid financial asset, both at domestic and international levels (futures). The used in tests is decribed detailly in the Appendix. The data period and frequency is 01.1988-02.2006 and monthly based.

Conte and Oldani (2006) splitted modern money demand estimates can be into short term analysis, which use the error correction approach (ECM), i.e. the Maximum Likeli-hood-ARCH estimator, and long term analysis, which use the Vector Auto Regression (VAR) or the Vector Error Correction Mechanism (VECM).

The ECM representation is based on relevant lags of variables, chosen according to their informative power with respect to the function (i.e. using the Akaike or the Schwarz-Bayesian information criteria). We will also use VECM to establish a long term analysis and construct a transmission mechanism.

All the variables are explained in Appendix and featured in Graph 1a. The empirical analysis starts with the preliminary tests of nonstationarity. We chose ADF tests and KPSS tests which are more compatible for this thesis. The results of the unit root tests are in Tables 1a, 1b, 1c through the ADF and KPSS tests show that LnDjFut_Sa, LnIndpro_Sa, LnMsim2_Sa, FedRate_Sa, LnM2_Sa and LnCE_Sa are all non-stationary and appears to have a unit root.

The main reason of choosing these variables is that The Federal Reserve controls the three tools of monetary policy open market operations, the discount rate, and reserve requirements. The Board of Governors of the Federal Reserve System is responsible for the discount rate and reserve requirements, and the Federal Open Market Committee is responsible for open market operations.

In this context, changes in the federal funds rate trigger a chain of events that affect other short-term interest rates, foreign exchange rates, long-term interest rates, the amount of money and credit, and, ultimately, a range of economic variables, including employment, output, and prices of goods and services.

The effects of financial innovations that have distorted conventional money demand functions are captured well by the new monetary aggregates because micro foundations approach is based on the user cost argument. As the opportunity costs of monetary assets that have recently been introduced into the market are accounted for, the effects of different choices made by economic agents are incorporated into the definition of monetary services indexes.

The next step in the empirical analysis is the test for the presence of a cointegrating vector in the money-demand function. We test for the presence of cointegration between the monetary index services, industry production, Dow Jones Futures transaction volume and interest rates using the Johansen Test methodology.

To determine the number of cointegrating relations r conditional on the assumptions made about the trend, we can proceed sequentially from $r=0$ to $r=k-1$ until we fail to reject. The result of this sequential testing procedure is reported at the bottom of each table block. The result of tests both including and excluding trend is reported in Table 1d which shows that there is one cointegrating vector.

Once again, we test for the presence of causality between the Dow Jones futures, industrial production (output), and Federal Reserve fund interest rates using the JJ methodology. Results are represented in Table 1f. Based on the test results we cannot reject the hypothesis that DJFUT does not Granger cause FEDRATE but we do reject the hypothesis that FEDRATE does not Granger cause DJFUT. Therefore it appears that Granger causality runs one-way from FEDRATE to DJFUT and not the other way**.**

Again based on the test results, we cannot reject the hypothesis that INDPRO does not Granger cause DJFUT as well as DJFUT does not Granger cause INDPRO. Therefore it appears that Granger causality runs two-ways both from DJFUT to INDPRO and not the other way**.**

Finally we cannot reject both the hypothesis that MSIM2 does not Granger cause DJFUT and the hypothesis that DJFUT does not Granger cause MSIM2. Therefore it appears that Granger causality does not from both DJFUT to INDPRO and the other way. But we should remember that the fact that DJFUT does not granger-cause MSIM2 doesn't necessarily imply that MSIM2 is independent of DJFUT, granger causality only refers to the capacity of DJFUT to forecast MSIM2, if your reject granger-causality tests, it just means that lead-lags of DJFUT could not be used to properly forecast MSIM2.

Same Granger Causality tests are also applied with Simple Sum Aggregate (M2) and Currency Equivalent Index (CE). Based on the results CE is performing better than both MSIM2 and M2 to establish a transmission mechanism.

In this context we performed a Vector Error Correction Estimation as mentioned in Tables 1g, 1h and 1i for M2, MSIM2 and CE. We can accept these equations as brief transmission mechanisms. Based on the test results Dow Jones futures affect Monetary Service Index and Currency Equivalent Index in short term. The coefficients of the Cointegration Equation 1 are statistically significant for CE while the coefficients of M2 and MSIM2 cointegration test are not for Industrial Production Index coefficients.

As a result we investigate the cointegration relationship between Monetary Aggregates and Dow Jones Futures, Fed Fund Rates and Industrial Production Index by splitting in to two terms; short term analysis and long term analysis as Conte and Oldani (2006).

While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR.

In the long run as mentioned in Tables 1j, 1k and 1l. explanatory variable are quite sufficient to explain Monetary Aggregates as Dow Jones Futures can explain %14.47 of Monetary Services Index, 17.35% of Simple Sum and 1.529% of Currency Equivalent Index. Consedering the main purpose of this thesis which is implementing derivatives in to money demand function in order to establish a transmission mechanism with a monetary aggregate approach, Currency Equivalent Index is most significant monetary aggregate type as it's not logical for Dow Jones Futures volume to be able to explain the change in Monetary Aggregate with 14.47% or 17.35%. In their study Conte and Oldani 2006, their results also show that fractional cointegration is useful for underlying the role of future transactions, i.e. financial innovation, in explaining instability in money demand. Futures help money demand function to come back to a stable long-run equilibrium path after instability periods.

In the next step we performed an Impulse Response analysis as mentioned in the multiple graphs in Graph 1b. According to the results, after 1σ shock is given, response of Monetary Service Index to Dow Jones futures stands permanent after three periods lag. Monetary Service Index responses also in the same way to Fed Fund Rates. The response of MSI to Industrial Production Index is also negatively but faster with one lag. Both M2 and CE also response in the same way to Fed Rates, Dow Jones Futures and Industrial Production Index. Recent literature about money demand in the US show that the interest rate and income elasticity have been subject to changes over the last decades and that money demand is negatively affected by the return on stocks, the return on long bonds, and the expected inflation rate (Hsing and Chang, 2003), confirming that a portfolio approach to money demand is consistent with a mature financial system, as the American.

We know that the derivatives' market is hundreds of times bigger than the underlying. Liquidity of futures markets is the same or higher that the underling markets'; in some cases the underlying asset does not exist as such (like in the DJIA case) and then futures have higher liquidity by definition. Looking at costs and potential profit, the leverage effect of futures allow for higher (potential) profit and lower costs of investments. Risk profile of futures is the same as the underlying, given matching price and price discovery effect, but because of their high liquidity and general efficiency, they are preferred for hedging activity. Moreover, futures and traditional stock exchange show different economic functions (derivatives exhibit leverage, hedging and substitutability), while hedging and lev-erage cannot be exploited in the same way in the underlying market. We can conclude that they represent different assets and satisfy different functions in the money demand and asset allocation of investors.

Finally in Table 1e we obtain the most important test results of this thesis. In a sense mainstay of this thesis is based on this table. Based on Normalized Conintegration Coefficients Currency Equivalant Index performs better than Monetary Services Index and Simple Sum Monetary Aggregate. Although including trend in to the equation increases the t-statics values of explanatory variables, trend variable is not statistically significant for explaining CE.

In this context our equation is:

$$LnCE\_Sa + 0.33 LnFedRate\_Sa + 2.221 LnDJFut\_Sa - 12.97 LnInd\Pr o = I(0)$$

$$LnCE\_Sa = -0.33 LnFedRate\_Sa - 2.221 LnDJFut\_Sa + 12.97 LnInd\Pr o$$

Given that we enriched the specification of money demand function and included an innovation, which represents market evolution. Frank et al. (2007)'s paper[6] is the first attempt to model empirically the transmission of liquidity shocks across US financial markets during the recent period of financial stress.

Their findings address the links between market and funding liquidity effects and the for dynamics of bank insolvency pressures among the largest complex financial institutions. This connection is of critical importance since this latest crisis, which in its early stages was perceived as a temporary liquidity episode, eventually metastasized into one of solvency for a number of major global banks.

On the other hand examining how supply side bank liquidity shocks get transmitted to the rest of the economy, Khwaja and Mian (2008) state that banks around the world, especially in emerging markets, often face large

[6] Transmission of Liquidity Shocks: Evidence from Subprime Crisis

shocks to their supply of liquidity due to regime shifts, speculative bank runs, “hot money” flows, or exchange rate volatility.

Many (Ben Bernanke 1983, Kashyap and Stein 2000, Khwaja and Mian 2008) argue that banks pass these fluctuations on to borrowing firms even when there is no change in the firms’ overall credit worthiness. While banks pass their liquidity shocks on to firms, large firms-particularly those with strong business or political ties-completely compensate the losses by additional borrowing thorough the credit market while small firms are unable to do so.

Moreover, The Long Term Capital Management’s failure in 1998 pointed out to a liquidity problem and the Federal Reserve had to be involved as a counterpart to avoid a credit crunch. Other important financial tragedies such as Enron, MetallGesellSchaft (experienced a cash flow mismatch between long-term over-thecounter (OTC) forward contracts and marked-to-market short-term exchange-traded Futures) and Barings, posed to the possibility of safety and liquidity problems. The monetary authorities acting to the malignant of the solvency of the monetary and financial system had to be on alert.

Hunter and Marshall (1999) and Hunter and Smith (2002) also confirm this proposition, stating that the role of derivatives on financial markets is not ruinous, since they increase the efficiency of markets. However, derivatives tend to make the conduct of policy more difficult and complicate the regulatory process. Weithers (2007) states that the mission of the Federal Reserve System falls into four categories (my emphasis added):

i. conducting the nation's monetary policy by influencing the monetary and credit conditions in the economy in pursuit of maximum employment, stable prices, and moderate long-term interest rates;
ii. supervising and regulating banking institutions to ensure the safety and soundness of the nation's banking and financial system and to protect the credit rights of consumers;
iii. maintaining the stability of the financial system and containing systemic risk that may arise in financial markets;
iv. providing financial services to depository institutions, the U.S. government, and foreign official institutions, including playing a major role in operating the nation's payment system. (BOGFRS 2005, 1)

There is no doubt that credit derivatives affect at least three of these duties in a significant way. The probability of systemic risk in the banking industry stemming from macroeconomic events related to credit derivatives is probably much lower than in the past because of the dissemination of default risk among a broader investor base. This claim may not be true, though, of the insurance industry ("insurance companies account for only 1% of protection buyers versus 20% of protection sellers" [Jorion 2005, 523]). For the financial system as a whole—recognizing that hedge funds, on balance, supply and demand comparable magnitudes of credit derivatives to and from the market—hedge funds would appear to provide a buffer for traditional lending institutions. One caveat is the potential for concentration risk if hedge funds all end up taking on the same (losing) positions.

The distribution of risk has its downside, though, in terms of control. Some may recall the days when the Fed targeted the money supply. Because banks were so clever at creating money substitutes (regardless of the various definitions of money: M1, M2, M3b), eventually the Fed simply gave up attempting to control or target the monetary aggregates. One wonders whether there is an analogue at work with the control of credit risk (through credit derivatives).

On 10th of August 2007 the Fed governors in Washington and the presidents of the twelve regional banks agreed to do the first thing that Fed always does in crisis: try the calming effects of words. They promised enough money to keep the federal funds rate close to its 5.25 percent target and long through the discount window.

The Friday morning message of August 17 was clear: a cut in interest rates was new on the table for the first time in Bernanke's tenure: "The Fed is prepared to act as needed to mitigate the adverse effects on the economy arising from the disruptions of financial markets” which means “we will cut rates unless markets turn around soon”.

However, the discount rate maneuver and the hint of lower interest rates to come hadn’t been sufficient as the banks were reluctant both borrowing from the Fed and lending to one another. At that point the problem was not that banks lack capital or could not fund themselves but it was that the solvency of a rage of non-banks[7] which threats the financial stability and highly resistant to Fed’s traditional cutting interest rates.

The impressive growth of the marketplace for credit derivatives speaks for itself. Recent developments in the settlement procedure, reductions in operational risks, and other advances to improve the clearing, transparency, and liquidity of the market bode well for the continued success of these products. Nevertheless, potential concerns still remain: These include moral hazard associated with the due diligence responsibilities of those involved in the debt origination process; the relatively small number of large broker-dealers; potential conflicts of interest.

[7] Investment Banks, Brokarege Firms and Insurance Companies.

5. CONCLUSION

Based on our thesis results, derivatives effects the monetary aggregate negatively in the shor-run while the effect is positive in the long-run. Moreover, the effects of financial innovations that have distorted money demand functions are detected better by the new monetary aggregates as microfoundations approach is based on the user cost argument. Since the opportunity costs of monetary assets that have recently been introduced into the market are accounted for, the effects of different choices made by economic agents are incorporated into the definition of monetary services indexes.

Derivatives are contingent claims that complete financial markets. Their use allow agents and firms to ameliorate the impact over consumption, production and investment given a change in relative prices induced by an active monetary policy. In this sense, derivatives generate in some cases a loss in the effectiveness of the traditional monetary transmission channels in the short run, and in others, they promote an increase in the speed of transmission itself.(Gomez, Vasquez and Zea 2005.)

The current crisis might be characterized as an example of the final stage of a well-known boom-and-bust pattern that has been repeated so many times in the course of economic history. There are, nevertheless, some aspects that make this crisis different from its predecessors. The preceding boom had its origin – at least to a large part – in the development of new financial products that opened up new investment possibilities (while most previous crises were the consequence of overinvestment in new physical investment possibilities). Second, the global dimension of the current crisis is due to the increased connectivity of our already highly interconnected financial system. ('Modeling of Financial Markets' The 98th Dahlem Workshop, 2008.)

Monetary policy has lost some effectiveness to affect real variables in the short-run, due to the partial dilution of the main monetary transmission channels caused by the completion of financial markets that derivative instruments imply. The former occurs even considering the lack of development and depth of the domestic capital market. This conclusion, which may seem discouraging since it indicates the loss of effectiveness of monetary policy is, on the contrary, positive. Following Mies et Al.(2003), "...the impact of monetary policy over [economic] activity is produced, in most cases, due to the existence of a market imperfection whose existence may have certain costs in terms of effciency".

REFERENCES

Anderson,G., Richard, Jones, E., Berry & Nesmith, D., Travis. 1997, "Introduction to the St. Louis Monetary Services Index Project", *The Federal Reserve Bank of St. Louis Review*, January/February, Vol. 79, No.1, http://research.stlouisfed.org/publications/review

Bae, Youngsoo & De Jong, M., Robert. 2007, "Money Demand Function Estimation by Nonlinear Cointegration", *Journal of Applied Econometrics*, June. – July, Vol. 22, No. 4, pp. 767-793, http://www.econ.ohio-state.edu/dejong/mdemand_revison_6.pdf

Barnett, W.A. 1978, "The User Cost of Money." *Economics Letters* 1 (2): 145–9

Barnett, W.A. 1980, "Economic Monetary Aggregates: An Application of Index Number and Aggregation Theory." *Journal of Econometrics*, 14 (1): 11–48.

Barnett, William A., Jones, Barry E. & Nesmith, Travis D. 2008, "Divisia Second Moments: An Application of Stochastic Index Number Theory", Unpublished, http://mpra.ub.uni muenchen.de/9124/1/MPRA_paper_9124.pdf

Barnett, A., William, "Recent Monetary Policy and the Divisia Monetary Aggregates", The American Statistician, Vol. 38, No. 3, August, 1984, pp. 165-172, http://www.jstor.org/stable/pdfplus/2683646.pdf

Barnett, A., William. 2005, "Monetary Aggretation", *Working Papers Series in Theoretical and Applied Ecomomis*, University of Kansas, Department of Economics, March http://www2.ku.edu/~kuwpaper/2005Papers/200510.pdf

Barro, Robert J & Santomero, Anthony J. 1972. "Household Money Holdings and The Demand Deposit Rate," *Journal of Money, Credit and Banking, Blackwell Publishing*, vol. 4(2), pages 397-413, May, http://www.jstor.org/stable/pdfplus/1910543.pdf

Baumol, William J. 1952, "The Transactions Demand for Cash: An Inventory Theoretic Approach", *Quarterly Journal of Economics*, November, Vol. 66, pp.545-556, http://www.jstor.org/stable/pdfplus/1882104.pdf

Bernanke, Ben S. 1983, "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression", *The American Economic Review,* June Vol. 73, No. 3, pp. 257-276, http://www.jstor.org/stable/pdfplus/1808111.pdf

Chetty, V Karuppan. 1969 "On Measuring the Nearness of Near-Moneys", *American Economic Review*, Vol 59, No 3. pp 270-81, http://www.jstor.org/stable/pdfplus/1808957.pdf

Coenen, Günter & Vega, Juan-Luis. 1999, "The demand for M3 in the euro area", *Working Paper Series 6*, European Central Bank, http://www.ecb.int/pub/pdf/scpwps/ecbwp006.pdf

Conte, Anna & Oldani, Chiara. 2006, "Money Demand: Theories And Estimation Methods. A Fractional Cointegration Application", *Economia, Societa', e Istituzioni*, Vol. XVIII, Issue 3, http://econpapers.repec.org/article/luirivesi/1831.htm

Cox, J. C & J. E. Ingersoll, JR. - S. A. Ross. 1985, "A Theory of the Term Structure of Interest Rates," *Econometrica,* 53, 385-407.

Dickey, A., David & Fuller, A. Wayne. 1979, “Distribution of the Estimators for Autoregressive Time Series With a Unit Root”, *Journal of the American Statistical Association*, Jun., Vol. 74, No. 366, pp. 427-431, http://www.jstor.org/stable/pdfplus/2286348.pdf

Diewert, W. Erwin. 1976, "Exact and Superlative Index Numbers". Journal of *Econometrics* 4, 115-146, http://www.jstor.org/stable/pdfplus/1909755.pdf

Donmez, C.A. & Yilmaz, M.K. 1999, “Do Derivatives Markets Constitute a Potential Threat to the Stability of the Global Financial System?”, *ISE Review*, Vol. 3, No. 11, pp. 51-82.

Draghi, Mario. 2007, “Monetary policy and new financial instruments”, *Governor of the Bank of Italy and Chairman of the Financial Stability Forum Speech at Session I on Challenges in the World’s Financial Markets of the 2007 Money and Banking Conference* "Monetary Policy Under Uncertainty", hosted by the Central Bank of Argentina, Buenos Aires, 4 June, http://www.bis.org/review/r070608b.pdf

Engle, F., Robert & Granger, C., W., J. 1987, “Co-Integration and Error Correction: Representation, Estimation, and Testing”, *Econometrica*, Mar., Vol. 55, No. 2, pp. 251-276, http://www.jstor.org/stable/pdfplus/1913236.pdf

Fama, Eugene F. 1968, “Risk, Return and Equilibrium: Some Clarifying Comments”, *Journal of Finance*, Vol. 23, No. 1, pp. 29-40, http://www.jstor.org/stable/pdfplus/2325308.pdf

Fama, Eugene. 1968, "Dividend Policy: An Empirical Analysis". *Journal of the American Statistical Association* 63 (324): 1132–1161. December, http://www.jstor.org/stable/pdfplus/2325308.pdf

Fleissig, R., Adrian &Serletis, Apostolos. 2002, “Semi-Non-Parametric Estimates of Substitution for Canadian Monetary Assets”, *Journal of Economics / Revue canadienne d'Economique*, February, Vol. 35, No. 1 pp. 78-91, http://www.jstor.org/stable/pdfplus/3131904.pdf

Frank, Nathaniel, Hermosillo, Gonzalez, Brenda & Hesse, Heiko. 2007, “Transmission of Liquidity Shocks:Evidence from the 2007 Subprime Crisis”, *IMF Working Paper*, http://www.imf.org/external/pubs/ft/wp/2008/wp08200.pdf

Friedman, Milton & Schwartz, Anna J. 1963, ”Money and Business Cycles”, *The Review of Economics and Statistics, Supplement*, Feb, Vol. 45, No. 1, Part 2, pp. 32-64, http://www.jstor.org/stable/pdfplus/1927148.pdf

Friedman, M. and A. Schwartz. 1963, *A Monetary History of the United States, 1867–1960*, Princeton, N.J.P, Princeton University Press.

Grandmont, Jean-Michel & Younes, Yves. 1873, “On the Efficiency of a Monetary Equilibrium”, *The Review of Economic Studies* , Vol. 40, No. 2, Apr., pp. 149-165, http://www.jstor.org/stable/pdfplus/2296645.pdf

Goldfeld, M., Stephen, Fand, I., David & Brainard, C., William. 1976, “The Case of the Missing Money”, *Brookings Papers on Economic Activity*, Vol. 1976, No. 3, pp. 683-739, http://www.jstor.org/stable/pdfplus/2534372.pdf

Gómez, Esteban, Vásquez, Diego & Zea, Esteban. 2005, "Derivative Markets' Impact on Colombian Monetary Policy”, *Borradores De Economia 002277*, Banco De LA Republica, http://www.banrep.gov.co/docum/ftp/borra334.pdf

Henderson, Todd. 2009, “Credit Derivatives Are Not 'Insurance”, *University of Chicago Law & Economics, Olin Working Paper*, July, No. 476, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1440945

Helpman, Elhanan. 1981, “Optimal Spending and Money Holdings in the Presence of Liquidity Constraints”, *Econometrica,* Vol. 49, No. 6, pp. 1559-1570, http://www.jstor.org/stable/pdfplus/1911418.pdf

Hsing , Yu & Chang, Hui S. 2003, "Testing the Portfolio Theory of Money Demand in the United States," *Economia Internazionale / International Economics, Camera di Commercio di Genova,* vol. 56(1), pp: 13-21, http://ideas.repec.org/a/ris/ecoint/0167.html

Hull, J. 2002, *Options, Futures and Other Derivatives*, Fifth Edition, Prentice Hall.

Hunter W.C. & Marshall, D. 1999, “Thoughts of Financial Derivatives, Systemic Risk, and Central Banking: Some Recent Developments”, *Federal Reserve Bank of Chicago Working Paper*, n. 20, Chicago, http://www.chicagofed.org/digital_assets/publications/working_papers/1999/wp99_20.pdf

Hunter, W.C. & Smith, S.D. 2002, “Risk Management in the Global Economy: A Review Essay”, *Journal of Banking and Finance*, No. 26, pp. 205-221, http://www.sciencedirect.com/science/article/B6VCY-4509H9W-3/2/313ba8fb959914132d0f5eccd7ed9bf0

Hutt, William H. 1963, *Keynesianism - Retrospect and Prospect: Chicago: Regnery.*

Jensen, C., Michael, 1969, “Risk, the Pricing of Capital Assets, and the Evaluation of Investment Portfolios”, *Journal of Business*, April, Vol. 42, No. 2, pp. 167-247, http://www.jstor.org/stable/pdfplus/2351902.pdf

Johansen, Søren. 1995, "A Stastistical Analysis of Cointegration for I(2) Variables," *Econometric Theory, Cambridge University Press*, February, Vol. 11(01), pages 25-59, http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=3182432

Jorion, Philippe. 2007, "Bank Trading Risk and Systemic Risk," *NBER Working Papers 11037*, National Bureau of Economic Research, Inc, http://www.nber.org/papers/w11037.pdf

Jovanovic, Boyan. 1982, “Inflation and Welfare in the Steady State”, *Journal of Political Economy*, vol. 90, no. 3, pp.561-577, http://www.jstor.org/stable/pdfplus/1831370.pdf

Kashyap, K, Anil & Stein, Jeremy C. 2000, “What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?” *The American Economic Review*, June, Vol. 90, No. 3, pp. 407-428, http://www.jstor.org/stable/pdfplus/117336.pdf

Khwaja, I, Asim & Mian, Atif. 2008, “Tracing The Impact of Bank Liquidity Shocks: Evidence from an Emerging Market”, *The American Economic Review*, Vol. 98, No. 4, pp: 1413-1442

Kwiatkowski, Denis, Phillips, C., B., Peter, Schmidt, Peter & Shin, Yongcheol. 1992, “Testing the Null hypothesis of Stationarity Against the Alternative of a Unit Root: How sure are we that economic time series have a unit root?”, *Journal of Econometrics*, vol. 54, issue 1-3, pages 159-178, http://cowles.econ.yale.edu/P/cp/p08a/p0827.pdf

Lintner, John. 1965, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets", Review of Economics and Statistics, 47 (1), 13-37, http://www.jstor.org/stable/pdfplus/1924119.pdf

McCafferty, Stephen. 2007, "Aggregate Demand and Interest Rates: A Macroeconomic Approach to the Term Structure", *Economic Inquiry*, Volume 24, Issue 4, Pages 521 – 533, http://www3.interscience.wiley.com/journal/120026303/abstract?CRETRY=1&

Makropoulou, Vasiliki & Markellos, N., Raphael. 2005, "What is the Fair Rent Thales Should Have Paid?", *Financial Engineering Research Centre (FRC)*, Management Science Laboratory (MSL), http://www.aueb.gr/pympe/hercma/proceedings2005/H05-FULL-PAPERS-1/MAKROPOULOU-MARKELLOS-1.pdf

Mies, V., F. Morand & M. Tapia. 2003, "*Poltica Monetaria y Mecanismos de Transmisin. Centro de Estudios Monetarios Latinoamericanos"*, Rodrigo Gomez Award 2003

Mohan, Rakesh. 2009, "Global financial crisis – causes, impact, policy responses and lessons", *Deputy Governor of the Reserve Bank of India Speech at the 7th Annual India Business Forum Conference*, London Business School, London, 23 April, http://www.bis.org/review/r090506d.pdf

Mossin, Jan. 1996, "Equilibrium in a Capital Asset Market", *Econometrica*, Vol. 34, No. 4, pp. 768-783, http://www.jstor.org/stable/pdfplus/1910098.pdf

Oldani, Chiara. 2004, "An Overview of the Literature About Derivatives", *EconWPA in its series Macroeconomics*, April, http://129.3.20.41/eps/mac/papers/0504/0504004.pdf

Reinhart, Carmen, Arrau, Patricio, DeGregorio, Jose and Wickham, Peter. 1995, "The Demand for Money in Developing Countries: Assessing the Role of Financial Innovation", *Journal of Development Economics*, 46, pp. 317-340, http://mpra.ub.uni-muenchen.de/14096/1/MPRA_paper_14096.pdf

Rand, Ayn. 1957, *Atlas Shrugged,* Pan American, New York, United States of America, pp. 89-90.

Romer, David. 1986, "A Simple General Equilibrium Version of the Baumol-Tobin Model", *The Quarterly Journal of Economics*, November, Vol. 101, No. 4 pp. 663-686, http://www.jstor.org/stable/pdfplus/1884173.pdf

Romer, C. & D. Romer. 1990, "New Evidence on the Monetary Transmission Mechanism" *Brookings Papers on Economic Activity*, pp. 149-213, http://www.jstor.org/stable/pdfplus/2534527.pdf

Samuelson, Paul A. (1947, Enlarged ed. 1983). *Foundations of Economic Analysis*, Harvard University Press.

Savona, P. 2003, *La finanza dei derivati, in corso di pubblicazione per l'Enciclopedia Treccani del Novecento*, Roma.

Serletis, Apostolos. & Terence E. Molik. 2002, "Monetary aggregates and monetary policy", *In Money, Monetary Policy, and Transmission Mechanisms,* Ottawa: Bank of Canada, http://www.bankofcanada.ca/en/res/wp/1999/serletismolik-final.pdf

Sharpe, William F. 1966, "Mutual Fund Performance", *The Journal of Business,* Vol. 39, No. 1, Part 2: Supplement on Security Prices, January, pp. 119-138, http://www.jstor.org/stable/pdfplus/2351741.pdf

Sims, Christopher A. 1972, "Money, Income, and Causality," *American Economic Review*, American Economic Association, September, Vol. 62(4), pages 540-52, http://www.jstor.org/stable/pdfplus/1806097.pdf

Savona, P. 2003, *The Finance of Derivatives*, Istituto Treccani.

Sims, A., Christopher. 1972, "Money, Income, and Causality", *The American Economic Review*, Vol. 62, No. 4, pp. 540-552, http://www.jstor.org/stable/pdfplus/1806097.pdf

Sims, A., Christopher. 1989, "Models and their Uses," *American Journal of Agricultural Economic*, May, 71, p. 489-494, http://minneapolisfed.org/research/DP/DP11.pdf

Stockman, A. C. 1981, "Anticipated Inflation and the Capital Stock in a Cash-in-Advance Economy", *Journal of Monetary Economics 8*, pp. 387-393, http://www.sciencedirect.com/science/article/B6VBW-45F9242-4T/2/d45924811b112d71d5dad9260a8af7b7

Tinsley, P.A. 1998, "Short Rate Expectations, Term Premiums, and Central Banks use of Derivatives to Reduce Policy Uncertainty", *Discussion Paper*, n. 99/14, Board of Governors of the Federal Reserve System, Washington D.C. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=158650

Tobin, James. 1956, "The Interest Elasticity of the Transactions Demand for Cash", *Review of Economics and Statistics*, August, Vol. 38, no. 3, pp.241-247. 22, http://www.jstor.org/stable/pdfplus/1925776.pdf

Treynor, Jack L., "Market Value, Time, and Risk". Unpublished manuscript dated 8/8/1961, No. 95-209.

Treynor, Jack L. 1965, "How to Rate Management of Investment Funds". *Harvard Business Review*, 43, pp. 63-75.

Vrolijk, C. 1997, “Derivatives Effect on Monetary Policy Transmission”, *IMF Working Paper,* No. 121, September, Washington D.C., http://www.imf.org/external/pubs/ft/wp/wp97121.pdf

Weithers, Tim. 2007, “Credit Derivatives, Macro, Risks, and Systemic Risks”, *Atlanta Fed’s Financial Markets Conference*, http://www.frbatlanta.org/filelegacydocs/erq407_weithers.pdf

APPENDIX

DEFINITION OF VARIABLES AND DATA SPANS

FedRate_Sa: Effective Federal Funds Rate

LnDjFut_Sa: Dow Jones Futures Transaction Volume(Mil$)

LnIndpro_Sa: Industrial Production Index

LnMsim2_Sa: Monetary Services Index: M2 (Mil$)

LnM2_Sa: Simple Sum Monetary Aggregate

LnCE_Sa: Currency Equivalant Index

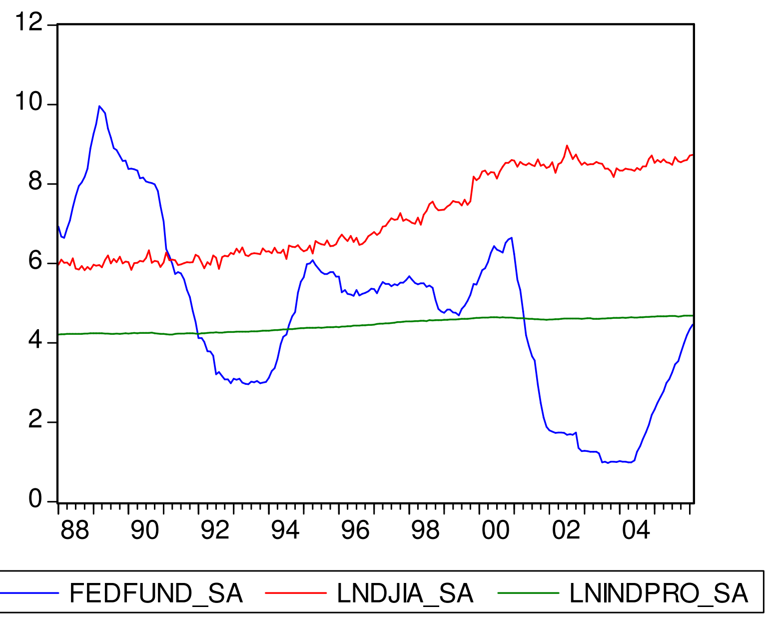
Ln stands for natural logarithm

D stands for difference operator

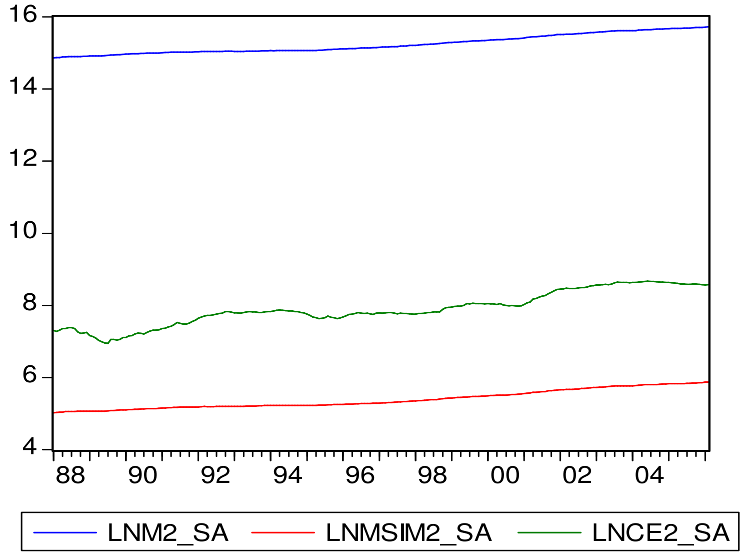
Sa stands for seasonal adjustments

Graph 1a --- Variables: 01.1988-02.2006, monthly

Dow Jones Futures, FED Fund Rates, Industrial Production Walk



Monetary Serice Index vs Simpel Sum



TABLES

Unit Root Tests

Table 1a --- ADF Test

Variable	Case	Lags	Level	Case	Lags	Difference
FedRate_Sa	No Trend	14	-1.8678	No Trend	14	-4.6637***
LnDjFut_Sa	No Trend	14	-0.1390	No Trend	14	-20.730***
LnIndpro_Sa	No Trend	14	-0.4176	No Trend	14	-5.3372***
LnMsim2_Sa	No Trend	14	2.0139	No Trend	14	-5.6937***
LnM2_Sa	No Trend	14	1.9692	No Trend	14	-4.2852***
LnCE_Sa	No Trend	14	-0.5617	No Trend	14	-9.4490***

Notes: The critical values for the case with No Trend are -3.51, -2.89, and -2.58 for 1%, 5% and 10% significance levels, respectively. (*) denotes significance at 10 % level, (**) denotes significance at 5 % level and (***) denotes significance at 1 % level. Variable Definitions are given in DEFINITION OF VARIABLES and DATA SPANS.

Table 1b --- KPSS Test

Variable	Case	Lags	Level	Case	Lags	Level
FedRate_Sa	No Trend	14	0.9475**	Trend	14	0.1218*
LnDjFut_Sa	No Trend	14	1.8197***	Trend	14	0.2575***
LnIndpro_Sa	No Trend	14	1.8562***	Trend	14	0.2384***
LnMsim2_Sa	No Trend	14	1.8461***	Trend	14	0.4531***
LnM2_Sa	No Trend	14	1.8587***	Trend	14	0.4507***
LnCE_Sa	No Trend	14	1.6890***	Trend	14	0.1469**

Notes: The critical values for the case with No Trend are 0.739, 0.463, and 0.347 for 1%, 5% and 10% significance levels, respectively. The critical values for the case with Trend are 0.216, 0.146, and 0.119 for 1%, 5% and 10% significance levels, respectively. (*) denotes significance at 10 % level, and (**) denotes significance at 5 % level and (***) denotes ignificance at 1 % level. Variable Definitions are given in DEFINITION OF VARIABLES and DATA SPANS.

Table 1c --- KPSS Test

Variable	Case	Lags	Difference	Case	Lags	Difference
FedRate_Sa	No Trend	14	0.0958	Trend	14	0.0783
LnDjFut_Sa	No Trend	14	0.1642	Trend	14	0.1224
LnIndpro_Sa	No Trend	14	0.2071	Trend	14	0.2041
LnMsim2_Sa	No Trend	14	0.7127**	Trend	14	0.1883**
LnM2_Sa	No Trend	14	0.7531***	Trend	14	0.2184***
LnCE_Sa	No Trend	14	0.0740	Trend	14	0.0731

Notes: The critical values for the case with No Trend are 0.739, 0.463, and 0.347 for 1%, 5% and 10% significance levels, respectively. The critical values for the case with Trend are 0.216, 0.146, and 0.119 for 1%, 5% and 10% significance levels, respectively. (*) denotes significance at 10 % level, and (**) denotes significance at 5 % level and (***) denotes significance at 1 % level.

Cointegration Tests

Table 1d --- Johansen Tests

Variables	Null	No Trend	Trend	No Trend	Trend
		Trace	Trace	Max-Eigen	Max-Eigen
LnMsim2_Sa	r = 0	73.15*	86.82*	39.62*	43.25*
FedRate_Sa	r ≤ 1	33.52*	43.57*	26.42*	26.43*
LnDjFut_Sa	r ≤ 2	7.10	17.13	5.27	12.41
LnIndpro_Sa	r ≤ 3	1.83	4.72	1.83	4.72

Variables	Null	No Trend	Trend	No Trend	Trend
		Trace	Trace	Max-Eigen	Max-Eigen
LnMs2_Sa	r = 0	83.60*	94.05*	50.20*	51.97*
FedRate_Sa	r ≤ 1	33.39*	42.08*	27.55*	27.56
LnDjFut_Sa	r ≤ 2	5.84	14.51	4.69	10.24
LnIndpro_Sa	r ≤ 3	1.14	4.26	1.14	4.26

Variables	Null	No Trend	Trend	No Trend	Trend
		Trace	Trace	Max-Eigen	Max-Eigen
LnCE_Sa	r = 0	47.59*	72.51*	28.71*	36.54*
FedRate_Sa	r ≤ 1	18.88	35.96	8.59	24.05
LnDjFut_Sa	r ≤ 2	10.28	11.91	6.43	7.93
LnIndpro_Sa	r ≤ 3	3.84	3.97	3.84	3.97

Notes: The 5 % critical values for the Trace test are 47.85, 29.79, 15.49 and 3.30 for the No Trend case and, 63.87, 42.91, 25.87 and 12.51 for the Trend case. The 5 % critical values for the Max-Eigen test are 27.58, 21.13, 14.26 and 3.84 for the No Trend case and, 32.11, 25.82, 19.38 and 12.51 for the Trend case. (*) denotes significance at 5 % level. The (nonstandard) critical values are taken from Osterwald-Lenum (1992), which differs slightly from those reported in Johansen and Juselius (1990)

Table 1e --- Normalize Cointegration Coefficients

No Trend	FEDRATE_SA	LNDJFUT_SA	LNINDPRO_SA
LNMSIM2_SA	-0.02893 (-0.01804) [1.603714]	-0.07636 (-0.11249) [0.678851]	-2.27713 (-0.63344) [3.594861]
LNM2_SA	-0.08549 (-0.02262) [3.77931]	-0.14722 (-0.13094) [1.124339]	-2.61654 (-0.74333) [3.520023]
LNCE_SA	0.339881 (0.06648) [-5.11253]	2.221838 (-0.45319) [-4.90266]	-12.9703 (-2.55913) [5.068254]

Trend	FEDRATE_SA	LNDJFUT_SA	LNINDPRO_SA	@TREND
LNMSIM2_SA	-0.002641 (-0.04242) [0.06226]	-0.16181 (-0.18883) [0.85668]	8.128734 (-1.79333) [-4.53276]	-0.01811 (0.00524) [3.455344]
LNM2_SA	0.351718 (-0.17925) [-1.96216]	0.052503 (-0.777) [-0.06757]	26.6353 (-7.21978) [-3.689222]	-0.04734 (-0.02071) [2.285756]
LNCE_SA	0.090282 (-0.00781) [-11.5598]	0.019334 (-0.03356) [-0.5761]	0.154273 (-0.30227) [-0.51038]	-0.0054 (-0.00088) [6.138636]

Causality Tests

Table 1f --- Granger Causality Tests

M2		
Derivatives	Derivatives→ Output	Output → Derivatives
DJFUT	8.1157 (0.0004)	7.4414 (0.0007)
Derivatives	Derivatives→ Interest	Interest → Derivatives
DJFUT	1.9520 (0.1445)	2.5708 (0.0788)
Derivatives	Derivatives → Money	Money → Derivatives
DJFUT	16.2541 (0.0000)	1.7216 (0.1812)
MSIM2		
Derivatives	Derivatives→ Output	Output → Derivatives
DJFUT	8.1157 (0.0004)	7.4414 (0.0007)
Derivatives	Derivatives→ Interest	Interest → Derivatives
DJFUT	1.9520 (0.1445)	2.5708 (0.0788)
Derivatives	Derivatives → Money	Money → Derivatives
DJFUT	13.4839 (0.0000)	1.8898 (0.1536)
CE		
Derivatives	Derivatives→ Output	Output → Derivatives
DJFUT	8.11571 (0.00040)	7.4414 (0.00075)
Derivatives	Derivatives→ Interest	Interest → Derivatives
DJFUT	1.9520 (0.1445)	2.5708 (0.0788)
Derivatives	Derivatives → Money	Money → Derivatives
DJFUT	3.2384 (0.04118)	1.6232 (0.1997)

Notes: The values in brackets under the Granger F-test are P-Values for causality. Variable Definitions are given in DEFINITION OF VARIABLES and DATA SPANS.

Vector Error Correction Estimates

Table 1g --- VECM Estimates: Simple Sum

Vector Error Correction Estimates
Date: 05/29/10 Time: 09:45
Sample (adjusted): 1988M04 2006M02
Included observations: 215 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNM2_SA(-1)	1.000000
FEDFUND_SA(-1)	-0.125787
	(0.02634)
	[-4.77466]
LNDJIA_SA(-1)	-0.577178
	(0.15374)
	[-3.75431]
LNINDPRO_SA(-1)	-0.324221
	(0.86931)
	[-0.37296]
C	-9.070077

Error Correction:	D(LNM2_SA)	D(FEDFUND_SA)	D(LNDJIA_SA)	D(LNINDPRO_SA)
CointEq1	-0.003864	0.035476	-0.036766	0.004013
	(0.00069)	(0.03477)	(0.02948)	(0.00122)
	[-5.62923]	[1.02032]	[-1.24707]	[3.29303]
D(LNM2_SA(-1))	0.083902	-2.061552	-4.049957	0.062201
	(0.06960)	(3.52582)	(2.98957)	(0.12358)
	[1.20544]	[-0.58470]	[-1.35469]	[0.50331]
D(LNM2_SA(-2))	0.022498	5.191175	-0.111159	0.147364
	(0.06894)	(3.49243)	(2.96127)	(0.12241)
	[0.32633]	[1.48641]	[-0.03754]	[1.20383]
D(FEDFUND_SA(-1))	-0.002309	0.432838	0.097028	0.008461
	(0.00137)	(0.06936)	(0.05881)	(0.00243)
	[-1.68622]	[6.24027]	[1.64978]	[3.48004]
D(FEDFUND_SA(-2))	-0.001747	0.254145	-0.077804	-0.002248
	(0.00134)	(0.06770)	(0.05741)	(0.00237)

	[-1.30719]	[3.75382]	[-1.35533]	[-0.94739]
D(LNDJIA_SA(-1))	0.002869	-0.126342	-0.393867	0.004207
	(0.00167)	(0.08482)	(0.07192)	(0.00297)
	[1.71345]	[-1.48949]	[-5.47630]	[1.41498]
D(LNDJIA_SA(-2))	0.000432	0.098907	-0.137924	0.006027
	(0.00165)	(0.08356)	(0.07085)	(0.00293)
	[0.26184]	[1.18363]	[-1.94662]	[2.05763]
D(LNINDPRO_SA(-1))	-0.007555	7.733719	2.292579	-0.043385
	(0.03938)	(1.99502)	(1.69160)	(0.06993)
	[-0.19182]	[3.87651]	[1.35527]	[-0.62043]
D(LNINDPRO_SA(-2))	-0.063534	1.232395	0.172740	0.114493
	(0.04089)	(2.07159)	(1.75652)	(0.07261)
	[-1.55361]	[0.59490]	[0.09834]	[1.57681]
C	0.003596	-0.033896	0.030261	0.001126
	(0.00041)	(0.02088)	(0.01770)	(0.00073)
	[8.72576]	[-1.62370]	[1.70956]	[1.53883]
R-squared	0.355369	0.526445	0.166672	0.160043
Adj. R-squared	0.327068	0.505655	0.130087	0.123167
Sum sq. resids	0.001494	3.834031	2.756481	0.004710
S.E. equation	0.002700	0.136757	0.115958	0.004793
F-statistic	12.55680	25.32174	4.555729	4.340014
Log likelihood	971.6904	127.8008	163.2717	848.2566
Akaike AIC	-8.945958	-1.095821	-1.425783	-7.797736
Schwarz SC	-8.789184	-0.939047	-1.269009	-7.640962
Mean dependent	0.003947	-0.010149	0.012646	0.002175
S.D. dependent	0.003291	0.194507	0.124326	0.005119

Determinant resid covariance (dof adj.)	3.97E-14
Determinant resid covariance	3.28E-14
Log likelihood	2117.311
Akaike information criterion	-19.28661
Schwarz criterion	-18.59681

Table 1h --- VECM Estimates: Monetary Service Index

Vector Error Correction Estimates
Date: 05/29/10 Time: 09:46
Sample (adjusted): 1988M04 2006M02
Included observations: 215 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNMSIM2_SA(-1)	1.000000
FEDFUND_SA(-1)	-0.098267
	(0.02466)
	[-3.98414]
LNDJIA_SA(-1)	-0.659594
	(0.15130)
	[-4.35941]
LNINDPRO_SA(-1)	0.478778
	(0.85114)
	[0.56251]
C	-2.331458

Error Correction:	D(LNMSIM2_SA)	D(FEDFUND_SA)	D(LNDJIA_SA)	D(LNINDPRO_SA)
CointEq1	-0.003453	0.038067	-0.037254	0.004997
	(0.00068)	(0.03795)	(0.03234)	(0.00133)
	[-5.06018]	[1.00321]	[-1.15182]	[3.75948]
D(LNMSIM2_SA(-1))	0.192377	-4.374744	-4.055485	0.129021
	(0.06979)	(3.88128)	(3.30828)	(0.13594)
	[2.75655]	[-1.12714]	[-1.22586]	[0.94908]
D(LNMSIM2_SA(-2))	0.096451	7.998297	-1.818273	0.152858
	(0.06902)	(3.83875)	(3.27203)	(0.13445)
	[1.39735]	[2.08357]	[-0.55570]	[1.13689]
D(FEDFUND_SA(-1))	-0.001946	0.433438	0.092466	0.008713
	(0.00125)	(0.06926)	(0.05904)	(0.00243)
	[-1.56227]	[6.25787]	[1.56622]	[3.59177]
D(FEDFUND_SA(-2))	-0.002326	0.255619	-0.084457	-0.002060
	(0.00122)	(0.06758)	(0.05760)	(0.00237)

	[-1.91419]	[3.78251]	[-1.46621]	[-0.87035]
D(LNDJIA_SA(-1))	0.000971	-0.110685	-0.393214	0.004636
	(0.00153)	(0.08518)	(0.07261)	(0.00298)
	[0.63407]	[-1.29938]	[-5.41564]	[1.55369]
D(LNDJIA_SA(-2))	-0.000305	0.095063	-0.143454	0.006044
	(0.00148)	(0.08227)	(0.07013)	(0.00288)
	[-0.20615]	[1.15548]	[-2.04568]	[2.09765]
D(LNINDPRO_SA(-1))	0.023649	7.441535	2.209865	-0.059087
	(0.03598)	(2.00107)	(1.70565)	(0.07009)
	[0.65726]	[3.71877]	[1.29561]	[-0.84305]
D(LNINDPRO_SA(-2))	-0.039171	1.341265	0.276124	0.102914
	(0.03720)	(2.06863)	(1.76324)	(0.07245)
	[-1.05310]	[0.64838]	[0.15660]	[1.42039]
C	0.002731	-0.035373	0.036583	0.000915
	(0.00037)	(0.02045)	(0.01743)	(0.00072)
	[7.42817]	[-1.72985]	[2.09889]	[1.27687]
R-squared	0.424244	0.531350	0.166607	0.169956
Adj. R-squared	0.398967	0.510776	0.130019	0.133515
Sum sq. resids	0.001227	3.794313	2.756695	0.004655
S.E. equation	0.002446	0.136047	0.115962	0.004765
F-statistic	16.78373	25.82523	4.553611	4.663884
Log likelihood	992.8855	128.9202	163.2633	849.5329
Akaike AIC	-9.143121	-1.106234	-1.425705	-7.809608
Schwarz SC	-8.986347	-0.949461	-1.268931	-7.652834
Mean dependent	0.003881	-0.010149	0.012646	0.002175
S.D. dependent	0.003155	0.194507	0.124326	0.005119

Determinant resid covariance (dof adj.)	3.16E-14
Determinant resid covariance	2.61E-14
Log likelihood	2141.883
Akaike information criterion	-19.51519
Schwarz criterion	-18.82539

Table 1i --- VECM Estimates: Currency Equivalent Index

Vector Error Correction Estimates
Date: 05/29/10 Time: 09:47
Sample (adjusted): 1988M04 2006M02
Included observations: 215 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LNCE2_SA(-1)	1.000000
FEDFUND_SA(-1)	0.194494
	(0.02133)
	[9.11629]
LNINDPRO_SA(-1)	-4.445689
	(0.78974)
	[-5.62933]
LNDJIA_SA(-1)	0.603625
	(0.13750)
	[4.38988]
C	6.645116

Error Correction:	D(LNCE2_SA)	D(FEDFUND_SA)	D(LNINDPRO_SA)	D(LNDJIA_SA)
CointEq1	-0.003901	-0.003421	-0.008156	-0.070651
	(0.00642)	(0.04524)	(0.00151)	(0.03738)
	[-0.60783]	[-0.07562]	[-5.38433]	[-1.88996]
D(LNCE2_SA(-1))	0.151321	0.138506	0.015087	-0.503514
	(0.06986)	(0.49239)	(0.01649)	(0.40687)
	[2.16612]	[0.28129]	[0.91503]	[-1.23752]
D(LNCE2_SA(-2))	-0.028077	-0.114613	-0.006016	-0.651770
	(0.06320)	(0.44549)	(0.01492)	(0.36812)
	[-0.44424]	[-0.25727]	[-0.40328]	[-1.77054]
D(FEDFUND_SA(-1))	-0.043854	0.424741	0.009674	0.102550
	(0.01008)	(0.07107)	(0.00238)	(0.05873)
	[-4.34923]	[5.97638]	[4.06495]	[1.74622]
D(FEDFUND_SA(-2))	-0.029579	0.238817	-0.002106	-0.113617
	(0.01049)	(0.07395)	(0.00248)	(0.06111)
	[-2.81928]	[3.22949]	[-0.85033]	[-1.85935]

D(LNINDPRO_SA(-1))	-0.183045	8.058604	-0.167169	0.810524
	(0.31471)	(2.21822)	(0.07428)	(1.83296)
	[-0.58163]	[3.63291]	[-2.25062]	[0.44219]
D(LNINDPRO_SA(-2))	-0.041081	1.893051	0.013160	-1.021087
	(0.31803)	(2.24159)	(0.07506)	(1.85227)
	[-0.12917]	[0.84451]	[0.17533]	[-0.55126]
D(LNDJIA_SA(-1))	0.019633	-0.160385	0.003952	-0.369400
	(0.01182)	(0.08333)	(0.00279)	(0.06886)
	[1.66058]	[-1.92459]	[1.41641]	[-5.36444]
D(LNDJIA_SA(-2))	0.022577	0.061771	0.005015	-0.148380
	(0.01173)	(0.08271)	(0.00277)	(0.06835)
	[1.92394]	[0.74681]	[1.81077]	[-2.17097]
C	0.004246	-0.023309	0.002425	0.026011
	(0.00175)	(0.01236)	(0.00041)	(0.01021)
	[2.42144]	[-1.88577]	[5.85915]	[2.54664]
R-squared	0.397986	0.519819	0.222694	0.197495
Adj. R-squared	0.371556	0.498738	0.188568	0.162263
Sum sq. resids	0.078253	3.887675	0.004359	2.654524
S.E. equation	0.019538	0.137711	0.004611	0.113793
F-statistic	15.05817	24.65803	6.525711	5.605581
Log likelihood	546.1607	126.3071	856.5896	167.3233
Akaike AIC	-4.987541	-1.081926	-7.875252	-1.463473
Schwarz SC	-4.830767	-0.925153	-7.718479	-1.306699
Mean dependent	0.005865	-0.010149	0.002175	0.012646
S.D. dependent	0.024646	0.194507	0.005119	0.124326

Determinant resid covariance (dof adj.)	1.84E-12
Determinant resid covariance	1.52E-12
Log likelihood	1705.015
Akaike information criterion	-15.45130
Schwarz criterion	-14.76150

Impulse Response Analysis

Graphs 1b --- Multiple Graphs

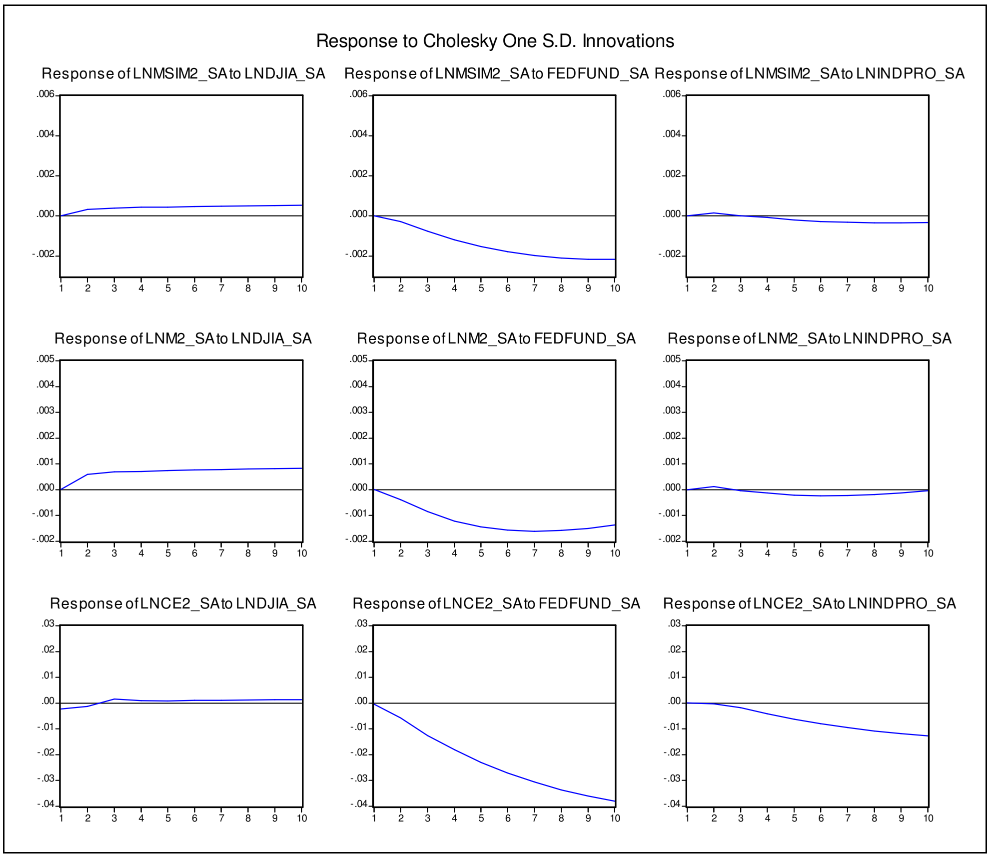


Table 1j --- Variance Decomposition: Monetary Service Index

Variance Decomposition of LNMSIM2_SA: Period	S.E.	LNMSIM2_SA	FEDFUND_SA	LNDJIA_SA	LNINDPRO_SA
1	0.002446	100.0000	0.000000	0.000000	0.000000
2	0.003885	98.68308	0.321849	0.924808	0.070259
3	0.005193	96.70718	1.539444	1.678968	0.074410
4	0.006366	93.88684	3.195217	2.786335	0.131608
5	0.007418	90.86216	4.813572	4.066163	0.258104
6	0.008376	87.81209	6.191188	5.612420	0.384300
7	0.009258	84.93104	7.146536	7.429576	0.492846
8	0.010077	82.24858	7.668157	9.519695	0.563572
9	0.010850	79.73872	7.788076	11.87760	0.595601
10	0.011590	77.34299	7.585119	14.47945	0.592441

Table 1k --- Variance Decomposition: Simple Sum

Variance Decomposition of LNM2_SA: Period	S.E.	LNM2_SA	FEDFUND_SA	LNDJIA_SA	LNINDPRO_SA
1	0.002700	100.0000	0.000000	0.000000	0.000000
2	0.004059	97.35716	0.533351	2.104202	0.005289
3	0.005132	94.41763	1.700791	3.456745	0.424833
4	0.006051	91.43843	3.120689	4.712277	0.728602
5	0.006860	88.54594	4.211014	6.206202	1.036839
6	0.007593	85.94151	4.888967	7.949414	1.220107
7	0.008267	83.63811	5.110219	9.944891	1.306784
8	0.008900	81.52384	4.973089	12.20025	1.302822
9	0.009509	79.48159	4.596154	14.68612	1.236134
10	0.010108	77.39778	4.118499	17.35199	1.131726

Table 1l --- Variance Decomposition: Currency Equivalent Index

Variance Decomposition of LNCE2_SA: Period	S.E.	LNCE2_SA	FEDFUND_SA	LNDJIA_SA	LNINDPRO_SA
1	0.019538	100.0000	0.000000	0.000000	0.000000
2	0.030828	95.16735	4.357131	0.417635	0.057880
3	0.041374	83.19821	14.92439	1.512854	0.364544
4	0.051716	71.99805	25.42627	1.600312	0.975374
5	0.062350	62.35739	34.47757	1.505479	1.659564
6	0.073012	55.05497	41.20088	1.452785	2.291365
7	0.083509	49.58664	46.16545	1.420005	2.827903
8	0.093732	45.41702	49.87190	1.426128	3.284961
9	0.103598	42.20944	52.64932	1.464939	3.676296
10	0.113068	39.71120	54.74369	1.529480	4.015627

Caner ÖZDURAK Uluslararası Finans Yüksek Lisans Programı 2010