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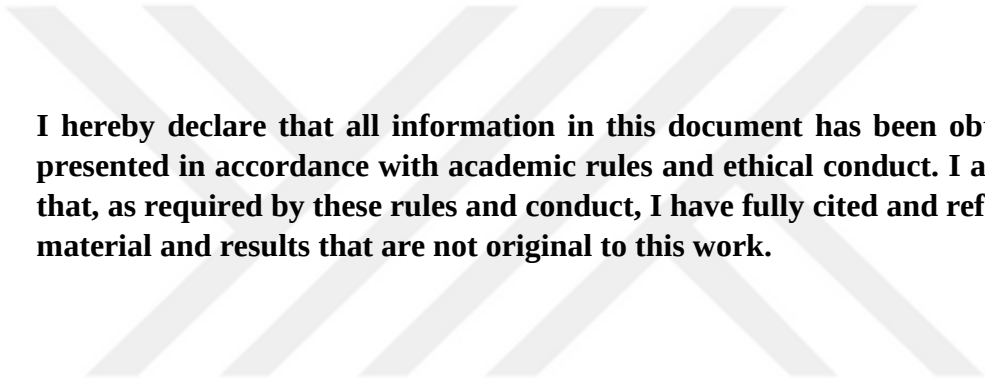
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ABSTRACT

MONEY DEMAND AND FINANCIAL DEVELOPMENT

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Macroprudentials have become the one of the major policy tool to control money stock following the Global Financial Crises, and widely employed to combat post-Covid inflation. To account for the non-neutral and heterogenous effects of monetary expansion across different countries, one might go beyond traditional quantity theory and focus how the money growth through macroprudentials reflect on expenditure. Despite the well-established link between macroprudentials and money-credit channel, the link between the latter and expenditures is rather weak, thereby casting a role for money demand. In this thesis, after reviewing the literature on money demand by emphasizing its prominence in the previous century, we present Gurley and Shaw (1960) framework to account for the notion of “diversification demand for money” they introduced in its historical context. Accordingly, they consider financial development not only as the growth of the financial sector but also specialization in

the financial intermediation, which improves the facilitation of saving-investment processes. Therefore, in the development process, the governmental financial intermediaries are to be complemented by private non-bank financial intermediaries. The growth of these non-bank financial intermediaries, by increasing the debt levels of the nonfinancial sector, might induce increasing demand for money provided that diversification motive dominates the substitution effect, as postulated previously by Gurley and Shaw (1955, 1957). We test this proposition regarding the long-run relationship between money demand and financial development for most of the OECD and BRICS countries with available data. Using the most recent panel time series and panel cointegration techniques, we find evidence for a cointegrating relationship between money demand and financial development at the panel level, which is positive in the long-run for most of the countries.

Keywords: Money demand, financial development, financial intermediation, diversification demand for money, panel cointegration.

ÖZET

PARA TALEBİ VE FİNANSAL KALKINMA

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Makro ihtiyati tedbirler, Küresel Finans Krizi'nin ardından para arzını kontrol etmek için başlıca politika araçlarından biri haline gelmiş ve Covid sonrası enflasyonla mücadele etmek için yaygın olarak kullanılmıştır. Farklı ülkelerde parasal genişlemenin tarafsız olmayan ve heterojen etkilerini açıklamak için, geleneksel miktar teorisinin ötesine geçilebilir ve makro ihtiyati tedbirler yoluyla para arzı büyümesinin harcamalara nasıl yansıdığına odaklanılabilir. Makro ihtiyati tedbirler ve para-kredi kanalı arasındaki iyi kurulmuş bağlantıya rağmen, ikincisi ile harcamalar arasındaki bağlantı oldukça zayıftır ve bu da para talebine bir rol biçmektedir. Bu tezde, önceki yüzyıldaki önemini vurgulayarak para talebi üzerine literatürü inceledikten sonra, Gurley ve Shaw'ın (1960) inşa ettikleri teorik çerçeveyi ortaya attıkları "çeşitlendirme amaçlı para talebi" kavramını tarihsel bağlamıyla birlikte açıklamak amacıyla sunuyoruz. Buna göre, finansal gelişmeyi yalnızca finansal

sektörün büyümesi olarak değil, aynı zamanda tasarruf-yatırım süreçlerinin kolaylaştırılmasını ve etkinleştirilmesini sağlayan finansal aracılıkta uzmanlaşma olarak da değerlendiriyorlar. Bu nedenle, kalkınma sürecinde, kamusal finansal araçlar, özel banka dışı finansal araçlar tarafından tamamlanmaktadır. Banka dışı finansal araçların büyümesi, finansal olmayan sektörün borç seviyelerini artırarak, Gurley ve Shaw (1955, 1957) tarafından daha önce varsayıldığı gibi, çeşitlendirme motifinin ikame etkisine domine etmesi sonucunda, para talebini arttırabilir. Bu çalışmada borçluluk verilerine erişebildiğimiz OECD ve BRICS ülkelerinin çoğunluğu için para talebi ve finansal gelişme arasındaki uzun vadeli ilişkiye yönelik bu önermeyi test ediyoruz. En yeni panel zaman serisi ve panel eşbütünleşme tekniklerini kullanarak, panel düzeyde para talebi ve finansal gelişme arasında uzun vadede çoğu ülke için pozitif olan eşbütünleşme ilişkisine dair kanıtlar buluyoruz.

Anahtar Kelimeler: Para talebi, finansal kalkınma, finansal aracılık, çeşitlendirme amaçlı para talebi, panel eşbütünleşme,

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To My Dad...

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LIST OF ABBREVIATIONS

AMG	Augmented Mean Group
BR	Borrowing Rate
BRICS	Brazil, Russia, India, China, South Africa
BSM	Buffer Stock Model
CCE	Common Correlated Effect
CS	Cross-sectional
CSA	Cross-sectional Average
CS-DL	Cross-sectionally Distributed Lag
CS-ARDL	Cross-sectionally Autoregressive Distributed Lag
DCCE	Dynamic Common Correlated Effect
ECM	Error Correction Model
FRED	Federal Reserve Economic Data
GDP	Gross Domestic Product
GNP	Gross National Product
MG	Mean Group
PMG	Pooled Mean Group
M1, M2, M3	Monetary Aggregates (different types of money supply)
MMDA	Money Market Deposit Account
MPC	Marginal Propensity to Consume

NBFI	Non-bank Financial Intermediaries
OECD	Organisation for Economic Co-operation and Development
PAM	Partial Adjustment Model
QE	Quantitative Easing
RP	Repurchase Agreement
VAR	Vector Autoregression



LIST OF SYMBOLS

M	Money supply
V	Velocity of money
P	Price level
R	Debt-to-GDP
Y	Income or output
C	Consumption
I	Investment
I()	Order of Integration
T	Volume of transactions
i	Interest rate
π	Inflation rate
σ	Standard deviation
ε	Elasticity
k	Proportional demand for money
M^d	Demand for money
M^s	Supply of money
$\frac{M3}{GDP}$	Money-to-GDP
$\frac{DEBT}{GDP}$	Debt-to-GDP
$\frac{D}{G}$	Debt-to-GDP

r_m	Expected nominal rate of return on money
r_b	Expected nominal rate of return on bonds
r_e	Expected nominal rate of return on equities
N	Population or number of economic agents
Y_p	Permanent nominal aggregate income
P_p	Permanent price level
y_p	Permanent aggregate income in real terms
γ, δ	Behavioral parameters
V	Measured velocity

CHAPTER 1

INTRODUCTION

Money demand was one of the main concepts that has been widely investigated following the Great Depression in the context of monetary policy through its crucial role in macroeconomics, impacting interest rates, inflation and asset allocation as recommended by Goldfeld and Sichel (1990). On the other hand, the instability of the money demand function detected in the late 1960s (Poole, 1970), limitations in the quality of the data, theoretical shortcomings, and limited model variables, such as absence of financial innovations, portfolio diversification, and uncertainty, are some of the reasons why money demand has lost its prominence in monetary theory (Goldfeld et al., 1976). In addition, the emergence of rational expectations framework in macroeconomics had gradually resulted in dominance of models with microfoundations and has led to a paradigm shift in estimating macroeconomic relationships through structural and deep parameters that are invariant to policy changes rather than reduced-form models after the critique Lucas (1976). The traditional reduced-form models built through the historical relationship between money demand, interest rates, and income may no longer hold under the new policy regime due to their inability to account for changes in economic agents' behavior in response to policy shifts. When policies change, rational agents will adjust their behavior in ways that are not captured by a reduced-form model that relies on fixed historical relationships. Therefore, the instability in the link between money growth and inflation have gradually undermined the role of monetary aggregates in monetary policy, and with the dominance of the New-Keynesian framework in monetary theory following Woodford and Walsh (2005), "money" itself has been abandoned in the models that are supposed to be used in the implementation of monetary policy, despite recent studies including Lucas and Nicolini (2015); Mogliani and Urga (2018); Benati et al. (2021) on demand for money.

The surge in Post-Covid inflation levels (Koch and Noureldin, 2023) due to expansionary measures taken by central banks (Cantú et al., 2021) increased the correlation

between broad money (M2, M3, or M4) and inflation (Borio et al., 2023), and revitalized the theory of money quantity, that is, the first attempt to establish a one-to-one relationship between money growth and inflation, through a long-term stable demand for money increasing in real income, while reducing the opportunity cost of holding money Wicksell (1898); Fisher (1911); Pigou (1917). On the other hand, the relationship between money growth and inflation was not unitary elasticity as implied by quantity theory (Schnabel, 2023), the positive link between broad money growth and inflation is strong, almost one-to-one, when inflation is high and weak, almost nonexistent, when inflation is low, suggesting that the drivers of inflation differ with respect to the inflation regime (Borio et al., 2023). In addition, Schnabel argues that

”...the extent to which the economy reacts to an increase in the monetary base on the back of asset purchases fundamentally depends on the broader state of the economy, as reflected in its balance sheet capacity. Quantitative easing (QE) is not inflationary on its own, it only becomes inflationary if and when banks, firms, households, firms, and governments are both able and willing to respond to low interest rates, thereby boosting money growth, economic activity, and, ultimately, inflation regime.” (Schnabel, 2023)

Macroprudential policies have become one of the most crucial policy tool after the Global Financial Crisis in providing liquidity into the economy Garcia Revelo et al. (2020), but according to Başçı (2023), ”The connection between macroprudential policy and the quantity of money supply has largely been ignored in the literature, after the main policy instrument has become the short-term interest rate. However, there is a connection between macroprudential easing of bank capital requirements and rapid money growth in the post-Covid-19 era. Therefore, despite the strong link established between macroprudentials and money-credit channels, such as Gambacorta and Shin (2018) establishing the connection between macroprudential easing and money-credit channel, and Gropp et al. (2019) establishing the link between macroprudential tightening and the money-credit channel for Europe by studying the 2011 quasi-natural experiment of higher capital requirements for banks, the link between money-credit and expenditures is not well established. Therefore, following Schnabel (2023); Borio et al.

(2023), to establish this link, the point of departure would be the fact that the impacts of purchases of financial assets, through quantitative easing (QE) or open market operations, on broad money growth, inflation and overall economic activity are highly state dependent. This implies that financial structure of economy, so the inflation regime, might uncover the non-neutral effects of broad money growth on inflation through its reflection on expenditures via distributive and intermediating aspects of money-credit channel by influencing the portfolio asset composition of the non-financial sector.

Gurley and Shaw (1960) developed a theoretical framework, which has, unfortunately, been widely overlooked despite its unique approach, to account for the financial aspects of the real economic development process. Contrary to the conventional wisdom in late 50s, they introduce the concepts of inside money and outside money together with inside and outside financial assets to uncover the role of financial intermediation and distributive techniques on the non-neutrality, and therefore, the demand for money (Gurley and Shaw, 1955, 1956), and came up with a unique concept "the diversification demand for money" encompassing transaction, precautionary and speculative motives in Keynesian liquidity preference framework. They later build a five sector theoretical model and offer a new function for money demand encompassing diversification demand (Gurley and Shaw, 1957), but did not include in their monograph *Money in a Theory of Finance* (Gurley and Shaw, 1960), where they exclusively elaborate the diversification demand for money balances through their theoretical construct, the implicit deposit rate of money. The framework will be elaborated to a great extent in the literature review section, but to briefly introduce, this demand increases with the accumulation of financial assets in the economy and decreases as economic agents prefer to hold a larger proportion of their wealth in primary securities reflecting the role of money as a store of value and a means of managing portfolio risk.

In their monograph, Gurley and Shaw argue that:

"Over the period during which the money-income ratio rose, the ratio of financial assets in spending units' portfolios to national income also rose. And roughly over the period of stability in the money-income ratio, the ratio of financial assets to income stabilized. If the growth of financial

assets did have the effect we suggest on the demand for money, trends in the financial asset-income ratio could have accounted for the observed behavior of the money-income relationship and velocity. That is to say, the ratio of money to income may have risen before 1900 because the demand for money was stimulated by the accumulation of financial assets relative to income. And perhaps the money-income ratio has tended to stabilize in the past half century because financial assets have accumulated in rough proportion to income levels.” ((see Gurley and Shaw, 1960, pp. 177))

Despite this brief mention in the monograph, they specify a demand function for money and provide empirical results for USA between 1800-1950 in Gurley and Shaw (1957). On the other hand, no further studies have been conducted to estimate the diversification demand for money. Given that the money-to-income ratio reflects the demand for money in the quantity theory formulation, and the debt-to-income standing for the accumulated stock of financial assets, we are going to test the validity of diversification demand for money through the broad money growth-to-income ratio, and the debt-to-income ratio of the nonfinancial sector for a panel sample of 24 countries by using recent panel cointegration methods to account for the secular relationship between money demand and financial development.

The intended contributions of this study include (1) a revitalization and concise revision of the Gurley and Shaw framework in its historical context, which requires a review of most previously recognized theories of money demand to unfold the unique specification of diversification motive by Gurley and Shaw (1955, 1960) differs; (2) conducting an empirical analysis for the long-run demand for money, which has never attempted since the descriptive analysis by Gurley and Shaw (1957) for only the United States, at the panel level for most of the OECD and BRICS countries using the most recent panel time series methods to predict long-run relationships; (3) proposing a new dimension to strengthen the link between money-credit channel and expenditures through the diversification demand induced by the growth of financial sector and sophistication in the financial intermediation to distinguish between neutral and non-neutral effects of monetary expansion through the macroprudential policies.

The remainder of this thesis is structured as follows. Chapter 2 provides a comprehensive review of the literature, tracing the evolution of money demand theory from classical foundations through Keynesian and monetarist perspectives to modern empirical approaches. Besides, we provide an extensive review of the Gurley and Shaw framework by combining the arguments in all of the three papers and the monograph (Gurley and Shaw, 1955, 1956, 1957, 1960). We conclude chapter 2 by presenting the major part of the literature on cointegration and panel cointegration methods in estimating long-term relationship between macroeconomic variables. Chapter 3 describes our data and descriptive statistics together with the empirical strategy that will be used to estimate the long-term relationship between the money-to-income ratio and the debt-to-income ratio through the methods introduced in the cointegration literature. Chapter 4 presents the empirical results detailing the econometric techniques employed to address cross-sectional dependence, nonstationarity, and heterogeneity in long-run coefficients together with the panel cointegration test results and robustness check through the Cross-sectional Error Correction Model. Finally, Chapter 5 presents the concluding remarks.

CHAPTER 2

LITERATURE

2.1 Theories on Money Demand

2.1.1 Quantity Theory

The quantitative theory of money can be traced back to the earlier formulations of Salamanca School in the 16th century (Jace, 2019), but it was Fisher (1911) providing a formulation, the so-called equation of exchange, in a way that enables empirical analysis. He also explicitly outlined the core propositions of the theory, including the equiproportionality of money and prices, the neutrality of money, and the causality running from money to prices. The famous equation of exchange: $MV = PT$ where M , V , P and T respectively stand for the money supply, the velocity of money, the price level, and the volume of transactions. While this equation is an identity in essence, it was transformed into a theory of price level determination through Fisher's assumptions of stable velocity and transaction volume being determined by real factors. Given that $PT = Y$, we have $1/V = M/Y$. Fisher (1911) states that the V is determined by external factors such as habits, technology, and institutions, which are effective in the long-run. So velocity can be considered as constant in the short-run, and one can cast V as a money demand function. Based on this, Fisher (1911) argues that "the changes in the money supply lead to proportional changes in the price level in the long run."

Although he is not considered as a quantity theorist, Knut Wicksell holds that the implication of the theory is only the proposition that proportionality is only between prices and hard money or metallic currency in the long-run equilibrium (Humphrey, 1997). Wicksell (1898) interprets the quantity theory of money through the real balances, defined as the nominal money stock divided by the price level, and their role in achieving price level determinancy. He suggests that agents desire to hold a certain level of real balances, determined by factors like the volume of transactions, buffer against the financial fragility, and the opportunity cost of holding money. This demand

for real balances, in conjunction with a given nominal money supply, ensures a unique equilibrium price level. In Wicksell's view, a random shock generating a deviation of the price level from the equilibrium level would trigger a real balance effect, driving price adjustments to restore the equilibrium level. For example, an unexpected increase in the price level would make real balances less than the desired level by deteriorating the purchasing power of existing money holdings. Agents would then respond by reducing their expenditures or rising the supply of goods and services to reestablish their real balances. This decline in aggregate demand would reflect downward pressure on prices until they are restored to a level comparable to the desired level of real balances and the given nominal money supply.

Wicksell supports this argument with his cumulative process framework, which shows how discrepancies between the natural rate, the equilibrium rate that balances saving and investment at full employment, and money market rates, the rate charged by banks on loans and paid on deposit, lead to changes in bank money and consequently to the price level. Assuming that all savings are lent to banks as deposits, all investments are financed by banks, and banks lend only to finance investment, and changes in aggregate demand have an impact on prices but not real output so that full employment prevails Humphrey (1997). A monetary impulse, say increase in money supply, would lead the natural rate to exceed money market rate, investment demand to exceed savings, triggering the expansion in credit creation, fueling demand for commodities, and pushing prices upward. This process continues as long as the interest rate discrepancy persists, leading to a cumulative increase in prices.

In a pure-cash economy where transactions take place solely through hard money or metallic currency, Wicksell upheld the validity of the classical quantity theory. An increase in the money supply, such as a discovery of gold, would directly affect the level of real balances. Having excess real balances, agents would increase spending, driving up prices until reaching a new equilibrium level proportional to the expansion in the money stock. Subsequently, in a mixed cash-credit economy, on the other hand, Wicksell believed that the rate discrepancy would eventually erode due to the public's demand for real cash balances. Increases in prices would result in a higher demand

for currency for transaction purposes, causing a drain on bank reserves. The banks' response would be raising the market rate to protect their reserves; ultimately, the gap with the natural rate would close, calling a halt in the price increase. Finally, in the hypothetical case of a pure credit economy without currency, Wicksell suggests that quantity theory breaks down. In the absence of real balances to adjust, the price level becomes indeterminate since deposit demand and supply turn out to be synonymous. Nevertheless, he argued that central bank intervention by changing the market rate could restore nominal determinacy and stabilize prices.

In summation, in both pure cash and mixed cash-credit economies, deviations from the equilibrium price level deteriorate real balances, triggering adjustments in spendings and asset holdings as agents seek to adjust their desired level of real balances. This process, triggered by changes in the money supply and credit conditions, ultimately leads the price level to stabilize at a new equilibrium. Thus, through a maladjustment of two interest rates, Wicksell's cumulative process framework effectively illustrates how real balance effects, in accordance with the quantity theory of money, act as a fundamental mechanism for achieving price-level determinacy.

In his seminal book "Interest and Prices", (Wicksell, 1898) devotes a chapter on the velocity of circulation of money, reflecting the average number of times a unit of currency changes hands within a specific time period, which is a crucial concept for his understanding on dynamics of price level and the effectiveness of monetary policy. He delves into the behavior of velocity under different economic structures, underscoring the factors affecting its magnitude and flexibility. As economies evolve from a pure cash system to a more complex and organized credit system, velocity becomes increasingly flexible and accelerates.

Wicksell's analysis regarding velocity primarily circles around the development of credit in the form of bank notes and deposits, as a substitute for hard money or physical currency. Thus, his major proposition is that the velocity of hard cash is increasing through the replacement of gold with bank notes and deposits. Nevertheless, he also emphasizes the role of institutional developments in affecting the public's holding of currency, notes, and deposits (Jonung, 2017). As an economy transitions "from a barter

economy to a monetary economy, called monetization, the demand for currency and other bank-produced means of payment will be increasing” (Wicksell, 1901). Then, expanding his velocity concept with the broad definition of money ($M2$), including notes and deposits, the expansion of the banking system and monetization induces a decrease in velocity, while increasing the velocity of physical currency.

(Jonung, 1979) used Wicksellian framework to explain the long-run secular demand for money, and argued that the fall in the velocity in Sweden between 1870-1920 was a result of monetization process, increasing usage of ”money” for arranging transactions in exchange for other payment methods and the expansion in commercial banking in supplying notes and deposit facilities to the public, while the following secular rise in velocity between 1920-1970 was caused by the increasing financial sophistication together with increasing economic stability and security. Here, financial sophistication stands for (1) the expansion and diversification in the number of close substitutes for money like stocks, bonds and other financial assets; and (2) the developments in financial techniques in economizing money such as use of credit cards, electronic transfers, etc. He concludes that the direction of velocity depends on the relative dominance of these two distinct forces through a chain of substitutions, initially, the substitution metallic currency into ”money” as notes and deposits, and subsequently, ”money” into new financial assets.

2.1.2 The Cambridge Equation

After the formulation of the equation of exchange by Fisher (1911), the concept of money demand, in determining the effect of the money supply on prices, is incorporated into the quantity theory by (Pigou, 1917) and (Marshall, 1923). Given that M^d , P , T and k respectively denoting the money demand, the average price level, real output and proportional demand for money, the Cambridge Equation can be formulated as $M^d = kPT$, where money demand is proportional to income (Xingyun, 2015). When we divide both sides by k , we get $M^d/k = PT$, and at the equilibrium where $M^s = M^d = \bar{M}$, we have $M^s \times 1/k = \bar{M}^s V = PT$ which is quite similar to Fisher’s equation in the sense that it implies neutrality of money. While the inverse of k implies

the V in the equation of exchange and both approaches entail the transaction demand for money by treating the money as a medium of exchange, the motives for holding money by agents were the main focus of Cambridge economists, casting a role for velocity in determining desired demand for money unlike Fisher whose analysis revolves around the institutional aspects of the payment mechanism Sriram (1999).

In addition, Pigou (1917) implicitly incorporated the precautionary motive by acknowledging money as a store value that provides convenience and security to the holders, and (Marshall, 1923) introduced the concept of "real balances," which considers the impact of changes in the price level on the purchasing power of money holdings, casting a limited role for the speculative motive through individuals' desire to maintain a certain level of real balances, thereby incorporating interest rate and wealth in determining money demand. Thus, k is not constant and could also depend on the interest rate and wealth together with the transactions, and plays a role for the demand for money in determining the price level. More explicitly, k , and thus the money demand, depends on the (1) degree of preference for current consumption over future consumption, (2) expectations regarding the stream of return to investments and (3) expectations on the changes of price level Boorman and Havrilesky (1972). The Cambridge approach constituted a point of departure for studies considering money as an asset in a multi-asset portfolio, and paved the way for the development of Keynes' Liquidity Preference Theory.

2.1.3 Keynes

In explaining the effects of price level on the public's demand for cash balances, (Keynes, 1930) delves deeper into the problem of real balances in his book "Treatise on Money". He points to the proportionality between the public's demand for money as real balances and transaction volume, the rate of interest and expectations on future behavior of the price level. In General Theory, (Keynes, 1937) proposed three motives for money demand: (1) transaction motive, following the Cambridge Approach, that individuals demand money for transaction purposes proportionally to the income level; (2) precautionary motive that demand for holding money for unforeseen expenditures

and get utilize from unexpected opportunities, which is proportional to income level; (3) speculative motive, his most significant contribution to the subject, that reflects the people's desire to hold some money as a way to profit from the changes in the future price of financial assets, such as bonds. Following Marshall and Pigou's efforts to incorporate the impact of uncertainty on the demand for money holdings, Keynes' formalization considers the future yield on bonds as one variable. Essentially, individuals speculate on future interest rates and adjust their money holdings accordingly Sriram (1999).

According to (Leijonhufvud, 1967), Keynes had a broader conception of speculative demand where the concept of liquidity preference is a special case with its underlying assumption of inelastic expectations, but the concept has been reduced to a narrower scope in the Keynesian literature as "the demand for money". Following the Wicksellian framework, Keynes points to a "normal interest rate" in every individual's mind, which reflects their choice on whether to hold money or bond. When the actual rate is lower than the normal, we see a rise in the expected interest rates reducing the bond prices. Then, people will be more inclined to hold money by selling certain amount of their existing bonds to prevent the loss caused by the fall in bond prices, increasing the overall money demand, and vice versa.

By combining these three motives, we can construct a Keynesian money demand function of the following form: $M^d = M^t + M^s = f(Y, i)$ where M^t stands for the transaction and precautionary demand for money as a function increasing in the income level; M^s reflects the speculative motive as a function decreasing in the rate of interest (Xingyun, 2015). Incorporating this into the equation Fisher (1911), we get $f(Y, i) \times V = P \times Y$, where $V = \frac{P \times Y}{f(Y, i)}$, implying that the increase in the interest rate will reduce the speculative demand for money together with $f(Y, i)$, increasing the velocity of money. So, unlike the Fisher viewpoint, the velocity is instable in the short period as interest rates are constantly changing. The key point here is that when there is a change in the perception of the agents about the normal rate, it will become followed by the change in the differential between the actual and this subjective normal rate, affecting the expectations regarding the level of actual interest rate in the future. Therefore, a fall in the perception of normal rates leads to a lower level of expected actual rates,

raising bond prices and reducing the speculative demand for money as people will be more willing to accumulate bonds rather than money.

2.1.4 Keynesians

Although Keynes (1930) elaborates the role of the opportunity cost of money in transactions demand for money, posing a negative relationship with the interest rate in the Treatise, it is missing in the liquidity preference theory in the General Theory as the focus has shifted to the problem of unemployment. Later on, the Baumol-Tobin model, or so-called inventory theoretic approach, is built on the intention to emphasize the role of interest rate in the transaction demand for money. Baumol (1952) considers an individual that needs to make payments T dollars in total over a period by incurring a fixed "broker's fee" of b for each withdrawal of C dollars and an interest cost of i per dollar per period for holding cash. By minimizing the total cost of cash management, Baumol derives a formula indicating the proportionality of optimal average cash holding to $\sqrt{(bT/2i)}$, suggesting economies of scale in cash management, where the money demand increases less than proportionally to transactions or expenditure volume. This nonproportionality implies an income elasticity of money demand being less than the unity.

Similarly, Tobin (1956) develops a model that considers an individual who receives income periodically, which is to be allocated between cash holdings and interest-bearing bonds by considering the costs related to transactions between these two assets. The model conveys that even in an economy with perfect certainty regarding future interest rates, the demand for money is negatively related to the interest rate because of the costs incurred in switching between cash and bonds. In particular, this relationship is relevant for large transactors, that are more likely to treat the interest earnings sufficient to offset the transaction costs. Notably, even with a constant level of interest rate, the model suggests a higher transaction velocity of money during economic prosperity than during recessions due to the fact that the higher volume of transaction might increase the attractiveness of holding interest-bearing assets.

Barro and Fischer (1976) and Cuthbertson (1991) provides a summary of the

extensions of these models. On the other hand, there are alternative models highlighting the factors such as the timing of payments, threshold targets, and adjustment costs, implying that money demand can exhibit complex dynamics and might not adjust smoothly to changes in economic variables all the time. Clower and Howitt (1978) challenged the conventional separation of portfolio and transaction decisions, arguing that agents jointly decide for both by considering the adjustment cost of money and asset holdings. Besides Akerlof (1979) and Akerlof and Milbourne (1980) developed inventory-theoretic models where agents set "target thresholds" for their money balances and adjust them solely when these thresholds are exceeded. Santomero and Seater (1981) proposed a model with partial adjustment where individuals face both fixed and variable costs when changing their money balances.

The precautionary motive for holding money balances arises from the uncertainty about future payments and is proportional to the income level according to Keynes (1937). By relaxing the assumptions on payments and receipts, Whalen (1966) developed a model incorporating the cost of illiquidity (penalties for insufficient cash), the opportunity cost of holding cash (forgone returns on alternative assets), and the variance of net disbursements (variability of income and expenditure fluctuations). The model considers a firm that encounters uncertainty in its receipts and payments, which requires precautionary cash balances to avoid illiquidity. By deriving an equation for optimal precautionary cash balances, Whalen demonstrates that they increase with the cost of illiquidity and the variance of net disbursements but decrease with the opportunity cost rate. On top of these, the model verifies the earlier observation by Patinkin's that "The amount of precautionary cash balances needed to maintain a given level of protection against financial embarrassment increases less than proportionally with the volume of transactions, if that increase in volume comes from a higher number of transactions rather than larger individual transactions." (Patinkin, 1965), implying that an increase in the overall transaction volume would bring a less than proportional increase in the holdings of money (Sriram, 1999). Patinkin's reasoning was that, with a larger number of smaller transactions, the likelihood of receipts and disbursements to offset each other increases, decreasing the overall variability in the net cash flow and

precautionary demand. This suggests a contribution of the precautionary motive to the interest elasticity of money demand, since it is not only a fixed proportion of expenditure or income, but also depends on other factors including the cost of illiquidity and the opportunity cost, meaning that a change in the interest rate generates an incentive to adjust their precautionary balances.

Keynes was dealing with his General Theory during the Great Depression, a period of very low interest rates, so his focus was on the speculative motive for holding money, driven by the uncertainty about future interest rates reflected this context in his theory of liquidity preference. He considered the transactions and precautionary motives relatively insensitive to changes in interest rates, especially in the short-run, as these motives were mainly determined by the income and expenditure levels and that agents would not significantly change their money holdings for these purposes as a response to small interest rate fluctuations. This speculative demand for money was depicted as highly interest elastic, especially at low interest rates, where individuals would hoard cash due to their fear regarding capital losses on bonds. Keynes' assumptions of inelastic interest rate expectations for different individuals and allowing one to hold either money or bonds based on interest rate expectations, not both at the same time, enable a simplifying mechanism to generate a downward-sloping money demand curve. This amplifies the impact of the speculative motive for holding money, which Keynes believed to be more dominant than other motives.

Inelastic interest rate expectations, where the concept of a "normal" long-term interest rate in individuals' minds is fixed and are slow to adjust their beliefs even in the change in current rates, lead to a discontinuous and steplike demand curve for each individual, and at their critical rate (where their expectation of future rate switches), they suddenly shift their entire portfolio from money to bonds (or vice versa). However, as individuals have diverse "normal" rates along the interest rate spectrum, these individual step-like curves are staggered. As the market interest rate changes, different individuals reach their critical rates at different times, so some will switch to bonds, while others will switch to money. These individual shifts occur at various levels of interest rate i , not all at once. When you aggregate these numerous individual demand curves,

the result is a smoother, downward-sloping liquidity preference curve for the economy as a whole by blending these high number of small, sudden shifts at the individual level, constituting the appearance of a continuous and gradual response to interest rate changes. However, when we look at individual behaviors, we cannot obtain a smooth money demand curve as Keynes thought (Tobin, 1958).

In his article, "Liquidity Preference as Behavior Towards Risk," Tobin (1958) develops a model of liquidity preference based on investor behavior under uncertainty to make up for the unexplained part in Keynes' speculative motive that rules out possibility of holding both money and bonds at the same time under the assumption of inelastic interest rate expectations. Tobin argues that individuals, in diversifying their portfolios, consider not only the return on cash and interest-bearing assets (consols in his model) but also risks of holding each asset based on their risk aversion and expectations about interest rates in the future. He introduces indifference curves reflecting an investor's trade-off between risk and expected return, measured by the standard deviation of returns. The riskiness arises from the market price volatility of bonds and equities, while money is not. Thus, when the expected return to alternative assets exceeds that of money, individuals become more willing to take the risk.

In his model, investor chooses an optimal portfolio to maximize expected utility, derived from a quadratic utility function, subject to an opportunity locus determined by riskiness of consols and the interest rate. This framework enables a more nuanced analysis of money demand by incorporating factors including changes in risk perception, the presence of multiple assets, and taxation effects. Tobin shows that when investors become more risk-averse or perceive higher risk level in consols, the demand for money increases, and this framework may lead to a downward-sloping liquidity preference curve even with perfectly elastic interest rate expectations. Hence, the model highlights that risk-averse people would still choose to hold some cash because of the inherent risk related with interest-bearing assets even with perfect foresight about future interest rates, providing an empirically relevant and more robust explanation for liquidity preference than the earlier Keynesian framework. On the other hand, Fisher (1975) shows that because money is not riskless as Tobin (1958) argued and is subject to variations in the

price level. Hence, the risk aversion behavior of economic agents does not constitute a basis to hold money, since there are safer assets with risk characteristics quite similar to money, but yielding higher returns, such as time deposits.(Sriram, 1999). To sum up, The Portfolio Balance Approach is an extended version of the speculative motive in Keynes' theory with a integration of modern portfolio theory, where demand for money demand stems from the expected returns and risks associated with different assets, together with individual risk preferences since individuals desire to hold a certain amount of money as part of a diversified asset portfolio to manage risk.

2.1.5 Friedman

Friedman (1956) presents a model of the demand for money, embedded in "Quantity theory of Money: A Restatement" paper in his seminal work "Studies in the Quantity Theory of Money,". In his words "The quantity theory is in the first instance a theory of the demand for money. It is not a theory of output, or of money income, or of the price level. Any statement about these variables requires combining the quantity theory with some specifications about the conditions of supply of money and perhaps about other variables as well." His treatment regarding the theory of money demand is a special case within a broader theory of capital by considering money both as an asset or one way of holding wealth and a capital good utilized by productive businesses. Then, he derives a money demand function through the perspective of utility-maximizing economic agents allocating their wealth across different forms of assets to achieve the highest level of satisfaction by arguing that the demand for money by agents should be analyzed in a similar fashion to the demand for consumer goods, depending on the total wealth, the price and return of money relative to other assets, and the tastes as well as preferences regarding to holding wealth by agents. Besides, Friedman (1956) used his permanent income hypothesis before formally introducing in his book "Theory of the Consumption Function" (Friedman, 1957). In applying the Permanent Income Hypothesis to demand for money, Friedman posits that individuals and firms determine their money demand based on their expected long-term average income (permanent income), that provides a more stable foundation for decision-making compared to current

income level, and helps to explain the relative stability of money demand and its low sensitivity to interest rates and short-term fluctuations in income.

Friedman (1970) discusses the demand for money built on his earlier works (Friedman, 1956, 1959, 1966) and work of Keynes and the Cambridge cash-balances using the broad money definition as opposed to earlier formulations upon narrow money definition. Therefore we present his approach through his updated formulations in Friedman (1970) rather than (Friedman, 1956). He distinguishes the demand for money between ultimate wealth holders (individuals) and business enterprises. According to Friedman (1970), "For ultimate wealth holders, the demand for money, in real terms, is primarily a function of:

- **Total wealth:** This serves as a budget constraint, and is conceptualized broadly to include all sources of income and consumable services together with the productive capacity of the human beings. In practice, income, especially the permanent income as it is a long-term concept and independent of short-term fluctuations, can be used as a proxy for wealth.
- **The division of wealth between human and nonhuman forms:** This refers to the proportion of wealth held in the form of personal earning capacity (human wealth) to other assets like financial securities and physical goods (nonhuman wealth).
- **The expected rates of return on money and other assets:** This includes the nominal rate of return on money (which can be positive, negative, or zero) and the expected nominal rates of return on other assets like bonds, equities, and real assets. As in Keynesian Speculative Motive, Friedman posits that opportunity cost of holding money is the expected return from bonds, equities and physical goods.
- **Other variables determining the utility of money:** This includes factors like real wealth or income, expected degree of economic stability in the future, and the volume of capital transfers relative to income, unexpected changes in tastes and preferences for holding money."

(Friedman, 1970)

Total wealth is conceptualized broadly to include "all sources of income and consumable services together with the productive capacity of the human beings" (Friedman, 1970). The choice among different forms of wealth depends on prices, individual preferences and relative returns, determined by the factors including convenience yield of money, interest payments and potential price changes for bonds, dividends and potential price changes for equities, and the potential depreciation or appreciation in value for physical goods. By incorporating the transaction demand with relative returns and costs of holding money compared to other assets, he proposed the following money demand function derived using real variables, implying that it is determined by the real returns on alternative assets and the purchasing power of money, rather than nominal values.

$$\frac{M}{P} = f(y, w; r_m, r_b, r_e, \frac{1}{P} \frac{dP}{dt}, u) \quad (2.1)$$

where:

M = the nominal quantity of money demanded

P = the price level

y = the real income

w = the fraction of wealth in nonhuman form

r_m = the expected nominal rate of return on money

r_b = the expected nominal rate of return on fixed-value securities

r_e = the expected nominal rate of return on equities

$\frac{1}{P} \frac{dP}{dt}$ = the expected rate of change of prices (expected inflation)

u = other variables affecting the utility of money

(Friedman, 1956, 1970)

For business enterprises, total wealth is not a constraint for the demand for money, as they can obtain additional capital from the market. Instead, to serve as an index for the productive value of money, the scale of the enterprise is considered as a relevant variable. Besides, the division between the human and nonhuman forms of wealth is not relevant for businesses, since they can purchase both of them on the market. On the other hand, the relevant rate of return for businesses determine the net cost of holding money, such as bank loan rates. Other variables affecting the productivity of money balances, such as the cost of substitute resources and expectations about economic stability, are also considered.

In total, the main factors affecting the demand for money in Friedman (1956) are permanent income (positively), the proportion of human wealth to the non-human form (positively) and the relative return of money compared to other financial assets (negatively). Afterwards, Friedman (1956) discusses the necessary characteristics that define a "quantity theorist", and identifies three key points that differentiate quantity theorists from other economists:

"(1) Believing the stability and importance of the demand function for money, meaning that it is predictable and not subject to erratic fluctuations; (2) asserting the independence of the factors affecting demand and supply, allowing them to analyze the impacts of changes in the money supply on the economy, assuming a stable demand function; (3) acknowledging the specific mathematical form of the money demand function unlike the Keynesian underemployment analysis positing that money demand becomes infinitely elastic at a low but slightly positive interest rate, entailing a "liquidity trap" where changes in the money supply becomes ineffective on the economy, challenging the quantity theory's assertion that changes in the money supply have a direct impact on prices and money income." (Friedman, 1956)

Later on, Friedman (1956) mentioned three pieces of empirical evidence presented in the book, namely Lerner's study on the Confederacy, Klein's examination of German experience in World War II, and Cagan's study on hyperinflations, supporting

the quantity theory's claims about the stability and importance of the money demand function. He acknowledges that the empirical studies raise questions regarding the theoretical formulation by suggesting potential modifications together with comments on some of those through the other papers in the book. Selden, based on his finding that "the secular rise in real income has been accompanied by a rise in real cash balances per unit of output, meaning a decline in velocity" (Selden, 1956), argues that the income elasticity of the demand for money is greater than unity, implying that money balances are luxury. Selden's another finding that velocity rises during economic expansions and decreases during contractions might appear to be inconsistent with the secular stability of velocity, but according to Friedman, this can be reconciled by replacing the measured income with permanent income, reflecting the long-term average, as it is the appropriate measure of income for theoretical analysis. During cyclical peaks, permanent income is less than measured income, leading to a higher level of measured velocity, and vice versa. Therefore, the observed cyclical behavior of velocity is consistent with Friedman's theory when incorporating the concept of permanent income, which supports the stability of money demand over the long-run despite the fluctuations in the short-run. Besides, by distinguishing between "short-term and long-term bonds, treating the former as substitutes for money and the latter as the cost of holding money", Selden (1956) finds that "both of them are significantly related to quantity of money demanded", thereby casting a role for changes in interest rates expectations. Finally, Friedman concludes through the findings of Cagan (1956) highlighting the effect of changes in prices on demand for money that higher rates of price change lead to lower demand for money due to the attractiveness of alternative assets.

Briefly, Friedman's hypothesis states that "during cyclical expansions, measured income exceeds permanent income, causing a temporary increase in velocity as individuals adjust their money holdings to their perceived long-term income. Conversely, during cyclical contractions, measured income falls below permanent income, leading velocity to decline as individuals maintain their desired level of money holdings based on their long-term income expectations." Friedman (1959) presents a summary of empirical results from his monograph "A Monetary History of the United States,

1867–1960” coauthored by Anna Schwartz (Friedman and Schwartz, 1963) on the secular and cyclical behavior of the money stock and its relationship with prices and income. They derive the following money demand and velocity equations to empirically test his hypothesis in explaining the observed behavior of money demand:

$$„ \frac{M}{NP_p} = \gamma \left(\frac{y_p}{NP_p} \right)^\delta \quad (2.2)$$

$$V = \frac{Y}{Y_p} \frac{1}{\gamma} \left(\frac{Y_p}{N} \right)^{1-\delta} \quad (2.3)$$

where:

Y = measured aggregate income in nominal terms

P = measured price level

M = be aggregate stock of money in nominal terms

N = population

Y_p = be permanent nominal aggregate income

P_p = permanent price level

y_p = permanent aggregate income in real terms, $y_p = \left(\frac{Y_p}{P_p} \right)$

γ, δ = behavioral parameters

V = measured velocity, $V = \frac{Y}{M}$,”

(Friedman, 1959)

Equation 2 implies that real per capita money balances demanded is a function of real per capita permanent income, and interest rate and changes in price level is no longer an explanatory variable in the empirical money demand function. Equation 3 represents the velocity function and derived from the money demand function in Eq. 2. Using data on income, money stock, and prices for the United States from

1867 to 1957, empirical findings presented show a close correspondence between the observed cyclical patterns of velocity and the patterns predicted by the permanent income hypothesis. In addition, the permanent income elasticity of the money demand, δ , is found to be 1.8 which is greater than unity, indicating that money balances are treated as "luxury" by consumers. Hence, the demand for real money balances increases faster than permanent income, Y_p , and the velocity is negatively correlated to Y_p , which is the secular pattern he points out. Moreover, Friedman's analysis suggests that the money demand is primarily determined by prices and permanent income, with interest rates playing a less significant role, and the cyclical movements in money to income could be attributed to variations in both nominal stock of money and velocity, with neither dominating the other. According to Friedman, the results in this paper and their later work Friedman and Schwartz (1963) show that the demand for money is a stable function of a few key variables, including wealth, income (permanent), and interest rates, and this stability implies that changes in the money supply will have predictable effects on prices and nominal income.

Meltzer (1963a,b) investigate the demand for money, particularly focusing on the short-run behavior of velocity. They propose a wealth-adjustment process model where the demand for money is a function of interest rates and non-human wealth, and find that this model outperforms alternative theories in predicting velocity, including Keynesian and Friedman's permanent income models. Meltzer (1963a), by focusing on the long-run aspect, finds that the wealth model is stable over the long run, irrespective of the definition of money. Meltzer (1963b) extend this analysis to the short-run and find that the wealth model accurately predicts turning points in income. Both papers challenge Friedman's permanent income hypothesis, which assumes that the demand for money is primarily determined by permanent income and is insensitive to interest rates. Meltzer (1963a) argues that Friedman's findings are due to his specific measurement procedures like using the broad money (M2) definition, and show that the demand function for money is more stable when money is defined as currency plus demand deposits (M1). When controlling for these factors, interest rates significantly affect the demand for money. Besides, Meltzer (1963b) find that the wealth model including interest rates

performs better than Friedman's model in predicting velocity, and unit elastic demand for money, contradicting with Friedman's claim that money is "luxury" good.

While acknowledging the importance of the precise value of the interest elasticity of money demand in quantitative analysis, Friedman (1966) argues that it does not have crucial implications for monetary theory and policy. Empirically, Friedman acknowledges a consensus that interest rates influence the real quantity of money demanded, with lower elasticities for short-term rates than for long-term rates. Despite the inelastic response (elasticity less than unity) of money demand documented in numerous studies, Friedman (1966) holds that variations in real income or wealth are generally found to be more important than interest rate variations in explaining changes in the real quantity of money demanded. Furthermore, Friedman (1970) acknowledges that there have been some periods of instability in the demand for money, particularly during times of financial crisis or rapid economic change. However, he argues that these episodes are exceptions rather than the rule and that the demand for money generally exhibits a high degree of stability in the long run.

Friedman (1977) develops a theoretical framework to analyze the demand for money, emphasizing the importance of the entire term structure of yields (from short-term to long-term) and the time perspective of individuals in making cash-holding decisions. The model suggests that the demand for money is determined not only by the level of interest rates but also by the expected holding period of money and the shape of the yield curve, with a steeper yield curve implying lower money demand for a given average interest rate (Friedman, 1977).

Friedman (1983) argues that the Federal Reserve's claim of low variability in monetary aggregates of USA is misleading due to a biased comparison with other countries. The Fed used averages of daily figures for the USA but single-day (end-of-month) figures for other countries, which inherently have higher variability. Friedman argues that this methodological inconsistency makes the USA appear to have more stable monetary growth than it actually does compared to other countries, highlighting the importance of accurate measurement and consistent data when analyzing monetary trends. This increased volatility in reported money growth could lead to increased

demand for money as individuals and businesses seek to hold more liquid assets in uncertain times. Later on, this phenomenon was conceptualized as "Friedman Hypothesis" that increase in the volatility in the money growth can lead to increasing demand for money, thereby reducing the velocity (Basci and Gherbi, 2020)

There are a number of studies empirically testing the Friedman hypothesis by using time series methods. Mascaro and Meltzer (1983), Hall and Noble (1987), Fisher and Serletis (1989) and Payne (1992), by using the Granger Causality method, find evidence supporting the Friedman hypothesis, while Darrat and Osman Suliman (1994) finds no relation between the volatility of money growth and the velocity of money with the six-variable vector autoregressive model.

Basci and Gherbi (2020) investigate the declining trend in money velocity observed in the United States in recent decades by employing an Agent-Based Model to simulate and analyze the impact of consumer heterogeneity on money velocity. They build on Friedman hypothesis, which attributes temporary declines in money velocity to increased volatility in money growth, and Santoni hypothesis, which suggests a negative relationship between wealth relative to income and velocity of money (Santoni, 1987). The authors extend the Santoni Hypothesis by incorporating consumer heterogeneity, using an Agent-Based Model (ABM) to simulate an economy with agents possessing different propensities to spend. Their empirical results demonstrate that consumer heterogeneity alone can lead to a decline in money velocity, together with a sustained deterioration in wealth distribution. They argue that while short-term fluctuations in velocity might be attributable to volatility in money growth (Friedman Hypothesis), the long-term trend is more likely driven by the increasing concentration of wealth among low-spending individuals (Santoni Hypothesis). As money is accumulated by agents with the lower propensity to spend, the velocity of the money continues to decline, exerting downward pressure on nominal aggregate demand and the price level in general. This combined approach offers a nuanced understanding of the complex factors influencing money velocity and its implications for demand deficiency and deflationary pressures in the economy.

2.1.6 Buffer Stock Approach

The buffer stock approach to demand for money points to the individuals' and firms' desire to hold money as a buffer against unexpected fluctuations in expenditure and income, emphasizing the role of uncertainty and precautionary motives. The concept of buffer stock is initially introduced by Miller and Orr (1966) where they develop a model of optimal cash management for firms, where cash balances fluctuate randomly and are controlled by upper and lower bounds. The model solution indicates that the optimal average cash balance of the firm (money demand) is determined by the cost of transferring funds, the interest rate and the variance of daily net cash flows, highlighting the role of cash flow variability in determining money demand (Miller and Orr, 1966). Mizen (1994), in his extensive overview on "Buffer Stock Models on the Demand for Money", argues that there are two approaches based on the reformulations of precautionary and transaction demand for money. The first approach combines adjustment costs with real balance effect, based on but not limited to Artis and Lewis (1976), Carr and Darby (1981) Cuthbertson and Taylor (1987), Cuthbertson (1988) and Muscatelli (1988). Here the demand for money stems from the individuals' responses in adjusting the illiquid asset balances when experiencing a shock, treating the money as an asset acting as a 'shock absorber'. Because the adjustment cost is higher in altering asset balances, individuals hold money as a buffer to slowly adjust their money balances to long-run equilibrium through the real balance effect. The latter framework, based on Santomero and Seater (1981) and Davidson and Ireland (1987), points to the search theory and irreversible investment literature.

Another stream on the buffer stock framework are based on disequilibrium in the money market. Milbourne (1988), in his comprehensive overview, "Disequilibrium Buffer Stock Models: A Survey", classifies these models based on the nature of disequilibrium in the money market and the exogeneity of the money supply. (1) Flow Equilibrium/Stock Disequilibrium Models (Jonson, 1976) emphasize temporary equilibrium in the money market. While agents may experience initial stock disequilibrium due to exogenous shocks, they quickly adjust their consumption and real balances to reach a new equilibrium. In these models, money demand is determined

by standard factors like income and interest rates, but temporary deviations from the desired level of real balances occur due to exogenous shocks, triggering adjustments in consumption and real balances to restore equilibrium. Empirical applications of this approach typically focus on the impact of initial monetary disequilibrium on expenditures, without explicitly estimating money demand functions. Subsequently, (2) Keynesian flow-disequilibrium models exemplified by Laidler (1982) and Laidler (1984) feature a Keynesian-style disequilibrium where both stocks and flows are out of balance. Money demand is influenced by standard factors, but also by constraints in adjusting money holdings, leading to potential discrepancies between desired and actual balances. Empirical studies in this vein often examine the role of interest rates and credit markets in the adjustment process. (3) Flow-disequilibrium models with rational expectations (Carr et al., 1985) incorporate rational expectations, positing that individuals form expectations about future monetary policy, and only unanticipated changes in the money supply are believed to cause disequilibrium, suggesting that unanticipated changes in the money supply influence the demand for money together with the other standard factors. However, Milbourne (1988) highlights the internal inconsistency of these models, as they require agents to rationally expect market disequilibrium. Finally, (4) Models with Endogenous Money treat the money supply as endogenous, affected by factors including loan expansions and money demand shocks. These models often augment standard formulations of money demand equation with additional variables to capture supply side disturbances. However, their interpretation can be challenging due to the simultaneous endogeneity of money and the variables influencing it.

2.2 Empirical Studies

Empirical studies on money demand have a long and rich history in monetary economics as a stable money demand function has long been considered as a prerequisite in conducting monetary policy by using monetary aggregates (Goldfeld, 1989). Early research, dating back to before World War II, primarily focused on estimating the velocity of money and understanding its long-run behavior (Selden, 1956). As explained earlier, the findings of Friedman (1959) suggest that interest rates might not be as crucial

in explaining velocity movements as initially thought, and the demand for money is primarily determined by long-run income expectations and asset motives, rather than short-term transaction needs or speculative motives. On the other hand, together with Meltzer (1963a,b), a stable long-run relationship between demand for money and short-term interest rates also presented by Laidler (1966) using annual time series data for the United States from 1892 to 1960, with an interest elasticity of demand estimated to be between -0.155 and -0.192. This suggests that money demand is negatively related to short-term interest rates, yet the effect is relatively small, implying that money demand is primarily determined by factors other than interest rates, such as income or wealth.

Goldfeld et al. (1973) estimates a money demand function specified in a log-linear form using quarterly data from USA between 1952 and 1972, employing a partial adjustment model and exploring various specifications regarding the definition of money, interest rates, and the role of income and wealth. The study finds that a conventional money demand function, relating real money balances to real GNP and interest rates, performs well and exhibits a reasonable speed of adjustment, with a long-run income elasticity significantly less than unity, suggesting economies of scale in money holdings (Goldfeld et al., 1976). The conventional money demand function appears stable in both the short-run and long run, with no evidence of instability when splitting the sample at 1961, a period marked by institutional changes. However, the M2 money demand equation is found unstable over time, suggesting that aggregating money to include time deposits might not be appropriate due to the inherent instability of the time deposit component.

Similarly, Hamburger (1977), by using data from USA between 1955 and 1976, and employing a modified version of the St. Louis reduced form equation as well as an alternative money demand function that incorporates a broader range of assets, finds that the instability in money demand, particularly for the narrow money stock (M1), is primarily due to the restrictive specification of the money demand function, rather than a fundamental shift in the asset preferences of the public. The demand for money is determined not only by short-term rates but also through long-term bond rates and the yields on equities. Besides, the relationship between money growth and GNP growth

has remained remarkably stable, suggesting that the monetary aggregates remain useful policy guides. However, the stability of these money demand functions was questioned in the mid-1970s when they began to significantly overpredict real money balances (Goldfeld et al., 1976). This instability coincided with a period of financial innovation and deregulation, prompting a reevaluation of existing money demand models.

One prominent explanation is the Lucas critique (Lucas, 1976), which argues that the parameters of econometric models are not policy invariant and may change with shifts in policy regimes. In the context of money demand, this implies that changes in monetary policy rules or operating procedures can alter the underlying relationship between money demand and its determinants, leading to instability in the estimated money demand function. Furthermore, Judd and Scadding (1982), in their comprehensive survey of the post-1973 literature on money demand instability, attributed this instability to financial innovations as well as regulatory changes that had occurred during this period. The high inflation and interest rates of the 1970s, combined with legal obstacles for offering yields on transaction balances at a market rate of return, had led to financial innovations that allowed public to economize on their holdings of noninterest-earning transaction deposits. These innovations include security repurchase agreements (RP), cash management accounts, and money market mutual funds. The emergence of new financial instruments and cash management techniques allowed individuals and businesses to economize on their money holdings, leading to a downward shift in money demand. This shift posed challenges for traditional money demand models and required new approaches to capture these structural changes. Lucas (1988), in a quantitative review, reaffirms the stability of the long-run money demand function using a microfounded, yet acknowledges the instability in the short-run. Ozmen (1996) further explored the instability of money demand, attributing it to factors such as misspecified dynamics, invalid conditioning, and changes in the relevant variable space due to changes in the economic environment.

To address this instability, researchers explored various approaches: (1) expanding the definition of money to include new instruments such as RPs and money market mutual funds (Garcia and Pak, 1979; Tinsley et al., 1981); (2) incorporating measures of

transaction costs and financial innovation into the money demand function (Enzler et al., 1976; Simpson and Porter, 1980); (3) exploring alternative measures of transactions, wealth, and interest rates, and relaxing the assumption of constant elasticity (Goldfeld et al., 1976); (4) reconsidering the definition of money itself, with some researchers advocating for narrower or disaggregated measures while others explored broader definitions like Divisia indexes (Barnett, 1980). Lucas (1988), in a quantitative review, reaffirms the stability of the long-run money demand function, yet acknowledges the instability in the short-run.

The instability observed in money demand functions led to a renewed focus on improving specification and estimation techniques. Researchers explored various econometric methods to capture the changing dynamics of money demand and to address issues of misspecification and omitted variables. Sriram (1999) characterized the evolution of the econometric techniques by three main approaches: partial adjustment models, buffer-stock models, and error-correction models.

Partial adjustment models (PAMs), introduced by Chow (1966) and popularized by Goldfeld et al. (1973), were extensively used in the early stages of money demand research. These models distinguished between the desired and actual holdings of money and incorporated a mechanism to adjust the actual holdings to the desired levels. PAMs performed well with postwar-1973 data, but struggled to explain the apparent instability in money demand functions experienced since the early 1970s (Goldfeld and Sichel, 1990). The limitations of PAMs led to the development of buffer-stock models (BSMs) in the 1980s. BSMs viewed money holdings as a shock absorber for unexpected variations in receipts and expenditures. These models explicitly incorporated money shocks and featured more complex lag structures compared to PAMs. BSMs aimed to address issues such as interest rate overshooting and implausibly long adjustment lags associated with PAMs (Milbourne, 1988). However, BSMs also faced criticism, including their assumption of money stock exogeneity and limitations in empirical testing. As a result, attention shifted to error correction models (ECM) in the late 1980s and 1990s.

”ECMs have proven to be one of the most successful tools in applied money de-

mand research, as they embed the long-term equilibrium relationship between money and its determinants within an equation that captures short-term variation and dynamics” (Kole and Meade, 1995). ECMs address the tension between long-run equilibrium and short-run dynamics that plagued earlier approaches. The ECM approach is closely tied to the concept of cointegration (see Boswijk et al. (2010) for more detailed elaboration on the historical perspective on cointegration), as developed by Engle and Granger (1987). This technique allows for inferences on long-run relationships while providing a basis for investigating short-run dynamics. The Johansen (1988) and Johansen and Juselius (1990) procedures further extended this framework to allow for multiple cointegrating vectors. ECMs have several advantages over previous approaches: (1) they avoid spurious correlations among strongly trended variables; (2) they capture long-run relationships that may be lost when expressing data in differences; (3) they distinguish between short-run (first-differences) and long-run (lagged-levels) effects; (4) they provide a more general lag structure without imposing too specific shape on the model” (Sriram, 1999).

That is why there was a shift towards using cointegration techniques to estimate long-run money demand relationships in the 1990s. Among many studies, Baba et al. (1992), by using a dynamic error correction model, estimates United States M1 demand functions for the period between 1960-1988, addressing issues of instability and incorporating variables like inflation, real income, bond yields, and learning curve weighted yields to explain earlier breakdowns in money demand. Lütkepohl (1993) also investigates the sources of the instability in money demand in USA using a flexible least squares approach, and finds that while the long-run coefficients of money, interest rates, and GNP had remained relatively stable over 30 years, the instability was primarily due to changes in short-term dynamics, suggesting potential misspecification or omitted variables in the model. Together with studies on the United States, it is concluded in several previous studies that the demand for broad money in countries like Japan, and the United Kingdom remained stable during 70s, a period previously identified as one of monetary instability when using conventional models (Corker, 1990; Adam, 1991; Hendry and Ericsson, 1991; Mehra, 1993).

Fase (1994) presented a survey of empirical research on the demand for money in the G7 and EC countries, highlighting the diversity of empirical findings and the lack of convergence in estimated elasticities, even when similar specifications are used. In another literature survey, Sriram (1999) reviews dozens of studies across developed and developing countries that estimate money demand functions using the ECM, and in his words "A common result of these studies is that the demand for real money balances is cointegrated with traditional arguments in the money demand function, such as income and interest rates" (Sriram, 1999). He also finds that recent studies increasingly find evidence supporting the impact of international factors on domestic money demand.

Besides, Knell and Stix (2006) conducts a meta-analysis of nearly 1,000 estimations on demand for money from three different samples, and come up with stylized facts regarding money demand estimation: (1) they found that the average of all estimated income elasticities is approximately one, aligning with the quantity theory of money; (2) income elasticities for broad money are typically higher than those for narrow money; (3) when using narrow money, OECD countries exhibit lower income elasticities than non-OECD countries, a pattern that reverses when broad money is used; (4) income elasticity estimates for Germany are generally higher than those for the USA, highlighting the significance of considering country specific factors and macroeconomic conditions when analyzing money demand; (5) studies incorporating wealth measures or two interest rates tend to report lower income elasticity estimates; (6) finally, the authors observed that the demand for money is negatively correlated with interest rates, with long-term rates having a more substantial impact than short-term rates (Knell and Stix, 2006).

As explained above, the instability of money demand, particularly post-1980, has been a central theme in monetary economics. More recently, Ball (2012) addressed this short-run instability by incorporating the average return on "near monies" (highly liquid substitutes for M1, including savings accounts and money market mutual funds) into the money demand function. This approach successfully explained the behavior of money demand and velocity fluctuations, particularly the increased volatility after 1980 attributed to the deregulations and financial innovations in the late 70s and early

80s. These innovations led to the emergence of new financial instruments, including credit cards and money market mutual funds, and the withdrawal of Regulation Q, which had restricted interest rates on savings accounts (Ireland, 1994). The removal of this regulation allowed "near monies" to become more attractive, as they could now offer competitive interest rates, leading to a substitution away from traditional M1 components and increased volatility in velocity. This aligns with the findings of Lucas and Nicolini (2015) attributing the apparent instability of money demand to the weakening of Regulation Q. They proposed a new monetary aggregate, called "New M1", including the money market deposit accounts (MMDAs) alongside traditional M1 components, and demonstrated its stability over time. The underlying mechanism was the increased substitutability between different types of deposits due to the relaxation of interest rate restrictions. This increased substitutability made it easier for individuals agents and business firms to switch between different types of deposits in response to changes in interest rates or other economic conditions, eventually leading to changes in the composition of the demand for money.

Berentsen et al. (2015) further explored the role of financial innovations, particularly the introduction of sweep technology in the 1990s, enabling banks to automatically move funds between checking accounts and MMDAs, further blurring the lines between different types of deposits and impacting money demand. Their model suggest that the increased access to money markets thanks to the sweep technology could explain the observed changes in money demand by making it easier for economic agents to access and utilize interest-bearing accounts for transaction purposes. This complements the findings of Lucas and Nicolini (2015), as both studies highlight the role of financial innovation in shaping money demand, with Berentsen et al. (2015) focusing on the specific impact of sweep technology on the substitutability between different types of deposits.

Krishnamurthy and Li (2023) broadened the scope of analysis by examining the demand for money, near-money, and Treasury bonds as assets that satisfy investors' demand for liquidity. They found that these assets are imperfect substitutes, with varying degrees of substitutability. Their findings have implications for understanding the

monetary transmission mechanism and the role of different assets in meeting liquidity needs. The imperfect substitutability between these assets suggests that changes in the supply of one asset, such as through quantitative easing, can affect the demand and prices of other assets, highlighting the interconnectedness of financial markets. This study builds upon the work of ? by considering a wider range of assets and their interactions in the context of money demand.

Although he was one of the main figures who led to a paradigm shift in monetary theory and policy, gradually diminishing the prominence of money demand, Lucas had never lost his interest in money demand until he passed away (Rest in peace the Great Master). Benati, Lucas, Nicolini, and Weber (2021) extends the Lucas and Nicolini (2015) to a broader international context and finds support for a stable long-term relationship between the ratio of M1 to GDP and short-term interest rates in most countries. However, they also observed that the traditional log-log specification of the money demand function does not hold during periods of very low interest rates. To address this, they proposed an extension of the theory that incorporates borrowing constraints, suggesting that the ability of individuals and businesses to borrow can influence their money demand, especially when interest rates are low. Therefore, this finding introduces an additional layer of complexity to understanding of money demand by highlighting the role of credit market conditions in shaping the demand for money, thereby casting a role for macroprudential policies.

2.3 Gurley and Shaw Approach: Diversification Demand for Money

The seminal work by Gurley and Shaw (1955) was one of the earlier attempts to account for the financial aspects of economic development and sustained economic growth by introducing the crucial role that financial intermediaries play in this process. The authors propose that a robust financial theory of growth must integrate real and financial development into the analyzes by addressing the complexities of financial systems and recognizing financial institutions as both determined and determining variables in economic growth. Therefore, Gurley and Shaw (1955) criticize the limitations of the Keynesian short-period model, which focuses primarily on short-term liquidity

preferences and neglects long-term growth dynamics that are essential to understanding economic development. They argue that the growth of non-monetary intermediaries, by increasing the varieties of financial claims, diversifies the channels that loanable funds can flow as a result of institutionalization of saving and investment, thereby influencing the accumulation of debt and financial assets together with its composition in the portfolios of spending units. On the other hand, the Keynesian Liquidity Preference Framework fails to account for the accumulation of debt over time due to the exclusion of borrowing as well as the evolving role of financial intermediaries through their influence on the flow of loanable funds.

That is why Gurley and Shaw (1955) advocacy for an extended analytical framework that allows for the accumulation of both debt and financial assets necessitated the reevaluation of quantity theory of money by extending the definition of money with time deposits and non-monetary financial assets which are close substitutes for money in terms of liquidity, and reformulation of the traditional relationship between money velocity and interest rates through the elasticity of liquidity preference, marginal efficiency and consumption. The definition of liquidity in their framework encompasses the quantity of money circulated in the economy together with the amount of money in the economy that agents think they can acquire in the form of income, by selling financial or capital assets, or by borrowing. As a result, interest rates are not only determined by the distribution of bonds between banks and the public, as proposed in the Liquidity Preference Framework, in the presence of non-monetary financial intermediaries.

Gurley and Shaw (1955) briefly introduced the concept of diversification demand for money, then formalized after delving deeper into financial intermediaries and their role in saving-investment process (Gurley and Shaw, 1956), and derived a new money demand function (Gurley and Shaw, 1957) accounting for the diversification demand. Later on, they developed "a theory of finance that encompasses the theory of money, and a theory of financial institutions that includes banking theory" (see Gurley and Shaw, 1960, pp.1) by incorporating these papers in their monograph named "Money in a Theory of Finance". A theoretical framework can maintain its prominence so long as its advocates reformulate the underlying preliminary assumptions and causal

mechanism with respect to the evolving conditions of objective reality, and discovery or development of the new scientific concepts and methods. Despite wide attraction to the subject at the beginning (Marty, 1961; Minsky, 1961; Patinkin, 1961; Lerner, 1962), their project had later been obsoleted like many other frameworks offering an alternative paradigm to the mainstream. Therefore, the diversification demand for money and its implications on macroeconomic variables under different circumstances, elaborated by the authors in an unstructured fashion in the book, have been overlooked in the literature. Nevertheless, based on their intimate knowledge of the facts about the financial system, the authors establish a theoretical structure Patinkin (1961) through a number of postulates deviating from those usually made to convey their fundamental thesis that how financial institutions and their usages determine the equilibrium and growth characteristics of an economy (Minsky, 1961).

To uncover how the interaction between real and financial markets results in an equilibrium level of real output and prices, Gurley and Shaw (1960) develop their framework by a series of models starting from a rudimentary economy with minimal financial institutions and markets to increasingly more complex financial structures. That is why their discussion about the neutrality and the demand for money is subject to confusion because of the dynamic specification of the assumptions on the behavior of economic agents with respect to changing and evolving conditions of the overall economic structure Patinkin (1961). Therefore, it is worth briefly presenting the theoretical framework together with its assumptions to account for the long-run implications of the growth of non-monetary financial intermediaries on money demand to revitalize its diversification motive.

They start with a modeling of an economy based on "Rudimentary Finance", composed of three sectors: consumers, business firms, and government, comprising non-financial spending units; and three markets: current output, labor, and money. It is a neoclassical world with competitive markets and flexible prices for the markets for labor and current output. There is no financial sector, only a governmental monetary system comprising of a Policy Bureau resembling an embryonic central bank and a Banking Bureau responsible for the purchases of output, transfer payments, and issue of the only

money the only financial asset based on the instructions from the former. The consumer sector obtains income by providing labor services to business firms and spends part of it on goods and services supplied by the business sector. Money is their only asset, and they do not accumulate tangible wealth. On the other hand, business firms hold tangible wealth to combine them with the labor services provided by consumer sector to produce output to sell it back part of it to them, part of it to government, and remaining part to other business firms as private investment goods. They hold their gross profit as money balances and cannot issue new securities to borrow money. The government sector in this economy is both a monetary system, and monetary authority provides payment mechanism, defines monetary policy, and issues fiat money accordingly through the purchases of goods and services provided by the business sector or through transfer payments to the consumer sector.

Investment in capital goods is a crucial aspect of economic growth and development, as reflected in national accounts. Part of the economy's spending is directed towards investment, which, after accounting for depreciation allowances, leads to an increase in tangible assets on social balance sheets. This process results in a corresponding increase in net worth, representing the economy's net saving. The excess of gross national income over the consumption and government expenditures, and the depreciation allowances signifies the net saving capacity of the economy. However, while national income and product accounts offer a comprehensive view of economic activities, they have limitations, particularly regarding changes in financial assets and debt. These accounts do not capture the dynamics of financial transactions, as they focus on changes within the nation's consolidated balance sheet, thereby omitting to report important aspects of financial activities, such as sectoral borrowing and lending. To account for the accumulation of debt and financial assets through the flow of loanable funds between spending units, Gurley and Shaw (1955) analyze economic transactions and their implications on financial stability using the social accounts, the consolidated sectoral balance sheets of the spending units, known as flow-of-fund accounts, recording the tangible and financial assets, debt and equity at the end of fiscal periods.

In a rudimentary economic model, the consolidation of sectoral budgets involves a government deficit paired with surpluses in the private sectors. Balanced budget units maintain equilibrium between income and their spending on consumption, investment, government goods. Surplus-budget units have excess income over spending, resulting in improved financial positions and increased financial assets relative to liabilities, thereby becoming suppliers of loanable funds. Conversely, deficit-budget units spend more than their income, requiring loanable funds by issuing debt or releasing financial assets, thereby increasing their liabilities relative to assets. As financial corollaries of these dynamics resulting from the ex-post identity between receipt income and expenditures, saving and investment, and surplus and deficit, at the aggregate level, the supply of loanable funds equals the demand, and the increase in financial asset for surplus units equals the financial liabilities of deficit units, so that accumulation of debt and financial assets accompanies economic growth in the presence of unbalanced budget. In addition, an ex-ante balance between the same identities above implies an ex-ante balance in offers and bids for loanable funds with financial assets, as well as willingness to incur debt and hold debt instruments, aligning equilibrium level of income and wealth with corresponding levels of debt together with its counterpart in the volume of financial assets.

The financial dynamics in this model are centered on the government's method of financing its deficit by issuing money, where the flow of money directly links the government's deficit to the private sector surpluses. When government deficits occur, they are financed by issuing money, which private sectors acquire in proportion to their surpluses. In essence, the government borrows by issuing non-interest-bearing securities in the form of money, and the private sector lends by accepting these securities as part of its money holdings. Consequently, the government's net financial assets decrease as it incurs a deficit, while the net financial assets of the private sectors increase due to their surpluses. Given that the sole form of debt and corresponding financial asset is money in this model, the financial resolution of unbalanced budgets involves an increase in the money stock issued by the government sector and accumulated in money balances of the private sector. This borrowing by the government through the

issuance of money, and the lendings of the private sector through allowing additions to their money balances, are both commands on the current output level. Consequently, government's ability to spend more than its receipts on the income and product accounts hinges on the willingness of the private sectors to dishoard their savings in exchange for money, the financial asset. These dynamic results in differing distributions of income and spending across sectors are facilitated by the presence of at least single form of debt and financial asset. That is why the structure of debt and financial assets is notably simple in this rudimentary economy as the money is the only debt instrument that can be issued to secure external financing for excesses or deficits of savings over investments. Likewise, money is the only financial asset available for sectors to acquire as they transfer their excess saving over investment to those with deficits. As a result, increases in debt within the economy are directly correlated with increases in deficits, thus establishing a direct correlation between increases in the money stock and increases in the level of debt.

The records in the consolidated social accounts allow Gurley and Shaw (1960) to explore the underlying motivations behind the behaviors of the spending units. Business firms, as key players in the market for goods, determine their real production based on a combination of accumulated capital stock, labor services provided by consumers, and the prevailing technical capacities influencing production efficiency. Consumers supply labor in a fixed quantity that is fully employed with wages directly tied to the marginal product of labor. Consequently, the allocation of net national product between private sectors, in the form of real rents and wages, is governed by the marginal product of the factor they supply. On the other hand, firms allocate depreciation allowances to automatically replace the stock of capital, and encounter critical decisions regarding the use of net rental earnings that can either be reinvested into capital goods or retained as real money balances, with the firms striving to maintain a balanced portfolio by equating the real rental rate of capital to the real marginal benefit of holding money balances. Besides, the incremental demand for money by firms is linked to their net rental earnings relative to net investment, that could be positive, negative, or neutral, depending on whether firms seek to increase their money balances or invest more

heavily in capital goods. Consumers, on the other hand, direct their wage income towards consumption or saving, with any savings exclusively devoted to increasing real money balances, as they do not invest in tangible assets. The behavior of consumers is driven by their desire to maintain a certain level of money balances, which adjusts according to their real income, influencing their consumption patterns as any excess or deficiency in money balances alters their spending behavior. Thus, their demand for money stem from both income and real balance effects.

The implications of government spending is framed within the broader context of monetary policy, impacting the supply of money and the equilibrium of private sector finances through its effect on the composition of money balances and income distribution in private sector. The nominal stock of money at any given time reflects the cumulative historical deficits of the government, representing the total outstanding money in an economy. In contrast, the real stock of money adjusts the nominal amount to reflect its actual purchasing power by deflating it with an index of current output prices. Changes in the real stock of money are driven by two primary forces: the issuance of nominal money by the government and fluctuations in the price levels of goods and services. The supply of nominal money adds to the real stock, whereas inflation (deflation) reduces (enhances) its purchasing power, thereby decreasing (increasing) the real stock. The demand for money, particularly the real incremental demand, is influenced by the need of private sectors to maintain purchasing power through real balances rather than nominal ones. This demand can be met either by increasing nominal money issuance or through deflationary price adjustments.

Unlike speculative liquidity preference in Keynesian theory, money is not held as a safeguard against declining security prices simply because there is no market rate of interest determining the prices in the absence of securities other than money. Therefore, Marty (1961) suggest a fictional concept called "implicit deposit rate", a theoretical construct used to assess the opportunity cost of holding money versus spending or investing it, which serves as a benchmark for decision-making by both consumers and firms based on the perceived benefits of maintaining liquidity. Consumer demand increments in real balances until the marginal implicit deposit rate aligns with

the marginal utility foregone by not consuming. For firms, the demand for money continues until the implicit rate equals the marginal real rental rate on capital goods. There are three primary factors contributing to the implicit deposit rate: (1) anticipated deflation, offering the prospect of real capital gains in money balances, making money holdings attractive; (2) budget rotation, refers to the expected need for adjustments in the money balances in response to fluctuating budget surpluses and deficits, with money serving as a buffer against transaction costs associated with precise income-expenditure matching; and (3) investment risks for firms, associated with real investment lead to asset diversification between money and capital goods, with money providing a safer alternative in the face of uncertain returns on investment.

Ultimately, the equilibrium in the money market, where money demand matches the money stock, reflects a broader equilibrium in the market for goods, as demand for money responds to several economic indicators, including growth in real income, expansion of real capital goods, and inflationary pressures. When real money balances fall below the desired levels due to inflation, there is a natural push for increased money demand. This demand is also shaped by changes in the marginal utility of consumption, changes in the rental rate on capital, and variations in the implicit deposit rate. Furthermore, monetary policy, in the form of nominal money supply, is neutral in this model unless government actions disrupt the markets through purchases of output, resulting in distributive effects that influence relative demands for consumption and investment. Besides, nonneutrality arises in the presence of certain frictions or deviations from ideal economic conditions, leading to real effects on the economy. This occurs when the assumptions of price flexibility, the unitary elasticity of price expectations, and the absence of the money illusion do not hold. For example, if prices and wages are rigid, monetary policy becomes crucial for maintaining real growth and full employment because the economy cannot self-adjust through price changes. Similarly, when price expectations are not of unitary elasticity, changes in current prices can disproportionately affect future price expectations, leading to either excessive deflationary pressure or hyperinflation, both of which disrupt monetary equilibrium. Additionally, if economic agents operate under money illusion, defining their goals in

nominal rather than real terms, the effectiveness of monetary policy in maintaining equilibrium is compromised, as nominal adjustments in money supply or prices do not correspond to the real needs of the economy. In such cases, monetary policy is not neutral because it directly influences real variables such as output, employment, and investment, rather than merely adjusting nominal values. To conclude, the first model by arguing that "Rudimentary economy is inefficient since it provides neither the array of financial assets that would stimulate saving nor the array of financial markets that would allocate saving competitively to investment." (see Gurley and Shaw, 1960, pp.49).

The second model builds upon the rudimentary economy by incorporating a market for primary securities (bonds) alongside labor, goods, and money, while maintaining the three sector structure, where consumers and business firms interact directly in the all markets but the government is confined to the bond and money markets and does not engage in spending on goods or services. In this expanded setup, the government, through its Policy Bureau and Banking Bureau, influences the economy by purchasing business bonds, which directly impacts the money supply and facilitates the accumulation of real capital as well as the money balances of the spending sectors. Another considerable feature of this model is the maintenance of an ex-post balanced budget aggregatively for the private sectors, where the consumer sector is allowed to operate with either balanced or surplus budgets, whereas business firms tend to function with balanced or deficit budgets, so that the national output produced by business firms is now allocated in a more intricate manner—between wages paid to consumers and interest payments that accrue to them. Business firms issue primary securities in the form of bonds to finance their investments and increase money balances, so money is not the sole financial asset in the economy, and it also acts as an indirect security issued by the government to ensure that the supply of money is effectively managed to meet the broader financial needs of spending sectors through the sophisticated interplay between saving, investment, and debt accumulation. Consumers allocate their income between consumption and saving, with savings directed towards the acquisition of money and bonds, while business firms issue bonds to incur debt, thereby financing investments in capital and increasing money balances. The resulting intersectoral division of labor

between saving and investment links business firms and consumers more intricately through financial markets, driving the accumulation of business debt and consumer financial assets.

The government, in this model, plays a more crucial role, particularly through the Banking Bureau's engagement in open-market operations by issuing money to purchase business bonds, which facilitates indirect finance, enabling consumer savings to indirectly finance business investments through the injection of money into the economy. The model also accommodates direct finance, where firms issue primary securities directly to consumers, and the balance achieved between direct and indirect finance mechanisms helps balance the financial portfolios of consumers, who hold a diversified mix of money and bonds, supporting ongoing investment and consumption in the economy. In equilibrium, the financial assets held by consumers, consisting of money and bonds, are matched by the net debt of the business sector, after accounting for their money balances, thereby balancing the budgets of private sector units, with consumer surpluses offsetting business sector deficits. This balance reflects a sophisticated mechanism for managing the distribution of financial assets and liabilities across the economy, ensuring that a more efficient flow of funds between sectors, as lending by one sector corresponds to borrowing in another. Resource allocation and price determination within this economy occur through transactions in the four markets, where markets set the national income, determine how income is distributed between consumers and firms, and allocate income between consumption and investment. The model also incorporates real and nominal valuations of bonds and money, so that by managing the money supply, the government can directly influence the price level dynamics together with the composition of consumer financial portfolios and the income distribution between sectors.

The inclusion of the market for primary securities entails different patterns of economic behavior for all sectors. Now, the objective of business management is to achieve an optimal balance of assets and debt that maximizes net profit while effectively managing risk, that is reached when the marginal rental rate on capital, the market interest rate on business bonds, and the marginal implicit deposit rate on

money balances are equal, after adjusted for risks. Therefore, the financial flows of the business sector are further detailed, with net income and borrowing financing not only net investment, but also adjustments in money balances and debt redemption, with firms aiming to achieve a balanced mix of assets and debt by incrementally adjusting the capital, money and bonds stocks to compensate the constant gap between existing and desired stocks of assets and debt during the growth process. Similarly, the second model incorporates consumer decisions regarding long-term asset accumulation as real income, derived from wages and interest on business debt, is allocated among consumption, money balances, and bond portfolios, emphasizing the desired trajectory of financial growth rather than sole short-term consumption. Their choices are guided by real income, existing financial assets, and interest rates, extending the understanding of consumer behavior through the interaction between consumption and saving, and financial portfolios. They summarize the responses of both sectors to various stimuli, where "the demand for money is positively related to real net income, and negatively to marginal real rental rate, bond rate of interest, debt burden, and real money balances for the business sector; it is positively related to real consumer income and real bond holding, and negatively to bond rate of interest and real money balances (see Gurley and Shaw, 1960, pp. 64-66).

Besides, the government sector's role, previously limited to basic monetary policy, is expanded to include open-market operations that impact both money and bond markets through the Banking Bureau, which holds a portfolio of business bonds, by issuing money against these bonds or retiring money by selling bonds to manage the money stock. The model assumes that all economic units operate without money illusion and are guided by real variables, unaffected by changes in nominal values. Price expectations are static, with current prices assumed to be permanent, yet there is an uncertainty regarding future to some extent inducing firms and consumers to take precautions against movements in the price level. Next, the model introduces the money market's supply and demand sides, where the stock of money represents government debt, accepted as a means of payment by the community, and can be measured nominally or in real terms. Therefore, the money supply, in both nominal and real terms,

is the increments in the nominal money stock, and is subject to the real incremental demand for money arising from the gap between desired and existing level of real money balances, reflecting a shortage in the private sector, which could be satisfied by either issuing new nominal money at a stable price level or through price adjustments if the nominal supply remains unchanged Gurley and Shaw (1960).

On the demand side, the motivation for holding money balances by consumers and business firms is multifaceted. This is elaborated through the marginal implicit deposit rate on money, which encompasses traditional categorizations of money demand, such as transactions, precautionary, and speculative balances, by treating total desired money balances as a singular asset. This approach allows for the analysis of the opportunity cost of holding money versus other assets, in line with earlier specifications in rudimentary finance. Consumers seek to maintain an inventory of financial assets to avoid the inconvenience and costs associated with synchronizing the flows of funds. Additionally, for speculative purposes, they may anticipate potential deflationary pressures on goods prices that could yield real capital gains on their portfolios. The benefits of diversifying this inventory between money and bonds arise from the potential fluctuations in the relative value of these assets, balancing the potential returns of bonds against the safety and liquidity of money. In addition, higher consumer income and spending, leading to short-term drains on their financial asset inventory, leads to an increase in the demand for money relative to current balances, generating an incremental demand for money. Therefore, the implicit deposit rate provides a rational basis for holding money, even in the presence of interest-bearing alternatives. This dynamic relationship between income, spending, interest rates, and money demand underscores the importance of money as a buffer against the short-term financial fluctuations, the inherent uncertainty in economic systems, and as a component of a diversified financial asset portfolio.

Business firms, as chronic deficit spenders and borrowers, hold real assets exceeding their net worth. Their preference for holding both capital goods and money, even at the cost of higher gross debt, is influenced by considerations similar to those underlying consumers' preference for diversifying financial assets. Additionally, for business firms, the demand for money aligns with their strategy to balance real assets

against net debt, particularly when income and spending increase, threatening short-term liquidity. The model advances this understanding by incorporating the speculative motives related to deflation and the need to manage debt-to-capital ratios. Firms face additional pressures from the marginal rental rate on capital and respond to uncertain financial conditions by adjusting their net debt positions and increasing their money holdings, particularly when bond yields decline, prompting them to favor liquidity over additional capital investments. The aggregate incremental demand for money across consumers and firms is closely tied to real national income, the real capital stock, and bond holdings within their financial asset portfolios. As these factors grow, so does the demand for money, although this demand can decrease with falling interest rates, lower marginal rental rates, and reduced real money balances.

Gurley and Shaw's segregation between inside and outside money has significant implications for wealth transfers and price level determinacy. Outside money, being a net external claim held by private sector against the government as in the rudimentary economy, leads to wealth transfers between them when the price level changes. Conversely, the inside money, that is issued by government in purchasing primary securities from the private sector, is based on internal debt counterbalanced by primary debt of the business sector, and does not result in net wealth transfers between the private economy and the government when the price level changes. This distinction between inside and outside money fundamentally alters the wealth transfer dynamics. While outside money facilitates transfers between sectors, inside money precludes such transfers, leading to different economic outcomes where changes in the price level result solely in wealth redistributions within the private sector, with one gaining while the other losing by the same amounts.

The model's differentiation between inside and outside money underscores their distinct impacts on wealth transfers and price level determinacy. The rudimentary economy's structure leads to direct transfers involving the government, whereas the second economy's reliance on inside money ensures that price level alterations yield no net wealth effect across the private and government sectors. The determinacy of the price level in the second economy is driven by the portfolio mix or diversification effect,

wherein price deviations from equilibrium induce compositional changes in wealth that inherently restore the price level to its original state. This self-correcting mechanism operates independently of any net wealth transfers, stabilizing the economic system through the intrinsic dynamics of the portfolio composition.

When all money is of only the inside or outside variety, monetary policy results in neutral effects on the real variables in the rudimentary economy within the neo-classical framework (Gurley and Shaw, 1960). A nominal change in money supply results in proportional changes to prices and money wage rates, adhering to the quantity theory framework. This neutrality is maintained, as the doubling of nominal money merely adjusts nominal prices and bonds, leaving real variables unaffected. Nevertheless, the neutrality of monetary policy is disrupted if conditions such as price rigidity, non-unitary elasticity of price expectations, money illusion, or distribution effects arising from wealth transfers are present. The transition process between equilibrium positions, following monetary injections, involves intricate interactions among diverse economic variables. An open-market operation that augments the nominal money stock initially induces an oversupply of real money and an undersupply of real bonds within consumer portfolios. This disequilibrium triggers a series of adjustments in goods prices, money wage rates, and interest rates, eventually leading to an equiproportional increase across nominal money, nominal bonds, output prices, and money wage rates (Gurley and Shaw, 1960).

On the other hand, if the monetary system consists of a combination of inside and outside money, monetary policy may have non-neutral effects on real variables, even within a strict neoclassical framework (Gurley and Shaw, 1960). Specifically, when the Banking Bureau backs its monetary liabilities with both business bonds and outside securities like foreign securities or gold, increase in nominal money, primarily the inside, by the Bureau through an open market operation generates a reel effect. This adaptation is achieved through deflationary pressures on goods prices and money wage rates, obviating the need for nominal money expansion via the Banking Bureau's acquisition of business securities. Thus, an increase in nominal money through the purchases of business bonds by the Bureau leads to a proportionally greater increase

in the holdings of real bonds of the Bureau relative to its real monetary liabilities. Hence, this dynamic reduces the real holdings of business bonds by the private sector compared to their real money holdings, lowering the equilibrium interest rate. This process ultimately leads to a greater real capital stock, a higher real income level, and a surge in the price level that is proportionally less than the increase in nominal money. Besides, the price level instability, stemming from the bifurcation of the private sector into debtor and creditor entities, introduces significant distributional effects that can alter economic growth trajectories. Persistent incremental money demand, exerting downward pressure on price levels, facilitates wealth transfers from debtor firms to creditor consumers, potentially depressing saving and investment propensities, decelerating real capital accumulation, and inhibiting output growth.

The static neo-classical analysis circumvents these distributional effects through the assumption of perfectly flexible nominal bond refunding. However, deviations from this frictionless paradigm emphasize the real costs associated with price-level instability, manifesting itself in short-term disruptions to savings and investment rates and perturbations in the allocation of savings across investment opportunities. This underscores the imperative for continuous monetary intermediation in channeling real savings toward investment and maintaining portfolio balance within the private sector. Finally, the interplay between inside and outside money provides the monetary authority with leverage over levels of real income and wealth, ensuring that monetary policy is no longer trivial but instead has substantive effects on real economic outcomes.

The motivations behind financial growth and security differentiation are further elaborated in Gurley and Shaw (1960) to account for the determinants of growth in financial assets in spending unit portfolios and the impacts of differentiation on the quality of primary securities. In the second model, primary securities are defined as debt and equity issued by non-financial spending units focused on production and production purchase, while indirect securities are debt issued by financial intermediaries, including the monetary system. The classification becomes less clear when considering a broader range of securities, but is maintained for analytical purposes. Non-financial spending units hold primary securities that include, but are not restricted to, corporate equities,

bonds, consumer debt, foreign securities, mortgages and government debt, as well as indirect securities, consisting of monetary and non-monetary indirect debt, where the former is issued by the monetary system and can be further divided into currency, demand, and time deposits, while the latter is issued by financial intermediaries.

Financial intermediaries operate by acquiring primary securities and issuing other securities, obtaining revenue from interest on primary securities, and incurring costs from interest on indirect securities and administration expenses. Although the distinction between primary and indirect securities can become blurred in certain cases, such as with holding companies or secondary intermediaries, the analytical framework remains robust. Bank deposits are categorized as indirect debt, while bank stock issues may be considered primary securities depending on the perspective. Interestingly, issues backed by gold, classified as money, are treated as indirect debt, despite gold being regarded as a commodity. The classification system helps in analyzing the interplay between real and financial growth, focusing on the specific function of financial intermediation and the varying contributions of monetary and non-monetary financial intermediaries to the growth process. Financial growth refers to either only the growth of primary securities or the combined expansion of primary and indirect securities, with the absolute growth rate of financial assets equivalent to the growth of primary securities when all new issues are held by non-financial units. In the context of the second model, financial assets were initially limited to money balances and primary securities, specifically homogeneous bonds issued by business firms. These bonds were purchased by the governmental monetary system or by consumers, resulting in the accumulation of money balances by both business firms and consumers.

In a stationary equilibrium, the private sectors' demand for real financial assets is stable, with consumers demanding both real money and bonds, while firms demanding only the former, all in accordance with a neo-classical environment. The process of real growth generates primary debt, as emphasized in the second model, and an increasing demand for real financial assets, necessitating a deeper examination of how primary securities are issued and accumulated. Notably, if all primary issues are acquired by financial intermediaries, financial growth doubles due to equal growth in

both primary and indirect securities, emphasizing the pivotal role of intermediaries in financial expansion, which will be elaborated further. In the context of an economy with stable prices, where only the consumers sector acquire financial assets, the issuance of primary securities by firms is exactly balanced by the financial assets (money and bonds) acquisitions of consumers in each fiscal period. This equilibrium state implies that the issuance of primary securities by firms is inherently linked to their budget deficits, while consumers' acquisition of financial assets corresponds to their budget surpluses, operating under the assumption that firms do not hold money balances, preserving the equilibrium of financial flows across periods. During the balanced growth process, the ratio of primary securities issues to income level is contingent upon how spending is allocated between the two private sectors in relation to how income is distributed among them.

When the distribution of spending does not reflect the income distribution, there is a specialization between sectors in spending and receiving income, whereby one sector undertakes all spending while the other receives all income. In such scenarios, the budget deficit of one sector and the budget surplus of the other both equate to national income, thereby making financial growth during the period equivalent to that of national income. Conversely, these distributions being entirely similar implies the absence of specialization, thereby leading to balanced budgets across both sectors and no financial growth. All in all, this degree of specialization hinges on various factors, including firms' net investment expenditures, consumption expenditures, and demand for bonds. This interdependence illustrates that all determinants of financial asset growth function through the distribution of spending relative to the income distribution between sectors, regardless of whether the channels are direct or indirect. Furthermore, the primary security issues with the income ratio depend on the growth rate of the output, the rental rate, the interest rate, and the capital-output ratio. These variables are also the determinants of the ratio of stock of primary securities to income. When the monetary system purchases primary securities to meet the nominal demand for money arising from the real growth process, it stabilizes the interest rate and facilitates the simultaneous growth of both primary and indirect securities, leading to an overall

expansion of financial assets that surpasses the growth of primary securities alone.

During balanced growth, while accumulating primary securities, consumers complement their financial asset portfolios with a constant proportion of money balances. The monetary system, therefore, creates money by purchasing primary security issues, contributing to the growth of indirect securities, so that the overall growth of financial assets will be equal to the sum of primary security issues and a proportionate amount reflecting the creation of indirect securities. Consequently, during balanced growth, the stock of all financial assets, comprising primary securities and money balances, grows at the same percentage rate as the real output. Simultaneously, the income velocity of money remains constant, as it is determined by the proportion of financial assets held in money balances, which depends on the stock of primary securities relative to national income. This implies that the income velocity of money is influenced by changes in the growth rate of output. A higher output growth rate increases the stock of primary securities relative to income, leading to a greater demand for money and a reduction in income velocity. Initially, when the stock of primary securities falls below its long-term balanced relationship with income level, the debt-to-income ratio increases, leading to a gradual increase in the ratio of money-to-income. Correspondingly, this implies a decline in income velocity, occurring asymptotically and eventually stabilizing at a lower level once balanced growth is sustained. As a result, the total amount of financial assets in the economy increases relative to income during this process, and upon reaching balanced growth, the income velocity stabilizes, while total financial assets grow nearly in proportion to real output.

The differentiation of financial assets diminishes the likelihood of pure asset-debt positions, which involves holding either financial assets or debt, and promotes the expansion of primary securities. If financial assets were homogeneous, spending units would be indifferent between acquiring assets or retiring debt, but the heterogeneous nature of these assets drives spending units to maintain mixed positions. In both the business and consumer sectors, mixed asset-debt positions contribute to financial growth, for instance, business firms might increase the issue-income ratio to both cover deficits and increase money balances during output growth, expanding the stock of

primary securities and raising financial assets relative to national income, resulting in a higher money-to-income ratio and a decrease in income velocity, while consumers, despite running surpluses, might issue debt to acquire additional financial assets, such as business bonds or money. Hence, the introduction of a mixed asset-debt position enables Gurley and Shaw (1960) to integrate chronic deficits and surpluses into the understanding of the dynamics of the economic growth process through the relationship between the output growth rate and the real rental rate. When output growth exceeds the rental rate, businesses face chronic deficits, while consumers maintain surpluses. Conversely, when output growth is lower, businesses accumulate surpluses, shifting deficits to consumers. In a balanced growth context, the growth rate is steady, either above or below the real rental rate, meaning that deficit rotation primarily takes place within business cycles or short period fluctuations in output growth rate, rather than in balanced growth scenarios.

Deficit rotation, therefore, refers to the shifting of deficits from one sector to another during periods of economic fluctuations, and in an "unbalanced world", the different deficit-surplus patterns observed in balanced growth provide insight into what happens during these cycles. For instance, during economic downturns, businesses could shift from deficits to surpluses by reducing investment, which leads consumers to incur deficits if they maintain their consumption patterns or reduce their consumption levels. This relationship reverses during economic downturns, where increased consumer savings and corresponding increase in business investment flip the deficit-surplus balance. Furthermore, deficit rotation may be triggered by the fluctuations expenditures in other sectors, such as that of government expenditure, especially during periods like wartime as exemplified in the book or real crises in general leading to effective demand failures in Keynesian sense, where an increase in public spending often generates deficits in the government sector while causing surpluses in the private sectors, which are often aided direct controls. When government spending is reduced just after crises, the previous relationships between sectors are typically restored, leading to a re-rotation of deficits.

Gurley and Shaw (1960) emphasize how understanding different deficit-surplus

patterns observed across sectors during such fluctuations are crucial to account for broader impact of economic cycles on financial stability, thereby casting a role for the monetary policy in real development process. Deficit rotation impacts financial markets by slowing the growth of primary securities and financial assets, such that a sector incurring debt to finance the deficit repays when it has a surplus, and respectively a sector accumulating financial assets when it has surplus tend to dishoard them when it has deficit. Over several fiscal periods, deficit rotation tends to reduce the algebraic sum of net deficits and surpluses across sectors, which in turn slows the issuance of primary securities and the accumulation of financial assets. Therefore, this rotation reduces the degree of specialization in spending and receiving income among sectors because when, for instance, business firms constantly shift between investing and reducing debt, they cannot consistently specialize in long-term investment strategies. In an open economy setting, the balance of payments with the foreign sector plays a significant role in determining the scale of primary security issues within the domestic economy. When including the foreign sector deficit, representing net exports, increases domestic financial assets by augmenting primary security issues. Conversely, a foreign sector surplus, which represents net imports, decreases domestic financial assets as the foreign sector acquires domestic securities. sector plays a crucial role in determining the scale of primary security issues within the domestic economy. When the foreign sector incurs a deficit, the accumulation of financial assets in the domestic economy outpaces primary security issuance since they also accumulate the financial assets issued by foreign sector to incur their deficit, and vice versa.

Primary securities are differentiated due to varying degrees of borrower assurances and the unique risks associated with each borrowing, and the markets for these securities are imperfectly competitive and compartmentalized and displaying inflexible interest rates so that excess demand is resolved by rationing techniques. These features contribute to imbalances in the bargaining power across sectors and entail various market structures such as monopoly, monopsony, oligopoly, or oligopsony. That is why individual spending units engage in the diversification of primary issues, issuing both debt and equities with varying maturities and ownership rights. As in the motive for

holding money balances, this diversification strategy serves as a defense mechanism against the hazards associated with specialization in saving and investment. The risks faced by spending units can be categorized into general and specific risks, where the former stem from unforeseen changes in aggregative aspects of growth, including shifts in output and employment growth rates, wealth and income distribution, and price levels in goods or primary securities markets. These changes can lead to unexpected debt-wealth or asset-income positions, forcing investors and savers to reassess their financial plans to avoid bankruptcy for debtors or destruction of saved net worth for creditors. The latter risks arise from the uneven distribution of real growth, for example, when both debtors and creditors are trapped in a stagnant sectors or those who exceed the general pace of growth may face harsh penalties through depreciation in the real value of financial assets or appreciation in the real value of debt. Therefore, to mitigate these general and specific risks, both borrowers and lenders employ diversification strategies for primary issues and financial assets, respectively.

Gurley and Shaw (1960) also argue that debtors aim to minimize an artificial and subjective "disutility function" of debt burden by diversifying their issues, that involves mixing various forms of debt and, in some cases, acquiring financial assets to lighten the disutility of a given net debt position. Creditors, on the other hand, seek to maximize a "utility function" of their portfolio by selecting an optimal mix of assets that provides the maximum prospective net yield, considering factors such as accessibility, relative prices, and risk tolerance. Moreover, the accumulation of debts and financial assets, while integral to the functioning of economic units specializing in spending, saving, and investment, increases vulnerability to instability in the distribution of output, income, and bond prices, where they will have to preserve some assets while minimizing the debt burden. To mitigate debt burden, spread debt across various instruments by differentiating the primary securities equalize marginal increments in debt burden. On the other hand, savers diversify financial assets to protect against real value depreciation, ensuring that marginal yields, adjusted for risk, are same for all sectors. In imperfectly competitive markets, borrower-lender negotiations tend toward a balance where lending terms reflect both the former's marginal debt burdens and and

latter's anticipated marginal yields.

Gurley and Shaw (1960) suggest that money is less risky than other assets, and offers savers a safeguard while alleviating debtors' risks and reducing marginal debt burden. In their words, "By supplying nominal money, the monetary system may reduce the burden of accumulated debt and assets upon new financing of economic growth. The easing of the past's dead hand upon the present by nominal monetary expansion works itself out, in a world where money is not neutral, through the interest rate and through rates of real saving and investment." (see Gurley and Shaw, 1960, pp.127). Monetary expansion can be implemented through either price deflation or monetary system action, but the latter, satisfying the diversification demand for money at a given interest rate, is often favored when money is non-neutral as it alters the long-term real composition of financial assets while also influencing the short-term conditions. The stock of money, as defined within the context of the second model, includes debts of the monetary system accepted as payment across various markets, so they regard it as sum of currency and demand deposits after accounting for checks that are drawn but not charged against deposit accounts yet, thereby allowing for combination of inside and outside money. This is why Gurley and Shaw (1960) made a clear distinction between the measurement approaches of the net money doctrine and the gross money doctrine.

Briefly mention, gross-money refers to a broad measurement that includes all forms of money in the economy, encompassing both inside money and outside money, where the former is the money created within the private domestic economy, typically through financial institutions like banks, where deposits are created by extending loans, and the latter, on the other hand, is money backed by assets external to the private sector, such as government securities, gold, or foreign assets. Gross-money, therefore, considers the total money supply, including all financial assets that serve as money or money substitutes within the economy, while the net-money, in contrast, is a more restrictive measure that focuses exclusively on outside money in assessing the overall money supply while consolidating and eliminating inside money and private domestic primary securities from the money stock. For this reason, the net-money doctrine minimizes the importance of financial institutions by consolidating all pri-

vate domestic financial claims (such as savings deposits, loans, and securities) against their corresponding liabilities in such a way that it effectively disregards the roles of these institutions in the economy as it views their financial activities as merely internal transfers within the private domestic sector that cancel each other out. As a result, the complex intermediation functions of financial institutions, which are crucial for credit creation, risk management, and liquidity provision, are removed from the analysis.

To elaborate on the implication of the gross-money approach in the demand for money in diversified portfolios, Gurley and Shaw (1960) once again uses the implicit deposit rate of money, defined as the marginal return expected from holding money compared to other assets. Despite low or zero explicit returns on money, its unique characteristic of having a fixed price in terms of the accounting unit, which provides protection against real capital losses that may occur with other assets when interest rates rise or goods prices decline, is the primary feature contributing to the implicit deposit rate. Additional contributors to the implicit deposit rate include savings on brokerage fees and turnover expenses, reduced borrowing costs due to strong cash positions, and the ability to capitalize on cash discounts or bargain opportunities. In addition, spending units continually seek to equalize marginal expected rates of return across different assets, leading to a chronic excess supply of primary securities during growth processes because the marginal return on portfolios consisting solely of primary securities is lower than that on portfolios including both primary securities and money. Consequently, the implicit deposit rate also plays a significant role in portfolio management decisions and helps explain the persistent demand for money in financial asset allocation, even in the presence of positive yields on alternative assets.

Differentiation in primary securities results in a varying influence on the demand for money with respect to the nature of the financial assets introduced, and has broader implications for labor services, current output, and primary securities in the presence of non-neutrality. When the homogenous bonds are the only alternative, the relationship between interest rates on these bonds and real money balances determines portfolio preferences, where high interest rates reduce money demand because of the higher opportunity cost of holding money stemming from the capital gains for bonds due to

the potential fall in the interest rate in the future, while lower rates increase it due to the potential for future capital losses on bonds. Besides, recall that the real growth process leads to an increase in demand for money not only because of the transaction motive, but also the continuous increase in the primary debt that business sector incurs by issuing these bonds. Therefore, this excess supply of bonds stemming from growth process, as well as dishoarding of bonds in the portfolios of the spending units as a response to increase in their desired stock of money increase will lead to a rise in the interest rate. When money is neutral in the long-run, price deflation or nominal money growth serves as a mechanism to eliminate this excess supply of bonds and excess demand for money. The continuous growth of nominal money to meet the demand for real balances during the growth process involves the prospect of inflation, thereby giving a room for speculation through the price of output and labor services because of the unique feature of money as an asset with fixed price in terms of its own accounting unit, and the fixed nominal yield of bonds, which means that the interest they pay does not fluctuate even if the price of the bond does.

When the economy anticipates price inflation, the real value of money and bonds decreases because the purchasing power of the fixed nominal amounts erodes. In such a scenario, spending units expect the prices of goods and services to rise, leading to excess demand for current output, in which the market responds with a higher interest rate to suppress the excess demand by making borrowing more expensive, thereby restraining consumption and investment that would increase prices. The interest rate increase effectively shifts demand away from both bonds, which now yield less in real terms, and money, which is losing its purchasing power, towards current output. However, raising the interest rate above a certain threshold introduces a challenge for maintaining equilibrium in the money market as business firms now face higher borrowing cost, discouraging them from taking out loans to finance new projects, and consumers will regard bonds less attractive due to the potential for capital losses in case of further rise in interest rates, leading them to hold onto money instead. Therefore, the implicit deposit rate associated with each amount of real money balances is influenced by expected price behavior of the markets for bonds and output. The market finds a

new equilibrium where the demand for money balances the available stock, despite the higher interest rate, which will be surpassed by nominal money growth and dishoarding of bonds, that will also lead to inflation expectations, and so on. As in Wicksell (1898), the monetary system will expand through a circular flow as the real demand for money balances is intensified by the accumulation of financial assets.

Next, Gurley and Shaw (1960) introduced other primary securities that vary by maturity, purchasing power clause, productivity clause, gilt edgeness, and marketability to account for the effect of security differentiation on demand for money as well as the growth of the monetary system. Specifically, when the maturity of primary securities shifts from long-term bonds to short-term bills, there is a notable reduction in the real demand for money due to the increased certainty of returns and decreased management costs associated with holding bills. Subsequently, introducing a purchasing-power clause in bonds, by stabilizing the real value of bonds against price-level changes, leads to a portfolio shift where money and nominal bonds become less attractive compared to real bonds, especially in inflationary environments, reducing the demand for money. When the alternative to money is real bonds with a productivity clause where returns are tied to business income, demand for money decreases in the expected rise in the business profits, and may increase in periods of uncertainty or declining business profits, depending on the broader economic outlook. Moreover, the demand for money decreases when primary securities are gilt-edged as these securities provide a similar level of safety without the need to hold money. Finally, marketability, or the ease with which securities can be traded, further negatively impacts the demand for money so that its relative importance diminishes as financial development enhances the marketability of primary securities, reducing transaction costs, and increasing liquidity.

In summary, the demand for money among spending units, as one of many financial assets, is significantly influenced by the frictions and uncertainties related to alternative assets. When long-term bonds serve as an alternative, money functions as a defense against potential increases in bond rates. In the case of real bonds offering fixed real return, money becomes a strategic tool for capitalizing on anticipated declines in the price level. When the real bonds are in the form of a productivity clause, tying payments

to a constant proportion of business income, money provides a defense against potential shrinkage in business profits. If non-gilt-edge bonds with their inherent risk of default are the alternative, money acts as a protective measure against the possibility of non-payment. Lastly, when bonds with low marketability are considered, money serves as a defense against the illiquidity risks posed by high transaction costs and narrow markets. Therefore, asset differentiation in financial markets engenders substantial implications for money demand and monetary equilibrium. This differentiation precipitates two primary effects: an augmentation in the stock of primary debt together with of financial assets for each level of real income and wealth due to the allowance for mixed asset-debt positions as well as an increase in propensity of spending units to incur budget surpluses or deficits, and a decline in real money balances demanded in proportion to total financial assets. In addition, the availability of diverse alternatives to money, such as bonds, bills, and equities, exerts influence on both the wealth (or scale) and substitution effects on the desired level of real money balances, where the former manifests itself as an increase in the overall demand for financial assets, including money, as the total portfolio value expands, while the latter operates to reduce the relative share of money in the portfolio as other assets offer competitive returns or defense against the risks.

Also, as financial assets become more diversified, money begins to play a more significant role in influencing real economic variables, entailing non-neutrality on real variables with the introduction of combination of inside and outside money. This non-neutrality enables monetary authority to influence the composition as well as scale of financial assets portfolios of the spending units, thereby creating channels through which monetary policy can influence real economic outcomes. Gurley and Shaw (1960) argue that one can think of various combinations of financial assets providing the monetary authority with mechanisms to manipulate the real money stock and desired levels. For instance, in a system encompassing inside money, bills, and bonds, assume that the monetary authority doubles nominal money stock by purchasing primary securities through open-market operations, thereby increasing proportion of bonds to bills in its own portfolio, leaving spending units end up with fewer bonds and

more bills. Inflationary pressures, which cause the price level to double together with the nominal value of all primary securities, including bonds and bills, increase the nominal amount of money, but leave the real value of their money balances unchanged. That is why the aggregate real value (adjusted for inflation) of the spending unit portfolios is now lower despite the higher nominal money and doubled values of the remaining bonds in their portfolio, as they hold fewer bonds than the initial equilibrium.

This change reduces the demand for real money balances among spending units since their portfolios have shifted towards shorter-term assets (bills), which typically require less cash holding for liquidity. Now, there is an excess supply of real money in the economy, putting downward pressure on the interest rate. That is why the volume and structure of inside debt together with financial assets prove relevant to both the demand function for real money balances and the monetary authority's ability to influence real economic variables. Next, Gurley and Shaw (1960) introduce the non-monetary or, as they call, non-bank financial intermediaries (NBFI), complementing the intermediation function of monetary system's, to elaborate the non-neutrality of money in differentiated financial systems. The primary function of these financial intermediaries is to enable the flow of funds from the surplus sectors, such as households, to deficit sectors, including businesses and governments. These intermediaries can be broadly categorized into two main groups: the monetary system and non-monetary intermediaries or non-bank financial intermediaries (NBFI), where the former creates money and administers the payments mechanism, while the latter create non-monetary claims such as savings deposits, shares, equities, and other obligations.

Private NBFIs, including mutual savings banks, savings and loan associations, private life insurance companies, and credit unions, while governmental intermediaries encompass federal land banks, the Postal Savings System, and government insurance and pension funds, and can be further classified based on various criteria, including ownership (private or governmental), profit orientation, and the types of primary securities they purchase or indirect debt they issue. Moreover, NBFIs play a crucial role in the saving-investment process by purchasing primary securities from the ultimate borrowers and issuing indirect financial assets for the portfolios of ultimate lenders,

thereby introducing the fifth market to the economy. Gurley and Shaw (1956, 1960) elaborate the NBFIs through their contribution to financial and real development process and resulting implications for non-neutrality of money and monetary policy to the full extent, so a brief explanation would suffice to uncover the implication of their growth on the demand for money as they influence the velocity of the money stock (Gurley and Shaw, 1956).

The Radcliffe Committee defines the money supply as consisting of notes outside banks (excluding coins) plus net deposits from London clearing banks and Scottish and Northern Irish banks, including both current accounts (non-interest bearing and on-demand) and deposit accounts (similar to time deposits), with the latter included due to their easy exchangeability for money. The underlying reason behind this choice stems from their conviction that "expenditures are not limited to cash or money in the bank but to the amount of money people think they can get hold of either by selling an asset or by borrowing or by receipts of income from sales" (Ghosh, 1964). This is widely interpreted to include credit, but Gurley (1960) was later extended by including other liquid assets because they regard a considerable volume of liquid assets as NBFIs provide close substitutes for money, facilitating liquidity for spending units, as a store of value. In a broad sense, Gurley and Shaw (1960) redefines the money through the distinction and the interaction between inside and outside money in the economy, where the former refers to money created within the private sector, primarily through the banking system's process of issuing loans. In addition, bank deposits are considered inside money because they are liabilities for banks backed by the assets and liabilities of the private sector, thereby originating from within the economy. Outside money, on the other hand, is money that comes from outside the private sector, typically issued by the government or central bank, such as currency, coins, and bank reserves.

As mentioned earlier, internal finance occurs when a company funds its operations or investments using its own retained earnings or equity, without relying on external borrowing, while external finance involves raising funds from outside the firm, usually through debt issuance or selling equity. When external finance is raised through indirect securities, such as bonds or loans intermediated by financial institutions like NBFCs, it

leads to the creation of inside money. Therefore, NBFCs play a significant role in this process by issuing indirect securities and providing liquidity to facilitate the flow of external finance, and the process of turning "internal finance" into "external finance" is an indicator of the efficiency of NFBI. All in all, financial intermediaries create indirect financial assets, which is created from underlying primary securities and offers its own bundle of utilities, such as serving as a means of payment, risk protection, and portfolio diversification, and are characterized by predictable redemption values, low investment costs, and divisibility, implying a high degree and pace of substitubility with money.

Besides, NBFIs benefit from economies of scale in lending and borrowing; they manage investments at lower costs and reduce risk through diversification, while also leveraging predictable repayment schedules to maintain illiquid portfolios, which enable them to specialize in specific assets and liabilities. This allows intermediaries to offer favorable terms that are more attractive than the other financial assets. That is why the growth of NBFIs is primarily triggered by the dominance of external finance in the expenditures of the private sectors, and may lead to non-neutral effects in monetary policy through their distributive techniques, where they efficiently distribute primary securities from borrowers to lenders and between lenders, and intermediating techniques, transforming primary securities into indirect securities for ultimate lenders' portfolios, by changing the porfoloio composition of the spending units. Gurley and Shaw (1960) investigates how the growth of NBFIs results in varying effects on demand for money balances with respect to the pure and mixed asset-debt combinations in their portfolios, particularly through the variety of indirect financial assets issued by financial intermediaries, and whether they are backed by inside or outside monetary or non-monetary liabilities. On the other hand, Gurley and Shaw (1957) account for the demand for money to a greater extent by providing an equation for the money demand function, but is excluded in the book.

The role of NBFIs in interest rate dynamics is significant, in particular, when non-monetary indirect assets and money are close substitutes, with their growth likely causing short-term decreases in interest rates at given commodity price levels, leading to an increase in real demand for current output by spending units. Consequently,

commodity prices tend to rise, which in turn pulls the interest rate back to its initial level, illustrating how the growth of NBFIs can impact interest rates as well as the price level in the short-run by generating an excess stock of money together with an excess of ex-ante investment over ex-ante saving. On the other hand, an increase in the demand for nonmonetary indirect assets by spending units could create an excess demand for money as well at the current interest rate on primary securities in the case of low substitutability with money. Therefore, NBFIs can simultaneously disturb the equilibrium in the money market and the primary securities market because an excess stock of money manifests itself initially as an excess demand for primary securities, while an excess demand for money appears as an excess stock of primary securities.

Furthermore, NBFIs have the capacity to change the supply of loanable funds, defined as the increase in the stock of money plus the sum of spending units' planned savings minus the increase in the economy's demand for money through hoarding, particularly through increasing it by demanding primary securities to issue indirect debt. Therefore, unless this incremental demand by NBFIs is not balanced by a decline in the demand by the spending units as well as the monetary system, the total supply of loanable funds increases. Then the net increase in the demand for primary securities, resulting from the activities of NBFIs, depends on several factors. When spending units increase their demand for non-monetary indirect assets, the likelihood of a net increase in demand for primary securities is greater if there is a more significant accompanying decline in the demand for money rather than that for primary securities by spending units. This relationship underscores the interconnectedness between the growth of NBFIs, changes in money demand, and the demand for primary securities. "The creation of indirect financial assets by NBFIs can lead to an excess stock of money and an excess demand for primary securities at current levels of interest rate, commodity prices, and real income" (see Gurley and Shaw, 1960, pp.221). This creation operation is one of the primary mechanisms through which NBFIs influence financial markets and the broader economy. By issuing indirect financial assets, these intermediaries alter the composition of assets held by spending units, which in turn affects their money demand and the overall equilibrium in financial markets.

As explained earlier to a greatest extent possible, Gurley and Shaw (1957) presents the following specifications regarding the structure of the economy. The monetary system, including Treasury monetary accounts, Federal Reserve banks, and commercial banks, operates as one of many financial intermediaries, purchases primary securities, such as debt issued by non-financial businesses, households, governments, and foreign sectors, and pays for them by creating its own debt in the form of money—currency, demand deposits, and time deposits. Primary securities are issued by deficit sectors, where spending on consumption or investment exceeds income, and represent a net increase in debt for deficit sectors, which matches the net increase in financial assets for surplus sectors, whose income surpasses their spending. Therefore, surplus sectors would potentially absorb all primary securities if the lending terms were favorable enough, but they are not limited to holding only primary securities. Instead, they can hold indirect financial assets by purchasing the debt of financial intermediaries, which can take the form of money or non-monetary assets like savings and loan shares, mutual savings deposits, and insurance reserves. Initially, they specify the short-run implications of their framework on the demand for money using the following equation:

$$(1 - e)(aY - t\Delta Y) + t\Delta Y - wbY \quad (2.4)$$

namely, the total incremental demand for money balances, consisting of several key components. Initially, Transactions demand: $t\Delta Y$, where t is the proportion of money held for transactions and ΔY is the change in gross national product. After satisfied by the transaction demand, spending units desire to add financial assets in their portfolios, represented by $(aY - t\Delta Y)$, where a is the fraction of primary security issues to gross national product, Y . Therefore, $(1 - e)(aY - t\Delta Y)$ stands for the (2) incremental diversification demand for money balances at given terms of lending, where e is the proportion of primary securities absorbed by surplus spending units, and they prefer an increasing proportion $(1 - e)$ of portfolio assets in the form of indirect financial assets. Finally, we have the (3) Substitution effect of non-monetary assets on money demand: $-wbY$, where w is the portion of non-monetary indirect financial assets that replace money demand and bY is the periodic increase in demand for these assets. Although

this formulation accounts for the competition between money and other financial assets in satisfying portfolio demand, the model also considers structural changes over long periods, such as changes in the ratio of money payments to total transactions and variations in income payment frequency, depicting financial development.

Another key feature of this model is its treatment of NBFIs, where their growth affects money demand through the substitution effect, represented by the term $-wbY$. As NBFIs grow, b increases, meaning that a larger portion of income is directed toward non-monetary indirect financial assets. The magnitude of the substitution effect depends on the degree to which these assets are substitutes for other financial assets, where the substitution effect is strong if w is close to 1, and growth of the NBFIs significantly reduces the demand for money, while the effect is weak if w is close to 0. In order to account for the long-term trend in the demand for money, they develop the following function that stands for total demand for money in any year.

$$M_n = (1 - e)P_n + etY_0[(1 + r)^n - 1] \quad (2.5)$$

by assuming that money is the only indirect financial asset through accumulation of the incremental demand for money functions in any year, $(1 - e)(aY - t\Delta Y) + t\Delta Y$. $Y_n = Y_0(1 + r)^n$ is gross national product in year n , Y_0 is the initial GNP, and r is the constant growth rate. The monetary system must purchase $etY_0[(1 + r)^n - 1]$ amounts of primary securities to satisfy the demand for money in transactions, as e is the proportion of primary securities absorbed by surplus spending units, while $(1 - e)$ represents the portion that will be absorbed in the form of indirect financial assets. Given that $(aY - t\Delta Y)$ stands for the financial assets that spending units desire to absorb after satisfying the demand for transactions, $(1 - e)P_n$ represents the diversification demand for money based on the growth of primary securities, where the accumulation of primary securities (P_n) is modeled as follows:

$$P_n = a'Y_0 \left[\frac{[(1 + r)^{n+1} - 1]}{r} - (1 + n) \right] \quad (2.6)$$

where a' is the marginal ratio of primary security issues to GNP. Then, they

introduce non-monetary indirect financial assets into the equation to account for the substitution effect, wbY_n , on the accumulated demand for money in any year in the growth of NBFIs.

$$M_n = (1 - e)P_n + etY_0[(1 + r)^n - 1] - wbY_0[(1 + r)^{n+1} - 1] \quad (2.7)$$

where w is the substitutability of non-monetary assets for money and b is the demand for indirect non-monetary financial assets. Dividing M_n by Y_n , we obtain the money-to-income ratio:

$$\frac{M_n}{Y_n} = (1 - e)R_n + et \left[1 - \frac{1}{(1 + r)^n} \right] - wb \left[\frac{(1 + r)}{r} - \frac{1}{r(1 + r)^n} \right] \quad (2.8)$$

where (R_n) stands for the ratio of primary securities to GNP, or Debt-to-Income ratio, is obtained by dividing P_n by Y_n :

$$R_n = \frac{a'(1 + r)}{r} \left[1 - \frac{1 + \frac{rn}{1+r}}{(1 + r)^n} \right] \quad (2.9)$$

Gurley and Shaw (1960) identify seven key determinants of money demand trends: growth rate of GNP (r), terms of lending, marginal propensity to issue primary securities (a'), diversification preference for money ($1 - e$), demand for non-monetary indirect financial assets (b), substitutability of non-monetary assets for money (w), and transactions demand for money (t). The model suggests that primary debt accumulation occurs in three phases: initial explosive growth, slower growth, and eventual stabilization at a plateau value of $\frac{a'(1+r)}{r}$ as n increases. Monetary growth is influenced by both transactions and diversification demands, and substitution effect. The growth of non-bank financial intermediaries, represented by an increase in b , significantly affects the composition of financial assets and money demand. As b increases, it leads to a greater variety and volume of non-monetary financial assets in the economy through the two competing effects on money demand: (1) substitution of non-monetary assets for money, potentially reducing money demand, (2) through the portfolio balance effect, where the increased growth and differentiation of financial assets can stimulate the demand for money. As the financial sector becomes more complex, economic agents

may demand more money for transaction and precautionary, or speculative purposes to manage their diverse portfolios. As mentioned earlier, the increase in R_n as a result of financial development process through the growth of NBFIs, it puts upward pressure on the money-to-income ratio, particularly if e is relatively small.

Despite conventional wisdom, they incorporate the interest rate into the determination of demand for money indirectly through impact of financial intermediaries on the liquidity facilitation, particularly that of NBFIs because the yields on primary securities are influenced not only by the money supply but also by the holdings of non-monetary intermediaries. This perspective introduces a more complex relationship between financial intermediation and interest rates. For instance, if non-monetary assets like savings and loan shares become more attractive relative to bank deposits, it can lead to an excess supply of money. Assuming a constant money supply, this situation would cause yields on primary securities to fall. Consequently, the same level of money supply and national income can correspond to different interest rate levels, depending on the size and competitiveness of non-monetary intermediaries. Gurley and Shaw (1956) also explain this phenomenon from the perspective of supply and demand for primary securities, where a shift in demand toward non-monetary assets can increase the demand for primary securities by non-monetary intermediaries, creating downward pressure on primary yields. This pressure persists as long as the indirect debt of non-monetary intermediaries remains competitive with money and their demand for primary securities roughly matches their creation of indirect debt.

Therefore, the terms of lending significantly impact the e , decreasing with favorable terms (lower interest rates, easier credit conditions), and increasing in tighter terms increasing it. When e decreases due to favorable lending terms, such as zero-lower bound or regulation Q Lucas and Nicolini (2015), $(1 - e)$ in the money demand equation increases, amplifying the effect of primary securities (P_n) on money demand. On the other hand, in the money-to-income ratio equation, a lower e increases the coefficient on R_n , strengthening the relationship between the debt-to-income ratio and the money-to-income ratio. Consequently, the growth of NBFIs may lead to a substitution effect that potentially reduces money demand, it also contributes to the accumulation

of financial assets relative to income. This accumulation, combined with the increased complexity of financial management, can further stimulate the demand for money for transaction and precautionary purposes, as well as for that of speculative. Therefore, the debt-to-income ratio, influenced by this financial development, puts upward pressure on the money-to-income ratio. This effect is particularly pronounced when the terms of lending are favorable (with low e), as it strengthens the relationship between debt accumulation and money demand. Thus, the growth of NBFIs plays a crucial role in the financial ecosystem that links debt accumulation to an increase in the demand for money relative to income.

At the end, this long framework provides a microfounded structural model, with deep parameters obtained from the, so called, maximization decisions with respect to evolving economic environments, which was quite progressive considering the period that authors develop this theory. No wonder that further improvements are essential for the validity of this framework, yet the rigorous reasoning of Gurley and Shaw (1960) in reducing the model with four sectors, two financial institutions, five markets, various financial assets in two different forms (inside and outside), three different finance methods, and various other parameters into two variables entails a considerable causal relationship that can be used to account for an ongoing phenomenon even more than 60 years from its release.

The growth of NBFIs leads to a growth in financial assets, thereby increasing the primary security stock as the financial assets provided by the NBFIs should be backed by them. Considering the total demand for money function, we drive all the diversification, transaction, and substitution components from the primary security issues. The substitution effect depends on the growth of indirect financial assets which are backed by purchased primary securities. The diversification component depends on the term $(1 - e)(P_n)$, the stock of primary securities not absorbed by surplus spending, which in turn depends on the primary securities. The transaction demand component is also affected by the growth primary securities as the monetary system creates the transaction balances by purchasing primary securities, which in turn depend on the income level. So in the end, we can determine the demand for money through

the debt-to-income ratio (R_n), as it corresponds to the accumulated stock of primary securities, and as mentioned earlier, whether the diversification demand dominates the substitution effect will determine the magnitude of the demand for money after accounting for the transaction demand, which in turn depends on the growth of primary securities, equivalently the debt-to-income ratio. Therefore, we can estimate the secular trend in the money demand through the money-to-income and debt-to-gdp ratios.



CHAPTER 3

DATA, DESCRIPTIVE STATISTICS, AND EMPIRICAL METHODS

3.1 Data and Descriptive Statistics

We combine nominal aggregates measured by domestic currency from the following sources: "Main Economic Indicators" from the OECD for Broad Money Growth, M3; "International Financial Statistics" from the IMF for GDP; and "Credit to the non-financial sector" from Bank of International settlements for the Debt, and build a dataset using quarterly data for a panel of 24 cross sections, consisting of 23 countries plus a single cross-sectional unit comprising all countries within the Eurozone, capturing the periods between 1999Q1-2023-Q2. Among other things, the main criterion for the country selection is the availability of the data, yet we have a reasonably sufficient sample as depicted in Table 3.1, capturing most of the OECD and BRICS countries.

In particular, all of the OECD countries, except for Costa Rica and Iceland, are included together with the (initial) BRICS countries, apart from India. These three countries are deliberately excluded due to missing data on the debt, along with many other developing countries. In addition, two non-OECD Eurozone countries Cyprus and Malta are also included within the Euro Area group as well as other OECD countries including Austria, Belgium, Croatia, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Portugal, Slovakia, Slovenia, and Spain. Because the subject of this study is related to Financial Development, which is a more prevalent phenomenon among the countries within the Eurozone, our data start from the first quarter of 1999, coinciding with the foundation of the Eurozone. On the other hand, despite the missing observations for China, Colombia, Russia and Türkiye due to the unavailability of the debt data for those countries, they are not excluded as they are developing countries with recently emerging private financial sector, making them unavoidable in an analysis within Gurley and Shaw framework.

Table 3.1: Descriptive Statistics and Financial Development Index

Country	Number of Observations	Period	FDI (Rankings)
Australia	98	1999Q1-2023Q2	0.896 (10)
Brazil	98	1999Q1-2023Q2	0.663 (34)
Canada	98	1999Q1-2023Q2	0.920 (7)
Chile	98	1999Q1-2023Q2	0.680 (32)
China	80	1999Q1-2018Q4	0.753 (24)
Colombia	71	2005Q4-2023Q2	0.516 (55)
Czech Rep.	98	1999Q1-2023Q2	0.652 (37)
Denmark	98	1999Q1-2023Q2	0.839 (14)
Euro Area*	98	1999Q1-2023Q2	0.708 (-)
Hungary	98	1999Q1-2023Q2	0.577 (43)
Israel	98	1999Q1-2023Q2	0.783 (22)
Japan	98	1999Q1-2023Q2	0.938 (4)
Korea	98	1999Q1-2023Q2	0.870 (18)
Mexico	98	1999Q1-2023Q2	0.516 (56)
New Zealand	98	1999Q1-2023Q2	0.744 (25)
Norway	98	1999Q1-2023Q2	0.856 (17)
Poland	98	1999Q1-2023Q2	0.594 (41)
Russian Federation	96	1999Q1-2022Q4	0.710 (30)
South Africa	98	1999Q1-2023Q2	0.744 (27)
Sweden	98	1999Q1-2023Q2	0.880 (13)
Switzerland	98	1999Q1-2023Q2	0.982 (1)
Türkiye	90	2001Q1-2023Q2	0.551 (50)
United Kingdom	98	1999Q1-2023Q2	0.934 (5)
United States	98	1999Q1-2023Q2	0.943 (2)

* Euro Area values are simple averages of 20 Eurozone countries. No specific ranking.

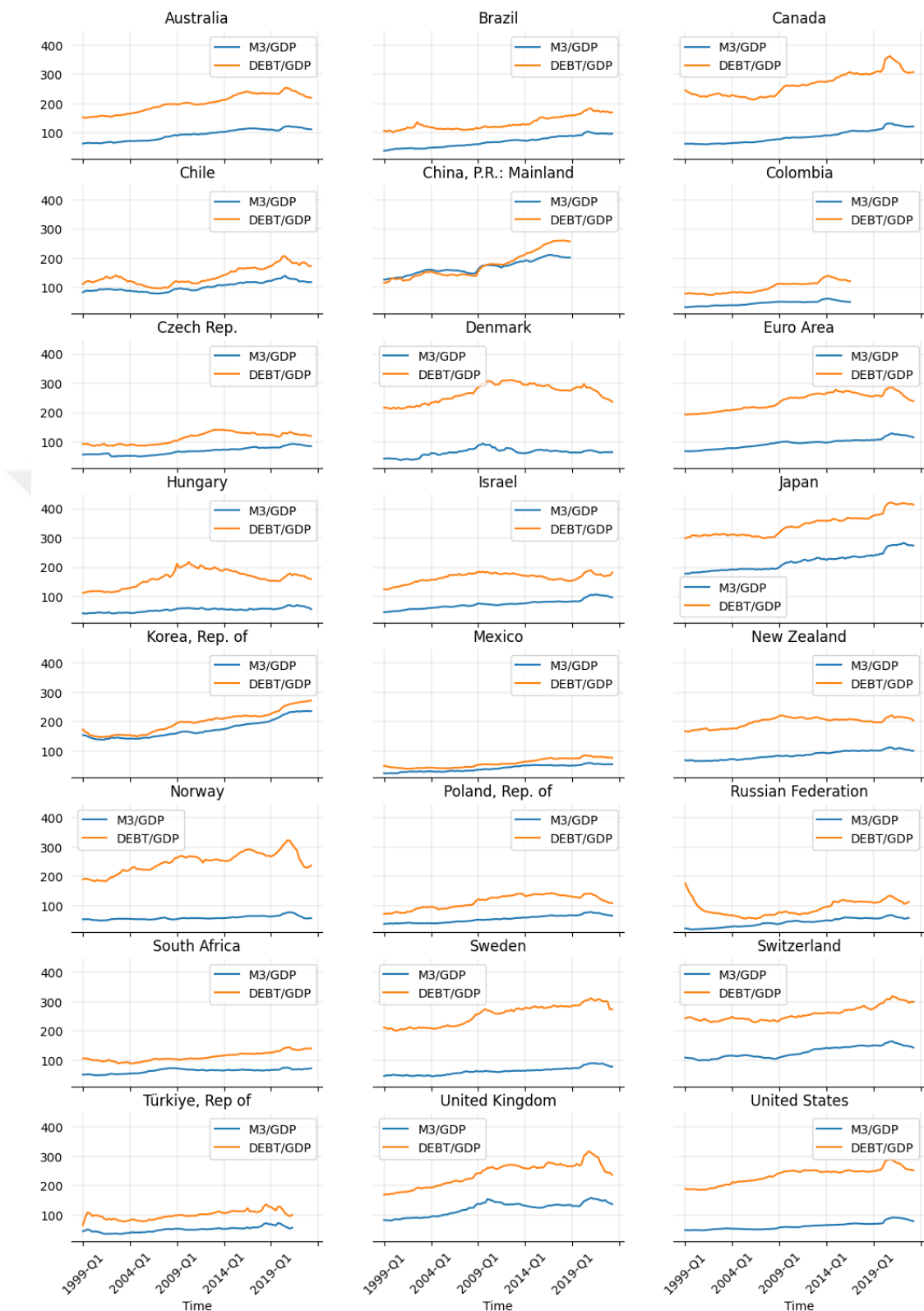


Figure 3.1: Money Growth and Debt Growth

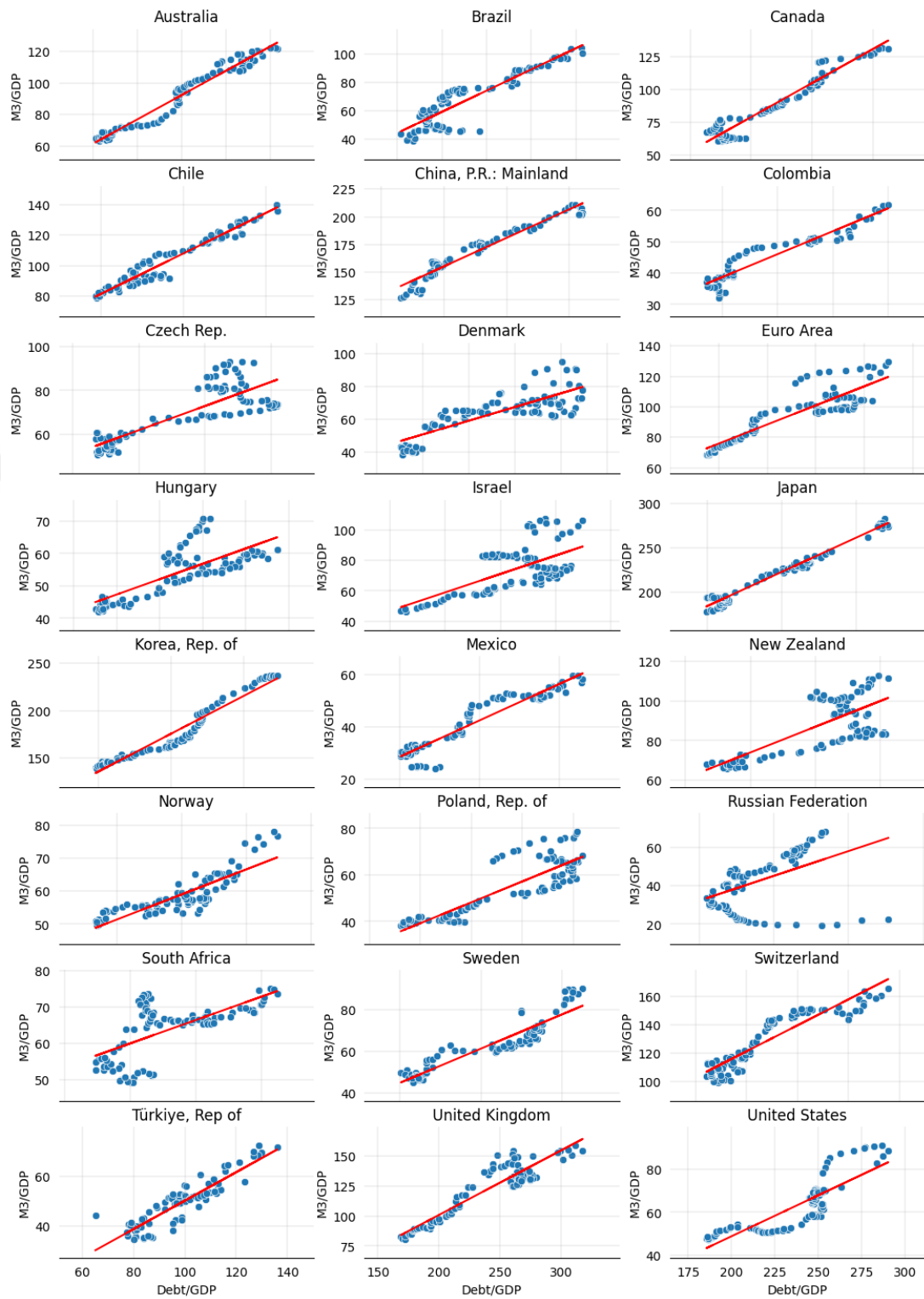


Figure 3.2: Money Growth and Debt Growth, Scatter Graph

Table 3.1 depicts the whole list of panels in our sample together with the number of observations with their respective time periods and rankings in the Financial Development Index (FDI) from International Monetary Fund (2021). Overall, 44 of the 60 highest ranked countries in FDI are captured, and several small financial centers like Hong Kong (3), Singapore (8) and Iceland (47); Gulf countries including United Arab Emirates (29), Saudi Arabia (35), Kuwait (36), Bahrain (38), and Qatar (44); developing East Asian countries such as Malaysia (26), Thailand (33), Kazakhstan (58), Philippines (59) and India (60); non-Eurozone countries within the European Union such as Romania (52) and Bulgaria (53); and Morocco (54) and Peru (57) are omitted because of the missing data.

The long-run relationship between money-to-income and debt-to-income ratios, as depicted in Figure 3.1, reasonably positive for many of the developing countries, and weakly positive for some of the developed countries at first glance. Besides, the positive relation is further observed, roughly, for all the panels when scattering the observations as in the Figure 3.2. On the other hand, given the stationarity problem that is commonly detected in most of the macroeconomic time series, the positive relationship between these two variables depicted in the descriptive statistics might be misleading. In order to build a causal relationship following Gurley and Shaw (1957, 1960), we also apply the most recent panel time series techniques to capture the long-run relationship between money demand and financial development.

3.2 Econometric Methodology

It is widely known that many macroeconomic variables exhibit trends and unit roots, making them non-stationary. In establishing long-term relationships between economic variables, ignoring nonstationarity can lead to spurious regressions and misleading inferences. The concept of cointegration, introduced by (Granger, 1981) and further formalized by Engle and Granger (1987), offers a solution to identify a stable, long-term equilibrium relationship between non-stationary variables. If two or more time series are individually non-stationary but their linear combination is stationary, then they are cointegrated, implying that the variables have a common stochastic

trend and will move together over time, maintaining a consistent relationship despite short-term deviations. To estimate and test the cointegrating relationship between non-stationary variables, Engle and Granger (1987) proposed a two-step procedure as the following: (1) estimating an OLS regression using the potentially cointegrated variables, $y_{1t} = \alpha - \beta y_{2t} + u_t$, where y_{1t} and y_{2t} are $I(1)$, to obtain the predictions for the residual $\hat{u}_t$; (2) testing whether the predicted residuals, $\hat{u}_t$, are $I(0)$ by conducting a unit root test. Engle and Granger (1987) also show that when there is a cointegrating relationship between two variables, there must exist an Error-Correction Model (ECM) incorporating both the short-term dynamics and the long-term relationship between cointegrated variables. Thus, if y_{1t} and y_{2t} are cointegrated, their relationship can be expressed as an ECM of the form:

Later on, Johansen (1988); Johansen and Juselius (1990) extended the Engle-Granger to the multivariate case by reformulating vector autoregressive (VAR) model as a VECM to incorporate both short-term dynamics and long-term equilibrium relationships. Perron (1989) and Gregory and Hansen (1996) highlighted that ignoring structural breaks can lead to misleading conclusions about cointegration, and developed tests that account for potential shifts in the cointegrating relationship due to events such as economic crises, policy changes, or technological innovations to improve the reliability of cointegration analysis in the presence of structural breaks. On the other hand, before the development of specialized panel cointegration tests, researchers adapted time series techniques for panel data as well (Pedroni, 2019). The foundation for panel cointegration tests lies in the development of panel unit root tests, which extend time series unit root tests to panel data. Levin et al. (1992, 2002) proposed a panel unit root test that improves the power of unit root testing by pooling cross-sectional and time series data. However, the test assumes independence across individuals and identical unit root properties, which may be restrictive in the presence of cross-sectional dependence and heterogeneous autoregressive coefficients.

Cross-section dependency (CSD) refers to the correlation of error terms across different cross-sectional units in a panel dataset (Chudik and Pesaran, 2015a), which can arise from various factors such as common shocks, spatial interactions or unob-

served common factors. The first generation of panel cointegration techniques focused primarily on testing for cointegration in the presence of cross-sectionally independent panels. However, ignoring CSD can lead to endogeneity or omitted variable bias, and therefore inconsistent estimates, as it violates the most fundamental OLS assumption that iid error term (Choi, 2015). Therefore, the detection of CSD became a crucial first step in panel analysis, leading to development of a general diagnostic test for cross-sectional dependence (Pesaran, 2004). Later on, based on the Mean Group (MG) Estimator, allowing for heterogeneous slope coefficients in both short-run and long-run by estimating separate regressions for each cross-sectional unit and then averaging the coefficients (Pesaran and Smith, 1995), and Pooled Mean Group (PMG) Estimator, which allows heterogeneity in short-run dynamics but homogeneity in long-run, Pesaran (2006) introduced the Common Correlated Effects (CCE) estimator, that adjusts for CSD by incorporating cross-sectional averages of variables.

In panel time series analysis, especially within the panel cointegration framework, it is essential to begin by testing for cross-sectional dependence because it ensures that the chosen econometric models are robust, reliable, and appropriately tailored to the data structure. Given that CSD often results from unobserved common factors that affect multiple units simultaneously, ignoring it can lead to biased and inconsistent parameter estimates Pesaran (2006); Chudik and Pesaran (2015a). In our dataset, common factors driving CSD could include global economic conditions, international trade dynamics, coordinated monetary and fiscal policies, and regional economic integration. Besides, the presence of CSD can affect the results of other diagnostic tests, such as unit root and cointegration tests. By initially testing for CSD, researchers can adjust their methodologies to account for dependence, leading to more accurate diagnostic tests and subsequent analysis Chudik and Pesaran (2015a); Ditzen (2018). Finally, testing for CSD helps to select the appropriate model specification, such as selecting models that incorporate cross-sectional averages in the presence of strong CSD.

Therefore, to identify cross-section dependency, following Ditzen (2021a), we (1) estimate the number of common factors influencing the observed variables as the detection of one common factor simplifies the task of modeling cross-sectional

dependence to some extent, so that instead of having to account for complex dependence structures between all pairs of units, we can focus on modeling the impact of the single common factor (Ahn and Horenstein, 2013; Ditzen and Reese, 2023); (2) estimate the exponent of cross-section dependence to quantify the strength of the dependency, measured by a constant $0 \leq \alpha < 1$, where we have (semi) weak CSD for $(0 < \alpha < 0.5)$ $\alpha = 0$ and (semi) strong CSD for $(0.5 \leq \alpha < 1)$ $\alpha = 1$, using the procedure proposed by Bailey et al. (2016, 2019); Ditzen (2021a); (3) test for weak cross-section dependence to determine if the correlations among units diminish as the panel size increases using the procedure offered by Pesaran (2015, 2021) and further improved by Xie and Pesaran (2022); Juodis and Reese (2022). Especially, the bias-corrected version of the cross-sectional dependence (CSD) test (Xie and Pesaran, 2022) improves the reliability and precision of detecting cross-sectional dependence by correcting for estimation biases that can arise from the presence of common factors.

Next, we will test for slope heterogeneity following Bersvendsen and Ditzen (2021) because assuming homogeneity when it does not exist can distort the true relationship between variables, which can mislead conclusions drawn from empirical studies (Pesaran and Smith, 1995). The delta test, as introduced by ?, and its robust versions ?, provide guidance on whether to use pooled or mean group estimators. Then, we test for the existence of panel unit root using the CIPS test is an aggregate panel unit root test derived from the Cross-sectionally Augmented Dickey-Fuller (CADF) statistics Pesaran (2007). It extends the IPS (Im et al., 2003) test, which aggregates individual ADF tests to the panel level. Although the CADF test gives individual unit root results for each series, the CIPS test combines these results to make an inference about the entire panel. If the CIPS statistic is greater than the critical value, the null hypothesis is not rejected, indicating the presence of a unit root (non-stationarity) in the panel series.

Upon detection of the panel unit root, we initial implement Westerlund's ECM-based tests for panel cointegration that accommodate heterogeneous dynamics and cross-sectional dependence unlike earlier traditional residual-based tests (Kao, 1999; Pedroni, 1999, 2004). Westerlund (2007) proposes four test statistics: two panel

statistics (P_τ and P_α), assuming homogeneity and the test for cointegration in the entire panel; and two group mean statistics (G_τ and G_α), allowing for heterogeneity between units and the test for cointegration in at least one unit. Significant negative values in these statistics indicate rejection of the null hypothesis of no cointegration, thus confirming the presence of long-run equilibrium relationships among the variables in the panel. These tests involve estimating the error correction model. Next, following Banerjee and Carrion-i Silvestre (2017), we test for panel cointegration by estimating Pooled Common Correlated Effects (PCCE) model, augmenting the regression model with cross-sectional averages of the dependent and independent variables, serving as proxies for the unobserved common factors following Pesaran (2006). Before describing the testing procedure, it is worth briefly mentioning about CCE Estimator.

CCE estimator, developed by Pesaran (2006), captures unobserved common factors that can affect panel units simultaneously by including the cross-sectional averages of both dependent and independent variables, mitigating the omitted variable bias. Chudik and Pesaran (2015b) proposed to include at the amount of floor of $p_T = \lfloor T^{1/3} \rfloor$ lags of cross-sectional averages to approximate common factors to ensure the consistency of the estimator. In addition, the CCE model can be fitted using a mean group estimator (CCE-MG) (Pesaran and Smith, 1995; Pesaran, 2006; Chudik and Pesaran, 2019) or a pooled estimator (PMG) (Pesaran et al., 1999; Juodis et al., 2021), depending on the assumed homogeneity of the long-term coefficients. The CCE Mean Group (CCE-MG) estimator method involves estimating individual regressions for each cross-sectional unit i to obtain individual-specific coefficients $\hat{\beta}_i'$, $\hat{\gamma}_i'$ and $\hat{\delta}_i'$, and the mean group estimator is obtained by averaging the individual coefficients: $\hat{\beta}_{MG} = \frac{1}{N} \sum_{i=1}^N \hat{\beta}_i$. While allowing for heterogenous short-run dynamics, CCE-PMG estimator balances between capturing common long-run relationships and allowing for individual short-run adjustments, and implemented by pooling the long-run coefficients across all units while allowing the short-run coefficients and error variances to differ. The long-run coefficients are calculated as: $\hat{\theta}_{PMG} = \frac{\sum_{i=1}^N \hat{\beta}_i (1 - \hat{\lambda}_i)}{N}$

We specify both static and dynamic PCCE model to implement the Banerjee and Carrion-i Silvestre (2017) procedure. The CCE method assumes strictly exogenous

regressors, which means that they are not correlated with past, present, and future errors. This assumption ensures the consistency of CCE estimator in static settings because it effectively addresses cross-sectional dependence by including cross-sectional averages of the dependent and independent variables to proxy for unobserved common factors. However, in practice, many economic variables are only weakly exogenous, implying that they can be influenced by past values of the dependent variable or other regressors (Pesaran, 2006)). The consistency of the CCE estimator, in its original form, is limited to non-dynamic panels because it does not account for lagged dependent variables, which introduce dynamic relationships and potential endogeneity problems (Chudik and Pesaran, 2015b). The Dynamic Common Correlated Effects (DCCE) estimator, developed by Chudik and Pesaran (2015b), extends the CCE approach to dynamic panel data models by incorporating the lag dependent variable and lags of the cross-sectional averages to estimate long-run relationships.

Another significant advantage of the PCCE approach for the cointegration testing in panel data is its ability to pool information between units and provide consistent and unbiased estimates by accounting for common shocks and trends affecting all units in the panel by including cross-sectional averages (Banerjee and Carrion-i Silvestre, 2017). The estimator captures the long-term relationship by leveraging the pooled information and accounting for common factors through cross-sectional averages. This approach ensures that the long-run average coefficient is consistently estimated, even if individual units are not cointegrated. Initially, for each unit, a cross-sectionally augmented Dickey-Fuller (CADF) regression is run on the residuals obtained from the PCCE estimation. The CADF test results are aggregated to form the Cross-Sectionally Augmented Im-Pesaran-Shin (CIPS) test statistic, providing a single summary measure of the panel's overall unit root behavior. The CIPS test effectively summarizes the unit-specific CADF results into a single panel statistic, facilitating a more easy interpretation of the cointegration status of the entire panel. This combined approach of using the PMG estimator for obtaining consistent residuals and the CIPS test for summarizing the unit root behavior ensures robust testing for cointegration in panel data with cross-sectional dependence. The null hypothesis of homogeneity and non-

stationarity, i.e. no cointegration and homogenous long-run coefficients, is rejected if the CIPS statistic is smaller than the critical value using the implementation procedure proposed by Sangiacomo (2018) based on Pesaran (2007), implying the existence of panel cointegration together with heterogenous slopes.

Finally, for the robustness check we build several error correction models including the Augmented Mean Group (AMG) (Eberhardt, 2013), and the Cross-Sectional Error Correction Model (CS-ECM) through the Dynamic CCE-MG estimator (Chudik and Pesaran, 2015b). Eberhardt (2013) proposed the Augmented Mean Group (AMG) estimator method to address unobserved heterogeneity, nonstationarity, and cross-section dependence in macro panel data analysis is to enhance the Pesaran (2006) Common Correlated Effects (CCE) estimators by explicitly incorporating a "common dynamic effect" in the group-specific regressions, thus addressing cross-section dependence more directly. While it is obsoleted in estimating the mean group regressions, it is widely utilized to check for the robustness of short-run and long-run estimations (Shen et al., 2021; Chien et al., 2021; Saqib et al., 2023). To the best of our knowledge, the DCCE-MG estimator is the most recent, and likely the most advanced, technique to estimate the long-run cointegrating relationships and correct for short-run deviations using the error correction mechanism while accounting for heterogeneity across units (Ditzen, 2018, 2021a). Therefore, we also specify a Cross-Sectional Error Correction Model (CS-ECM) based on DCCE-MG estimator (Chudik and Pesaran, 2015b) derived from the Cross-Sectional Autoregressive Distributed Lag (CS-ARDL) estimator (Chudik et al., 2013) in order to capture the long-run effect of growth in debt on the money growth by incorporating the short-run dynamics. Lastly, we estimate the CS-DL estimator, which directly estimates long-run coefficients without the intermediate step of estimating short-run coefficients (Chudik et al., 2016), making it simpler and more robust to dynamic misspecification and error serial correlation (Ditzen, 2021a)

CHAPTER 4

RESULTS

4.1 Empirical Findings

4.1.1 Testing for Number of Common Factors

Following Ditzen (2021b); Ditzen and Reese (2023) we start by testing for the number of common factors driving the CSD to enhance the validity of subsequent econometric analyses. For example, different units may be influenced by different common factors, so testing the number of common factors allows for better modeling of this heterogeneity. Besides, common factor analysis provides the necessary input for constructing error correction models (ECMs) that capture both short-term dynamics and long-term equilibrium relationships among variables, so identifying common factors is a precursor to developing dynamic factor models like CCE or DCCE.

Table 4.1: Testing for Number of Common Factors

IC	# factors	IC	# factors	IC	# factors	IC	# factors
(1) M3-to-GDP				(2) M3-to-GDP & Debt-to-GDP			
PC_p1	8	IC_p1	8	PC_p1	8	IC_p1	8
PC_p2	8	IC_p2	8	PC_p2	8	IC_p2	8
PC_p3	8	IC_p3	8	PC_p3	8	IC_p3	8
ER	1	GR	1	ER	1	GR	1
GOS	9	ED	4	GOS	1	ED	6

8 factors maximally considered.

PC_p1, ..., IC_p3 from Bai and Ng (2002)

ER, GR from Ahn and Horenstein (2013)

ED from Onatski (2010)

GOS from Gagliardini et al. (2019)

The various test results presented in Table 4.1 suggest a different number of common factors when individually tested for the dependent variable, (1) M3-to-GDP, and the joint distribution (2) M3-to-GDP & Debt-to-GDP. While other criteria suggest

a higher number of common factors, both the ER and GR estimators (Ahn and Horenstein, 2013) consistently identify a single common factor across both specification (dependent variable and two variables estimated by standardizing the variance of each cross-section to 1 and removing individual fixed effects). This suggests that the most significant source of variation in the data sets is attributable to one dominant underlying factor that could represent a dominant economic variable or a systematic influence affecting both variables, such as financial development or deepening. The detection of a common factor simplifies the task of modeling cross-sectional dependence to some extent. Instead of having to account for complex dependence structures between all pairs of units, we can focus on modeling the impact of a single common factor. This can be done using various methods, such as the CCE and DCCE estimators, which approximate the common factor using cross-sectional averages.

4.1.2 Testing for Weak CSD

Testing for weak cross-sectional dependence is crucial in the presence of a common factor. To recap, in the existence of weak CSD, the sum of the effect stemming from the common factor in the data remains constant even if the number of cross-sectional units tends to infinity, while it increases in the case of strong CSD. Because it validates the assumption that the correlations among cross-sectional units decay sufficiently as the number of units increases, detection of Weak CSD ensures that the cross-sectional averages used in CCE and DCCE estimators effectively capture the unobserved common factors without being overwhelmed by pervasive correlations. Following Ditzén (2021b), we test for weak CSC using the implementation algorithm Ditzén (2023a).

The results presented in Table 4.2, including CD test by Pesaran (2015, 2021) and CD* test by Xie and Pesaran (2022) estimated using principal components analysis (PCA) to account for the influence of the one common factors detected by ER, GR from Ahn and Horenstein (2013), suggest strong cross-sectional dependence in both variables.

Table 4.2: Weak Cross-Sectional Dependence Test

	CD	CD*
M3-to-GDP	111.18 (0.000)***	86.14 (0.000)***
Debt-to-GDP	98.95 (0.000)***	52.24 (0.000)***

p-values in parentheses.

CD: Pesaran (2015, 2021)

CD*: Xie and Pesaran (2022) with 1 PC(s)

4.1.3 Estimating the exponent of CSD

The exponent of cross-sectional dependence (α) provides a quantitative measure of the strength and nature of the dependence among cross-sectional units, thereby helping to understand the underlying data generation process, guiding the selection of appropriate econometric models to avoid biased estimates. We use Ditzgen (2023b) to implement the estimation procedure suggested by Bailey et al. (2016, 2019)

Table 4.3: CSD Exponent Estimation and Test

Variable	alpha	Std. Err.	[95% Conf. Interval]
M3-to-GDP	0.8078457	0.1258889	0.5611081 1.054583
Debt-to-GDP	0.9038248	0.1955026	0.5206467 1.287003

$0.5 \leq \alpha < 1$ implies strong cross-sectional dependence.

The estimated values of α using, presented in Table 4.3, confirm earlier results by suggesting the existence of a semi-strong CSD. Given the difficulty in differentiating between the effects of common factors and individual-specific factors in the existence of strong CSD, semi-strong CSD is favored as it indicates varying degrees of influence from common factors across different units. Therefore, it may be necessary to incorporate more sophisticated factor models that can capture varying degrees of influence between units Chudik and Pesaran (2015a). Estimators such as Common Correlated Effects (CCE) and Dynamic Common Correlated Effects (DCCE) may need to be supplemented with additional techniques to handle the nuances of semi-strong dependence, such as incorporating Mean Group (MG) estimators, as they allow hetero-

geneous coefficients across units, effectively capturing the varying degrees of influence that common factors exert on different units Chudik and Pesaran (2015b).

4.1.4 Panel Unitroot Test (CIPS-test)

The presence of the CSD in the data points to the implementation of the second-generation panel unit root test to determine the order of integration, namely the CIPS-test (Pesaran, 2007) employing Cross-Sectional Augmented Dickey-Fuller (CADF) by Pesaran (2007). Another method developed by Chen et al. (2022) accounts for the structural breaks in panel time series in the unit root testing, but since we did not detect structural breaks in the data using the testing procedure developed by Ditzen et al. (2021), CIPS test would suffice.

Table 4.4: Pesaran (2007) Panel Unit Root Test (CIPS)

Variable	Specification without trend		Specification with trend	
	Zt-bar	p-value	Zt-bar	p-value
M3-to-GDP	1.164	0.878	3.893	1.000
Debt-to-GDP	1.204	0.886	3.877	1.000

CIPS tests: series is I(1).

CIPS test assumes cross-section dependence is in the form of a single unobserved common factor.

Table 4.4, estimated by the test procedure developed by Lewandowski (2007), suggests that both variables are I(1), making them suitable for testing cointegration.

4.1.5 Testing for Slope Heterogeneity

The detection of CSD requires the slope heterogeneity to be taken into account across cross-sectional panels, which has significant implications for modeling in determining whether to construct ECM based on the mean group specification (MG) or the pooled mean group (PMG).

The results presented in Table 4.5, estimated by performing the testing procedure coded by Bersvendsen and Ditzen (2021) based on Pesaran and Yamagata (2008) test for slope homogeneity accounting for CSD and further extended by Blomquist and Westerlund (2024) to conduct HAC correction, suggest heterogeneity in slopes.

Table 4.5: Testing for Slope Heterogeneity

	Delta	p-value
	56.213	0.000
adj.	57.135	0.000

H0: slope coefficients are homogenous

4.1.6 Testing for Panel Cointegration (Westerlund)

As we detect semi-strong CDS together with heterogeneous long-run slopes, we initially employ Westerlund and Edgerton (2007) second-generation error-correction–based panel cointegration tests to investigate the long-run relationships among our integrated variables.

Table 4.6: Westerlund ECM Panel Cointegration Tests

Statistic	Unbalanced Panel		Balanced Panel	
	P-value	Robust P-value	P-value	Robust P-value
Gt	0.159	0.090*	0.089*	0.000*
Ga	0.735	0.313	0.757	0.100
Pt	0.040**	0.069*	0.006**	0.000***
Pa	0.058*	0.053*	0.012**	0.000***

Given the cross-sectional dependency and heterogeneous long-term coefficients detected by previous tests, the robust P-values from the Westerlund ECM panel cointegration tests are most relevant. For the unbalanced panel, the Gt and Ga statistics do not suggest strong evidence of cointegration in individual units, while the Pt and Pa statistics provide marginal evidence of cointegration across the panel as a whole. Therefore, considering the cross-sectional dependence, the borderline significance of the Pt and Pa statistics indicates that there may be some long-run equilibrium relationships within the entire panel, but this evidence is not strong. However, the estimation of the error correction model parameters can be biased if the missing data are not random (i.e. if there is a systematic pattern to the missing data), which can affect the test statistics and potentially lead to incorrect conclusions about cointegration. Given the missing data from the four countries, we also performed a Westerlund test for a balanced version of our dataset, consisting of 20 countries. The second test outperforms the first primarily

due to the use of a balanced panel. In the balanced panel, all units have observations for all time periods, reducing estimation bias and increasing the power of the cointegration tests. As a result, robust P-values are more significant in the second test, providing stronger evidence of cointegration. The results of the second test show that the null hypothesis of no cointegration is rejected at conventional significance levels in all statistics, which was not the case in the first unbalanced panel test.

4.1.7 Testing for Panel Cointegration (CCE-PMG Estimator)

Next, we implement the testing procedure proposed by Banerjee and Carrion-i Silvestre (2017) to test for the panel cointegration. The reason behind choosing the PCCE estimator is its ability to effectively address cross-sectional dependence, which is critical in macroeconomic panel data. The Gauss program code provided by Banerjee and Carrion-i Silvestre (2017) does not work in unbalanced panels. In order to avoid removing the observations of the four financially developing countries, namely China, Colombia, Russia, and Turkiye, that we have missing data, we specify and then fit the PCCE estimator following Ditzen (2018) to implement the test procedure on the predicted residuals. Both static and dynamic specifications are utilized; the static model focuses on long-term relationships, while the dynamic model accounts for short-term adjustments, providing a comprehensive understanding of temporal behavior. This approach provides a robust estimation of CSD no matter the statistics are weak or strong, and handles slope heterogeneity and stationarity or non-stationarity issues. Following Pesaran et al. (1999); Pesaran (2006); Chudik and Pesaran (2015b); Ditzen (2019), we estimate the following static PCCE Estimator:

$$\frac{M3}{GDP_{i,t}} = \alpha_i + \beta \frac{DEBT}{GDP_{i,t}} + \delta_1 \overline{\frac{M3}{GDP_t}} + \delta_2 \overline{\frac{DEBT}{GDP_t}} + u_{i,t} \quad (4.1)$$

and then based on the following CS-ARDL(1,1) model:

$$\left(\frac{M3}{GDP} \right)_{i,t} = \mu_i + \lambda_{l,i} \left(\frac{M3}{GDP} \right)_{i,t-l} + \sum_{l=0}^1 \beta_{l,i} \left(\frac{DEBT}{GDP} \right)_{i,t-l} + \sum_{l=0}^p \gamma'_{i,l} \bar{z}_{t-l} + e_{i,t} \quad (4.2)$$

where

$$\bar{z}_t = \left(\frac{1}{24} \sum_{i=1}^{24} \left(\frac{M3}{GDP} \right)_{i,t}, \frac{1}{24} \sum_{i=1}^{24} \left(\frac{DEBT}{GDP} \right)_{i,t} \right)' \quad (4.3)$$

we estimated a Dynamic CCE-PMG estimator through the below Cross-Sectional Error Correction Model (CS-ECM):

$$\Delta \frac{M3}{GDP}_{i,t} = \mu_i - \phi_i \left(\frac{M3}{GDP}_{i,t-1} - \theta_{PMG} \frac{DEBT}{GDP}_{i,t} \right) - \beta_{1,i} \Delta \frac{DEBT}{GDP}_{i,t} + \sum_{l=0}^4 \gamma'_{i,l} \bar{z}_{t-l} + e_{i,t} \quad (4.4)$$

to get a consistent estimates of the long-run coefficients that is calculated as: $\hat{\theta}_{PMG} = \frac{\sum_{i=1}^N \hat{\beta}_i (1 - \hat{\lambda}_i)}{N}$ in order to obtain the residuals at the cross-sectional level.

Table 4.7: Static PCCE & Dynamic CCE-PMG

VARIABLES	(1) M3-to-GDP	(2) M3-to-GDP
short-run Est.		
Mean Group:		
$\Delta DEBT\text{-to-GDP}_t$		0.181*** (0.024)
Adjustment Term		
Mean Group:		
ECT_{t-1}		-0.076*** (0.001)
Long Run Est.		
Pooled Mean Group:		
$DEBT\text{-to-GDP}_{t-1}$	0.209*** (0 .055)	0.182*** (.093)
CIPS Stat. (Balanced Panel)	-2.381***	-6.190
CIPS Stat. (Unbalanced Panel)	-3.652***	-23.432
Observations	2,297	2,153
R-squared	0.76	0.78
Number of groups	24	24

Standard errors in parentheses

*** p < 0.01, ** p<0.05, * p < 0.1

The initial results presented in 4.7 provide insights into both the short-run and long-run relationships between M3-to-GDP and DEBT-to-GDP using Static and Dynamic PCCE Estimators. On the other hand, as far as the slope heterogeneity test results

are concerned, we will delve deeper into the long-run relationship through the CCE-MG estimator presented in ???. Following Banerjee and Carrion-i Silvestre (2017), we presented CIPS test statistics obtained by aggregating the individual CADF regressions to test for non-stationarity as well as homogeneity in the long-run coefficients (?) to test for panel unit root in the predicted residuals for both balanced and unbalanced panel cases. As the testing procedure proposed by Sangiacomo (2018) implements the CADF test only for balanced panels, we complemented the CIPS test with the procedure offered by Lewandowski (2007) which calculates the CIPS test statistic by averaging the CADF statistics across cross-sectional units in the case of an unbalanced panel as well. The CIPS statistics obtained from the predicted static (Model 1) and dynamic (Model 2) PCCE estimators suggest a significant evidence for stationarity, implying an evidence for the existence of a cointegrating relationship between M3-to-GDP and DEBT-to-GDP in the long-run as suggested in Gurley and Shaw (1960).

4.2 Robustness Check (CCE-AMG CCE-MG CS-DL)

To verify the robustness of the long-term relationship detected by testing for panel cointegration, we estimate the CCE-AMG estimator following Eberhardt (2013); CCE-MG estimator by fitting the CS-ECM model following Pesaran (2006); Chudik and Pesaran (2015b) and the CS-DL model (Chudik et al., 2016). The dynamic specification with the lagged error correction term and lagged cross-sectional averages allows capturing both the short-run dynamics and the long-run equilibrium relationship between M3-to-GDP and DEBT-to-GDP. In essence, the CCE-MG estimator transforms the original model with cross-sectional dependence into a model where the error terms are (approximately) cross-sectionally independent, thus allowing for valid statistical inference.

Initially, we estimate the CCE-AMG model using the following equation:

$$\frac{M3}{GDP}_{i,t} = a_i + \beta'_i \frac{DEBT}{GDP}_{i,t} + c_i t + d_i \hat{\mu}_{i,t} + e_{it} \implies \hat{\beta}_{AMG} = \frac{1}{N} \sum_i \hat{\beta}_i \quad (4.5)$$

Next, using the CS-ARDL(1,1) model we fit the following CS-ECM model with different cross-sectional lag specifications:

$$\Delta \frac{M3}{GDP}_{i,t} = \mu_i - \phi_i \left(\frac{M3}{GDP}_{i,t-1} - \theta_{1,i} \frac{DEBT}{GDP}_{i,t} \right) - \beta_{1,i} \Delta \frac{DEBT}{GDP}_{i,t} + \sum_{l=0}^p \gamma'_{i,l} \bar{z}_{t-l} + e_{i,t} \quad (4.6)$$

The results for the robustness check are presented in Table 4.8 supports the previous findings. The AMG estimator results, presented in Model 3, establishes a positive and statistically significant relationship, where 1% increase in Debt-to-GDP leading to 0.149% increase in M3-to-GDP in the long-run. To take the short-run dynamics into consideration as well, we present Cross-Sectional Error Correction Model results in Models 4, 5 and 6 by adding the lags of cross-sectional averages. Following Chudik and Pesaran (2015b), we add the floor of $p_T = \lceil 98^{1/3} \rceil$, that is, 4, cross-sectional lags, and fit Model 5 with the (4,4) number of lags. Consequently, the positive and statistically significant short-run coefficient indicates that the 1% increase in the growth rate of Debt-to-GDP is associated with an almost 0.176% increase in M3-to-GDP, and the negative and statistically significant coefficient of the adjustment term implies that the system corrects about 9.4% of the deviation from the long-run equilibrium in each period, while we do not find evidence for a statistically significant relationship in the long run. Given that the estimated coefficient in Model 5 is more than twice that of Model 3, we also fit Model 4 with (1,4) lags and Model 6 with (5,4) lags to check the consistency of Model 5 in the long-run. Despite similar results for short-run and adjustment term coefficients, we get varying but statistically significant estimates for the long-term coefficient.

Table 4.8: Regression Results for Dynamic CCE-MG Estimator (CS-ECM)

VARIABLES	(3) M3-to-GDP _t	(4) ΔM3-to-GDP _t	(5) ΔM3...	(6) ΔM3...	(7) ΔM3...	(8) ΔM3...	(9) ΔM3...
Short-run Est.							
ΔDEBT-to-GDP _t		0.176*** (0.022)	0.177*** (0.022)	0.173*** (0.022)			
ΔDEBT-to-GDP _{t-1}					0.046*** (0.015)	0.048*** (0.015)	0.052*** (0.015)
Adjustment Term							
ECT _{t-1}		-0.097*** (0.013)	-0.094*** (0.013)	-0.095*** (0.013)	-0.128*** (0.013)	-0.125*** (0.020)	-0.125*** (0.020)
hline							
Long-Run Est.							
DEBT-to-GDP _t	0.149*** 0.045	0.573* (0.325)	0.343 (0.232)	0.305** (0.167)	*0.593* (0.346)	0.201 (0.132)	0.273** (0.120)
Number of Cross-sectional lags		(1,4)	(4,4)	(5,4)	(1,4)	(4,4)	(5,4)
Observations	1,960	2,177	2,177	2,177	2,153	2,153	2,129
CD Statistics		-0.12	0.65	0.92	0.07	0.99	0.71
R-squared		0.755	0.756	0.757	0.868	0.871	0.872
Number of groups	20	24	24	24	24	24	24

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4.9: Cross-Section Level Results (CS-ECM) - Part 1

	Model 4			Model 6		
Dep. Var.	S-R	Adj.	L-R	S-R	Adj.	L-R
$\Delta M3\text{-to-GDP}_t$	$\Delta(\frac{DEBT}{GDP})_t$	ECT_{t-1}	$(\frac{DEBT}{GDP}_t)$	$\Delta(\frac{DEBT}{GDP})_t$	ECT_{t-1}	$(\frac{DEBT}{GDP}_t)$
Mean Group	0.176***	-0.097***	0.573*	0.173***	-0.095***	0.305*
Individual						
Australia	0.171**	-0.117*	0.381**	0.145*	-0.107*	0.461**
Brazil	0.033	-0.113**	0.008	0.023	-0.104**	0.006
Canada	0.098**	-0.097*	0.402*	0.088**	-0.109*	0.420**
Switzerland	0.078	-0.030	-0.661	0.084*	-0.045	-0.340
Chile	0.315***	-0.196**	0.323*	0.319***	-0.190**	0.332*
China	0.384***	-0.151***	0.468***	0.391***	-0.146***	0.481***
Colombia	0.139***	-0.081	0.146	0.119**	-0.078	0.071
Czech Rep.	0.063	-0.128**	-0.024	0.059	-0.132***	-0.017
Denmark	0.233***	-0.156***	0.269	0.256***	-0.150***	0.264
Euro Area	0.165***	-0.073*	-0.222	0.152***	-0.032	-0.551
United Kingdom	0.103	-0.092**	0.739	0.083	-0.088**	0.903**
Hungary	0.128***	-0.188***	0.075	0.132***	-0.188***	0.072
Israel	0.067	0.003	5.946	0.090**	0.016	0.810
Japan	0.312***	-0.230***	0.608***	0.301***	-0.243***	0.633***
South Korea	0.327***	0.004	5.309	0.320***	0.008	3.570
Mexico	0.147	-0.149***	-0.082	0.174*	-0.165***	-0.061
Norway	0.084***	-0.040	-0.028	0.091***	-0.044	0.001
New Zealand	0.153**	-0.124*	0.053	0.154**	-0.126*	0.054
Poland	0.108**	-0.100	0.013	0.104**	-0.093	0.039
Russia	0.158***	-0.083*	0.237*	0.155***	-0.078*	0.226
Sweden	0.141***	-0.074	-0.496	0.149***	-0.067	-0.654*
Türkiye	0.426***	-0.079**	0.046	0.424***	-0.091**	0.087
United States	0.177***	0.022	-0.161	0.160***	0.010	-0.527
South Africa	0.226***	-0.052	0.411	0.182**	-0.030	1.053

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4.10: Cross-Section Level Results (CS-ECM) - Part 2

	Model 7			Model 9		
Dep. Var.	S-R	Adj.	L-R	S-R	Adj.	L-R
$\Delta M3\text{-to-GDP}_t$	$\Delta(\frac{D}{G})_{t-1}$	ECT_{t-1}	$(\frac{DEBT}{GDP}_t)$	$\Delta(\frac{D}{G})_{t-1}$	ECT_{t-1}	$(\frac{DEBT}{GDP}_t)$
Mean Group	0.046***	-0.128***	0.593*	0.052***	-0.125***	0.273**
Individual						
Australia	0.004	-0.156***	0.422***	-0.022	-0.137**	0.515***
Brazil	-0.013	-0.117**	0.024	-0.011	-0.110**	0.023
Canada	0.088**	-0.128***	0.389***	0.112***	-0.131**	0.399**
Switzerland	-0.081	-0.040	0.037	-0.083*	-0.056*	0.142
Chile	0.120**	-0.380***	0.354***	0.115**	-0.367***	0.357***
China	-0.029	-0.190***	0.596***	0.016	-0.204***	0.554***
Colombia	0.083	-0.090	0.056	0.091*	-0.078	0.152
Czech Rep.	0.116*	-0.143***	-0.050	0.113	-0.152***	-0.035
Denmark	0.093	-0.163***	0.299	0.103	-0.161***	0.281
Euro Area	0.049	-0.081**	-0.164	0.048	-0.034	-0.437
United Kingdom	-0.096	-0.116***	0.862***	-0.098	-0.106***	0.922***
Hungary	0.036	-0.215***	0.081*	0.035	-0.225***	0.085*
Israel	0.031	0.002	8.341	0.044	0.012	1.182
Japan	0.054	-0.325***	0.617***	0.106	-0.325***	0.628***
South Korea	0.211**	0.010	1.489	0.230**	0.012	1.526
Mexico	-0.044	-0.143***	-0.026	-0.019	-0.173***	0.011
Norway	0.080***	-0.069*	-0.015	0.079***	-0.070	-0.017
New Zealand	0.042	-0.118*	0.063	0.030	-0.116	0.079
Poland	-0.005	-0.099	0.119	-0.001	-0.090	0.081
Russia	0.121***	-0.101**	0.171	0.123***	-0.099**	0.162
Sweden	0.019	-0.077	-0.146	0.022	-0.066	-0.222
Türkiye	-0.013	-0.287***	0.374**	-0.012	-0.283***	0.452***
United States	0.143**	0.014	-0.220	0.130***	0.002	-1.440
South Africa	0.099**	-0.058*	0.553	0.102	-0.033	1.162

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4.11: Cross-Section Level Results (CS-DL) - Part 1

	(10)		(11)		
M3-to-GDP _t	$(\frac{DEBT}{GDP})_t$	$\Delta(\frac{DEBT}{GDP})_t$	$(\frac{DEBT}{GDP})_t$	$\Delta(\frac{DEBT}{GDP})_t$	$\Delta(\frac{DEBT}{GDP})_{t-1}$
Mean Group	0.190***	0.088**	0.189***	0.086**	0.103***
Individual					
Australia	0.266***	-0.221*	0.277***	-0.167	-0.182
Brazil	0.099***	0.011	0.097***	-0.003	0.015
Canada	0.315***	-0.170*	0.317***	-0.182**	-0.078
Switzerland	0.292***	-0.037	0.313***	-0.063	-0.101
Chile	0.375***	0.171***	0.372***	0.127	0.126*
China	0.408***	0.134	0.400***	0.114	0.082
Colombia	0.193***	0.137	0.175***	0.132	0.158
Czech Rep.	-0.052	0.066	-0.052	0.069	0.134
Denmark	0.426***	0.251	0.421***	0.295	0.221
Euro Area	0.041	0.142	0.025	0.153	0.229
United Kingdom	0.762***	-0.516**	0.808***	-0.577**	-0.557**
Hungary	0.092***	0.107*	0.091***	0.108**	0.121**
Israel	0.128***	0.146	0.140***	0.181	0.264**
Japan	0.574***	-0.024	0.578***	-0.001	0.001
South Korea	0.573***	0.463	0.536***	0.533	0.308
Mexico	0.100	0.316	0.132*	0.319	0.204
Norway	0.074***	-0.004	0.074**	-0.027	0.130
New Zealand	0.004	0.184*	0.003	0.158	0.157
Poland	-0.070***	0.142	-0.074***	0.125	0.140
Russia	-0.049*	0.194*	-0.033	0.150	0.251**
Sweden	0.045	0.124	0.023	0.168	0.125
Turkiye	0.243***	0.138*	0.202***	0.147*	0.096
United States	-0.089**	0.213	-0.084*	0.198	0.374*
South Africa	-0.202**	0.153	-0.209**	0.113	0.249

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Table 4.12: Cross-Section Level Results (CS-DL) - Part 2

	(12)		(13)		
M3-to-GDP _t	$(\frac{DEBT}{GDP})_t$	$\Delta(\frac{DEBT}{GDP})_t$	$(\frac{DEBT}{GDP})_t$	$\Delta(\frac{DEBT}{GDP})_t$	$\Delta(\frac{DEBT}{GDP})_{t-1}$
Mean Group	0.239***	-0.004	0.236***	0.001	0.023
Individual					
Australia	0.221***	-0.239*	0.273***	-0.281*	-0.355**
Brazil	0.066**	0.039	-0.002	0.036	0.029
Canada	0.199***	-0.098*	0.220***	-0.173***	-0.084
Switzerland	0.750***	-0.290**	0.671***	-0.425**	-0.410**
Chile	0.394***	0.180**	0.385***	0.130*	0.083
China	0.475***	0.118	0.459***	0.317**	0.284**
Colombia	0.175***	0.102	0.188***	0.060	0.135
Czech Rep.	0.152***	-0.117	0.140***	-0.121	-0.018
Denmark	0.528***	0.205	0.426***	0.235*	0.269
Euro Area	0.159*	0.013	0.059	0.230	0.275**
United Kingdom	0.843***	-0.489*	0.862***	-0.430*	-0.421*
Hungary	0.138***	0.022	0.130***	0.091**	0.096**
Israel	0.131***	-0.163*	0.176***	-0.148*	-0.065
Japan	0.519***	0.056	0.540***	0.058	-0.021
South Korea	0.146**	0.164	0.136**	0.260	0.112
Mexico	0.306***	0.100	0.336***	0.112	0.169
Norway	0.146***	0.009	0.179***	0.034	0.122*
New Zealand	-0.040	0.184*	-0.095**	0.098	0.088
Poland	-0.021	0.018	0.092**	-0.012	-0.042
Russia	0.159***	-0.162	0.190***	-0.220***	-0.123
Sweden	0.113***	0.077	0.097*	0.132**	0.144***
Turkiye	0.115**	0.239***	0.097*	0.228***	0.191***
United States	-0.044	0.113	0.045	0.157	0.256**
South Africa	0.094	-0.174	0.083	-0.350	-0.163

Standard errors in parentheses

*** p < 0.01, ** p < 0.05, * p < 0.1

Later on, by including the same number of CSA lags in Model 4, 5 and 6, we fit Models 7, 8 and 9 by specifying the first lag of Debt-to-GDP to account for the case where the growth in diversification demand influence the growth in money demand in the following period. Capturing the short-run relationship through the lagged independent variable resulted in a similar and significant long-run estimations for Model 7 and 9 as in the Model 4 and 6, but insignificant and considerably lower for Model 8. On the other hand, there is more than three times a decrease in the short-run

coefficients and an increase in the adjustment parameters around 30%. Given that the mean group estimator is obtained by averaging the cross-section level estimates, we also document the individual level results for Models 4 and 6 in Table 4.9 ,7 and 9 in Table 4.10. The short-run coefficients reveal to be significant for more countries in Models 4 and 6, while Model 7 and 9 predict a significant adjustment parameter for more countries. On the other hand, long-run estimates are only significant for negligible number of countries in all models and are found to be negative for more than five countries in each model. Based on these results, we can conclude that Model 6 performs better in capturing the short-run dynamics, but further investigation would be necessary to account for long-run dynamics. Therefore, we conclude the robustness check by estimating a CS-DL estimator to directly estimate long-run coefficients without accounting for the short-run coefficients.

Following Chudik et al. (2016); Ditzen (2021a) we specify the following equation to fit CS-DL model by adding $p_{\bar{x}} = \lfloor 98^{1/3} \rfloor = 4$ and $p_{\bar{y}} = 0$ cross-sectional lags:

$$\frac{M3}{GDP}_{i,t} = \mu_i + \theta_i \frac{DEBT}{GDP}_{i,t} + \sum_{l=0}^p \delta_{i,l} \Delta \frac{DEBT}{GDP}_{i,t-l} + \sum_{l=0}^4 \gamma_{x,i,l} \Delta \frac{DEBT}{GDP}_{t-l} + u_{i,t} \quad (4.7)$$

where $p = 0$ for Models 10 and 12 in the Table 4.11, and $p = 1$ for Model 11 and 13 in the Table 4.12. Models 11 and 13 are estimated by applying recursive mean adjustment to initial model to account for small-sample time series bias. The results indicate that different lag specification for the differenced Debt-to-GDP do not lead to a considerable deviation in coefficient values and their significance, while recursive mean adjustment does to a varying extent for each cross-section. To conclude, the robustness results reveal solid support for the cointegrating relationship between financial development and money demand in the long-run at the panel level.

4.3 Discussion

Based on the results presented through the comprehensive analysis using the most recent panel time series techniques, we can argue for a nuanced relationship between the

M3-to-GDP and Debt-to-GDP ratios, according to the theoretical framework presented by Gurley and Shaw (1960). The heterogeneity in the results, reflected in the slope coefficients, across different levels of financial development offers strong implications for the evolution of money demand with respect to the growth of financial intermediaries as financial systems mature. No wonder that the Global Financial Crisis in 2008 and the 2020 Pandemic are common factors behind the increase in the debt level for all countries given the increase in the accumulation of financial assets by the governmental monetary system through open market operations and other macroprudential measures. Together with altering the composition of financial assets in the portfolios of the private sector, the demand for diversification of money is triggered by Keynesian speculative and precautionary motives, as well as the implicit deposit rate of money as argued by Gurley and Shaw (1960).

Apart from those, we also exemplify the country-level motives contributing the estimated outcomes. Countries with high rankings in financial development according to International Monetary Fund (2021), including Switzerland (1), United States (2), Japan (4), United Kingdom (5), Canada (7), and Australia (10), depict strong positive relationships between broad money growth and growth of debt, particularly in the long-run, aligning with postulation by Gurley and Shaw (1957, 1960) that the substitution effect induced by the growth of NBFIs tends to be dominated by the diversification demand for money as the financial environment becomes more sophisticated in facilitating the saving-investment process. In particular, the consistent significant positive relationship predicted for Switzerland, characterized by its strong banking sector together with the sophisticated market for NBFIs, implies that the long-run diversification demand for money strongly dominates any substitution effects.

The robustness of these results for Switzerland could be attributed to its exclusive position as a global hub and a safe haven for international financial capital. Diversification in financial assets is likely to induce a more complex structure for financial transactions, thereby necessitating a substantial amount of money balances even in the rise in the debt levels. Furthermore, Switzerland's well-recognized tradition in wealth management as well as its banking secrecy is likely to contribute this higher liquidity

demand relative to debt, as their customers might prefer to hold certain cash positions together with diverse financial assets in their portfolios. Similar results are also presented for another global financial center with an advanced NBFIs sector. The strength of the results for the United Kingdom also suggests the dominance of the diversification demand. As in the Swiss system, their sophistication in global wealth management combined with their leading role in financial innovation result in a higher demand for money as the diversification of financial assets increases the debt levels. Besides, the uncertainty around and following the Brexit process is likely to increase the precautionary money holding by both financial and non-financial sectors, contributing to the estimated money-debt relationship.

On the other hand, The United States manifests a specifically complex results, requiring special focus because of its aspects such as being the world's largest economy as well as issuing reserve currency of the world. In the CS-ECM models, the positive short-run impact, with adjustment coefficients around 0.16, could imply that immediate rise in debt reflects as an increase in the demand for money money demand, yet the inconsistency in results for the long-run, depicted in CS-DL models as well, with long-run coefficients varying between -0.089 and 0.045, although insignificant. These mixed results presented in different models for the United States could be attributed to several reasons: (1) the advanced NBFIs sector, providing diverse and more sophisticated substitutes for money, could likely offset the dominance of diversification demand to some extent; (2) the role of United States dollar as the global reserve currency widely demanded by central banks of foreign countries, private and non-private institutions, and individuals, which may disrupt the responsiveness of domestic debt levels as in the domestic money demand as formulated in Gurley and Shaw (1960); (3) continuous frontline financial instrument innovations in the United States as close substitutes for money could constantly recast the relationship between demand for money and overall debt; (4) higher transaction demand for international trade and financial transactions as the United States dollar is the most commonly acknowledged one, its demand likely responds to shifts in global trade patterns and financial capital flows, potentially deviating from domestic debt levels to a certain degree.

Similarly to Switzerland and the United Kingdom, persistently significant positive relationships detected in Japan (4) in the short-term and long-term across different models could also imply the dominance of diversification demand. Along with its advanced financial system with a sophisticated NBFIs sector, this consistent relationship could also be attributed to (1) prolonged low or negative interest rates, and resulting (2) deflationary pressures increasing the real value of Japanese Yen, enhancing the relative attractiveness of holding money for balances for speculative purposes or for the sake of its implicit deposit rate as conceptualized by Gurley and Shaw (1960); (3) extensive Quantitative Easing policies, increasing the monetary base and at the same time the debt; (4) cultural factors, such as higher savings preferences of Japanese households, contributing to the link between money demand and overall debt levels, triggering the diversification demand. Furthermore, other financially developed countries like Canada (7), Australia (10), Sweden (13), Denmark (14), and Norway (17) validate the hypothesis proposed by Gurley and Shaw (1960) for, more or less, the similar reasons as mentioned above.

Korea (18) and China (24) exhibit positive relationships, particularly stronger in the long term, reflecting the fast-paced financial development they have experienced in recent decades. Together with the growth of NBFIs, the presence of large conglomerates in both countries could also contribute to this relationship, as well as the state-directed financial system in China. However, Israel (22) and New Zealand (25) confirm the positive relationship in the long run but present mixed results in the short-run, which might be attributed to their relatively small size, making their money demand schedule more prone to be influenced by external factors. When we move from the developed to emerging countries, similar long run patterns are observed. Chile shows a positive relationship both in the long-run and in the short-run, suggesting that it has reached a financial development stage where the substitution effect is dominated by the demand for diversification.

However, Brazil (34), Czech Republic (37), Poland (41) rather exhibit weak short-run effects of debt level on money demand but some positive long-term relationships, especially in CS-DL models, reflecting the gradual development of financial sector,

where the growth of NBFIs could initially generate substitution effects. Over time, this leads to greater sophistication in the issuance of financial assets and, respectively, to a greater diversification demand for money. The strong positive relationships in Turkey deserve special attention given its history of high inflation together with the growth of the NBFIs sector. The high inflation environment, by fuelling the uncertainty regarding the future, could lead to the revitalization of both Keynesian precautionary and speculative motives, where money is treated as a flexible and easily convertible asset, aligned with the notion of an implicit deposit rate of Gurley and Shaw (1960). Therefore, this positive relationship implies that the increase in debt, possibly because of government or private sector borrowing, results in an almost proportional increase demand for money, perhaps as a hedging strategy together with the diversification demand. A similar pattern can also be observed for Colombia. Other emerging economies Hungary (43) and Mexico (56) present more mixed results, which may illustrate the challenges faced by transitioning economies.

CHAPTER 5

CONCLUDING REMARKS

The instability in the money demand function detected in the 60s and 70s has gradually led to underrating its importance and then further obscuring by the emergence New-Keynesian framework. On the other hand, the Global Financial Crisis and Post-Covid inflation revitalized the importance of money supply through its implications on financial markets in the context of monetary policy, where macroprudential policies became the major tool in monetary policy (Schnabel, 2023). The inflationary pressure that is supposed to follow by the increase in nominal money stock is not always observed in the long-run as implied by the famous reformulation of Quantity Theory of Money by Friedman (1956). This suggests a permanent change in the velocity of money. When considered together with the financial development process, offering various financial assets as a substitute for money, this phenomenon may better be understood.

To account for the impact of money supply on inflation, the link between macroprudential policies and expenditures requires further investigation through the money-credit channel. Therefore, we initially review the major part of the literature on the quantity theory of money and money demand, which was quite popular during the 50s and 60s. We then reintroduce the concept of diversification demand for money after presenting an extensive review on the framework developed by Gurley and Shaw (1960) to account for the role of financial intermediation on real aspects of the development process. Accordingly, the growth of NBFIs, given the combination of inside and outside money as well as the mixed asset-debt position, may result in an increasing demand for money following monetary expansion due to the role of financial intermediaries in changing the composition of assets in the portfolios of the spending units, which they offer as an explanation as the rise in money-income, or equivalently the demand for money, is accompanied by an increase in financial asset-to-income ratio. Therefore, to uncover the role of the security differentiation by the growth of NBFIs on the demand for money, we employed panel cointegration test the quarter century

long secular relation between the money-to-income ratio and the debt-to-income ratio. After presenting the recent developments in the panel cointegration framework, we tested the long-run relationship for a panel of 24 countries following the procedure offered by Banerjee and Carrion-i Silvestre (2017); Ditzen (2018). The results confirm the long-run relationship at the panel level, while offering inconsistent results for few countries in different specifications.



REFERENCES

- Adam, C. S. (1991, November). FINANCIAL INNOVATION AND THE DEMAND FOR £M3 IN THE UK 1975–86. *Oxford Bulletin of Economics and Statistics* 53(4), 401–424.
- Ahn, S. C. and A. R. Horenstein (2013). Eigenvalue Ratio Test for the Number of Factors. *Econometrica* 81(3), 1203–1227. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.3982/ECTA8968>.
- Akerlof, G. A. (1979). The Case against Conservative Macroeconomics: An Inaugural Lecture. *Economica* 46(183), 219–237. Publisher: [London School of Economics, Wiley, London School of Economics and Political Science, Suntory and Toyota International Centres for Economics and Related Disciplines].
- Akerlof, G. A. and R. D. Milbourne (1980, August). Irving Fisher on His Head II: The Consequences of the Timing of Payments for the Demand for Money*. *The Quarterly Journal of Economics* 95(1), 145–157.
- Artis, M. J. and M. K. Lewis (1976). The Demand for Money in the United Kingdom: 1963–1973. *The Manchester School* 44(2), 147–181.
- Baba, Y., D. F. Hendry, and R. M. Starr (1992, January). The Demand for M1 in the U.S.A., 1960–1988. *The Review of Economic Studies* 59(1), 25–61.
- Bai, J. and S. Ng (2002). Determining the Number of Factors in Approximate Factor Models. *Econometrica* 70(1), 191–221. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/1468-0262.00273>.
- Bailey, N., G. Kapetanios, and M. H. Pesaran (2016). Exponent of Cross-Sectional Dependence: Estimation and Inference. *Journal of Applied Econometrics* 31(6), 929–960. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/jae.2476>.

- Bailey, N., G. Kapetanios, and M. H. Pesaran (2019). Exponent of Cross-sectional Dependence for Residuals. *Sankhya B: The Indian Journal of Statistics* 81(1), 46–102. Publisher: Springer & Indian Statistical Institute.
- Ball, L. (2012, November). Short-run money demand. *Journal of Monetary Economics* 59(7), 622–633.
- Banerjee, A. and J. L. Carrion-i Silvestre (2017). Testing for Panel Cointegration Using Common Correlated Effects Estimators. *Journal of Time Series Analysis* 38(4), 610–636. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/jtsa.12234>.
- Barnett, W. A. (1980, September). Economic monetary aggregates an application of index number and aggregation theory. *Journal of Econometrics* 14(1), 11–48.
- Barro, R. J. and S. Fischer (1976, April). Recent developments in monetary theory. *Journal of Monetary Economics* 2(2), 133–167.
- Basci, S. and T. Gherbi (2020). Demand deficiency, money velocity and heterogeneity. *The Central European Review of Economics and Management (CEREM)* 4(2), 137–153. Publisher: Wroc law: WSB University in Wroc law.
- Baumol, W. J. (1952, November). The Transactions Demand for Cash: An Inventory Theoretic Approach. *The Quarterly Journal of Economics* 66(4), 545–556.
- Başçıl, E. (2023). Macroprudential policy and inflation. In *Reference Module in Social Sciences*. Elsevier.
- Benati, L., R. E. Lucas, J. P. Nicolini, and W. Weber (2021, January). International evidence on long-run money demand. *Journal of Monetary Economics* 117, 43–63.
- Berentsen, A., S. Huber, and A. Marchesiani (2015, June). Financial Innovations, Money Demand, and the Welfare Cost of Inflation. *Journal of Money, Credit and Banking* 47(S2), 223–261.
- Bersvendsen, T. and J. Ditzen (2021, March). Testing for slope heterogeneity in Stata. *The Stata Journal* 21(1), 51–80. Publisher: SAGE Publications.

- Blomquist, J. and J. Westerlund (2024). Testing slope homogeneity in large panels with serial correlation. *Economics Letters* 121(3), 374–378.
- Boorman, J. T. and T. M. Havrilesky (1972). *Money Supply, Money Demand, and Macroeconomic Models*. Allyn and Bacon.
- Borio, C., B. Hofmann, and E. Zakrajšek (2023, January). Does money growth help explain the recent inflation surge? *BIS Bulletins*. Number: 67 Publisher: Bank for International Settlements.
- Boswijk, H. P., P. H. Franses, and D. van Dijk (2010, September). Cointegration in a historical perspective. *Journal of Econometrics* 158(1), 156–159.
- Cagan, P. (1956). The Monetary Dynamics of Hyperinflation. In *Studies in the Quantity Theory of Money*, pp. 25–120. University of Chicago Press.
- Cantú, C., P. Cavallino, F. D. Fiore, and J. Yetman (2021, March). A global database on central banks’ monetary responses to Covid-19.
- Carr, J. and M. R. Darby (1981, January). The role of money supply shocks in the short-run demand for money. *Journal of Monetary Economics* 8(2), 183–199.
- Carr, J., M. R. Darby, and D. L. Thornton (1985, September). Monetary anticipations and the demand for money: Reply to MacKinnon and Milbourne. *Journal of Monetary Economics* 16(2), 251–257.
- Chen, P., Y. Karavias, and E. Tzavalis (2022, September). Panel unit-root tests with structural breaks. *The Stata Journal* 22(3), 664–678. Publisher: SAGE Publications.
- Chien, F., M. Sadiq, M. A. Nawaz, M. S. Hussain, T. D. Tran, and T. Le Thanh (2021, November). A step toward reducing air pollution in top Asian economies: The role of green energy, eco-innovation, and environmental taxes. *Journal of Environmental Management* 297, 113420.
- Choi, I. (2015, January). Panel Cointegration. In B. H. Baltagi (Ed.), *The Oxford Handbook of Panel Data*, pp. 0. Oxford University Press.

- Chow, G. C. (1966, April). On the Long-Run and Short-Run Demand for Money. *Journal of Political Economy* 74(2), 111–131. Publisher: The University of Chicago Press.
- Chudik, A., K. Mohaddes, M. H. Pesaran, and M. Raissi (2013, November). Debt, Inflation and Growth: Robust Estimation of Long-Run Effects in Dynamic Panel Data Models.
- Chudik, A., K. Mohaddes, M. H. Pesaran, and M. Raissi (2016, January). Long-Run Effects in Large Heterogeneous Panel Data Models with Cross-Sectionally Correlated Errors. In *Essays in Honor of man Ullah*, Volume 36 of *Advances in Econometrics*, pp. 85–135. Emerald Group Publishing Limited.
- Chudik, A. and H. Pesaran (2015a, January). Large Panel Data Models with Cross-Sectional Dependence: A Survey. In B. H. Baltagi (Ed.), *The Oxford Handbook of Panel Data*, pp. 0. Oxford University Press.
- Chudik, A. and M. H. Pesaran (2015b, October). Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors. *Journal of Econometrics* 188(2), 393–420.
- Chudik, A. and M. H. Pesaran (2019, February). Mean group estimation in presence of weakly cross-correlated estimators. *Economics Letters* 175, 101–105.
- Clower, R. W. and P. W. Howitt (1978, June). The Transactions Theory of the Demand for Money: A Reconsideration. *Journal of Political Economy* 86(3), 449–466. Publisher: The University of Chicago Press.
- Corker, R. (1990, June). Wealth, Financial Liberalization, and the Demand for Money in Japan. *Staff Papers* 37(2), 418–432.
- Cuthbertson, Keith, D. B. (1991). Money demand analysis: an outline. *Money and financial markets*.
- Cuthbertson, K. (1988). The demand for M 1: a forward looking buffer stock model. *Oxford Economic Papers* 40(1), 110–131.

- Cuthbertson, K. and M. P. Taylor (1987). Buffer-Stock Money: An Appraisal. In C. Goodhart, D. Currie, and D. T. Llewellyn (Eds.), *The Operation and Regulation of Financial Markets*, pp. 103–124. London: Palgrave Macmillan UK.
- Darrat, A. F. and M. Osman Suliman (1994, May). Volatility of money growth and the U.S. velocity puzzle: Some further results. *Journal of Economics and Business* 46(2), 77–88.
- Davidson, J. and J. Ireland (1987, August). Buffer Stock Models of the Monetary Sector. *National Institute Economic Review* 121, 67–71.
- Ditzen, J. (2018, September). Estimating Dynamic Common-Correlated Effects in Stata. *The Stata Journal* 18(3), 585–617. Publisher: SAGE Publications.
- Ditzen, J. (2019, March). Estimating long run effects in models with cross-sectional dependence using xtdcce2. *CEERP Working Paper Series*. Number: 007 Publisher: Centre for Energy Economics Research and Policy, Heriot-Watt University.
- Ditzen, J. (2021a, September). Estimating long-run effects and the exponent of cross-sectional dependence: An update to xtdcce2. *The Stata Journal* 21(3), 687–707. Publisher: SAGE Publications.
- Ditzen, J. (2021b). Panel-data models with large N and large T: An overview. In *Economics virtual symposium*. Issue: 2.
- Ditzen, J. (2023a). XTCD2: Stata module to test for weak cross sectional dependence. Publisher: Boston College Department of Economics.
- Ditzen, J. (2023b). XTCSE2: Stata module to estimate the exponent of cross-sectional dependence in large panels. Publisher: Boston College Department of Economics.
- Ditzen, J., Y. Karavias, and J. Westerlund (2021). Testing for multiple structural breaks in panel data. *arXiv preprint arXiv:2110.14550 v2 [econ. EM]*.
- Ditzen, J. and S. Reese (2023, June). xtnumfac: A battery of estimators for the number of common factors in time series and panel-data models. *The Stata Journal* 23(2), 438–454. Publisher: SAGE Publications.

- Eberhardt, M. (2013). XTMG: Stata module to estimate panel time series models with heterogeneous slopes. Publisher: Boston College Department of Economics.
- Engle, R. F. and C. W. J. Granger (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica* 55(2), 251–276. Publisher: [Wiley, Econometric Society].
- Enzler, J., L. Johnson, and J. Paulus (1976). Some Problems of Money Demand. *Brookings Papers on Economic Activity* 1976(1), 261–280. Publisher: Brookings Institution Press.
- Fase, M. M. G. (1994, November). In search for stability: An empirical appraisal of the demand for money in the G7 and EC countries. *De Economist* 142(4), 421–454.
- Fisher, D. and A. Serletis (1989, June). Velocity and the growth of money in the United States, 1970–1985. *Journal of Macroeconomics* 11(3), 323–332.
- Fisher, I. (1911). *The Purchasing Power of Money ...* Macmillan. Google-Books-ID: YjcuAAAAYAAJ.
- Fisher, L. (1975, May). Using Modern Portfolio Theory to Maintain an Efficiently Diversified Portfolio. *Financial Analysts Journal*. Publisher: Routledge.
- Friedman, M. (1956). The Quantity Theory of Money: A Restatement. In *Studies in the Quantity Theory of Money*, pp. 3–21. University of Chicago Press.
- Friedman, M. (1957). Theory of the Consumption Function. In *Theory of the Consumption Function*. Princeton University Press.
- Friedman, M. (1959, August). The Demand for Money: Some Theoretical and Empirical Results. *Journal of Political Economy* 67(4), 327–351. Publisher: The University of Chicago Press.
- Friedman, M. (1966, October). Interest Rates and the Demand for Money. *The Journal of Law and Economics* 9, 71–85. Publisher: The University of Chicago Press.

- Friedman, M. (1970, March). A Theoretical Framework for Monetary Analysis. *Journal of Political Economy*. Publisher: The University of Chicago Press.
- Friedman, M. (1977). Time Perspective in Demand for Money. *The Scandinavian Journal of Economics* 79(4), 397–416. Publisher: [Wiley, The Scandinavian Journal of Economics].
- Friedman, M. (1983). Monetary Variability: United States and Japan: Note. *Journal of Money, Credit and Banking* 15(3), 339–343. Publisher: [Wiley, Ohio State University Press].
- Friedman, M. and A. J. Schwartz (1963). *A Monetary History of the United States, 1867-1960*. Princeton University Press. Google-Books-ID: Q7J_EUM3RfoC.
- Gagliardini, P., E. Ossola, and O. Scaillet (2019, October). A diagnostic criterion for approximate factor structure. *Journal of Econometrics* 212(2), 503–521.
- Gambacorta, L. and H. S. Shin (2018, July). Why bank capital matters for monetary policy. *Journal of Financial Intermediation* 35, 17–29.
- Garcia, G. and S. Pak (1979). Some Clues in the Case of the Missing Money. *The American Economic Review* 69(2), 330–334. Publisher: American Economic Association.
- Garcia Revelo, J. D., Y. Lucotte, and F. Pradines-Jobet (2020, November). Macropprudential and monetary policies: The need to dance the Tango in harmony. *Journal of International Money and Finance* 108, 102156.
- Ghosh, A. (1964, June). The Sayers-Radcliffe Thesis Compared with the Gurley-Shaw Thesis. *The Indian Economic Journal*. Publisher: SAGE PublicationsSage India: New Delhi, India.
- Goldfeld, S. M. (1989). Demand for Money: Empirical Studies. *Money*, 131–143.
- Goldfeld, S. M., J. Duesenberry, and W. Poole (1973). The Demand for Money Revisited. *Brookings Papers on Economic Activity* 1973(3), 577–646. Publisher: Brookings Institution Press.

- Goldfeld, S. M., D. I. Fand, and W. C. Brainard (1976). The Case of the Missing Money. *Brookings Papers on Economic Activity* 1976(3), 683–739. Publisher: Brookings Institution Press.
- Goldfeld, S. M. and D. E. Sichel (1990, January). Chapter 8 The demand for money. In *Handbook of Monetary Economics*, Volume 1, pp. 299–356. Elsevier.
- Granger, C. W. J. (1981, May). Some properties of time series data and their use in econometric model specification. *Journal of Econometrics* 16(1), 121–130.
- Gregory, A. W. and B. E. Hansen (1996, January). Residual-based tests for cointegration in models with regime shifts. *Journal of Econometrics* 70(1), 99–126.
- Gropp, R., T. Mosk, S. Ongena, and C. Wix (2019, January). Banks Response to Higher Capital Requirements: Evidence from a Quasi-Natural Experiment. *The Review of Financial Studies* 32(1), 266–299.
- Gurley, J. and E. Shaw (1960). *Money in Theory of Finance*. Washington DC.: Brookings.
- Gurley, J. G. (1960). The Radcliffe Report and Evidence. *The American Economic Review* 50(4), 672–700. Publisher: American Economic Association.
- Gurley, J. G. and E. S. Shaw (1955). Financial Aspects of Economic Development. *The American Economic Review* 45(4), 515–538. Publisher: American Economic Association.
- Gurley, J. G. and E. S. Shaw (1956, May). Financial Intermediaries and the Saving-Investment Process. *The Journal of Finance* 11(2), 257.
- Gurley, J. G. and E. S. Shaw (1957). The Growth of Debt and Money in the United States, 1800-1950: A Suggested Interpretation. *The Review of Economics and Statistics* 39(3), 250–262.
- Hall, T. E. and N. R. Noble (1987). Velocity and the Variability of Money Growth: Evidence from Granger-Causality Tests: Note. *Journal of Money, Credit and Banking* 19(1), 112–116. Publisher: [Wiley, Ohio State University Press].

- Hamburger, M. J. (1977, July). Behavior of the money stock: Is there a puzzle? *Journal of Monetary Economics* 3(3), 265–288.
- Hendry, D. F. and N. R. Ericsson (1991, May). Modeling the demand for narrow money in the United Kingdom and the United States. *European Economic Review* 35(4), 833–881.
- Humphrey, T. M. (1997). Fisher and Wicksell on the Quantity Theory.
- Im, K. S., M. Pesaran, and Y. Shin (2003, July). Testing for unit roots in heterogeneous panels. *Journal of Econometrics* 115(1), 53–74.
- International Monetary Fund (2021). Financial development index database.
- Ireland, P. N. (1994, May). Economic growth, financial evolution, and the long-run behavior of velocity. *Journal of Economic Dynamics and Control* 18(3), 815–848.
- Jace, C. (2019, December). An economic theory of economic analysis: the case of the School of Salamanca. *Public Choice* 181(3-4), 375–397.
- Johansen, S. (1988, June). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control* 12(2), 231–254.
- Johansen, S. and K. Juselius (1990). Maximum Likelihood Estimation and Inference on Cointegration — with Applications to the Demand for Money. *Oxford Bulletin of Economics and Statistics* 52(2), 169–210. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1468-0084.1990.mp52002003.x>.
- Jonson, P. D. (1976, April). Money, Prices and Output. *Credit and Capital Markets – Kredit und Kapital* (4), 499–518.
- Jonung, L. (1979). The Long-Run Demand for Money — A Wicksellian Approach. In S. Strøm and B. Thalberg (Eds.), *The Theoretical Contributions of Knut Wicksell*, pp. 88–102. London: Palgrave Macmillan UK.
- Jonung, L. (2017, October). *Demand for Money: An Analysis of the Long-run Behavior of the Velocity of Circulation*. New York: Routledge.

- Judd, J. P. and J. L. Scadding (1982). The Search for a Stable Money Demand Function: A Survey of the Post-1973 Literature. *Journal of Economic Literature* 20(3), 993–1023. Publisher: American Economic Association.
- Juodis, A., H. Karabiyik, and J. Westerlund (2021, February). On the robustness of the pooled CCE estimator. *Journal of Econometrics* 220(2), 325–348.
- Juodis, A. and S. Reese (2022). The Incidental Parameters Problem in Testing for Remaining Cross-Section Correlation. *Journal of Business & Economic Statistics* 40(3), 1191–1203. Publisher: Taylor & Francis Journals.
- Kao, C. (1999, May). Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics* 90(1), 1–44.
- Keynes, J. M. (1930). *A Treatise on Money*. Harcourt, Brace. Google-Books-ID: qAq8AAAAIAAJ.
- Keynes, J. M. (1937, February). The General Theory of Employment. *The Quarterly Journal of Economics* 51(2), 209–223.
- Knell, M. and H. Stix (2006, April). Three decades of money demand studies: differences and similarities. *Applied Economics* 38(7), 805–818. Publisher: Routledge. eprint: <https://doi.org/10.1080/00036840600569377>.
- Koch, C. and D. Noureldin (2023, March). How We Missed the Recent Inflation Surge. *Finance and Development. International Monetary Fund, Washington D.C* (21-23).
- Kole, L. S. and E. E. Meade (1995). German Monetary Targeting: A Retrospective View. *Federal Reserve Bulletin* 81, 917.
- Krishnamurthy, A. and W. Li (2023, April). The Demand for Money, Near-Money, and Treasury Bonds. *The Review of Financial Studies* 36(5), 2091–2130.
- Laidler, D. (1966, December). The Rate of Interest and the Demand for Money—Some Empirical Evidence. *Journal of Political Economy* 74(6), 543–555. Publisher: The University of Chicago Press.

- Laidler, D. (1984, December). The 'Buffer Stock Notion in Monetary Economics. *The Economic Journal* 94(Supplement), 17–34.
- Laidler, D. E. W. (1982). *Monetarist Perspectives*. Harvard University Press.
- Leijonhufvud, A. (1967). Keynes and the Keynesians: A Suggested Interpretation. *The American Economic Review* 57(2), 401–410. Publisher: American Economic Association.
- Lerner, A. P. (1962). Review of Money in a Theory of Finance. *Journal of the American Statistical Association* 57(299), 704–709. Publisher: [American Statistical Association, Taylor & Francis, Ltd.].
- Levin, A., C.-F. Lin, and C.-S. James Chu (1992, May). Unit root tests in panel data: asymptotic and finite-sample properties. *Discussion Paper*, 92–93.
- Levin, A., C.-F. Lin, and C.-S. James Chu (2002, May). Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of Econometrics* 108(1), 1–24.
- Lewandowski, P. (2007, October). PESCADF: Stata module to perform Pesaran's CADF panel unit root test in presence of cross section dependence. *Statistical Software Components*.
- Lucas, R. E. (1976, January). Econometric policy evaluation: A critique. *Carnegie-Rochester Conference Series on Public Policy* 1, 19–46.
- Lucas, R. E. (1988, January). Money demand in the United States: A quantitative review. *Carnegie-Rochester Conference Series on Public Policy* 29, 137–167.
- Lucas, R. E. and J. P. Nicolini (2015, July). On the stability of money demand. *Journal of Monetary Economics* 73, 48–65.
- Lütkepohl, H. (1993, December). The sources of the U.S. money demand instability. *Empirical Economics* 18(4), 729–743.
- Marshall, A. (1923). *Money, Credit & Commerce*. A.M. Kelley, Bookseller. Google-Books-ID: ogRXAAAAYAAJ.

- Marty, A. L. (1961). Gurley and Shaw on Money in a Theory of Finance. *Journal of Political Economy* 69(1), 56–62.
- Mascaro, A. and A. H. Meltzer (1983, November). Long- and short-term interest rates in a risky world. *Journal of Monetary Economics* 12(4), 485–518.
- Mehra, Y. P. (1993). The Stability of the M2 Demand Function: Evidence from an Error-Correction Model. *Journal of Money, Credit and Banking* 25(3), 455–460. Publisher: [Wiley, Ohio State University Press].
- Meltzer, A. H. (1963a, August). The Demand for Money: A Cross-Section Study of Business Firms*. *The Quarterly Journal of Economics* 77(3), 405–422.
- Meltzer, A. H. (1963b, June). The Demand for Money: The Evidence from the Time Series. *Journal of Political Economy* 71(3), 219–246.
- Milbourne, R. (1988). Disequilibrium Buffer Stock Models: A Survey. *Journal of Economic Surveys* 2(3), 187–208. eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1467-6419.1988.tb00044.x>.
- Miller, M. H. and D. Orr (1966, August). A Model of the Demand for Money by Firms. *The Quarterly Journal of Economics* 80(3), 413.
- Minsky, H. P. (1961). Review of Money in a Theory of Finance. *The Journal of Finance* 16(1), 138–140. Publisher: [American Finance Association, Wiley].
- Mizen, P. (1994). A Review of Buffer Stock Money Models. In P. Mizen (Ed.), *Buffer Stock Models and the Demand for Money*, pp. 25–59. London: Macmillan Education UK.
- Mogliani, M. and G. Urga (2018, October). On the Instability of Long-Run Money Demand and the Welfare Cost of Inflation in the United States. *Journal of Money, Credit and Banking* 50(7), 1645–1660.
- Muscattelli, V. A. (1988). Alternative Models of Buffer Stock Money: An Empirical Investigation. *Scottish Journal of Political Economy* 35(1), 1–21.

- Onatski, A. (2010, November). Determining the Number of Factors from Empirical Distribution of Eigenvalues. *The Review of Economics and Statistics* 92(4), 1004–1016.
- Ozmen, E. (1996). The Demand for Money Instability: Notes on the Empirical Literature. *ODTÜ Gelişme Dergisi* 23(2), 271–292.
- Patinkin, D. (1961). Financial Intermediaries and the Logical Structure of Monetary Theory: A Review. *The American Economic Review* 51(1), 95–116. Publisher: American Economic Association.
- Patinkin, D. (1965). Money, interest, and prices: an integration of monetary and value theory.
- Payne, J. E. (1992, January). Velocity and money growth variability: Some further evidence. *International Review of Economics & Finance* 1(2), 189–194.
- Pedroni, P. (1999, November). Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. *Oxford Bulletin of Economics and Statistics* 61(s1), 653–670.
- Pedroni, P. (2004, June). Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric Theory* 20(03).
- Pedroni, P. (2019). Panel cointegration techniques and open challenges. In *Panel data econometrics*, pp. 251–287. Elsevier.
- Perron, P. (1989). The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis. *Econometrica* 57(6), 1361–1401. Publisher: [Wiley, Econometric Society].
- Pesaran, H. and T. Yamagata (2008, January). Testing slope homogeneity in large panels. *Journal of Econometrics* 142(1), 50–93.
- Pesaran, M. and R. Smith (1995, July). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics* 68(1), 79–113.

- Pesaran, M. H. (2004, June). General Diagnostic Tests for Cross Section Dependence in Panels. Publisher: Faculty of Economics.
- Pesaran, M. H. (2006, July). Estimation and Inference in Large Heterogeneous Panels with a Multifactor Error Structure. *Econometrica* 74(4), 967–1012.
- Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics* 22(2), 265–312. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/jae.951>.
- Pesaran, M. H. (2015, May). Testing Weak Cross-Sectional Dependence in Large Panels. *Econometric Reviews* 34(6-10), 1089–1117. Publisher: Taylor & Francis _eprint: <https://doi.org/10.1080/07474938.2014.956623>.
- Pesaran, M. H. (2021, January). General diagnostic tests for cross-sectional dependence in panels. *Empirical Economics* 60(1), 13–50.
- Pesaran, M. H., Y. Shin, and R. P. Smith (1999, June). Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association* 94(446), 621–634.
- Pigou, A. C. (1917, November). The Value of Money. *The Quarterly Journal of Economics* 32(1), 38–65.
- Poole, W. (1970, May). Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model. *The Quarterly Journal of Economics* 84(2), 197.
- Sangiacomo, M. (2018, November). XTCIPS: Stata module to compute Pesaran Panel Unit Root Test in the Presence of Cross-section Dependence. *Statistical Software Components*. Publisher: Boston College Department of Economics.
- Santomero, A. M. and J. J. Seater (1981). Partial Adjustment in the Demand for Money: Theory and Empirics. *The American Economic Review* 71(4), 566–578. Publisher: American Economic Association.

- Santoni, G. J. (1987). The great bull markets 1924-29 and 1982-87: speculative bubbles or economic fundamentals? *Review* (Nov), 16–30. Publisher: Federal Reserve Bank of St. Louis.
- Saqib, N., I. Ozturk, M. Usman, A. Sharif, and A. Razzaq (2023, April). Pollution Haven or Halo? How European countries leverage FDI, energy, and human capital to alleviate their ecological footprint. *Gondwana Research* 116, 136–148.
- Schnabel, I. (2023). Money and inflation. In *Lecture at the annual conference of the Verein fur Socialpolitic, Regensburg*.
- Selden, R. T. (1956). Monetary Velocity In The United States. In *Studies in the Quantity Theory of Money*, pp. 163–178. University of Chicago Press.
- Shen, Y., Z.-W. Su, M. Y. Malik, M. Umar, Z. Khan, and M. Khan (2021, February). Does green investment, financial development and natural resources rent limit carbon emissions? A provincial panel analysis of China. *Science of The Total Environment* 755, 142538.
- Simpson, T. and R. Porter (1980). Some issues involving the definition and interpretation of the monetary aggregates. *Federal Reserve Bank of Boston Conference Series* 23, 161–234.
- Sriram, M. S. S. (1999, May). *Survey of Literature on Demand for Money: Theoretical and Empirical Work with Special Reference to Error-Correction Models*. International Monetary Fund. Google-Books-ID: PFQYEAAAQBAJ.
- Tinsley, P. A., B. Garrett, and M. Friar (1981, January). An exposé of disguised deposits. *Journal of Econometrics* 15(1), 117–137.
- Tobin, J. (1956, August). The Interest-Elasticity of Transactions Demand For Cash. *The Review of Economics and Statistics* 38(3), 241.
- Tobin, J. (1958, February). Liquidity Preference as Behavior Towards Risk¹. *The Review of Economic Studies* 25(2), 65–86.

- Westerlund, J. (2007). Testing for Error Correction in Panel Data*. *Oxford Bulletin of Economics and Statistics* 69(6), 709–748. _eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1468-0084.2007.00477.x>.
- Westerlund, J. and D. L. Edgerton (2007, December). A panel bootstrap cointegration test. *Economics Letters* 97(3), 185–190.
- Whalen, E. L. (1966, May). A Rationalization of the Precautionary Demand for Cash*. *The Quarterly Journal of Economics* 80(2), 314–324.
- Wicksell, K. (1898). *Interest and Prices*. Ludwig von Mises Institute. Google-Books-ID: 2_gvXMkULEC.
- Wicksell, K. (1901). *Lectures on Political Economy: Volume II: Money*. Augustus M. Kelley. Google-Books-ID: F2lfwQEACAAJ.
- Woodford, M. and C. E. Walsh (2005). Interest and prices: Foundations of a theory of monetary policy. *Macroeconomic Dynamics* 9(3), 462–468. Publisher: Cambridge University Press.
- Xie, Y. and M. H. Pesaran (2022, August). A Bias-Corrected Cd Test for Error Cross-Sectional Dependence in Panel Data Models with Latent Factors.
- Xingyun, P. (2015). Demand for Money. In *Financial Theory*, pp. 359–382. WORLD CENTURY PUBLISHING CORPORATION.