

# Today's Credit Market – How to Avoid a House of Cards?

## Austrian Full Reserves and the Chicago Plan as Alternatives to the Current Fractional Reserves



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Thesis 15 hp

Economics | Autumn 2017

## **Abstract**

Today's household debt consists for the most part of credit money, and this general phenomenon does not only occur in Sweden. Money in the economy is mostly created by private banks, as much as 97 percent of the money in the United States, while central banks only create a very small share of all money. This is the reason for the oppressed household debt. During this period of high debt in Sweden, the household consumption has also increased in comparison to earlier years. The aim is to study and compare how the money supply in two different full-reserve systems, the Austrian through convertibility and the Chicago plan through quantity control, would reduce the household debt in relation to today's fractional system.

The method used in this study is a time series analysis where data of Sweden's household debt, savings, money supply; M1 and M3, GDP, assets, currency reserves, gold reserves and interest rates has been collected for the years 2005-2013. These are further examined in three different equations. The data for all the variables was collected from SCB, IMF, Ekonomifakta and the World Data Bank. The first theory that is used in this study is Wicksell's cumulative process which will explain how the money supply M3 affects household debt in today's fractional reserve system. The second theory is the Austrian Business Cycle Theory which will examine the money supply M1 effect on household debt through full reserves by convertibility control. The third theory is the Friedman rule, where the effect of household debt by money supply M1 will be examined. This rule explains how the Chicago Plan is affecting household debt through a full reserve system by quantity control.

In the both systems, fractional reserves and full reserves, the debt will increase in this study. The result shows that with full reserves, the household debt would be backed by savings in comparison to fractional reserves, where household debt would be backed by credit money. Therefore, full reserves would contribute to a healthier economy in contrast to today's fractional system. Since it would involve a large cost for Sweden to transcend to an Austrian system through convertibility, where price inertia would occur as well, the conclusion of this study is that the Chicago Plan, based on the quantity principle, is to prefer.

**Keywords:** Full reserves, Austrian business cycle theory, the Chicago Plan, Household debt, Convertibility principle, Quantity principle

## **Sammanfattning**

Största delen av hushållens skuldsättning består idag av kreditpengar, och detta generella fenomen finns inte bara i Sverige. Pengarna i ekonomin är för det mesta skapade av affärsbankerna, så mycket som 97 procent i USA, medan centralbanken endast skapar en liten del av dessa pengar. Detta är anledningen till de höga hushållsskulderna. Under den här perioden av hög skuldsättning i Sverige så har även hushållens konsumtion ökat i förhållande till tidigare år. Syftet med denna studie är att jämföra hur penningmängden i två olika hundraprocentiga reservsystem, den österrikiska konjunkturcykeln, genom konvertibilitet, och Chicago planen, genom kvantitetskontroll, skulle reducera hushållens skulder i relation till dagens bråkdelsreservsystem.

Metoden som används i denna studie är en tidsserieanalys där data från hushållens skulder, sparande, penningmängd; M1 och M3, BNP, tillgångar, guldreserver, valutareserver och repo räntan har samlats in under åren 2005-2013. Dessa variabler är studerade i tre olika ekvationer och all data har samlats in från SCB; IMF, Ekonomifakta och the World Data Bank. Den första teorin som används är Wicksells kumulativa process som beskriver hur penningmängden M3 påverkar hushållens skulder i dagens bråkdelsreservsystem. Den andra teorin är den österrikiska konjunkturcykel teorin och kommer att undersöka penningmängden M1 effekt på hushållens skulder med ett hundraprocentigt reservsystem med konvertibilitetskontroll. Den tredje teorin är Friedmans regel, där effekten på hushållens skulder kommer att bli undersökt med hjälp av penningmängden M1. Denna regel förklarar hur Chicagoplanen påverkar hushållens skulder via ett hundraprocentigt reservsystem med kvantitetskontroll.

Hushållens skuldsättning ökade i samtliga regressioner och resultaten visar att med hundraprocentiga reserver så skulle hushållens skulder vara backade med sparande, jämfört med bråkdelsreserver, där hushållens skulder skulle vara backade med krediter. Därför skulle hundraprocentiga reserver bidra till en mer välmående ekonomi. Eftersom det skulle tillkomma höga kostnader att övergå till ett österrikiskt system med konvertibilitet, så är slutsatsen av denna studie att istället implementera Chicagoplanen baserad på kvantitetsprincipen.

**Nyckelord:** Hundraprocentiga reserver, Österrikisk konjunkturcykelteori, Chicagoplanen, Hushållens skuldsättning, Konvertibilitet, Kvantitetskontroll

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## 1. Introduction

*“In the real world banks extend credit, creating deposits in the process, and look for the reserves later” (Holmes, 1969, p.73).*

The households' debt in Sweden has increased since the middle of the 90s, according to Santen and Ölcer (2016). They state that the latest report shows that the households' debt has increased faster than the households' income. Santen and Ölcer states that during the last twelve months the debt ratio has increased by 5 percentage units to 343 percent, and almost 50 percent of the household does not decrease their mortgage debt which could lead to financial instability.

Fontana and Sawyer (2016) argue that the household debt consists of credit money and this general phenomenon does not only occur in Sweden. They point out that today money is mostly created by private banks, as much as 97 percent of the money in the United States, while central banks only create a very small share of all money. Jackson and Dyson (2012) stresses that this allowance of creating money affects us all and is the reason we have such a destructive and pronounced cycle of boom and bust, and it is the reason that individuals, businesses and governments are overburden with debt.

Wicksell (1906) wrote about his pure credit economy, since there were banks who granted credits, and that bills of exchange released the money from the gold. He criticized the gold standard, especially when it was restored during the middle war period. According to Wicksell, bills of exchange increases virtual velocity, while credit is a remedy to lack of money. He states that gold is not necessary for settling international payments, when bills of exchange exist since the use of credit money rather than commodity money is preferred. Furthermore, Wicksell argues that there is a demand for settlement of bills of exchange and also that gold can easily be replaced by credit since the gold is unnecessary. Finally, Wicksell's pure credit economy laid ground for endogenous money that was further developed by Moore (1988).

Moore argues that the money stock is endogenous and not exogenous as the conventional view says, thus, that developed monetary systems are essentially endogenously based. He states that when there is an increase in the total quantity of bank earning assets banks assets

and liabilities both expands. Moore explains that the assets of the bank are predominantly bank loans and as a result of this changes in monetary aggregates could empirically be explained by the changes in total bank loans. This leads to the conclusion that loans make deposits, according to Moore. In addition, he argues that increases in bank loans are not made by the banks, but rather at the initiative of bank borrowers themselves.

Moore (1988) states that implied by the monetary endogeneity, central banks do not exogenously determine the quantity of credit money in existence, but rather the short-term interest rate, that is the price at which it is supplied. He stresses that market forces endogenously determine the monetary supply. Loans make deposits rather than the reverse, meaning that credit money is credit driven and also that the supply of credit money is demand determined, according to Moore. His central argument for the endogeneity of credit money is that banks are quantity takers and price setters in both their deposit markets and their retail loan. Moore argues that as a result of this, both deposits and loans are demand determined.

Moore (1983) stresses that central banks must stand ready to perform the role of lender of last resort to ensure the ultimate liquidity of financial assets and so the viability of the financial system. He points out that the central institution in the liquidity-creating process is the commercial banking system. As a result of this, Moore concludes, that the most basic obligation of all monetary authorities is to support, maintain, and encourage orderly conditions in financial markets generally, and in the commercial banking system in particular. He argues that the central bank must somehow ensure that the required reserves are available at the settlement date once deposits have been created by an act of lending.

## **1.1 Background**

Endogenous money exists with fractional reserves, and this is the monetary system that we have today. Fontana and Sawyer (2016) states that today, household debt consists of credit money and the granting of credit today creates almost all of the money in the economy. Santen and Ölcer (2016) argue that the household debt in Sweden has increased since the middle of the 90s and since the grant of credit almost creates all the money in the economy today we could conclude that there is a correlation between household debt and money supply. This is an important correlation and today we have a broader money supply, which

include credit money, and in graph one and three we could observe that the household debt and the money supply M3 has increased rapidly since 2005.

Leijonhufvud (2000) describes the transition from a convertibility system to a quantity control system that we have today. The quantity control system can explain why the household debt has increased and that almost all of the money that is created today is granted by credits. Leijonhufvud discusses what kind of monetary constitution we ought to strive for. He argues that the proposals that recent debates has brought up are to either adopt a Friedman rule fixing the growth rate of some monetary aggregate or to return to the gold standard. Leijonhufvud points out that the best way to accomplish a price-level control is by the two examples, mentioned above, of constitutions built on the basis of contrasting conceptions. He refers to these as the quantity principle and the convertibility principle.

The quantity principle usually referred as the “quantity of money” aims through control of some monetary aggregate at control of the price level, according to Leijonhufvud. He argues that this system requires central banking and would in its logically tidiest form be on pure fiat standard. Leijonhufvud states that it is not a system and therefore you would leave that in private profit-motivated hands. He points out that this virtually implies government control of the banking system and that we may say that the private sector decides the level of prices after the government sets the quantity of money.

Leijonhufvud stresses that the convertibility principle, in contrast, lets the private non-bank sector decide the quantity of paper money and bank deposits it desires to hold but requires the government to set the legal price of a commodity such as gold. He argues that the commodity would be more cheaply obtained at the banks if over issuing of bank monetary liabilities were to raise the market price of the standard commodity above the legal conversion rate. Leijonhufvud points out that the over issuance would be eliminated by redemptions of bank money. He argues that to protect the economy from inflation the non-bank public, rather than the government, polices the banking system.

Dittmer (2014) points out that the purpose with full-reserve banking system is that the state has control over the money supply i.e. the quantity of money in an economy. He stresses that today the majority of most money supply in capitalist economies is bank money which is



created by commercial banks when lending as a new deposit for the borrower and a new liability of the bank. Therefore, Dittmer argues that, when loans are repaid, bank money is extinguished which means that under full-reserve banking it is only the state that would have the ability to create and destroy money through monetary authorities such as the central bank. He states that in an economy today with no full reserve banking, the banks have the largest share of the quantity of the money which is created by the commercial banks when businesses and people lend money. When the banks grant credit they create money by creating their own deposit, according to Dittmer. Therefore, he argues that if a new deposit occurs for the borrower, a new liability occurs for the bank. Dittmer stresses that with the full-reserve banking system, the banks cannot create new money in the form of bank deposits. Lainà (2015) points out that when an economy is in steady state, full-reserve banking can put up a zero-growth economy and create both full employment and zero inflation. He argues that with full reserves, the household debt would decrease, since the banks cannot create money in this case. There are full reserves both with convertibility, the Austrian, and with quantity control, the Chicago Plan.

A quantity control monetary regime could be combined with full reserves, to prevent money creation through credit under fractional reserves, and thereby giving the central bank total control of the quantity of money. Benes and Kumhof (2012) describe how the Chicago Plan, proposed by Irving Fisher and Henry Simons during the Great Depression, would pass the total control of the quantity of money over to the central bank, since full reserves give them monopoly of money creation.

Huerta de Soto (1998) on the other hand, explains the Austrian full reserve system, including the gold standard, which is based on the convertibility principle. He states that the Austrian full reserve system, including the gold standard, implies that the commercial banks would have to be ready for the immediate withdrawal on demand by requiring keeping the full amount of each depositor's funds in cash because the lack of credit money and since the money supply consists of the gold reserve. Huerta de Soto argues that in this banking system the bank earns revenues when a check is withdrawn and from service fees to keep the reserves safe. He points out that the gold standard implies that one country's currency equals a certain amount of gold. Huerta de Soto stresses that this requires that the central bank has a gold reserve that is in a certain relation to the amount of banknotes. He states that in 1609 the bank of Amsterdam was founded on the principle of the 100 percent cash reserve, but in the 1780s

the bank of Amsterdam began to systematically violate the founding legal principles and their reputation all over the world started to collapse. Although, it led to a failure, the bank of Amsterdam succeeded to maintain the 100 percent cash reserve system for a very long time, according to Huerta de Soto.

## 1.2 Scope of the study

The aim of this study is to compare how two different full-reserve systems, the Austrian through convertibility and the Chicago plan through quantity control, would reduce the household debt in relation to today's system.

## 1.3 Methodology

This study is based on a statistical method with quantitative secondary data which has been collected from Statistiska Centralbyrån (SCB), International Monetary Fund (IMF) and Ekonomifakta. To be able to answer the research question of the study we need to quantify the variables and therefore Ordinary Least Square (OLS) has been applied as a method. The OLS will contain a time series analysis consisting of the years 2005 to 2013. The time period has been selected because, according to Studenmund (2017), more observations gives a more reliable result compared to if the study would have contained fewer observations. The time period for the money supply has been selected since the measure of the money supply changed before this time period.

There was no missing object in this research and Studenmund stresses that this gives this study a more reliable result. The study includes one major financial crisis which will show an abnormal pattern. The Austrian business cycle theory explains the financial crisis well, since it was caused by the credit expansion, which would not have occurred with full reserves.

The variables that will be studied in the first model are household debt, household savings through GDP, the foreign currency reserve through total assets of the Swedish central bank and the money supply M1 through GDP. The money supply M0 contains banknotes and coins and does not include reserves or savings, and therefore M1 will be applied. White (2012) argues that not every country can afford to transcend back to the gold standard since their amount of gold are too small which makes it too expensive since central banks all over the world have gone rid of the gold since they left the gold standard. He divides M1 by the gold

reserves in order to see how expensive it would be to transcend back to the gold standard. According to White's calculation, M1 could be applied for full reserves generally in this study, since convertibility on the current M1-level require gold reserves of that size. If we apply this calculation to Sweden's measures, by using data from the Swedish central bank's balance sheet, (appendix 2) we could conclude that it would be too expensive for Sweden to transcend back to the gold standard by using gold as commodity. White concludes that this is also the case for many countries, such as the United States, since after leaving the gold standard most of these countries got rid of the gold in their reserves. He states that if you are the first on your block to go shopping with gold coins or a gold-denominated debit card, you will find few stores ready to accept payments in gold. Therefore, if Sweden were heading back towards a gold standard, the foreign currency reserves would have to function as commodity or base money.

The second model also treats the household debt as the dependent variable and contains of the control variables household savings through GDP, the central banks total assets, the money supply M1 through GDP and the interest rate. If the Chicago plan were to be implemented the central bank would have monopoly of creating money and therefore total assets are applied since when the central bank creates money they increase their assets. The money supply M1 contains of coins and banknotes + savings account.

The independent variables of the third model are savings through GDP, the central banks total asset, the money supply M3 and the interest rate. M3 measures the money supply in today's credit economies with fractional reserves; credit money created by the commercial banks. Model one and two will show the impact on household debt if we were to transcend to a full reserve system. The third model shows the impact on household debt with the todays fractional reserve system. The three different models will also show how the different money supplies affect the household debt.

## **2. Literature review**

Jordà et al. (2015) states that the real estate lending has grown strongly in the 20<sup>th</sup> century and now accounts for the dominant share of bank lending in many countries; the sensitivity of mortgage lending and house prices to changes in monetary conditions has also increased substantially. He points out that a key implication of this result is that central banks cannot

pursue macroeconomic stabilization policy without being mindful of the consequences for credit markets and financial stability. Jordà argues that this is causal for mortgage and house price booms because these two are predictive of future financial crises.

Ekici and Dunn (2010) stresses that credit card debt has become a major financing instrument for household consumption in the last two decades. They point out that credit card debt has risen faster than household disposable income, raising concern among policymakers. Increased borrowing on credit cards to finance consumption is usually seen as a stimulating factor for the economy. However, there is a concern that high levels of debt may curtail spending in the future and hence ultimately slow the economic growth, according to Ekici and Dunn. Their previous results have shown a positive relation between credit card debt and consumption but in this study, there is a negative relation.

Dynan (2012) states that many households did borrow large quantities during the credit boom, which led to high levels of debt relative to their assets. He points out that with full reserves these bank loans would not exist. This shows during the past years that US households have made limited progress in reducing leverage over the past few years, according to Dynan. He also studies if a household's consumption is only a function of its own net worth, or if debt affects consumption too, and that it takes many years for some households to reduce its leverage. Dynan points out that there are some financial institutions that do not want to lend money to high leveraged households; in this case it means to finance the household's consumption. He stresses that this means that the households cannot consume as much because it is highly leveraged. Dynan's result showed that when households have a larger debt than before, as it was for many households during the financial crisis of 2008-2009, we consume fewer goods. He suggests a negative correlation between household debt and consumption. It is still difficult to estimate if the consumption would decrease when the household debt increases, if we're not in a credit boom, according to Dynan.

Crouch (2012) is comparing and studying the difference between Anglo-American economies with high household debt, high private consumption, and high employment, and continental European ones with low debt, low consumption and low employment. Even if high employment levels have been associated with high household debt in modern time Crouch observes that this was only partly confirmed in his study.

Andersen (2016) studies Danish households examining the relationship between household leverage prior to the financial crisis of 2007–2009 and the development in spending over the course of the crisis. He points out that the result indicated a strong negative relationship between leverage and the change in consumption during the crisis. Andersen argues that this implies that households during this period that are highly leveraged spend a larger share of their income than other less leveraged households. He stresses that this has led to a larger increase in debt over the years.

During past decades in the US Dynan and Kohn (2007) argue that there have been a lot of changes in the household saving and borrowing behavior. They point out that savings has decreased and they believe that the issue surrounding household borrowing is related to household savings. Dynan and Kohn found out that debt has increased a lot relative to the net income that has not increased as much. They state that this reflects the efforts of households to smooth consumption over time in response to shifting perceptions about future income. The main reason that household's borrowing has increased is because of the increase in house prices, according to Dynan and Kohn. They states that another reason could be that households has become less patient, they do not want to wait and substitute their consumption over time and instead consume more today and they appear to be more risk averse. Dynan and Kohn states that this implies less saving and more borrowing to be able to consume more today. Households that are very highly indebted, but might not have a large income, could have a tendency to be affected the most if or when a new finance crisis strikes, according to Dynan and Kohn.

To sum up the previous studies, we could see that household debt has increased rapidly over time because of credit expansion which has led to a decrease in savings due to increased consumption. Since there is a correlation between household debt and money supply we will consider different measures of money supply. We will compare how two different full-reserve systems, the Austrian through convertibility, and the Chicago plan through quantity control, would reduce the household debt in relation to today's system. This paper will contribute to the research area by examining if full reserves, with a narrower money supply, are an alternative to today's fractional reserves with a broader money supply including credit money.

### 3. Theory

In this section, the aim is to provide a theoretical framework to explain why there would be a correlation between household debt and money supply. The section will begin with the theory of Wicksell's cumulative process and the pure credit economy that explains why a change between the natural rate and the loan rate affect household debt. It is then continued with the Austrian business cycle theory that explains why a credit contraction has a great impact on household debt. Finally, the theory of the Friedman rule explains why a money growth targeting affects the household debt.

#### 3.1 Wicksell's cumulative process and the pure credit economy

In *Geldzins och Güterpreise*, Knut Wicksell (1898) develops the cumulative process in which he wanted to explain how high rates of interests related to high price levels. He argues that the new circumstances during the 19th century meant that the quantum theory of money did not provide a good description of the causes of changes in the price level. He therefore wanted to concentrate on the difference between the natural rate and the interest rate as the driven force for changes in the price level, instead of studying the money supply's effect.

Wicksell (1898) states in *Geldzins och Güterpreise*, that there are two different rates, the natural rate of interest and the loan rate of interest. He points out a difference between the two rates could appear and this results in a cumulative process. Wicksell explains that credit creates a gap between the natural rate of interest and the loan rate of interest which results in inflation.

The natural rate is a rate that reflects the return in the real economy and the loan rate is determined on the money supply market, according to Wicksell. He stresses that the natural rate is a natural rate level where the loan rate should be. Wicksell points out that if the natural rate was increased, so the natural rate is larger than the interest rate, we have incentive to invest because it is now more profitable than before the increase in the natural rate. He argues that this will lead to an increased demand for goods and therefore higher price levels. If the loan rate of interest and the natural rate is in equilibrium at the goods market, it means that savings and investment are equal ( $S=I$ ), according to Wicksell. He stated that this kind of

inflation in the economy would continue to increase until the banks' reserves had fallen to the limit that was desired or legal, according to Jonung and Ståhlberg (1990).

In *Föreläsningar i nationalekonomi*, Wicksell (1906) argues that the goal with monetary policy should be that we keep the price level constant, and by changes in productivity, let wages vary in relation to productivity. There were two main additions in comparison to his earlier publication. Wicksell now used the normal rate of interest which equals the loan rate of interest, according to his definition, that implies equilibrium in the aggregate goods market; savings equals investments. He points out that this only occurs if the market is in equilibrium but if the (money) rate becomes lower we get a cumulative process where investment is larger than savings. His definition indicates that factor markets are not necessarily cleared, but on the other hand Wicksell also discuss an economy's response to a shock where both goods and factor markets are cleared again by an adjustment in factor and nominal prices. In addition, Wicksell also pointed out that change of the general price level also can be caused directly by excess demand for goods and not only by the interest rate mechanism, according to Siven (1998).

Humphrey (2003) stresses that many people argue that Wicksell's model was a revolution in his time and that it showed how loans at commercial banks translated into changes in the interest rates and so the change in price levels, but not everyone agree with this.

In this study Wicksell's cumulative process is applied to examine how the money supply affects household debt. He explains that credit creates a gap between the natural rate of interest and the loan rate of interest which results in inflation. Wicksell argues that the loan rate of interest is determined on the money supply market and therefore the interest rate will be applied as a variable in the regression model.

### **3.2 Austrian Business Cycle Theory**

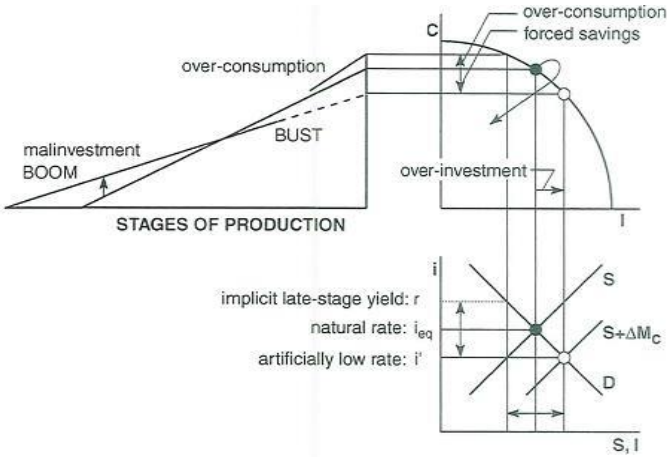
Dynan (2012) argues that households cannot consume as much when they are highly leveraged. He states that according to Austrian business cycle theory credit money leads to malinvestment which results in "forced savings". This theory originates from Ludwig von Mises (1912) and was further developed by Friedrich von Hayek (1929) and states that an

artificially low interest rate leads to expansion of credit which brings about artificial boom business which leads to a bust (recession). According to Garrison (2001), Hayek’s forced saving is actually a synonym for Mises’s malinvestment, rather than being the opposite of overconsumption. He points out that the Austrian business cycle theory states that savings is simply augmented by credit creation, since if there is no credit available to the consumer; abstinence to consume will appear and lead to an increase in savings. Garrison argues that since saving has not changed, the lower rate of interest means that the amount saved actually decreases.

Garrison states that this means that there is no other choice left for the consumer if they want to consume and therefore forced savings will appear.

In figure 2, Garrison explains the Austrian view of the boom-and-bust cycle. In the first stage, the government wants the economy to grow in order to accomplish that they lower the interest rate so people want to borrow more money. When they are able to do this, the economy grows. They invest more and this also leads to lower unemployment rates but it will push the inflation to higher levels. Garrison argues that when we reach the boom in the economy there are no-one that are interested in the oversupply of goods that have been made, the demand is very low and this is called malinvestment. He stresses that the economy is now declining when people do not want to spend their money, so businesses are slowing down and unemployment rates are getting higher.

**Figur 1. The Austrian Business Cycle Theory**



Source: Garrison (2001)



In the first stage Garrison (2001) explains that the government wants the economy to grow in order to accomplish that they lower the interest rate so people want to borrow more money. He points out that when they are able to do this, the economy grows. Garrison stresses that they invest more and this also leads to lower unemployment rates but it will push the inflation to higher levels. Garrison argues that when we reach the boom in the economy there are no one that are interested in the oversupply of goods that have been made. He stresses that the demand is very low and this is called malinvestment. Garrison states that the economy is now declining when people do not want to spend their money, so businesses are slowing down and unemployment rates are getting higher. He points out that the effect of this is that the government raises the interest rates back to the original market level. Now, the economy is in a bust, according to Garrison.

The Austrian Business Cycle Theory also says that if there is no credit available to the consumer, abstinence to consume will appear and lead to an increase in savings, according to Garrison. He stresses that this means that there is no other choice left for the consumer if they want to consume and therefore forced savings will appear.

Dobrescu, Badea and Paicu (2012) states that the cycles will be eliminated when banks do not grant credits. They point out that this means that all investments are financed through savings. Dobrescu, Badea and Paicu argue that since an artificially low interest rate, which is determined on the money supply market, leads to expansion of credit which brings about artificial boom business which leads to a bust (recession). They stresses that since forced savings will appear due to boom and bust the impact of saving on household debt will be observed in the regression of this paper.

### **3.3 The Friedman Rule**

Friedman (1959) discusses the choice of monetary policy target. Friedman specifically warns against adopting price stability as an operational objective for monetary policy due to the high degree of model uncertainty between monetary policy and prices, and advocates money growth targeting. He argues that the link between monetary changes and price changes is too imperfectly known and too loose over short periods to objectify the price level stability which makes the guide to policy unambiguous. Friedman states that only after a considerable lag and

over a long period of time, the monetary changes have their effect. With the Chicago Plan, based on a quantity principle, full reserves would contribute to a more stable money supply growth in the Swedish economy since it contains both real and nominal business cycles.

Friedman's rule is a rule for a stable money supply growth which would reduce uncertainty. Due to the uncertainty related to lags and magnitude in which the economy reacts to the policy stimulus, Friedman doubts the utility of state-contingent rules in monetary policymaking. According to Friedman, there is not possible to predict the price level or any other set of economic indicators under the circumstances mentioned below, but if there were, the price level for example could be an effective guide. He states that first of all it is not possible to predict the price level because the non-monetary factors on the price level only shows their effects after a significantly period of time in future. Second, another factor is that in each particular instance for monetary policy actions it could differ how long time it will take to show their effects, according to Friedman. Finally, he argues that alternative monetary actions will have a different amount of effect on the price level.

Friedman states that inflation around a constant rate will be stabilized provided there are no changes in the steady-state velocity growth rate and no changes in the steady-state output growth rate. He points out that in a setting with complete understanding of the economy the Friedman rule will typically deviate from the optimal policy derived from minimizing the impact of price inertia on economic welfare.

Wolman (1997) argues that in the last years, the economic trend has been for central banks to try and stabilize the inflation rate on a low level, which has proven to have many benefits. He points out that in monetary theory; it is popular for central banks to strive towards deflation, which implies negative inflation. Wolman states that if this is achieved, welfare would be maximized when inflation is at a low level that it all equals a zero nominal interest rate.

Leijonhufvud (2000) argues that during the fiat-system evolution, the goal has been to aspire towards arbitrary power. He stresses that this makes the political possibility very unrealistic due to a very restrictive constitutional version of it. The Friedman rule could, theoretically, stabilize the expectations of price levels and therefore reduce the risk of banking collapses, according to Leijonhufvud. Friedman argues, that his rule will also reduce the uncertainty

attaching to the expectations equal to a convertibility system, which only consists of real business cycles and not nominal, and therefore it is an alternative to a full reserve system.

In this paper the Friedman Rule is applied to examine how the nominal interest rate affects the household debt. If the Friedman Rule was applied it would contribute to a stable money supply with a constant growth rate which would reduce uncertainty. The nominal interest rate is determined on the money supply market and will therefore be observed in the regression of this study.

#### **4. Data and regression**

Wicksell (1898) wanted to concentrate on the difference between the natural rate and the interest rate as the driven force for changes in the price level, instead of studying the money supply's effect. According to Wicksell, income increases due to higher rents and nominal wages which therefore increase the demand for consumer goods. He explains that credits create a gap between the natural rate of interest and the loan rate of interest which results in inflation. Wicksell argues that the loan rate of interest is determined by the money supply and since we apply his cumulative process to examine what impact money supply has on household debt; interest rate will be included in the regression as a variable to measure inflation.

Wicksell (1906) states that if the loan rate of interest and the natural rate are in equilibrium at the goods market, it means that savings and investments are equal. He points out that this only occurs if the market is in equilibrium but if the (money) rate becomes lower we get a cumulative process where investment is larger than savings.

In accordance to the Austrian business cycle theory, Dobrescu, Badea and Paicu (2012) argue that the cycles will be eliminated when banks do not grant credits. This means that all investments are financed through savings. They point out that since an artificially low interest rate, which is determined on the money supply market, leads to expansion of credit, which brings about artificial boom business, which leads to a bust (recession). Since forced savings will appear due to boom and bust the impact of saving on household debt will be observed in the regression of this paper.

Leijonhufvud (2000) argues that the Friedman Rule will reduce the uncertainty attaching to the expectations equal to a convertibility system and therefore it is an alternative to a full reserve system. He points out that if the Friedman Rule was applied it would contribute to a stable money supply with a constant growth rate which would reduce uncertainty. If the Chicago Plan would be applied the central bank would have monopoly of money creation. The nominal interest rate is determined by the money supply and will therefore be observed in the regression of this study as an institutional variable, which refers to a monetary regime, to examine the effect on household debt. Although, the interest rate and the money supply are dependent of each other and have a negative correlation, the institutional variable is important for the regression to observe a monetary regime and will therefore be included.

Fontana and Sawyer (2016) indicates that the money today is created mostly by the private banks and not by the national central bank. They mean that the allowance of this money creation affect us all and is the reason we have such a destructive and pronounced cycle of boom and bust, and it is the reason that individuals, businesses and governments are overburden with debt. With full reserves, the money supply will become lower. Therefore, different money supplies will be observed in order to be able to study the different monetary regimes with full reserves.

#### 4.1 Regression models

The aim of this study is to compare how two different full-reserve systems, the Austrian through convertibility control and the Chicago plan through quantity control, would reduce the household debt in relation to today's system. Since there are a correlation between household debt and money supply we use two different measures of the money supply to represent the different systems; M1 to measure Austrian and the Chicago Plan and M3 to measure today's fractional system. To be able to compare the different reserve systems with today's fractional system we use different reserve ratios.

$$\text{Austrian: DEBT}_t = B_{0t} + B_1\text{SAVE/GDP}_t + B_2\text{RESERVES/ASSET}_t + B_3\text{MONEYM1/GDP}_t + \varepsilon_t$$

$$\text{Chicago: DEBT}_t = B_{0t} + B_1\text{SAVE/GDP}_t + B_2\text{ASSET}_t + B_3\text{MONEYM1/GDP}_t + B_4\text{RATE}_t + \varepsilon_t$$

$$\text{Today: DEBT}_t = B_{0t} + B_1\text{SAVE/GDP}_t + B_2\text{ASSET}_t + B_3\text{MONEYM3/GDP}_t + B_4\text{RATE}_t + \varepsilon_t$$

## 4.1.2 Explanations of the variables

$DEBT_t$  = Household debt (mkr)

$B_{0t}$  = Intercept

$B_{nt}$  = Correlation coefficient

$SAVE/GDP_t$  = Savings/GDP

$MONEYM1_t$  = Money Supply  $M_1$ /GDP (Riksbanken).

$MONEYM3_t$  = Money Supply  $M_3$ /GDP (Riksbanken).

$RESERVES/ASSET_t$  = Foreign Currency Reserves/Total Assets of the Swedish central bank (mkr)

$ASSET_t$  = Total assets (reserves) of the Swedish central bank (mkr)

$RATE_t$  = Nominal Interest Rate (Riksbanken)

$\varepsilon_t$  = Stochastic error term

## 4.2 Specifications of the variables

### 4.2.1. Household debt

Our dependent variable in our regression model is household debt and the data is collected from the Swedish Statistiska Centralbyråns database (2017). The household debt is measured in million Swedish kronor and we have observations from the years 2005-2013 in Sweden.

Andersen et al. (2016) observed that households with a high leverage spent more of their income than less leveraged households resulting in an increasing household debt. Therefore, household debt is an important explanatory and dependent variable in the regression models.

### 4.2.2. Savings

The variable savings is going to be applied as a ratio with Sweden's ratio of savings to GDP in order to see what amount of the savings that is of Sweden's GDP. The data of savings and GDP are collected by Carlgren (2017) and from the International Monetary Fund (2017).

Dynan and Kohn (2007) implies that savings have decreased and they believe that the issue surrounding household borrowing is related to household savings. They argue that the main reason for the decrease in savings is that consumers have become more risk-averse and less

patient because they do not want to substitute their consumption over time and instead consumes more today. Therefore, savings is an important explanatory and independent variable to include in the regression model. We expect a negative correlation between savings and household debt when a fractional reserve system is applied, and also when the Chicago Plan is applied. Since savings are included in M1 we expect a strong positive correlation between these variables and this is a problem to consider in the analysis.

Dobrescu, Badea, and Paicu (2012) argues that according to the Austrian business cycle theory it does not exist any bank credit and therefore abstinence of consuming will appear that finances investments from the outside of the consumers intertemporal preferences. They states that this mean that the savings will increase and later on also the consumption. When banks do not grant credit, the cycles will be eliminated. This means that all investments are financed through savings. Therefore we expect a negative relationship between debt and savings, because without credit money people will not be able to put themselves in debt, according to Dobrescu, Badea, and Paicu.

#### **4.2.3 Money Supply**

In the model, the different money supplies that will be observed are M1 and M3. This data is collected from the Swedish Statistiska Centralbyråns database (2017) and is measured in million Swedish kronor. The money supply is going to be measured by a ratio with GDP, in order to see what amount the money supply is of Sweden's GDP. The data for GDP is collected from the Swedish Statistiska Centralbyråns database (2017) and is also measured in million Swedish kronor.

$M_0$  is the measure of the population's holdings of paper money and coins.  $M_1$  is  $M_0$  + saving accounts and  $M_3$  is  $M_1$  + the credit money. Santen and Ölcer (2016) point out that since the Swedish central bank applies the  $M_3$  as a measure of money supply this will be used in this regression as an independent and explanatory variable. To be able to study the effect of the bank's deposit on household debt, according to Dittmer (2014), we will also include  $M_1$  in the regression model which will be used as an independent variable to measure full reserves.  $M_3 - M_1$  is credit money created by the commercial banks and exists in today's fractional reserve system. Benes and Kumhof (2012) argue that  $M_1 - M_0$  is the checking accounts that allow

deposits and direct withdrawals, which would exist in the full reserves. Their point of view is that the direct withdrawals could be based on the gold in the full reserves.

The Austrian reserve system equation will contain  $M1/GDP$  because in this full reserve system the only money available is the coins and banknotes ( $M0$ ) + saving accounts, where both measures are bound to the gold. The Chicago plan will contain  $M1/GDP$  because people can still put their money into a checking account, and withdrawal the money whenever they like. The central bank can issue new money if it is necessary in order to expand the balance sheet. The difference between these two full-reserve systems and the fractional reserve system we have today is that they cannot withdrawal money for the commercial bank because the banks cannot create new money.  $M3/GDP$  does not exist in these full reserve systems and therefore we expect the correlation between the variables to be negative. Since  $M3$  include credits we expect a positive correlation between the variables in the fractional reserve system.

#### 4.2.4. Assets

The assets in the Swedish central bank's balance sheet are the third variable that is included in the model and the data is collected from the Swedish Statistiska Centralbyråns database (2017).

White (2012) calculates what the cost would be to reestablish the gold standard today if using gold as commodity. By applying White's method to Swedish data it would be too expensive for Sweden to use gold as commodity. Therefore, the ratio between currency reserves and the assets is applied in the first model in order to study the Austrian full-reserve system. To differ the Chicago Plan from the Austrian we apply total asset as a reserve variable. This is because if we were to transcend to the Chicago Plan, the central bank would have monopoly of money creation and by increase the money creation they would also increase their assets in the balance sheet. To be able to compare these we will apply total asset as a variable in the third equation as well which measures the fractional reserve system. The expected outcome is a negative correlation between the reserve variable and the household debt in each of the equations.

#### 4.2.5. Interest rate

The nominal interest rate is the last independent variable in equation two and three. The data was collected from Ekonomifakta (2017) and is measured in million Swedish kronor. It is the

Riksbanken (2017) in Sweden that decides the interest rate and when they change the interest rate it also affects the banks' lending rates.

Hayek (1929) explains the boom-and-bust cycle and that an artificially low interest rate leads to more credit money which will bring about artificial booming business in which will leads to recession. According to Dobrescu, Badea and Paicu (2012), these cycles will be eliminated when credits do not exist. When there is an artificially low interest rate, which is determined on the money supply market, this will lead to an expansion of credit money. Therefore, we expect a negative correlation between the two variables in the third equation. This artificial interest would not exist in a full reserve system.

### 4.3 Expected outcome

In this section the expected outcome of the result will be presented in table one which are based on the theories that are explained in the section specifications of the variables.

**Table 1. Overview of the regression variables and expected outcome**

Variable	Description	Source	Expected outcome
DEBT <sub>t</sub>	Household debt	SCB	Dependent Variable
<b>Equation 1</b>			
SAVE/GDP <sub>t</sub>	Household savings/GDP	Ekonomifakta	-
RESERVES/ASSET <sub>t</sub>	Foreign currency reserve/total asset	Riksbanken	-
MONEYM1/GDP <sub>t</sub>	Money supply M1/GDP	SCB/Ekonomifakta	-
<b>Equation 2</b>			
SAVE/GDP <sub>t</sub>	Household savings/GDP	Ekonomifakta	-
ASSET <sub>t</sub>	The Swedish central banks total asset	Riksbanken	-
MONEYM1/GDP <sub>t</sub>	Money supply M1/GDP	SCB/Ekonomifakta	-
RATE <sub>t</sub>	The nominal interest rate = 0	Friedman rule	
<b>Equation 3</b>			
SAVE/GDP <sub>t</sub>	Household savings/GDP	Ekonomifakta	-
ASSET <sub>t</sub>	The Swedish central banks total asset	Riksbanken	-
MONEYM3/GDP <sub>t</sub>	Money supply M3/GDP	SCB/Ekonomifakta	+
RATE <sub>t</sub>	The nominal interest rate	Ekonomifakta	-



## 5. Empirical analysis

The study contains of three different equations in three different regression models where the variables will be added all at the same time. The dependent variable in all three equations is household debt. In the first equation the independent variables are household savings/GDP, foreign currency reserve/total asset and the money supply M1/GDP. In the second model the independent variables are household savings/GDP, total asset and the money supply M1/GDP. Interest rate will be excluded in the second model, according to the Friedman rule. In the third model the independent variables are household savings/GDP, total asset, the money supply M3/GDP and the nominal interest rate. The differences between the first and the second equation are the different reserve ratios, where currency reserves/asset measures the Austrian and total asset measures the Chicago Plan. The differences between the second and the third equation are that there is a wider money supply in the third model, which includes credit money, and also the interest rate which is also included in the third equation.

### 5.1 Regression result

**Table 2.** Regression result

\*,\*\* and \*\*\* specifies significance at 10-, 5- and 1 percent level. Standard error in parentheses and p-value in italic.

Equation	1
Constant	-239.884 (1026.88) <i>0.8246</i>
Savings/GDP	1689.05 (32202.7) <i>0.9602</i>
Currency/Assets	1244.87 (401.849) <i>0.0269 **</i>
M1/GDP	10579.4 (2004.39) <i>0.0032 ***</i>
R-squared	0.915601
Adjusted R-squared	0.864961
F-test	F(3,5) 18.08069 0.004087

**Table 3.** Regression result

Equation	2
Constant	105.931 (1009.41) <i>0.9205</i>
Savings/GDP	7956.34 (32984.2) <i>0.8190</i>
Asset	-0.00151248 (0.000497831) <i>0.0288 **</i>
M1/GDP	13593.1 (2238.54) <i>0.0017 ***</i>
R-squared	0.913427
Adjusted R-squared	0.861483
F-test	F(3,5) 17.58495 0.004351

**Table 4.** Regression result

Equation	3
Constant	1141.75 (2146.95) <i>0.6230</i>
Savings/GDP	-14644.1 (54498.4) <i>0.8014</i>
Asset	-0.00197495 (0.000896144) <i>0.0923 *</i>
M3/GDP	8548.68 (3249.44) <i>0.0581 *</i>
Interest rate	-124.115 ( 127.373) <i>0.3850</i>
R-squared	0.872808
Adjusted R-squared	0.745616
F-test	F(4,4) 6.862122 0.044418

The result in this study implies a good fit of the model because the adjusted R-squared is very close to one, according to Studenmund (2017).

## 5.2 Summary statistics

**Table 5.** Summary statistics

Summary Statistics, using the observations 2005 - 2013

Variable	Mean	Median	Minimum	Maximum	Std. Dev.
Debt	4226,2	4319,5	3618,2	5759	671,68
Save/GDP	0,0112	0,0112	0,0065717	0,016263	0,0032784
Assets	3.8729e+005	3.4573e+005	2.0062e+005	7.0884e+005	1.9605e+005
RATE	1,8686	1,708	0,541	4,04	1,2282
Currency/Asset	0,73934	0,83334	0,28627	0,28627	0,22114
M1/GDP	0,36172	0,38539	0,28442	0,43399	0,052127
M3/GDP	0,53169	0,55926	0,39712	0,60833	0,073541

## 5.3 Regression analysis

### 5.3.1. Assets

In the first equation the correlation between household debt and the reserve ratio is positive and significant at a five percent level. This differs from the expected outcome of the regression. The correlation in the second and the third regression the outcome is negative as we expected. In the second regression the correlation is significant at a 5% level and in the third regression the correlation is significant at a 10% level.

In the second equation the correlation is stronger than in the third model. This could be explained by the Chicago Plan based on what Leijonhufvud (2000) calls quantity principle, since the central bank has a monopoly of money creation. When a central bank creates new money they increase their assets which increase the velocity of money in the economy which leads to a decrease in household debt.

In the third regression, which measures the fractional reserve system, there are similarities to the second regression and could be explained by the money creation of the commercial banks. Money is created by the commercial banks in today's fractional system and by the Central bank in the full reserve system based on the Chicago Plan without being bound to the gold.

### 5.3.2. Money supply

In graph 5 (Appendix 1) we could see that M0 has decreased over time and at the same time as household debt has increased. In the first regression the correlation between M1/GDP and household debt is positive in contrast to the expected outcome. It is also significant at any level which indicates a strong relation between the variables. As we can see in graph 1 M1 and M3 has increased over time since 2005 and it also shows that the gap between M3 and M1 is large. In the second regression the outcome was positive, and also significant, which differs from the expected outcome. This could be explained by the variables M1 and savings/GDP since both include household savings which means that they are not independent of each other.

In the third regression there is a positive correlation between M3, which includes credit money and household debt similar to the expected outcome. This result was significant at a 10% level and the positive correlation could be explained by a broader money supply which makes room for a higher increase in household debt.

Leijonhufvud (2000) argues that the convertibility principle is more stable than the quantity principle since the first principle only has real business cycles and the second principle have both nominal and real business cycles. This could be seen in graph 1. It shows that the money supply M1 has increased over time but at a stable pace and that the money supply M3 also increased but in a more rapid and unstable pace. This confirms what Leijonhufvud says about the two monetary principles.

In accordance to the Austrian business cycle theory, Dobrescu, Badea and Paicu (2012) argue that the cycles will be eliminated when banks do not grant credits. This means that all investments are financed through savings. In the first and second regression, which does not include credit money, we could see that with the two full reserve systems, the household debt will increase when the money supply M1 increases. Compared to the third regression, which includes credit money, we could see that with a fractional reserve system an increase in the money supply M3 will lead to an increase in household debt.

Friedman's rule will reduce the uncertainty attaching to the expectations equal to a convertibility system (Austrian) and therefore the Chicago Plan is an alternative to a full reserve system, according to Leijonhufvud. In the first and second regression we could see that the money supply M1, which includes savings, impose a strong positive correlation between the variables M1/GDP and household debt. This could be explained by savings since M1 contains savings which make these two variables dependent of each other and differs from the expected outcome.

If the Friedman Rule was applied it would contribute to a stable money supply with a constant growth rate which would reduce uncertainty. If the Chicago Plan would be applied the central bank would have monopoly of money creation which the Austrian full reserve system would not have.

Fontana and Sawyer (2016) argue that with a full reserve system the money supply will become lower since credit money does not exist and this could be seen in the first and the second regression that measures full reserves. We could see that with a narrower money supply the household debt will increase.

In graph 4 in appendix 1 we could see that savings has fluctuated over time since 2005. It indicates that there is an increasing in savings when a financial crisis appears. We could notice this during 2005 and 2008 and we expected a negative correlation in all three equations. Although, there is a negative correlation as we expected in the third equation, the result is not significant at any level. In the first and the second equation the correlations are positive, but only the correlation in the first equation is significant.

In the second and the third equation the correlations are insignificant and this could be explained by the money supply M1 that includes savings. Therefore, the independent variables M1 and savings/GDP are not independent of each other.

Dynan and Kohn (2007) also argues that there have been a lot of changes in the household saving and borrowing behavior and this also could explain why saving is not significant at any level in the second equation.

According to the Austrian business cycle theory, credit money leads to abstinence to consume, since there does not exist any credit money, and therefore the consumers increase their savings. This could explain why savings is significant in the first equation and why there is a positive correlation between savings and household debt.

### 5.3.3. Interest rate

Instead of studying the money supply's effect Wicksell (1898) wanted to concentrate on the difference between the natural rate and the interest rate as the driven force in the price level. In the third regression the correlation between household debt and nominal interest rate is negative as in expected outcome. Although, there is a negative correlation it is insignificant at all levels and this is due to that the interest rate and money supply variables are dependent of each other.

Hayek (1929) explains the boom-and-bust cycle and that an artificially low interest rate leads to more credit money which will bring about artificial booming business in which will leads to recession. In the third regression we could see that an artificially low interest rate leads to more credit money which is included in the money supply M3.

Dobrescu, Badea and Paicu (2012) states that the boom and bust cycles will be eliminated when credits do not exist. When there is an artificially low interest rate, which is determined on the money supply market, this will lead to an expansion of credit money. In the first and the second regression that measures two different full reserve systems the interest rate is not included since an artificial interest rate would not exist in a full reserve system. According to the Friedman rule, the nominal interest rate should be set to zero for a stable money supply growth and this assumption is included in the second model that measures the Chicago Plan.

Wicksell (1906) argues that if the loan rate of interest and the natural rate are in equilibrium at the goods market, it means that savings and investments are equal, and this is in accordance with the Austrian business cycle theory. This only occurs if the market is in equilibrium but if the interest rate becomes lower we get a cumulative process where investment is larger than savings, according to Wicksell and this is due to cheap money.

Leijonhufvud (2000) states that the Friedman Rule will reduce the uncertainty, attaching to the expectations equal to a convertibility system (Austrian) that only contains of real business cycles. Therefore, the Chicago Plan is an alternative to a full reserve system even though they

have both real and nominal business cycles. If the Friedman Rule was applied it would contribute to a stable money supply with a constant growth rate which would reduce uncertainty. If the Chicago Plan would be applied the central bank would have monopoly of money creation.

## **6. Conclusion**

The aim of this study was to compare how two different full-reserve systems, the Austrian through convertibility control and the Chicago plan through quantity control, would reduce the household debt in relation to today's system. In all three equations the household debt will increase both due to a broader and narrower money supply. With full reserves the household debt would be backed by savings in comparison to fractional reserves, where household debt would be backed by credit money, and therefore full reserves could contribute to a healthier economy in contrast to the today's fractional system.

The Austrian full reserve system, based on the convertibility principle, includes only real business cycles compared to the Chicago Plan, based on the quantity principle, which includes both nominal and real business cycles. Since it would involve a large cost for Sweden to transcend to a convertibility system, where price inertia would occur as well, the conclusion of this study is that the Chicago Plan, based on the quantity principle, is to prefer.

There are some aspects in this study that has not been treated. Therefore, suggestions for future research are to examine if the money supply M1 would be the same as today regardless what system that is applied.

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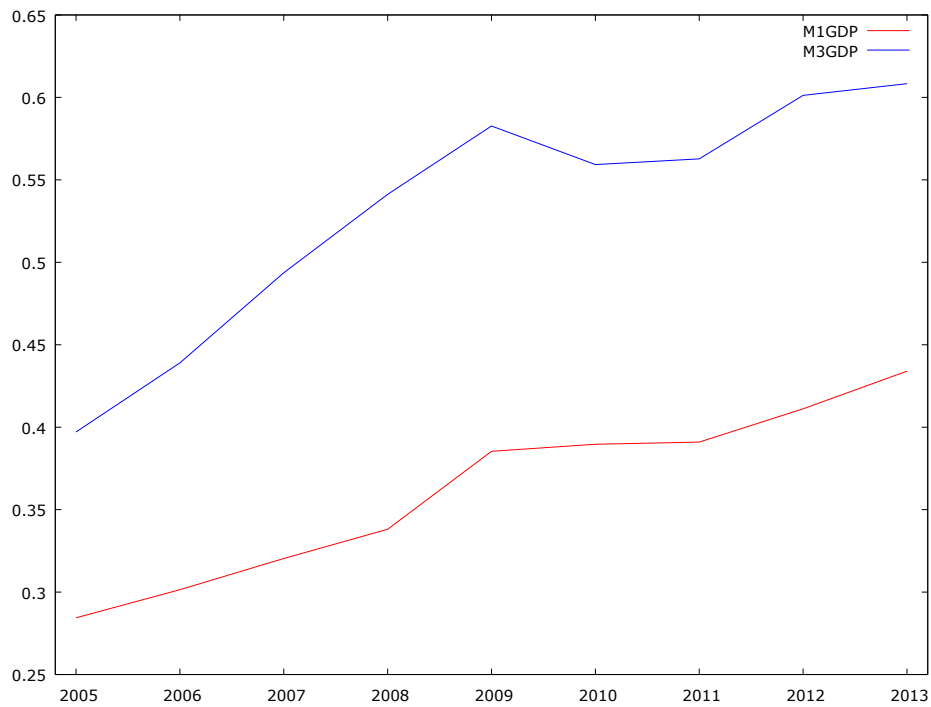
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## APPENDIX 1: Graphs

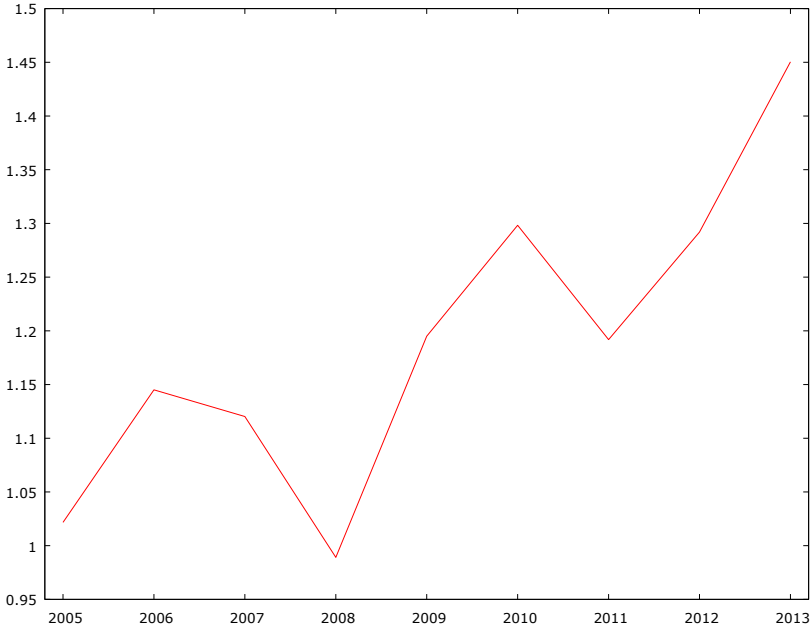
Graph 1: Money supply/GDP (M1 and M3) 2005-2013 (SCB, 2017)



Graph 2: Household debt and changes in credit money (M3-M1) 2005-2013 (SCB, 2017)



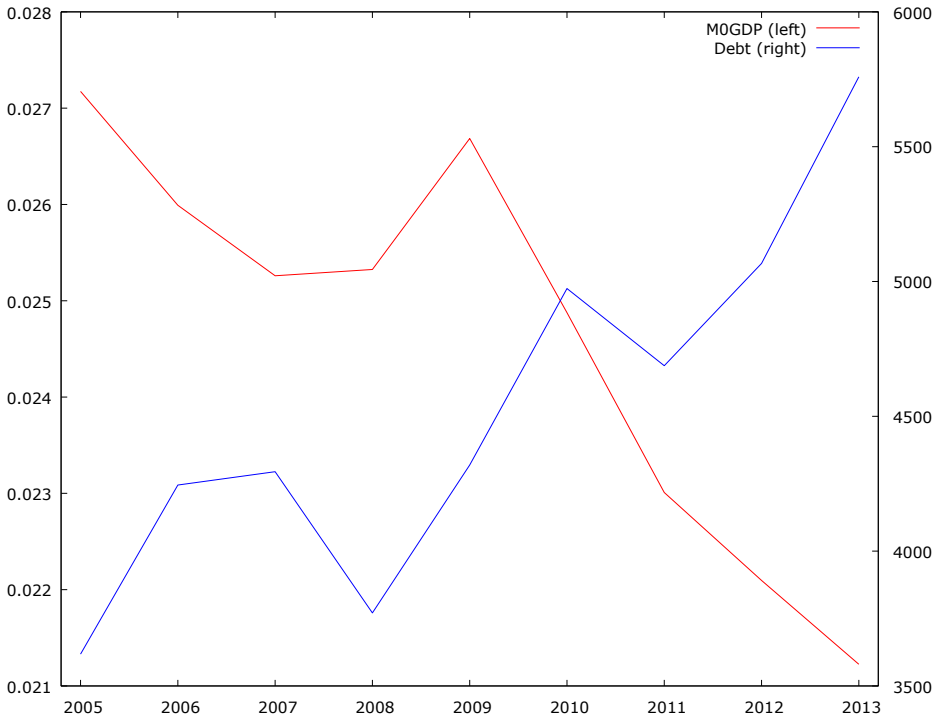
**Graph 3: Household debt/GDP 2005-2013 (SCB, 2017)**



**Graph 4: Household savings/GDP 2005-2013**



**Graph 5: M0/GDP and Household debt 2005-2013**



## APPENDIX 2: Calculation according to White (2012)

In this appendix we apply White's (2012) method to calculate the cost of transcending towards a gold standard based on commodities of gold and currency for Sweden.

The ratio between M1 and Gold shows the cost for Sweden to transcend to a gold standard. The ratio between M1 and Currency reserves shows the cost for Sweden to transcend to a foreign currency reserves. The measures below are in million Swedish kronor.

M1/Gold Reserves =	$1\,725\,202 / 31,425 =$	<b>54 899,03</b>
M1/Foreign Currency Reserves =	$1\,725\,202 / 386\,186 =$	<b>4,467283</b>

The result shows that it is more expansive for Sweden to transcend back towards a gold standard with the commodity gold, rather than foreign currency as commodity.