Empirical Testing of the Austrian Business Cycle Theory
Modelling of the Short-run Intertemporal Resource Allocation

Bachelor Thesis within Economics
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The Austrian Business Cycle Theory (ABC) provides a qualitative explanation of why economies go through ups and downs in terms of national income, production output and labor employment. The theory states that interest and money supply policy distort the time preferences of economic agents. If the monetary authority reduces the interest rate through artificial credit expansion the new economic conditions induce both increased production and consumption. The framework of the Austrian theory depends on savings to fuel investments, i.e. reduced consumption in order to create increased future consumption. Artificially induced expansions create a wedge between these producer and consumer preferences, and prolonging of the process widens the gap between the economic state and the free market equilibrium which is long-term sustainable. When the financial system eventually is unable to maintain inflation of credit to uphold the economy, there will be abandonment of capital investments, resulting in an unavoidable recession.

The purpose of this thesis is to analyze the theory from a short run perspective, using data from the United Kingdom economy. The theory has previously primarily been tested in long run perspectives and mainly on the American economy. To achieve the noted a model was constructed based on the description of the theory by economists Hayek and Garrison, members of the Austrian school of economics.

To empirically model the ABC theory the ratio between consumption and investment, the intertemporal resource allocation, was calculated and used as a dependent variable in regressions with money aggregates, credit and interest rate gap as independent variables. The empirical findings give some support to the theory, with a number of those findings directly in favor of the theory. Credit was shown to better explain changes in the C/I ratio than money aggregates, indicating that credit is more directly suited for investments. The coefficient for the interest rate gap, the difference between the natural interest rate and the market interest rate, showed strong significance. Overall differences between economic expansions and recessions were found statistically significant, which lends support to the model.
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1 Introduction

The study of business cycle theory is both fascinating and important. The long-run implications of economic policy go far beyond what is readily predictable, and has the ability to influence development and the wealth of nations. Several schools of economic thought are devoted to studying this subject, with the Keynesian school being the most prominent today. This study will put focus on the Austrian school and its theory of business cycles. This school emphasizes a free market, minimal government intervention, laissez-faire, and commodity-backed currency as opposed to fiat currency. Austrian economists have in the past been able to predict movements of the business cycle with a prominent early member, Ludwig von Mises, predicting the Great Depression. More recently Peter Schiff (2007) forecasted the 2007 Subprime mortgage crisis in the US, which plunged the world economy into a financial crisis.

The Austrian school is considered heterodox and separate from mainstream economics. The Austrian business cycle (ABC) theory has consequently been mostly neglected as a model in the discussion to predict and explain patterns in the business cycle. Intervention as a means to control the business cycle is commonly discussed, but the long-run repercussions of such short-run policies, which the ABC theory in particular discuss, are usually not highlighted.

The theory of business cycles as put forward by the Austrian school demonstrates strong qualitative arguments for long-run harmful effects. Austrian economists do not only argue that many policy efforts and tools of the government and central bank are ineffective, but that they can be directly harmful and destructive to the economy. The efforts to manipulate the economy through monetary means is shown to create inefficient production and eventual loss of resources due to abandonment of invested capital, making the economy worse off in the long run.

An analogy made by Faber (2007) of the Austrian explanation is to view the government and central banking as a bartender pouring drink after drink (cheap credit) to the customer or market. As the customer gets drunk (bubble builds) all is good. Sooner or later the hangover (recession) will come for the customer, a required aftermath of the burst bubble. Austrians argue that the issue is not the recessionary phase, but rather the bubble preceding it.

The same reasons that set the Austrian business cycle theory apart from others are what make it interesting for further study. This paper will attempt to contribute to the theory and further the understanding of the nature of business cycles empirically.

1.1 Problem

The ABC theory is an unorthodox business cycle theory, in that it stresses non-intervention as opposed to mainstream Keynesian policy. Because it is an outlier in economic teachings it has received less attention. In recent years empirical tests have largely confirmed the theory. However, all studies have been based on the US economy. In order to add credibility to the theory it must be tested on other economies. Additionally, as Garrison (2001) states the theory offers a linkage between the long run and the short run. This thesis will expand on the short-run connection and test the ABC theory in a short run model, in order to see if it can be confirmed in such a framework.
1.2 Purpose

The purpose of this paper is to analyze the effects of monetary policy variables on short-run intertemporal resource allocation, represented by the ratio of the value of consumption to the value of investment (C/I), and to find whether there is difference in these effects in expansion and recession. To do so a model will be constructed based on the description of the ABC theory. The model will be applied on the UK economy, setting it apart from previous studies made in the field.

1.3 Disposition

In part two a general introduction of the Austrian business cycle theory is made along with previous research. The third section discusses various business cycle theories and establishes the Austrian version. The fourth part discusses the method used to analyze the theory and data collection. The fifth section accounts for empirical testing, results and discusses those findings. The sixth and final section brings to a close the thesis with concluding remarks and suggestions of further research.
2 Background

Understanding the business cycle phenomena is a fundamental part of economics. It is important to understand the nature of business cycles in order to find efficient policies. Firms and companies are very much affected by occurring ups and downs of the economy, making the future hard to predict. In turn this effect has a big impact on the people in form of uncertainty.

From the Great Depression to the financial crisis in the beginning of the 21st century, business cycles have had a large impact on economies worldwide. One can argue that as the world becomes flatter and more interconnected, understanding business cycles is becoming more important as nations grow more interdependent. A recession in one country can now have greater effect on another country due to trade and intimate interconnectedness of capital markets.

For a brief example of the essential ABC theory, Reisman (2008) presents the Austrian view on the current financial crisis. He strongly dismisses laissez-faire economics as the cause, which according to him is what has been portrayed in media. Instead, “the actual responsibility for our financial crisis lies precisely with massive government intervention” in the sense that the central bank of the US, the Federal Reserve, has vastly created capital by the printing press. This “created” capital is not an increase in capital goods but rather a transfer between economic actors. Reisman (2008) expands upon this, stating that “the Federal Reserve’s policy of credit expansion based on the creation of new and additional checkbook money has thus served to give capital to unworthy borrowers who never should have had it in the first place and to deprive other, far more credit worthy borrowers of the capital they need to stay in business.” Eventually the state of the economy worsens, due to the unsustainable nature of credit expansion, and defaults start to occur on given loans. The recession manifest as a mean for the market to self-correct, driven by liquidation forces. Essentially Austrian economists argue that central banks create an unsustainable bubble with low interest rates and cheap credit, which inevitably bursts. A recession then occurs in order for the market to liquidate malinvestments and move back to equilibrium.

2.1 Previous research

Empirical research has been conducted on the ABC theory and several findings highlight its role as explanatory in the study of business cycles. Rothbard (1969) studied the Great Depression and argued that the boom in the 1920s was unsustainable and inevitably led to the depression. As the US Government stepped in and hindered liquidation of the malinvestments, it effectively delayed and transformed the downturn to a depression. Powell (2002) examined the Japanese recession in the 1990s, and concurred with Rothbard’s statement that government policy made things worse. Hughes (1997) and Cwik (1998) tested the ABC theory on the recession of the first Gulf War finding that capital intensive sectors got hold of new credit long before the less capitalistic sectors. Wainhouse (1984) again confirmed the ABC theory by showing that monetary shocks affect interest rates and subsequently influence output. However, Yaeger (1986) noted that the study of Wainhouse did not distinguish the Austrian view from its main rivals. Le Roux and Levin (1998) built on Wainhouse’s earlier work and confirmed the theory with new data between 1980 and 1996.

Rothbard (1969) published a short work critiquing the Keynesian system of government control and central bank policy. The basic framework of the ABC theory according to Rothbard was necessary to explain the failings in other current economic theories to
present a synthesis of a general theory of prices and business cycles. Rothbard argued that there was a form of market failure – if indeed the free market was in effect, why would formerly successful entrepreneurs in an industry all fail at the same time. The answer would be the need to respond to a market that offers an interest rate that does not reflect the economy’s current state. The theme of faulty signals given by the manipulated interest rate was also presented by Cowen (1997) as a list of problems brought on by the process of signal extraction from interest manipulation. Entrepreneurs could confuse the difference between nominal and real price changes brought on by lowered interest rates, and it might distort the estimation of future development. Finally, it is possible that entrepreneur’s will miscalculate the permanency of the interest rate change. Any one of these problems could be the start of a business cycle as described in the ABC theory.

Keeler (2001a) investigated eight post-war business cycles in the US and found that the data confirmed the hypothesis that changes in the interest rate structure further affect the capacity utilization and income. Keeler also argued that the macroeconomic data he investigated was significant and substantial in explaining the business cycles. Mulligan (2002) studied the allocation of resources according to changes in nominal interest rates, and these findings are in line with what the ABC theory hypothesizes. Mulligan (2006) found a close relationship between change in real output and the cumulative interest spread. Mulligan also concluded that the data showed support for the ABC theory as an explanation of resource allocation, production and employment.

In a paper on the dotcom bubble Callahan and Garrison (2003, pp. 96) emphasized that credit injections in the 1990s led to a mania on Internet stocks and fills in that “The Austrian theory offers a coherent explanation of the onset of the mania - a credit expansion - and the onset of the depression—the assation of the expansion”. A recent paper by Bismans and Mougeot (2009) substantiate the interest rate spread and expenditure spread as empirically significant in explaining the ABC theory, which confirms earlier hypotheses. Sechrest (2004) tested regression between several variables as per the description of the ABC theory, to provide quantitative empirical results, with findings supporting the theory.

Finally, Oppers (2002) summarizes the main groups of evidence that researchers tend to focus on concerning ABC theory. The first category analyzes how the economic boom precipitating the recession occurs. The second set focus on the recessionary stage after the peak as the market try to liquidate the malinvestments. The last group identifies the effectiveness of economic policies in recessions and explains why those might not be successful.
3  Theory

This section will discuss the theory of the Austrian business cycle, originally presented by Ludwig von Mises and Friedrich Hayek, including, drawing upon macroeconomic capital theory. It begins with a brief review of other business cycle theories.

3.1  Business cycle theories

Several schools of economics discuss the phenomenon of business cycles, all different from the Austrian version on some level. Garrison (2001) reviewed the most prominent of these. The Classical school states that the economy is at full employment, growing incrementally. At any point in time the interest rate will give the economy the ability to choose between more investment and more consumption. In the long run, a low interest rate moved resources to investment. In turn this lead to higher growth. Since the economy was always at full employment business cycles did not figure into the theory. The neoclassical school later presented the real business cycle based on the development of these principles Garrison (2001).

The Real business cycle views the economy as always at its full potential with no deviations. Business cycles are in fact movements of the production possibility frontier itself, thus moving the potential output due to real shocks to productivity. The work of Kydland and Prescott (1982) showed how an infinitely-lived household changed its consumption preferences due to changes in technology, more specifically how effective resource inputs were. With production characterized by multiple stages, and time needed to complete projects, fluctuations created by exogenous change were the cause of the ups and downs of the real business cycle. Long and Plosser (1983) theorized that individuals maximized consumption/production according to basic economic principles would lead to a business cycle-like behavior. The resulting competitive equilibrium would be Pareto-optimal, and attempts to stabilize that equilibrium would only lead to efficiency loss.

The Keynesian school emphasize that the economy is rarely at optimal level of production but that the economy can expand by increasing aggregate demand. Investment and consumption tends to move together rather than independently as an increase in aggregate demand is an increase in demand for labor (Garrison, 2001). The Keynesians view the business cycle as the effect of a change in aggregate demand. Proposed by John M. Keynes, the change in real aggregate demand due to investment instability was the cause of cycles, but in the 1960s and 1970s economists instead attributed cycles to the change in nominal aggregate demand due to money supply changes.

The Keynesian view also emphasizes expectations from consumers and businesses about the future and the tendency to be overoptimistic in economic expansions and overly pessimistic in recessions. In such times of uncertainty they look for safety which can be expressed as a form of herd behavior. Changes in expectations can take drastic turns, as the expected future always is uncertain (Zarnowitz, 1992). Another important point of Keynes was the multiplier effect which could leverage the economy into or out of a depression, as an initial injection of money spending would raise subsequent demand as it trickles down into the economy, increasing demand at all later stages. If aggregate demand decreased because of limited individual demand, businesses would accumulate unsold goods, as they are not adjusted to the change in the short run. This in turn, affects their suppliers of inputs. Production will decrease, leading to less income and employment which in turn reduce consumer demand further, starting over in a negative cycle. If for any reason aggregate demand is lo-
Finally, Monetarism states that a decrease in the supply of money can bring an economy into recession, as there is a lack of transactional means. If instead the money supply is expanded the economy can move beyond full employment temporarily with higher inflation, but will sooner or later move back to long term equilibrium at the long-run Phillips curve (Garrison, 2001). Ireland (2004) describes this monetary business cycle, based on microeconomics where the supply of real money is allowed to affect output and inflation dynamically. Households optimize their behavior, reacting to the simultaneous effect of change in real money supply. Optimizing is the result of three combined equations, describing money demand, a forward-looking Phillips curve and a form of the IS-curve. The business cycle occurs in turn as an adjustment to the change of an exogenous variable, the real money supply. Therefore, the economy can be governed by a central bank with steady monetary policies such as the predictable increases in the supply of money at roughly the speed of real economic growth dictated by Friedman’s k-percent rule (Friedman, 1960).

Central bank governing is one of the main points refuted by the Austrian school. The school argues that all forms of central planning fails, stating that government and central banks are the causes of economic fluctuation, not the relievers thereof. So while Keynesians argue that monetary policy should be demand driven to maneuver the economy and Monetarism argues that monetary policy should be neutral, Austrians argue that both neglect the subjective value of money while trying to impose an objective value (Taylor, 1980). Austrian theory focus on capital, instead of the Keynesian/Monetarism focus on employment. Hayek (1990) emphasized in a critique against Monetarism that by looking at money supply and general price levels, the relation to relative prics is missed which in effect causes disturbances in the allocation of investments. Garrison (1989) explained the Austrian capital theory as a theory of intertemporal coordination which is expanded to the Austrian business cycle theory in an intertemporal coordination. Garrison (2001, p. 8) stated that “in a modern capital-intensive economy … the fact that production takes time suggests that, for business cycle theory, capital and money should get equal billing … the troubles that characterize modern capital-intensive economies, particularly the episodes of boom and bust, may best be analyzed with the aid of capital-based macroeconomics.”

3.2 The Austrian business cycle theory

The main assertion of the ABC theory is that a policy-induced lowering of the interest rate will lead to an increase in nominal consumption and investments, changing the structure of production. In the long run the effects will be reversed as they are not sustainable, and in that adjustment process resources will be lost, in terms of lowered output, investment and consumption (Mulligan, 2006). That is the reason for the resulting recession following the unsustainable expansion, and it is the ABC theory’s main focus to explain how the creation of credit builds up the economy to the point of recession. The framework is built on a foundation of connections between two groups, producers and consumers, and the effect of the interest rate.

The origins of the Austrian business cycle theory can be found in the last pages of Ludwig von Mises text Theory of Capital and Money, originally published in 1912. In the text von Mises (1953), called for a return to “sound money” by reinstating the gold standard, to have all outstanding money backed by gold reserves, so that governments would not be able to print money that was not covered by public depositions. That would make the supply of credit independent of government planning and impossible to inflate, which was consi-
dered the cause of economic booms and busts. Under no circumstances could inflation be accepted as a way of stimulating the economy. Von Mises (1953, p. 439) stated that "The short-sighted observer sees only the things the government has accomplished by spending the newly created money" and that the inevitable effect of this behavior was malinvestments and loss of capital. The faulty underlying doctrine was that the economy needed to be expanded to full-employment level with a [unlimited] supply of credit, accompanied by inflation (Von Mises, 1953).

Building upon the teachings of von Mises (1953) and Wicksell (1898), Hayek (1967) formalized the foundation of the business cycle theory, as described by the Austrian school. This was based on (i) full employment equilibrium and the possibility to increase output not as an effect of improvement in technology but from a move to more (ii) capitalistic methods of production, determined by interest rate. The improved capitalistic form of production was based on the assumption that resources employed for a more distant future could yield increased output. In addition, Hayek made a theoretical distinction between the actual market interest rate and the natural interest rate, which was first discussed by Wicksell (1898). This natural interest rate was where the demand for savings equaled the supply of savings, in terms of investments in capital. In other words, the natural interest rate depicts economic agents' time preferences for current and future consumption. This natural rate could differ from the actual rate of interest, as the supply of money determines the actual or market interest rate. The monetary authority in turn decides the supply of money and as such the interest rate is susceptible to artificial changes, which would be able to determine the actual structure of production.

Hayek (1967) illustrated his reasoning with a model (Fig. 1) referred to as a Hayekian triangle of production. This triangle was used as a heuristic device, to put the qualitative characteristics of von Mises theory into an analytical framework (Garrison, 1994). The purpose of the model is to show how resources allocation and consumption spending in the economy changes due to interest rate changes (Mulligan, 2002). The triangle has an implicit time dimension of production horizontally and a consumption value dimension represented by the area of each stage. The final stage of the production process shows nominal value of final consumption. In order to reach that final stage (Fig. 1, marked in grey), production goes through a number of stages in sequential order, where every stage consists of all the accumulated capital from the previous stages and new input in form of land and labor (denoted original means of production in the figure), which can be thought of as a value adding process. For example, in Fig. 1 first the capital amount A is accumulated, followed in the next stage by the additional amount B, followed by the amount C, until capital accumulation reaches the final stage. This capital is called intermediate products, which is the continuing refinement of accumulated input that goes on until turned into consumer goods ready for consumption, so that the horizontal length of the triangle indicates time from production of the first intermediate goods to final consumption. In essence, every stage is the sum of the previous stage and the added original means of production. In the Hayekian triangle goods flow from left to right turning from intermediate goods into consumer goods (Hayek, 1967).
The entire area of the triangle up until the final stage (Fig 1. marked in grey) shows all successive stages that original means of production must pass through to become consumption goods, and at the same time it is the sum of all intermediate products that is available at any moment to complete consumer goods output. The stages consist of the capital accumulated as a result of land and labor, and how it is refined over time with additional land and labor consumed in the process. The capital in these stages are related to production; factories, warehouses and machines that allow the processing of greater amounts of output. In the first stage (furthest to the left in Fig. 1) there is no earlier capital accumulated, so the total intermediate goods is the value created by the original means of production - land and labor. In the subsequent stages the value added to the intermediate goods increase the value accumulated in goods form, with the area of each stage showing the value from previous stage and the added value of the original means of production (Hayek, 1967).

The reason why the triangle's blocks build up successively is because additional original means of production is added in a value adding process. The white area must, in other words, amount to the aggregate income from the original means of production, as each additional value-adding component from these factors are put into the final goods. The ratio between consumption (Fig 1. grey area) and output of intermediate goods (Fig. 1 white blocks), which according to Hayek (1967) was equivalent to new and renewed investment. This leads to the monetary value of producer goods being able to exceed the consumer goods in the same time period, simply because these goods can switch hands several times before being sold to final consumer. Hayek (1967) stated that the amount of total intermediate goods in the triangle depended on entrepreneurial decisions of investing and reinvesting into the chain of production that in turn depended on prices and profits that could be realized. Hence, a dominant fact to the shape of the triangle is relative prices. The capital structure and hence the triangle area is shown with different snapshots in succeeding time periods. The changes to these intertemporal changes is therefore analyzed in a short-run framework (Hayek, 1967).

The ratio between output of consumer goods to output of producer goods, which represents the intertemporal resource allocation (Consumption, C – greyed out area Fig. 2/Investments, I – white area Fig. 2), could be altered with a change in interest rate, which is very important in explaining the ABC theory. The purpose of this paper is essentially to determine these short-run changes. In Fig. 1, the intertemporal resource allocation can be calculated as the ratio of the area of the final stage (Fig. 1 marked in grey), the value of consumption, to the area of all other stages, the value of intermediate production. Garrison (1994) notes that the Hayekian triangle fail to capture several features of a modern capitalist decentralized economy, such as the fact that investments represented increases in capital stock. Despite this flaw Garrison (1994) writes that the point of the Hayekian triangle is not lost: the entrepreneurial managing of production has an effect on the entire economy.
Hayek (1967) described a set of agents operating in this structure of production - producers and consumers - and the motivation behind their actions. In the beginning stages of expansion producers would have idle savings accumulated from earlier production, and the ability to loan additional resources, depending on credit. The savings could be either invested to increase earnings from future production, or be retained as savings to earn the offered interest rate. The interest rate was the opportunity cost of investing in the production. Opportunities with higher return are preferred over those with lower return, so a lower interest rate would result in more projects for expansion of production being funded. Similarly, consumers have a choice between spending their income on consumption and saving it. The opportunity cost for consumption would be the interest rate earned on savings. At lower interest rates a larger proportion of income would be consumed as the cost to do so decreases.

Since the interest rate determines the opportunity cost faced by the agents, any manipulation of the interest rate influences the decisions taken by the producers and consumers. Fig. 2 shows the *intertemporal resource allocation* in an economy i.e. how the ratio of consumption in terms of consumer goods to investment in terms of producer goods change in accordance to fluctuations in the interest rate. The interest rate can be thought of as the hypotenuse of the triangle, the steeper the hypotenuse the higher is the interest rate. In the interest of simple illustrations the hypotenuse of the Hayekian triangle has been smoothed out, a practice that will be continued throughout the rest of this paper. Smoothing of the hypotenuse also ties into the fact that increasing the value of the intermediate products is not incremental, it takes place *over time* (Hayek, 1967).

The Hayekian triangle describes expansion with full employment and no technological change in production. In order to do so the economy must accumulate value in capital over a longer period of time, i.e. the structure of production must expand. In essence, additional stages make it possible to produce a greater amount of output using the same original means of production. To do so there must be a trade-off of consumption for investment. It is important to realize that resources are redistributed due to the relative prices in different stages of production. This is represented by a decrease in the height of the triangle (Fig. 3, movement to point A), as more resources are directed from immediate consumption into investment in a structure with a longer production process. The hypotenuse of the changed triangle shows what happens in each stage of production along the horizontal basis. For the description of the changes, looking from right to left in Figure 3, i) input demand is lowered in the late stages, ii) the further leftwards, away from consumption, the smaller the reduction of demand, iii) early stages get increased demand for inputs, and iv) new stages of production before the early stages has been created. The fall in demand in the later stages and the rise in demand in early stages redistribute resources away from late stages and elongates the triangle. Resources are therefore shifted from late to early stages. (Fig. 3, movement to point B) (Hayek, 1967).

When the investments mature they are incorporated as additional production stages in the Hayekian triangle. In essence, the triangle elongates. At that point the capital restructuring is completed so consumption can increase beyond its initial point, due to the increased
production output and the reduced need for investment (Fig. 3, Point C). In short, a short-run lowering of consumption increase investment, causing a long run increases of the nominal consumption.

![Figure 3 - The Expanding Structure of Production](image)

The most important point of the ABC theory is that this change can be brought on in different ways, which can result in either a sustainable or unsustainable expansion. These will now be discussed.

### 3.2.1 Sustainable growth

As stated, in order for the economy to expand there must be a financing of the investments in intermediate stages that are added to the Hayekian triangle and elongating it (Hayek, 1967). The change in the structure of production can be achieved in one of two ways. Either there can be an increase in the voluntary savings rate, due to an intrinsic change in consumer preferences, which increase the resources available for capital investment (Fig. 4) Starting in the lower right diagram in Fig. 4, if consumption preferences change and consumers decide to reduce their current consumption in favor of future consumption, savings increase making additional loanable funds available as discussed above. There has been a change in the intertemporal resource allocation (Garrison, 2001).

As the supply of loanable funds increase the interest rate offered is lowered, making funds available and lowering the cost for producers to invest in production. This is illustrated in the upper right picture, where resources are directed from consumption to investment. This possibilities frontier depicts the possible resource allocation given technological know-how, resource constraints and preferences in the economy (Garrison, 2001). It is concave since it reflects the reduced marginal benefit of adding additional consumption over investment, or vice versa. The relative preference in term of the ratios of consumption to in-
vestment has changed, reducing current consumption to achieve higher future consumption. In the last picture, the Hayekian triangle is altered due to time preference changes, lowering the vertical height known as consumption in order to *lengthen the production structure*. As the new investments mature, the economy is able to expand to a higher level of sustainable economic activity, with a larger *Hayekian triangle* and expansion of the possibility frontier between consumption and investment. (Garrison, 2001)

### 3.2.2 Unsustainable growth

It is possible for expansion to take place without any changes in the temporal resource allocation. The monetary authority can induce expansion to take place artificially if it reduces the interest rate via increased supply of money, also described as increased credit. As the actual interest rate differs from the natural interest rate (where the loanable funds market clears) this causes savings and investments to differ, giving rise to unsustainable growth in the economy (Garrison, 1997). With available funds and a low opportunity cost producers will invest in the structure of production. At the same time, there has been no increase in consumer preferences towards future consumption. Instead, consumers will seek to increase the level of consumption as the opportunity cost to do so has decreased as is illustrated in Fig. 5 (Garrison, 2001).

In the lower right picture, the increased supply of money (from S to S+ΔM) does not reflect a shift in the preference of consumers but instead credit injection from the central bank (where ΔM denote the change in money supply or credit injection). This causes the interest rate to decrease, loanable funds to increase but *genuine savings to decrease*. Consequently, the movement on the possibility frontier in the upper right picture shows first a movement to the right towards more investments due to the lower interest rate and increased supply of credit. At the same time consumption wants to increase or move to the left due to the lower interest rate and *constant time preferences*, however in the short run this consumption demand cannot materialize, as the production process cannot accommodate it (Garrison, 2001).

Carilli and Dempster (2001) provide an argument for why otherwise rational economic agents would act upon artificially stimulated booms. Producers and financial institutions expand due to profit-maximizing behavior. The authors argue that in order to remain competitive and stay in business, banks are in effect forced to lend out unjustified amounts of

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*Figure 5 - Unsustainable Structure of Production*
money, as it wants to maximize profit. They will loan out excessive amounts of money when the central bank increases the money supply since this will increase expected profits. Due to competition, not lending additional money would lead to a loss of market share. Producers will take on more loans for investments to stay competitive. If other firms increase investments and thus output potential while the producer deciding not to the producer will eventually realize a lower profit. On the other hand, the other firms will gain relatively more expected profit by taking on more investments.

The result of an artificial expansion is a structure where production takes more time while consumers demand increase immediately. The effect on the Hayekian triangle is seen in Fig. 5 where the increased investments in early-stage production processes elongate the stages of production and increase demand in the late stages of production by consumers. This creates a wedge located at the middle stages, where the intermediate products created in the early stage production cannot be shifted quickly enough into the late-stage products demanded.

The wedge is the conflict in producer and consumer preferences that makes the structure of production unsustainable in the long run. The economy will be able to expand in this way, however the economy will eventually drop into a recession as the foundation of growth is not sound (Mulligan, 2006). Hayek (1967, p.133) commented that "the consequent elongation of the process of production could not, however, be maintained, because a reversal in the price relationship of higher and lower order goods would appear as soon as the money supply ceased to increase owing to the fact that spending and saving habits had not changed." Due to the finite nature of the expansion and the conflicting producer and consumer preferences a reversal of the structure of production eventually occurs when the additional available credit no longer sustains producers during expansion.

### 3.2.3 Recession and Liquidation forces

Mulligan (2006) describes three distinct ways that the recession can follow from an unstable structure of production, as a deflation, steady inflation or accelerating inflation. The monetary authority may try to correct an earlier mistake of artificial expansion raising the interest rate. Such recessions are characterized by a severe but short recessionary period. If the monetary authority does not intervene the unstable structure of production will eventually unravel, due to the build-up of bad investments. The third option is for the monetary authority to try and uphold the unsustainable structure of production, with further injections of credit. Such monetary intervention will give incorrect signals as the interest rate in recession should be increasing in order to correct investments (Cochran & Yetter, 2004 pp.10).

The economy will appear to be prospering, but the eventual result is a larger loss of capital when the economy adjusts back to a sustainable structure of production, due to the large amount of malinvestments accumulated over time. These malinvestments are expressions of resource misallocation in the stages of the economy, where middle stages are starved on assets and creates bottle necks, thus the wedge, while early and late stages gets abundance. In effect the accelerating inflation is an attempt to steer the economy away from an approaching recession, however as explained by Mulligan (2006), by avoiding a recession in the short term there is a stronger build-up for a deeper and more severe future recession.

The driving force that causes the inevitable recession after a non-sustainable expansion is called liquidation forces, a move of agents towards more prudent investments and a higher interest rate. The interest should increase because (i) there is a scarcity of consumer goods so there is a pressure for the increase of the price of current to future consumption goods, equivalent to the market interest rate and (ii) the money creation process causes inflation
forcing the banking system to eventually raise the interest rate. As the interest rate increases, projects become less attractive and economic agents will spot signs of strain in the production structure. Lending institutions become risk-averse in order to minimize losses by increasing their minimum lending standards. This has two effects on producers. First, producers that cannot secure credit must abandon incomplete investments, liquidating physical capital to regain a sustainable structure of production. Second, opportunity cost dictates that producers should liquidate investments in physical capital in order to earn the higher interest rate available in savings.

The liquidation forces will build up momentum to the point where a large-scale rejection and redistribution of physical capital will be necessary, resulting in a recession with high unemployment. Labor demand and household income decrease, marking the beginning of a recession. At that time firms will need to restructure their operations and liquidate non-profitable investments to make production compatible with the time preference of consumer demand (Oppers, 1992). Physical capital would be turned back into savings if it could be liquidated quickly and at low cost. However, Bischoff (1970) showed that the liquidity of investments in residential structures, differ significantly from those in non-residential capital structures. In the ABC theory, capital is seen as a structure and network rather than a stock or fixed entity. Resources therefore have various degrees of substitutability and complementarity, varying from perfectly flexible and common to very specific and inimitable (Garrison, 1985). Capital in the production structure mostly has the property of being the least adaptable input and cannot be liquidated efficiently; there is a loss of resources as the economy contracts. This liquidation will make the economy worse off than during the expansion, but will be better than the results of a perpetuated unstable structure of production (Mulligan, 2006).

Liquidation forces also induce signaling, a process during recession that shifts resources in the economy towards businesses with rising production due to relative higher demand (Cochran & Yetter, 2004). Resources redistribute from firms with declining demand to those with relative high demand, but there will be friction in the resource allocation as shifted capital is not adapted to the new specific intermediate production (Cochran, Call & Glahe, 2003).

3.2.4 Suitability of the UK economy

The theory distinguishes between sustainable expansion and the inflating of an economic bubble. In order for the model to hold for the tested data, the UK economy must have experienced bubbles during the observed time period. In previous research on bubbles in the UK economy, Cameron, Muellbauer and Murphy (2006) found no evidence for a bubble in UK house prices between 1972 and 2003. However, Attanasio & Weber (1994) concluded that they found evidence of bubbles in the UK economy in the late 1980s partially based on the financial liberalization-imperfect housing market hypothesis by Muellbauer and Murphy (1990). In yet another paper Aron, Duca, Muellbauer, Murata and Murphy (2008) found that large shifts in credit over time started bubbles in the UK economy. Research supports then the notion of bubbles in the UK economy; hence the theory can be applied on the UK economy. However, this does not mean that the model automatically will be accurate.

3.3 Criticism

Though the persistence of Austrian economists and later empirical evidence in favor of the ABC theory, some economists have spoken out against it. For example, Yaeger (1986, p.
380) emphasize the lack of explanation of the depression phase in the ABC theory, that Austrians mainly states “maladjustments being worked out painfully over time.” Hicks (1967) objected to the Austrian notion that monetary deception in the market could move resources between sectoral areas. These resource movements could only be brought about by changes in savings – not by money supply. Lucas (1981) makes a similar point of the ABC theory as he is not convinced that the relatively small cause can have such disproportionate effect to the economy. In other words, the interest rate gap over time in the expansionary phase should not be able to cause so much harm in the investment sector.

In a defense of the theory, Garrison (1989, p. 23) summarizes in his paper that “the Austrian theory of the business cycle stands up well to criticism. The integration of monetary theory with a rich theory of capital … gives the Austrians a decided advantage over other schools in theorizing about cyclical movements in macroeconomic magnitudes—or more generally, about self-reversing intertemporal market processes.”
4 Method

4.1 Basis of the model

The theoretical framework presented provides the opportunity to develop a model, which can be used to test parts of the theory's implications. The goal is to examine the impact of several independent variables and their effect on the short-run intertemporal resource allocation in different phases of the business cycle, as described by the Hayekian triangle framework.

Testing utilizes short term observations of the business cycle, using quarterly data, and a framework developed to distinguish between recessions and expansions. The estimated equations consider the relationships of the change in the dependent variable, Δ\(C/G\), with the changes of each of the independent variables. This is expected to remove problems of non-stationarity and autocorrelation (Aczel & Sounderpandian, 2006). Recessions and expansions will be separated utilizing dummy variables in order to see the relative impact of the independent variables on the dependent variable in these different phases of the business cycle.

Since the ABC theory has a starting point in full employment the level of unemployment has been used as a determinant of the state of the economy. When the level rises above a specific rate of unemployment the economy is considered to be in a recession and when it falls below this level an expansion.

![Unemployment Rate 1984-2006](image)

Figure 7 - Rate of unemployment in the UK 1984 – 2006

Looking at the unemployment levels for all data in Fig. 6, the cut-off point between recession and expansion was set to eight per cent. The quarters where the economy had above eight per cent unemployment was used as recessionary periods and the quarters where the economy was below the limit as expansionary periods. This approximated threshold level was used for several reasons. Assuming that the economy is oscillating around full employment over time, full employment for the purpose of this paper has been estimated as the average unemployment rate for the observed periods at 7.82% (Table 1). Smith's (2003) findings arrive at a similar result. Smith estimates the non-accelerated inflation rate of unemployment (NAIRU) to be 8.875% (Table 1) for the United Kingdom, based on current and expected inflation. In light of these numbers 8% is found to be adequate. The estimated rate of unemployment at 8% also allows for an even distribution of the observed periods between phases.
<table>
<thead>
<tr>
<th>Source</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average unemployment rate of observations</td>
<td>7.82</td>
</tr>
<tr>
<td>Smith’s inflation-estimated NAIRU</td>
<td>8.875</td>
</tr>
<tr>
<td>Used estimated natural rate of unemployment</td>
<td>8</td>
</tr>
</tbody>
</table>

### 4.2 The Hayekian Triangle Model

The ABC theory uses the framework of the Hayekian triangle to illustrate the intertemporal dynamics of capital, production and investment. Hayek (1967) demonstrated how consumption-investment preference of economic agents changes as economic conditions change. The relation of consumption to investment can be modeled as dependent on monetary and interest rate changes (Mulligan, 2006). To test for the difference between expansion and recession a linear regression analysis is used including dummy variables to differentiate between recessionary and expansionary phases. The dummy variable set to 1 marks a recessionary period and 0 an expansionary period.

To test the intertemporal resource allocation, the ratio of consumption to investment was used, modified from Sechrest (2004) and originally developed by Hayek (1967). Hayek showed how the process of production was elongated in an expansionary phase as an effect of the increased incentive for firms to expand their operations, which in this context is synonymous to investments. The total amount of consumer goods produced remained relatively stable and is very rigid in the short run, while the total amount of producer goods increased. In an induced expansionary phase the ratio of consumption to investment should be decreasing as investments increase due to credit injections and lower interest rates. Symmetrically, in a recession the economy should work back towards a long-run equilibrium point and “force” the ratio in the other direction, had it been possible to liquidate capital investments, as Bischoff (1970) discussed. This subject will be dealt with below.

#### 4.2.1 Money

The monetary aggregates M0 and M4 were included when testing the intertemporal resource allocation, as unsustainable expansions are often attributed to changes in the supply of money (von Mises, 1953, 1996; Rothbard, 2000). M0 is the narrow monetary aggregate of the UK, and M4 is the broad money supply measure. M0 cover notes and coins in circulation, banks’ vault cash holdings and bankers’ deposit at Bank of England (BOE), also known as BOE’s and the government’s liabilities (Janssen & Andrews, 2005). M4 contain private sector holdings of sterling pounds, sterling pounds in deposit (here equivalent to certificates of deposit and debt securities up to five years) at banks and financial institutions, and sterling shares issued by financial institutions (Burgess & Janssen, 2007). M0 consists of roughly five percent of the amount of M4 (Congdon, 2007, p. 319).

#### 4.2.2 Interest

The Hayekian triangle also explains relative prices in different stages with disequilibrium of interest rates. This can be expressed as the difference between the natural interest rate and the actual interest rate. That is the actual difference between the interest rate uninfluenced by policies and the given market rate. The underlying disequilibrium that it represents make the interest rate differential essential. This was discussed in the Austrian context by Rothbard (1993) where the natural interest rate could be proxied as a ratio of savings and con-
umption time preference patterns. This thesis will use a proxy as previously modeled by Carilli and Dempster (2008) which was based on the savings-consumption ratio that Rothbard (1993) developed. The natural interest rate is calculated as the average propensity to save divided by the average propensity to consume. This allows the intertemporal relationship in purchasing patterns and the opportunity cost of holding money to be fully incorporated in the model.

4.2.3 Credit

The Austrian school of economics tend to use money supply increases and increases in the supply of credit interchangeably (von Mises, 1953), in the business cycle context. Therefore, the change in credit was included as an independent variable, in order to see the similarities or differences by using these two separate measures. Whether credit is suitable to determine temporal resource allocation will be concluded. The measure of credit utilized in this thesis is the outstanding bank credit compiled quarterly.

Given these variables and the chosen method of testing, a number of estimable equations to consider how the consumption-investment ratio is dependent on money supply, the interest rate differential and amount of credit outstanding.\(^1\)

\[
\begin{align*}
\Delta C^2_1 &= \beta_0 + \beta_1 D_1 + \beta_2 \Delta (M_0) + \beta_3 \Delta (M_4 - M_0) + \beta_4 \Delta (M_2 - M_0) + \epsilon \\
\Delta C^3_1 &= \beta_0 + \beta_1 D_1 + \beta_2 \Delta (M_0) + \beta_3 \Delta (M_4 - M_0) + \epsilon \\
\Delta C^4_1 &= \beta_0 + \beta_1 D_1 + \beta_2 \Delta (M_0) + \beta_3 \Delta (M_4 - M_0) + \epsilon \\
\end{align*}
\]

where \(\Delta C^2_1\) is the rate change in the ratio of consumption and investments \((\frac{C}{I})\), \(\Delta C^3_1\) is the change in the money supply \((\frac{M_t-M_{t-1}}{M_{t-1}})\), \(\Delta C^4_1\) is the change in given credit \(\frac{Cr_t-Cr_{t-1}}{Cr_{t-1}}\), and \(\Delta (ir_n)\) is the change in the differential between the actual interest rate and the natural interest rate where \(ir_n\) is a proxy of the natural interest rate: \(\frac{APS}{APC}\), the average propensity to save divided by the average propensity to consume (Rothbard, 1993; Carilli and Dempster, 2001).

The following sub-equations are then implied for phases of the business cycle:

Recession: \(\Delta C^2_1 = (\beta_0 + \beta_1) + (\beta_2 + \beta_3) \Delta (M_0) + (\beta_4 + \beta_5) \Delta (M_4 - M_0) + \epsilon\) \[1.1\]

Expansion: \(\Delta C^3_1 = \beta_0 + \beta_2 \Delta (M_0) + \beta_3 \Delta (M_4 - M_0) + \epsilon\) \[1.2\]

Recession: \(\Delta C^4_1 = (\beta_0 + \beta_1) + (\beta_2 + \beta_3) \Delta (M_0) + (\beta_4 + \beta_5) \Delta (Cr) + \epsilon\) \[2.1\]

Expansion: \(\Delta C^5_1 = \beta_0 + \beta_2 \Delta (M_0) + \beta_3 \Delta (Cr) + \epsilon\) \[2.2\]

Recession: \(\Delta C^6_1 = (\beta_0 + \beta_1) + (\beta_2 + \beta_3) \Delta (M_0) + (\beta_4 + \beta_5) \Delta (ir_n) + \epsilon\) \[3.1\]

Expansion: \(\Delta C^7_1 = \beta_0 + \beta_2 \Delta (M_0) + \beta_3 \Delta (ir_n) + \epsilon\) \[3.2\]

\(^1\) Several equations must be used since notably \(M_4\), credit and interest rates are interconnected, otherwise is likely to lead to multicollinearity.
4.3 Predictions

The variable M0, is expected to have a positive impact on C/I as the narrow money supply is very liquid and flexible. At the same time M0 is relatively less useful for business projects that need long term financial capital such as credit to finance structural investments. In accordance to Congdom (2007, p.14), M0 should therefore have a closer connection to consumption than investment, having a positive relation to C/I. Increases in the supply of money generally induce people to increase consumption, but less so during a recession, because of employment uncertainty. It should be noted that there is a theoretical limit to consumable output, which makes consumption rigid in the short run.

The independent variable M4 - which in performed tests is actually the M4 aggregate less M0 but for convenience referred to as M4 in this discussion - is expected to have a negative impact on C/I. The major part of this monetary aggregate consists of time deposits in banks and financial institutions, making M4 an illiquid measure of money, better suited for long-term projects and investments. Therefore, it can be assumed that the value of investment outweighs consumption when M4 increases. In recessions M4 is expected to have coefficients with the same sign as in expansion but to have a smaller magnitude, as the required return on investments increases.

The interest rate gap is assumed to have more influence on investment than consumption. When the interest rate is lowered, businesses rapidly see projects become profitable and new ventures are undertaken based on the low interest rate as shown by Carilli and Dempster (2008). Von Mises (1953, p. 346) stated that “There is no direct connection between the rate of interest and the amount of money held by the individuals who participate in the transactions of the market”. Instead, consumers react to a change in the interest rate in a roundabout way, due to the distribution of income and wealth. As the actual interest rate decreases, the interest rate gap change becomes negative, which induces a general expansion and cause an increase in investments. This should decrease the change in C/I, hence the relation must be positive.² In a recession, the actual interest rate should increase faster than the natural interest rate to equilibrate both interest rates. The theory dictates that interventionary policies oppose this effect, in order to “stimulate” the economy out of the recession. This leads to the stimulus force working against the liquidation force. Lowering of the interest rate should therefore have more influence on investment in an expansion than in a recession (von Mises, 1953).

Credit is expected to have a strong relation to investment as companies benefit more than consumers from credit. While there may be an equal number of agreements from the consumer and business sides, the value of those transactions should be different. Credit should work as M4 and lower the C/I ratio as the additional credit made available through banks should primarily be channeled as business investment into the structure of production. It is predicted to be more suitable for tracking investments compared to monetary aggregates, because it is more directly targeting such enterprises. Even if it get distributed more to consumption, the consumption should not be able to increase much, as output is fixed in the short run, where inventories diminish and prices increase. Businesses on the other hand can start increasing investment into the structure of production using credit.

If the ABC theory is correct, the analysis will show a greater magnitude from coefficients during the expansionary phases, before the hypothetical bubble bursts. Powell (2002) argued this case in the Japanese recession throughout the 1990s and Rothbard (2000) stated that this could be seen in the Great Depression. There should be a significantly steeper slope

² As ir, fall, $\Delta(ir_{-}ir_{n})$ fall, increasing $I$ and decreasing $\Delta(C)$
coefficients of the independent variables in expansion as there in general are contradicting forces in a recession, liquidating malinvestments, working against the economic growth that is based on money supply as described by Mulligan (2006). Building on the work of Cochrane & Yetter (2004), and Rothbard (2000), it could be hypothesized that difference in magnitude between phases could be attributed to liquidation force presence.

In a recession the C/I ratio should increase to restore equilibrium, not because of the discussed variables, but instead due to liquidation forces. It is the signaling and market correcting described in the theory that is key to recessions. Without signal disturbance, the market would liquidate capital efficiently, redistributing resources and identifying business opportunities. With monetary intervention, signals get distorted, and resources are effectively hindered from redistribution to *optimal use*. Some resources are redirected as firms liquidate capital to retain profit margins, while others are held back due to credit injections. The stimulus in form of credit and money should have less impact on the economy due to conflict with liquidation forces trying to restore equilibrium during the recession. The variables discussed should then have *less impact* on intertemporal resource allocation during recession.

The emphasis of the model is to see whether the predicted signs are accurate and in addition to see if there is a significant difference between economic phases. If the theory holds true and the model proves suitable then there should be an augmentation of the coefficients between recessions and expansions. There is no reason to believe that the interest rate gap, credit or money supplies would affect the C/I ratio differently at different times of the business cycle in terms of signs, the difference in impact should stem to contradictory forces, as discussed. The expected signs of the variables are seen in Table 2.

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>β-Sign</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0</td>
<td>+</td>
<td>A money supply increase impacts consumption positively more than investment, enhancing C/I ratio.</td>
</tr>
<tr>
<td>M4</td>
<td>-</td>
<td>Increasing in magnitude over expansionary periods, reducing the C/I ratio.</td>
</tr>
<tr>
<td>Credit</td>
<td>-</td>
<td>Increasing in magnitude over expansionary periods, reducing the C/I ratio. Stronger effect on investments than monetary aggregates</td>
</tr>
<tr>
<td>(ir,irn)</td>
<td>+</td>
<td>Positive over both periods, higher β during expansions.</td>
</tr>
</tbody>
</table>

### 4.4 Data

The data used in this paper was collected from the Bank of England and UK National Statistics. All data has been seasonally adjusted. For the money aggregates the three month-average of collected monthly observations has been calculated. The observations used in the tests ranged from the first quarter (Q1) of 1984 to the first quarter (Q1) of 2006, thus constituting of 421 observations in total. More details can be found in Appendix 1. In addition, from these variables several key variables have been extrapolated and calculated. All regressions of time series are calculated without any lag, since the effects described by the model can be assumed to have effect almost immediately. Table 3 shows a summary of the gathered data used in the thesis and source of this data. Some variables used in the thesis
could not be retrieved from any data source; these had to be calculated from other data inputs from Table 3. The source and the manner of calculation of these variables are shown in Table 4.

Table 3 - Gathered data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Source</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0</td>
<td>Bank of England</td>
<td>Official monetary aggregate</td>
</tr>
<tr>
<td>M4</td>
<td>Bank of England</td>
<td>Official monetary aggregate</td>
</tr>
<tr>
<td>Credit</td>
<td>National Statistics</td>
<td>Bank outstanding credit</td>
</tr>
<tr>
<td>Savings ratio</td>
<td>National Statistics</td>
<td>Savings ratio of the UK</td>
</tr>
<tr>
<td>Consumption</td>
<td>National Statistics</td>
<td>Household final consumption expenditure</td>
</tr>
<tr>
<td>Investment</td>
<td>National Statistics</td>
<td>Gross fixed capital formation: Business Investment</td>
</tr>
<tr>
<td>Actual interest rate</td>
<td>Bank of England</td>
<td>Official bank rate</td>
</tr>
</tbody>
</table>

Table 4 - Calculated variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Calculation</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/I</td>
<td>Consumption/Investment</td>
<td>Intertemporal resource allocation</td>
</tr>
<tr>
<td>Natural interest rate</td>
<td>Savings ratio/(1 - Savings ratio); Average</td>
<td>Natural interest rate proxy</td>
</tr>
<tr>
<td></td>
<td>Propensity to save/ consume</td>
<td></td>
</tr>
<tr>
<td>Interest rate gap</td>
<td>Actual interest rate – Natural interest rate</td>
<td></td>
</tr>
</tbody>
</table>
5 Empirical findings and Analysis

The section begins with accounting of the findings where the short-run intertemporal resource allocation model has been tested. The results section will be summarized with a discussion of whether or not the findings are in line with the model and theory and to what degree the results are significant.

5.1 Empirical findings

Table 5 - Regression analysis using M0 and M4 (less M0)

<table>
<thead>
<tr>
<th>R²</th>
<th>Adjusted R²</th>
<th>F-statistic</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.103</td>
<td>0.048</td>
<td>1.884</td>
<td>0.106</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beta</th>
<th>t-statistic</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>β₀</td>
<td>0.021</td>
<td>0.733</td>
<td>0.466</td>
</tr>
<tr>
<td>β₁D</td>
<td>-0.096</td>
<td>-1.946**</td>
<td>0.055</td>
</tr>
<tr>
<td>β₂Δ(M₀)</td>
<td>-1.286</td>
<td>-0.675</td>
<td>0.502</td>
</tr>
<tr>
<td>β₃D*Δ(M₀)</td>
<td>5.848</td>
<td>2.274**</td>
<td>0.026</td>
</tr>
<tr>
<td>β₄Δ(M₄-M₀)</td>
<td>-0.586</td>
<td>-0.766</td>
<td>0.446</td>
</tr>
<tr>
<td>β₅D*(M₄-M₀)</td>
<td>0.772</td>
<td>0.660</td>
<td>0.511</td>
</tr>
</tbody>
</table>

** Significant at the α=0.05 level

For the first estimates equation, shown in Table 5, display a low R² measure with and non-significant F-statistic. Since this thesis is strictly concerned with the impact on the intertemporal resource allocation by the variables important to the theory, the intercept and its dummy variable will not be discussed in this paper. M₀ has an estimated positive relation to C/I in recession, but turns negative in expansion. The expected effect of M₀ was positive in both phases, but with stronger positive impact in expansion. The recession multiplies by ΔM₀, has a coefficient estimate which is significant at the 5% level, thus showing a significant difference between the two phases of the business cycle. Here the coefficient estimate M₀ partly contradict the expectations from the ABC model when switching from recession to expansion, but follows expectation in recession. A notable feature is that the difference in magnitude of the beta of M₀ in the phases are highly divergent, which follows the t-statistics of the variables. The monetary aggregate M₄ (excluding the part constituting M₀) shows a beta that is negative in expansions and positive in recessions. The coefficient therefore follows predictions in expansions but not recessions. In addition the excess monetary aggregate is not significant on any level.

³ Earlier tests, not reported here (due to multicollinearity) obtained higher R² measure of about 0.350 with more variables tested simultaneously.
Table 6 - Regression analysis using M0 and the interest rate gap

<table>
<thead>
<tr>
<th>R²</th>
<th>Adjusted R²</th>
<th>F-statistic</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.272</td>
<td>0.228</td>
<td>6.125</td>
<td>0.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beta</th>
<th>t-statistic</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>β₀</td>
<td>-0.020</td>
<td>-0.915</td>
<td>0.363</td>
</tr>
<tr>
<td>β₁D</td>
<td>0.017</td>
<td>0.487</td>
<td>0.628</td>
</tr>
<tr>
<td>β₂Δ(M₀)</td>
<td>1.228</td>
<td>0.963</td>
<td>0.338</td>
</tr>
<tr>
<td>β₃D*Δ(M₀)</td>
<td>-1.755</td>
<td>-0.769</td>
<td>0.444</td>
</tr>
<tr>
<td>B₄Δ(irᵢ-irᵣ)</td>
<td>0.024</td>
<td>5.249*</td>
<td>0.000</td>
</tr>
<tr>
<td>β₅D*Δ(irᵢ-irᵣ)</td>
<td>-0.025</td>
<td>-3.910*</td>
<td>0.000</td>
</tr>
</tbody>
</table>

* Significant at the α=0.01 level

The second estimated equation, shown in Table 6, has a higher R², hence the model fits the data better. In addition there is a significant F-statistic, showing that some independent variables have means significantly different from zero. ΔM₀ has a positive coefficient estimate in expansion and negative one in recession. This again is partly contradictory to the model, where it should be positive during both periods. In addition the associated coefficient estimates are not found significant. The interest rate gap coefficient was found significant on the 1% level in expansion. At the 1% level there is also a significantly different effect of the interest rate gap in recession compared to expansion. The sign of the interest rate gap coefficient was predicted to be positive in both phases, which is supported by the findings for expansions, but not recessions. Interest rate is important in explaining the C/I ratio, however a change in the interest rate is shown to have less impact on C/I compared to the other variables, as measured by the magnitude of the betas.

Table 7 - Regression analysis using M₀ and credit

<table>
<thead>
<tr>
<th>R²</th>
<th>Adjusted R²</th>
<th>F-statistic</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.080</td>
<td>0.024</td>
<td>1.431</td>
<td>0.222</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beta</th>
<th>t-statistic</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>β₀</td>
<td>0.000</td>
<td>0.014</td>
<td>0.989</td>
</tr>
<tr>
<td>β₁D</td>
<td>0.006</td>
<td>0.137</td>
<td>0.891</td>
</tr>
<tr>
<td>β₂Δ(M₀)</td>
<td>1.929</td>
<td>1.353***</td>
<td>0.180</td>
</tr>
<tr>
<td>β₃D*Δ(M₀)</td>
<td>-1.806</td>
<td>-0.728</td>
<td>0.469</td>
</tr>
<tr>
<td>β₄ΔCr</td>
<td>-1.106</td>
<td>-1.728**</td>
<td>0.088</td>
</tr>
<tr>
<td>β₅D*ΔCr</td>
<td>0.423</td>
<td>0.515</td>
<td>0.608</td>
</tr>
</tbody>
</table>

*** Significant at the α=0.10 level
** Significant at the α=0.05 level

The last estimated equation again, shown in Table 7, portrays a low R² measure and a non-significant F-statistic. M₀ has a positive connection to C/I in both phases; it has stronger influence in the expansionary phase and weaker impact in the recessionary phase. However, the associated coefficient estimates are not statistically significant at any level. Credit on the other hand, shows a negative correlation to the intertemporal resource allocation in both phases, having a stronger negative effect during expansions. Both M₀ and credit follow the
expectations of the model, and the credit coefficient is significant on the 10% level during expansions. The variables show support for the model, although all but one of the coefficients estimates are not statistically significant.

5.2 Analysis and Discussion

The findings of the tests have the predicted signs in the short run in several cases. However, it is important to note that the findings in general are insufficient to conclude whether the modeled theory holds or not in the short run, as the data give many non-significant results. Some variables contradict the predictions, giving inconclusive answers. As most findings are insignificant, it could be the case that the model used to test the theory is inadequate to trace the short run effects of the theory.

There is also the possibility that using a short-run model creates problems in finding significance as it fails to capture the underlying predictions observable in the long run. Logically, a theory that is designed to have long run impact due to accumulating changes does not have the identical outcome when the incremental stages are examined. Narrowing the time frame of observation naturally leads to more uncertainty, hence observations in the short run need not necessarily match observations in the long run.

The narrow monetary aggregate M0 was predicted to track fluctuations in consumption better than the investment part of the C/I ratio. While consumption in the short run is rigid due to the scarcity of consumer goods available as explained, it can increase incrementally in relation to investments. The broader money aggregate, M4 was expected to have stronger effect on investment, which the data supports. Rothbard (1978, p. 153) defined the Austrian school’s supply of money concept: “all entities which are redeemable on demand in standard cash at a fixed rate”. Neither of the two considered official monetary aggregates in the UK corresponds to this statement, as M0 do not include redeemable time deposits while M4 includes illiquid deposits with constraints on withdrawal. Perhaps due to not being appropriate “Austrian monetary aggregates” both give conflicting coefficient signs compared to predictions. The finding that M4 and M0 as predicted affect C/I differently is important in further discussions of the ABC theory, with a proper monetary aggregate located in-between M4 and M0.

Credit behaves much as expected in the tests, showing a negative coefficient where increased credit supply increases investments, and lowers the C/I ratio. In the method section it was hypothesized that increased credit should have a greater effect on investment than consumption. When comparing recession to expansion, the credit coefficient was predicted to become increasingly negative. In addition, credit also has a higher magnitude effect than M4-M0, as predicted in the method section. Possibly, as credit is injected into the economy it goes directly to the private sector, while money take a roundabout way, so credit has more a direct relation to investment.

The coefficient estimate of the interest gap variable showed significance in the tests, indicating that it has a non-random influence on the resource allocation, and affects the C/I ratio differently during expansion and recession. The findings show that the net effect in the expansion in the short run of the lowered interest rate is a decrease in the C/I ratio, which means that there is indeed greater effect on investment than consumption in the short run.

An interesting fact is that although money, credit and interest rates are interconnected, the interest rate gap coefficient shows more consistent significance in explaining short run intertemporal resource allocation. The difference between interest rate and the other two variables, money and credit, is that it measures the cost of capital while the other measures
stock or quantity of financial capital. This is in line with the theory of the Hayekian triangle, which emphasizes relative prices getting distorted by interest rate changes, creating malinvestments. The coefficient of the interest rate gap is however relatively small compared to credit and money in terms of comparison in changing rate, which can be explained by the fact that the injection of money/credit into the economy causes a direct change while the interest rate indirectly affect the C/I ratio. So the changes in stock of financial capital seem to affect the quantitative changes in investment more directly than the price of that capital, which should be kept in mind for further studies.

The effect of liquidation force can be seen to some extent. The ambiguity found in some of the results when predictions are made for variables in recessionary periods, could be the result of conflicting liquidation and stimulating forces. These are arguably common as policies can distort the fundamental market movements.

Several issues exist that could be the source of distortion of the findings. Theoretical measures such as the proxy of natural interest rate may not be easily transferrable from theory to practice, as a measure based on theoretical derivation does not necessarily reflect the real world complexities. Lewin (1995) discussed whether or not aggregate time preferences could be calculated, since the natural rate of interest should be subjective, due to economic agents being a heterogeneous mass, with different time preferences. It is possible that one cannot generalize the natural interest rate based on all economic agents nor be able to proxy it. As mentioned in the method section, the division of economic phases based upon unemployment level can alter the findings as it may not follow other economic data such as GNP.

Finally, there is also the issue of exogenous effects in the short-run model. In other words, the model probably does not cover all explanatory variables that drive changes in short-run intertemporal resource allocation beyond those important for the ABC theory. Examples of such exogenous variables are taxation, psychological shifts in market agent’s behavior, productivity shifts, technology, and regulation changes. In a long run framework, the temporary effects of such policies would be of less significance.
6 Conclusion and Further Studies

This study has looked into the Austrian business cycle theory with a Hayekian triangle model approach. The paper is set apart from previous studies; the thesis has looked at the ABC theory from a short run perspective, examining the ABC theory in the UK economy while previous studies have been conducted on the US market. The analysis was based on quarterly data between 1984 and 2006. Regression analysis was performed to consider short run effects on explanatory variables for the consumption to investment ratio in both recessionary and expansionary periods.

The results of the study are positive. Most findings follow the expectations of the ABC theory while others to a small extent behave unexpectedly. As the testing is done in the short run, several external factors are amplified compared to the case of testing in a long run format. Despite these external factors the role of the interest rate gap is found significant, which implies that the variable has important applications for all of the ABC theory, more likely so in a long-run perspective. Credit had the expected reaction when tested, and had a greater coefficient in expansion, which is in line with the theory. The monetary aggregates overall did not behave as predicted, with aggregates targeting different components having different magnitudes, giving inconclusive results.

In conclusion, the findings of this paper show promise for further development of a model for intertemporal resource allocation. With the interest rate gap found statistically significant and behaving as predicted it is possible that other closely-related variables to the non-significant variables used can be helpful in describing the short-run process. The variables used behaved mostly as predicted, but since they did not display significance it would be necessary to research these in further development of the model. Although, it shows potential for future findings as the variables are showing the expected signs overall. The role of the natural interest rate, here included in the calculation of the interest rate gap, is found to play an important role in determining the intertemporal resource allocation. Essentially the findings favor parts of the ABC theory in the short run.

Further analyses on short-run approaches need to be done to substantiate the findings. It is of importance to further corroborate the findings in a short-run framework, to see whether a linkage can be found between the short and long-run in the ABC theory. Another important fact not discussed in the ABC theory is the impact of foreign financial markets on the domestic market. In the world economy, countries have different economic sizes. Hence, policies in some countries can flow to other smaller countries, in which their own monetary policies can have secondary importance in comparison. In addition further research can be focused on the sectoral impact of various injections of credit as the production process segments could possibly behave differently depending on the stages in the structure of production.

In summation, some findings show strong support for a model based on the ABC theory. However, many of the findings are not significant, but parts of the theory show validity in the short run. More research is needed to substantiate the findings, particularly concerning the role of the natural interest rate.
References


Appendix 1  Model variables

Source: National Statistics


YBEUGross - Domestic Product index: Current price: Seasonally adjusted Seasonally adjusted 2003 = 100 Updated on 7/10/2006

HBOMBoP - Investment Income Balance SA £m Seasonally adjusted Updated on 18/12/2008


ABJR - Household final consumption expenditure: National concept CVM NAYear SA Seasonally adjusted Constant 2003 prices Updated on 7/10/2006

VRVVBank - consumer credit: Amounts outstanding: SA Seasonally adjusted Updated on 7/10/2006

NPEK - Fixed Capital Formation: Business Investment: CP SA: £m Seasonally adjusted Updated on 16/ 3/2009

Source: Bank of England

Monthly average amount outstanding of total sterling M0 (in sterling millions) Seasonally adjusted (discontinued April 2006) – computed three month average

Monthly amounts outstanding of M4 (monetary financial institutions’ sterling M4 liabilities to private sector) (in sterling millions) Seasonally adjusted – computed three month average

IUQABEDR – Quarterly average of the official bank rate

Personal communication

Paul Cullihane – NRJS PUBL 27Mar09 Savings ratio of the UK, seasonally adjusted
Appendix 2  □ Variable development

Figure 6 - Bank outstanding credit
Source: National Statistics

Figure 7 - Consumption-Investment ratio
Source: National Statistics
Figure 10 - Interest rates Source: National Statistics, own calculation