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The Relevance of Haavelmo's Macroeconomic Theorizing for Contemporary Macro Policy Making

Sheetal K. Chand*

Abstract

The recent great financial crisis and the ensuing deep recessions have placed in sharp relief the fundamental issue of how financial factors, including financial instability, interact with the real economy. In order to understand the nature of these interactions and formulate policies that would help contain adverse outcomes it is essential to have an adequate conceptual framework. Unfortunately, the standard DSGE approach is deficient in this regard. This paper contends that Haavelmo's macroeconomic theorizing provides a better starting point for forging the required integration between the financial and real sectors. The paper extends the basic Haavelmo model to the contemporary scene and uses it to shed light on policy solutions to the current predicament.

Keywords: financial crisis, investment, monetary and fiscal policies

JEL classification: E22, E44, E52, E63

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1. Introduction

The recent great financial crisis and the ensuing deep recessions have placed in sharp relief the fundamental issue of how financial factors, including financial instability, interact with the real economy. In order to understand the nature of these interactions and formulate policies that would contain adverse outcomes it is essential to have an adequate conceptual framework. Unfortunately, as many commentators have noted, the framework that is in current widespread use, namely the "new neoclassical synthesis" between the real business cycle (RBC) and the "new" Keynesian approaches, otherwise known as the DSGE approach, is deficient.[1] While the standard DSGE formulation provides a role for monetary policy in the form of an interest rate rule (Taylor rule), and an elaboration of how consumption and investment are affected by the interest rate settings (usually smoothly), it did not until very recently provide any explicit role for financial intermediation, nor of liquidity preference based portfolio behaviour, and their respective influences on the real economy.

Issues of financial intermediation were dealt with separately. Any implications for the macro economy were confined to studying possible amplification effects that the financial sector could exert on real sector disturbances.[2] For example, under the financial accelerator hypothesis, a real shock to the net worth of firms lowers their eligibility for credit thereby constraining their outlays, which in turn could further erode net worths and cause a downward spiral. The possibility that the financial sector could itself be the source of disturbances that impact on the macro economy, as occurred during the recent crisis, was neglected. Several patches are now being proposed to overcome this inadequacy. These involve introducing financial frictions into the standard paradigm, with the preferred method that of providing a bridge to the financial intermediation literature by re-specifying the "credit channel".[3]

Financial frictions can exert an independent effect on financial intermediation itself. For example, an adverse financial shock such as a "toxic shock" can cause a breakdown in trust between the financial institutions, which in turn lowers the availability of credit to the real sector thereby leading to a reduction in its outlays and a slowdown in activity. This approach has some plausibility, as there has been a marked decline in loans from the financial sector to the small and medium-scale enterprises in particular. On the other hand, banks have

[1] See especially Caballero (2010), Colander et al., (2008), De Grauwe (2010), Leijonhufvud (2009), Pesaran and Smith (2011), and Stiglitz (2011). Woodford (2010), a major progenitor of DSGE modelling, is also critical of the lack of integration with the financial side.

[2] See Bernanke et., al. (1999)

[3] Of particular interest is Brunnermeir et al., (2011), and Gertler and Kiyotake (2011)

attempted to become more liquid. They also complain that there is a dearth of viable projects on which to lend, and that in the current recessionary context loans are frequently demanded merely to cover losses being incurred and to finance interest payments due, but not for investment. In contrast, many larger firms increasingly prefer to hold cash and have reduced their demand for loans, while also engaging in buybacks of their outstanding shares. Given these firms' prime debtor status as a result of their cash holdings and the unprecedented low interest rates that central banks have set, their curtailment of capital accumulation and merger and acquisition (M and A) activities through leveraged borrowing appear puzzling. This indicates that there may be deeper causal factors at work than just impediments to the credit availability channel, and that a more fundamental integration between the financial and real sectors is needed. [4]

The standard paradigm suffers from several other problems that affect its realism and scope, some of which should be noted here. Various frictions are usually introduced in an ad hoc manner such as the financial ones mentioned above so as to ensure a better match with the data. These frictions are typically viewed as impediments of temporary duration that slow down adjustments to the competitive market equilibrium, which is the default setting. For example, to allow for observed fluctuations in unemployment sticky prices are introduced the effects of which should dissipate over time. However, if they do not this would be regarded as symptomatic of structural deficiencies and reforms would be required so as to improve price setting practices and market efficiency.

Another problem with the standard paradigm is that it restricts the use of stabilization policies to the monetary instrument. This follows, in particular, from having consumption behaviour determined in accordance with the Euler conditions of intertemporal maximization, with the result that the main vehicle for affecting it is through interest rate changes. In this setting a stabilizing role for fiscal policy is ruled out, at any rate one on traditional Keynesian lines that involve multiplier effects operating through induced fluctuations in income.[5] Yet in the face of slumping consumption and falling investment and declining output it is precisely

[4] Although the earlier IS/LM reference framework includes portfolio behaviour with an emphasis on liquidity preference, its postulated linkage with the real sector is problematic. For example, if liquidity preference increases and interest rates rise, the IS/LM approach indicates that investment and output would decline, and that this would reduce the demand for liquidity and restore equilibrium. Aside from the problematic natures of the investment function assumed, and the output driven interest rate equilibrating mechanism, the ensuing adjustments have dynamical implications, including changes to expectations, but IS/LM is unable to take account of these factors. Essentially, it is a static mini-Walrasian approach that is imposed on an inherent dynamical process, which solves for equilibrating flows without taking note of their dynamical effects.

[5] Woodford (2011) has raised the issue of fiscal policy in a DSGE setting, but its impact is on modifying labour-leisure tradeoffs and not aggregate demand.

the traditional Keynesian fiscal policy that was invoked during the recent crisis. The standard approach does not take account of the possibility that financial shocks could so adversely affect balance sheets as to override intertemporal optimal consumption plans. The household is forced to comply with the balance sheet dictated requirements, for example, it may have to meet loan requirements such as servicing a mortgage. In a constrained cash flow situation households may have no other alternative than to adjust their consumption in accordance with immediate contingencies, in effect reproducing some elements of a traditional Keynesian consumption function, and hence the Keynesian multiplier effects.

Another significant problem is the lack of a fundamental liquidity role for money. The standard paradigm's assumption of complete markets together with full information implies that once an asset or commodity is priced it can always be sold at any time. This makes nonsense of any claims that some assets are more liquid than others. However, in practice this is not the case, and people do find it convenient to hold non-interest bearing money which they can readily deploy when the need arises (Haavelmo, 1969). More generally, this is a result of operating in a world of Knightian uncertainty, with uninsurable contingencies and incomplete markets, and transactions effected through nominal money contracts.

A useful, realistic, framework that copes better with the type of crises now being encountered is needed. It should be less exposed to the problems ascribed above to the DSGE approach, which could be characterized as a "fair weather "paradigm, where transactors are able to plan and implement their programs over long stretches of time, and where financial crises either do not arise or, if they do, are readily dispelled by the monetary authorities lowering interest rates. The ideal paradigm would be an "all-weather" one, that can accommodate both crisis and non-crisis situations. This paper contends that the elements of such a paradigm can be found in Haavelmo's macroeconomic theorizing. The latter provides a suitable starting point for forging the required integration between the financial and real sides, and for addressing the other problems noted above.

In his conceptualization of macroeconomic phenomena, Haavelmo kept coming back to a basic model that he had formulated in the 1950s. Versions of this model are to be found in his treatise on investment published in 1960, henceforth IT, and in lecture notes written in Norwegian that he eventually presented in 1966 as a "Study on Macroeconomic Theory", henceforth SMT.[6] This model integrates balance sheet transactions with flow activities such

[6] The latter is the more complete version and I shall draw upon it, specifically the version presented in chapter 26 of SMT in the published version of 1969. In preparing this paper I have been enlightened by the penetrating discussions in Andvig (1993), Anundsen, et al., (2011), and Moene and Rødseth (1991).

as production, consumption, and investment; allows shocks emanating from either the financial or real sides to impact on the other; and provides a unified theory of how under-employment and full employment can be generated. It also provides a natural transition to the longer-run temporal issues involving business cycle fluctuations and secular growth. [7]

Regarding Haavelmo's mode of theorizing there is often an air of deceptive simplicity in the models that he presents. [8] This is because of his conceptual focus on the interaction of major behavioural drivers such as optimization and arbitrage and the institutional environment. In order to bring out the inherent logic of such interaction he often drastically simplifies on the grounds that if after the removal of clutter a core interaction remains this would be fundamental. For example, in the development of macroeconomics it has been widely assumed that sticky prices and wages are required in order to explain under-utilization of resources and unemployment. Haavelmo demonstrates instead that these phenomena can be generated in a neoclassical context of flexible prices insofar as there is no inherent mechanism for immediately eliminating a certain kind of stock imbalance that arises when the marginal product of capital falls below the rental rate required by ultimate owners of capital.[9] It may be true that introducing sticky prices can reproduce the under-employment phenomena, and sticky prices may even be widespread. However, to the extent there is a more fundamental cause, and this is not addressed, a policy of eradicating sticky prices will not be successful in overcoming the unemployment problem that is of concern. [10]

The paper adopts the following plan. The next section describes some essentials of Haavelmo's basic model. This is followed by a section that introduces some extensions and elaborations to the basic model in order to better relate it to the contemporary situation. The third section attempts to relate aspects of the basic model and the proposed extension to the recent experience of the G-7 countries. Some observations on Haavelmo's macroeconomic concerns are presented in the concluding section.

[7] The presentation of Haavelmo's short-run model here uses the same terminology and is broadly similar to that contained in Anundsen, et al., (2011), but with some differences in structure and interpretation to facilitate the analysis of policy implications. The focus in Anundsen, et al., is on endogenously induced fluctuations in the business cycle for which they use a more elaborate version of the basic model.

[8] Some may object that the model does not meet contemporary standards of rigour. However, the purpose of the model is to set out a framework for surveying the landscape, which is needed before drawing a detailed operational map with specific directions.

[9] Both in IT and SMT.

[10] Le Gall (2011) describes Haavelmo's approach to modelling as an artistic endeavour, which is apposite. Haavelmo always seeks an artful minimalist representation, and liberally applies Occam's razor. One could add, since Haavelmo was also avidly interested in fishing, that he was always on the lookout for the "biggest fish" explanation. In his writings he incessantly subjects different bits of theory to searching examination. If the fish is too small, he puts it back as, for example, with Keynes's theory of investment. However, if promising, he preserves it for later use. His biggest fish was drawn from Wicksell.

2. Haavelmo's fundamental macroeconomic model: an interpretation

The objective of the model is to explain fluctuations in output, and by extension employment. To fully appreciate the model one has to go back to Wicksell, who provides the basic inspiration regarding the interplay between the banking determined interest rate and the real sector's natural rate.[11] Haavelmo, in a major refinement to Wicksell's original conception, incorporates a theory of capital and liquidity preference, on the basis of which he develops an endogenous theory of investment.

The actors of the economy are grouped into four categories: firms who produce output and undertake adjustments to their capital stock; households who provide labour, earn income, save, consume, and are the ultimate owners of the wealth of the economy from which they obtain returns; the banking sector, which accepts deposits and lends to wealth owners at some interest rate; and, finally, the public sector, which consumes, invests, levies taxes and borrows. The sum total of their consumption and investment activities determines national output, and the central issue is to explain how these activities, by reference to both the real and financial sides, affect output and employment.

The real side

This is a one sector closed economy model with output produced, consumed, and accumulated as capital, all at a common price *P*. [12] In real terms

$$Y = C + I \qquad (1)$$

Y is output; C indicates consumption; and investment is I. The latter two aggregates implicitly include government outlays.

Aggregate consumption *C* is the sum of private consumption, which is a function *g* of net disposable income *R*, and public consumption C_g which is assumed to be exogenous.

$$C = g(R) + C_g \qquad 0 < g'(R) < 1 \qquad (2)$$

Net disposable income is defined as

$$R = Y - \delta K - T \qquad (3)$$

Here δ is an assumed constant rate of depreciation of capital *K*, and *T* denotes taxes levied.

Three types of investment are distinguished

$$I = I_1 + I_2 + I_g \qquad (4)$$

[11] An accessible account is Wicksell (1907). The natural rate refers to the marginal product of capital, which Wicksell also referred to at times as the normal rate of profit on capital.

[12] All flow terms refer to a period *t*, while stock terms and balance sheets refer to a point in time in relation to the period. To save on terminology time referents are suppressed. Haavelmo presented an open economy version in SMT, which dealt with small open economies operating under fixed exchange rates, but this was not fully developed. Opening up raises several issues which are beyond the scope of this paper.

I_1 refers to firms' investments to increase the capital stock given the existing technology and is directly related to profitability considerations based on a comparison of the marginal product of capital and its imputed rental rate; I_2 denotes regular autonomous investment that is undertaken to exploit new technologies; and I_g represents investment undertaken by the public sector. The model treats I_1 as endogenous, and I_2 and I_g as exogenous.

Output is produced in accordance with a production function where *N* denotes the labour input and *K* is the given stock of capital.

$$Y = \phi(N, K) \qquad (5)$$

The production function has standard properties of substitutability, increasing returns and technical complementarities between the two inputs. [13]

Haavelmo distinguishes between two types of production situations.

(i) *Alternative A – the full employment regime*

In this regime, firms find demand for output to be adequate, for example as indicated by the behaviour of the inventories that they hold. They are assumed to be perfectively competitive price takers i.e. they are "quantity producers" in Haavelmo's description, and produce as much as they profitably can in accordance with their profit function

$$\Pi = PY - r^*PK - \delta PK - wN \qquad (6)$$

Here r^* is the (required) rate of return i.e. the rental rate that owners of capital demand from firms for the use of their capital, *w* is the given wage rate, and *P* is the given price level.

Given an imputed rental rate r^*, the firm's optimal recourse is to hire as much labour as is economically feasible for the capital stock in place, thereby increasing the marginal product of capital. How many to hire will depend on their wage demands. If labour accepts a wage that is at or below the marginal product of labour, firms will hire the maximum available labour force *H* and in the process will bid up and pay a wage equal to the full employment marginal product. However, if labour insists on a higher wage, firms will employ less labour *N* than the maximum available, but this is an outcome enforced by labour and not by inadequate demand. Unless the context requires otherwise, it will be assumed that under *Alternative A* the maximum available labour *H* is applied to the given capital stock *K*.

$$\frac{\partial \phi}{\partial N} = \frac{w}{P}, \text{ and } N=H \text{ or } \frac{\partial \phi}{\partial N} < \frac{w}{P} \text{ and } N<H \qquad (7)$$

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[13] $\frac{\partial \phi}{\partial N} > 0,\ \frac{\partial \phi}{\partial K} > 0,\ \frac{\partial^2 \phi}{\partial N^2} < 0,\ \frac{\partial^2 \phi}{\partial K^2} < 0,\ \frac{\partial^2 \phi}{\partial K \partial N} > 0$

Whenever the first part of (7) applies, the resulting maximum net marginal product of capital i.e. the natural rate is

$$r = \frac{\partial \phi(H,K)}{\partial K} - \delta \qquad (8)$$

If this *r* exceeds the rental rate *r**, firms will be making excess profits for the given capital stock. This situation leads firms and owners of capital to desire more capital stock *K** up to the point where the net marginal product equals the required rental rate

$$r = \frac{\partial \phi(H,K^*)}{\partial K^*} - \delta \equiv r^* \qquad (9)^{14}$$

Should an excess stock demand for capital result i.e. $(K^* - K) > 0$ owners will initially attempt to acquire the additional capital from each other. Since the capital stock is given in the aggregate, the result will be merely to drive up the price of capital *P*, which for the basic model is also the price of output. However, Haavelmo demonstrates on bringing in the financial side (see the discussion surrounding equations (10) to (13) below) that there is an alternative way of ensuring a temporary equilibrium for the holding of K, without recourse to unrealistic jumps in *P*. The temporary equilibrium concerning portfolio balance need not imply that the aggregate excess demand for capital has also been eliminated. In a closed economy this can only be achieved through investment. As Haavelmo pointed out, the instantaneous rate of investment would have to be infinite in continuous time to meet a discrete excess stock demand for capital. Since this is not possible, a mechanism is needed for determining observed investment flows that would eliminate the capital stock imbalance over time.

The mechanism that Haavelmo adopts in his basic model, and which also closes the real part of the model, is to postulate that firms accept as investment I_1 any surplus output that is left over after meeting consumption, public sector requirements, and other demands.[15]

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[14] For example, if $r > r^*$ and a Cobb-Douglas production function, $K^* = \frac{r}{r^*}K$. This follows since the elasticity of output with respect to the capital stock is invariant – a larger capital output ratio for example being offset by a lower marginal product of capital. Thus if *r* is 6 percent and *r** is 3 percent the desired capital stock would be double the current one. If the existing annual capital output ratio is 2, the desired capital output ratio at the existing level of output would be 4. If I_1 is, say, 10 percent of Y it would take 20 years to attain the desired capital output ratio. Thus relatively small changes in the gap between the rental rate and the marginal product of capital can cause big changes in the desired investment flow.

[15] This procedure rules out a conflict between saving and investment plans, but it is not an essential requirement for his model, and a more complex model could be set up with a separate equilibration mechanism for the flows.

Hence, there is no need for the price level or interest rates, or even wages, to adjust to ensure equilibrium in the output market. With the output market automatically equilibrated, attention can be more readily focused on the financial side and its implications for the real side.

(ii) *Alternative B – the under-employment regime*

The other situation that Haavelmo considers is a low output regime. In this situation firms produce to "orders" i.e. in accordance with their order books so as to avoid risking the piling up of excess inventories. This is because of inadequate aggregate demand, which Haavelmo attributes to a fall in investment as a consequence of the net marginal product of capital being lower than the required rental rate i.e. $r < r^*$. Owners will want to reduce capital, but since investment cannot be negative they have to rely on the natural depreciation of the capital stock.

With output lower than that under *Alternative A*, not all of the available labour force, even if they were willing to work at a wage lower than their marginal product, would be employed. This is a consequence of deficient aggregate demand and corresponds to Keynesian under-employment.[16] Haavelmo notes that since less labour needs to be applied to the given capital stock to produce the smaller output level, *r* will be lowered. This could further reduce desired capital stock and hence investment.

It might be noted that with less output and hence less labour being hired for the given capital stock, the marginal product of labour is higher than the real wage that would have prevailed for the same capital stock under *Alternative A* i.e. $\frac{\partial \phi}{\partial N} > \frac{w}{P}$, where more output is being produced. Thus reducing wages to help increase employment in *Alternative B* would not help, since the amount of employment needed has already been determined by the order book, and providing the substitutability of labour for installed capital is limited. It might even be harmful if it further reduces demand and the order book. In this situation, reducing wages, as is often recommended, would only increase profits of the firm at the expense of labour.

The financial side and its integration with the real side

The next step is to examine *r** and its determinants. This is done from the financial side. Here Haavelmo focuses on two key balance sheets. The first is a combined one for the household and public sectors i.e. the non-banking sector, while the second is for the banking sector.

[16] However, note that unemployment does not depend on sticky prices and wages, but arises in a classical context with deficient demand. It is simply a consequence of their being less investment and smaller order books because the net marginal product of capital is less than the required rental rate.

Table 1 portrays the balance sheet for the non-banking sector. Households own the capital K, the nominal value of which is PK. They also hold all the money stock issued *M*, the counterpart to which is the loans *L* they contracted.[17] In the assumed closed economy setting net worth of the non-banking sector is always non negative, since *M* must equal *L*.

Table 1 Balance Sheet for Non-Banking Sector

Assets	Liabilities
PK *M*	*L* Net Worth=*W*

Table 2 presents the balance sheet for the banking sector, which consolidates the central bank with the commercial banks. Its liabilities comprise deposits *M*, which funds the loans that it provides at some interest rate *i*. The sector's net worth is zero, which is a convenient simplification. [18]

Table 2 Balance Sheet for the Consolidated Banking Sector

Assets	Liabilities
L	*M* Net Worth=0

Certain features of the financial sector setup which is on Wicksellian lines should be noted. The banking sector engages in leveraged lending. Money is created through the issuance of loans, which in principle is the same as an open market operation.[19] The household sector contracts loans to finance capital acquisitions or cash holdings. Since the economy is closed all loan proceeds have to be deposited with the banks (Haavelmo abstracts from the complications of introducing currency). This creates potential for another round of loans, money, and so on.

[17] The entry shown in the table comprises the non-interest bearing component, since Haavelmo assumes that any interest bearing money is netted against loans L contracted from the banking sector.

[18] However, this could be still be construed as a capital requirement condition. More realistic alternative conditions could be introduced, but the essentials of the argument to be made remain unchanged.

[19] The model abstracts from flow injections of money, for example from financing a government budget deficit. Haavelmo (1978) construes such injections as an income statement entry and not a balance sheet one which would bear different consequences for the macro economy.

Haavelmo considers the problem of why non-interest bearing money should be held, and argues that it is because it has liquidity value. Different goods, even if they have the same nominal value, may face varying difficulties in how readily they may be converted into cash, which is the most liquid asset and therefore desirable for contingency and other reasons. He notes that when liquidity preferences change, transactors can acquire their desired amounts of money but only by adjusting the loans outstanding with the banks. They cannot effect changes in their money holdings by adjusting their holdings of claims on capital, since this would merely redistribute money balances and capital claims within the sector, leaving the latter two aggregate totals intact.

The model's financial side is formalized by setting up a preference function for the non-banking sector (on analogy with that for the individual portfolio owner) as to the composition of its portfolio.[20] This is maximized with respect to the balance sheet constraint

$$\begin{aligned} \underset{K,\frac{M}{P},\frac{L}{P}}{Max:} \quad & U\left(K,\frac{M}{P},\frac{L}{P};\frac{W}{P},r^*,i,Y\right) \\ wrt: \quad & W = PK + M - L \end{aligned} \tag{10}$$

The following demand functions, denoted with the superscript *d*, result

$$K^d = k\left(\frac{W}{P},r^*,i,Y\right) \tag{11}$$

$$\left(\frac{L}{P}\right)^d = l\left(\frac{W}{P},r^*,i,Y\right) \tag{12}$$

$$\left(\frac{M}{P}\right)^d = m\left(\frac{W}{P},r^*,i,Y\right) \tag{13}$$

These are functions of real wealth, rental rates, bank interest rates, and output, and have standard interpretations. Thus the demand for capital ownership increases with the rental rate that can be charged for the use of capital but declines if costs of borrowing to finance the acquisition of capital increase; demand for loans to finance capital acquisitions increases with the rental rate for capital but declines if borrowing costs rise; while liquidity preference declines with increases in the rental and borrowing rates, insofar as they raise the opportunity costs of not investing or paying down debt.

Haavelmo then proceeds to consider how optimal portfolio demands for a given constellation of determining values are reconciled with their supplies. The issue is that of the

[20] Haavelmo, both in IT and SMT was concerned about the aggregation problem. In the end he decided to adopt the procedure of reasoning by analogy as a convenient way of retaining the insights from individual behaviour, while at the same time allowing for macroeconomic interactions between groupings of individuals.

macroeconomic conditions for temporary equilibrium of the financial side. Haavelmo notes that if the desired stock of money is equal to the amount of loans outstanding, it follows from the non-banking sector's balance sheet constraint stated in (10) that the available stock of capital would also be held. Thus only one equilibrium condition, *M* equals *L*, is needed for the financial side to be in equilibrium

$$m(K,r^*,i,Y) = l(K,r^*,i,Y) \qquad (14)$$

The adjustment variable for ensuring equilibrium in (14) is *r**. For any interest rate *i* that the monetary authorities specify, there is a rental rate of capital that will ensure equilibrium. From (14) a solution for *r** can be expressed as

$$r^* = f(i,K,Y) \qquad (15)$$

An increase in the banking sector's loan rate will increase *r**. Since changes in *K* or *Y* have largely offsetting effects on the demand for loans and for real balances, the relationship (15) will be largely governed by *i*.

The rental rate is usually higher than the loan rate, because the latter represents a contractual requirement whereas the former takes account of the greater risk associated with production. Hence, the opportunity cost for liquidity preference is likely to be dominated by r^*. For portfolio balance to prevail if the demand for money is reduced, *r** will have to fall so as to lower the demand for loans. This indicates a positive monotonic relationship between the two rates.

In the basic model the price level *P* is treated as a state variable that changes over time but not in discrete jumps. Haavelmo adopted a Wicksellian approach for determining the rate of inflation. Under *Alternative A,* when the marginal product of capital exceeds the rental rate, pressure on full employment output will be present. If sustained over time because of increased investment demand, this would result in inflation, which Haavelmo expresses on Wicksellian lines

$$\frac{dP}{dt} = \gamma P(r - r^*) \qquad (16)$$

However, he does not specify in his basic model precisely how the inflationary adjustment in prices occurs. In Wicksell's case inflation is determined in the market for output, whereas in the basic model this market is characterised by investment passively absorbing the excess supply of output. This suggests that the inflationary impulse would have to come from labour demanding higher wages, and increases in other input costs, as a result of sustained pressure from investment on production.

3. Extending Haavelmo's Basic Model

Haavelmo developed his model in the 1950s, a period during which financial and other markets were heavily regulated.[21] Norway, for example, engaged in stringent credit budgeting until the 1980s, which renders his model all the more prescient with regard to how the macro economy would behave under free financial markets. His fundamental contribution was to incorporate liquidity preference and portfolio balance together with a theory of capital into the Wicksellian framework. However, a further extension is needed to take account of subsequent financial innovations such as deregulation of financial markets and transactions; the rise to prominence of secondary markets for capital claims; widespread recourse to leveraged borrowing; and greatly increased speculative behaviour, all of which increase the potential for balance sheet shocks. The latter can interact with and amplify the capital stock imbalance effects of Haavelmo's basic model. In extending the basic model to deal with such issues, the approach here builds on his fundamental distinction between the marginal product of capital and the required rental rate, while adding the prospect of balance sheet shocks, and their implications for these two rates. The sketch provided here of the proposed extension follows the mode of presentation of the basic model.

Extending the financial side

The principle extension is to the financial side of the basic model, specified in equations (10) to (14) in the preceding section. This part of the model determined the rental rate at which capital owners would be comfortable with their holdings, given their preferences regarding liquidity, and the loan rate of interest. The approach here is to introduce a secondary market involving claims on capital *K*. Capital claim owners may be comfortable with some rental rate r^*, but if they wish to trade their claims they go to a secondary market, e.g. the stock exchange. The output cost of capital remains *P*, but now a valuation price *V* is placed on the claim which adjusts to clear the market for these claims in the manner specified below. [22]

In Haavelmo's basic model the focus is on acquiring capital, which is undertaken to exploit differences between the equilibrium rental rate that balances portfolios and the

[21] However, his earlier exposure to the freer markets of the US is likely to have been helpful (see Bjerkholt (2007))

[22] A simple analogy is with the housing market. Owners of real estate may be quite happy to hold the stock at a given rental rate. However, from time to time some may test the market hoping to get a better price and to realise capital gains. Or they may be constrained for cash flow reasons to sell. The market prices so established affect the valuation of the entire stock. Even if the real rental rate is constant, when nominalised and expressed as a percent of the nominally valued stock the resulting effective rate for comparison with the loan rate could vary substantially.

marginal product of capital. This is arbitrage of a more restrained variety in contrast to speculative activities directed at quick capital gains, which have become increasingly prominent and arguably contributed to the contemporary financial crises. Modern finance provides many techniques for generating speculative gains, based on highly leveraged borrowing, but our approach here will be to consider the simplest formulation that introduces the possibility for balance sheet shocks.

The basic model's portfolio decision problem is modified as follows

$$\begin{aligned} &\underset{\frac{VK}{P},\frac{M}{P},\frac{L}{P}}{Max:} \quad U\left(\frac{VK}{P},\frac{M}{P},\frac{L}{P};\frac{W}{P},r^*,i,Y,\lambda,\sigma\right) \\ &wrt: \quad W = VK + M - L \end{aligned} \tag{17}$$

Nominal wealth is now based on the market valuation of the claim *V*, and not on the replacement price *P*. Several factors are likely to influence the valuation of the claim such as future expectations of its value and its uncertainty. Heuristically, two additional parameters are added to the objective function in (10). The first is λ, which refers to the ratio of loans to the value of capital $\frac{L}{VK}$. Its purpose is to indicate that portfolio preferences are partly dependant on perceptions of balance sheet risk, since the higher λ the more exposed the portfolio owner is to valuation shocks involving *V*. The second is σ, which refers to perceptions about the future and attendant emotions, especially those of optimism or pessimism, as was emphasised in Keynes (1936). Higher σ denotes more optimistic expectations.

On maximizing the preference function (17), the following demand functions are generated for real holdings of capital claims, loans and money, respectively

$$\left(\frac{VK}{P}\right)^d = k\left(\frac{W}{P},r^*,i,Y,\lambda,\sigma\right) \tag{18}$$

$$\left(\frac{L}{P}\right)^d = l\left(\frac{W}{P},r^*,i,Y,\lambda,\sigma\right) \tag{19}$$

$$\left(\frac{M}{P}\right)^d = m\left(\frac{W}{P},r^*,i,Y,\lambda,\sigma\right) \tag{20}$$

The interpretations with respect to the first four arguments of the demand functions remain the same as before (see (10)-(14)). Regarding λ increases beyond some critical level (not specified here but to be kept in mind), have the effect of restraining the demand for capital claims and for loans, while stimulating the demand for liquidity. In contrast, the more

optimistic expectations that an increase in σ conveys raises the demand for capital claims and for loans to provide the needed financing, while reducing liquidity preference.

As in the basic model the key condition for equilibrium on the financial side is *M=L*. Once this is attained, it follows from the balance sheet constraint in (17) that the nominal market value of the capital stock, *VK*, equals the nominal value of wealth *W*. Using this implication and equating (19) and (20) yields

$$m\left(\frac{VK}{P}, r^*, i, Y, \lambda, \sigma\right) = l\left(\frac{VK}{P}, r^*, i, Y, \lambda, \sigma\right) \qquad (21)$$

While the above is analogous to (14), the replacement of *K* by $\frac{VK}{P}$ requires an additional market clearance condition for determining *V* (*P* remains a state variable). This is generated on equating the demand for the real value of capital claims (18) to its supply, and solving for the equilibrating value of *V*.

$$V = \frac{k\left(\frac{W}{P}, r^*, i, Y, \lambda, \sigma\right)P}{K} \qquad (22)$$

The underlying demand for physical capital will then equal the given stock once *V* is determined, with *P* already given i.e. when $\left(\frac{VK}{P}\right)^d = \left(\frac{VK}{P}\right)$ for some *V*, $K^d = K$.

Inserting the equilibrium value of *V* into equation (21), an implicit solution for the required rental rate is obtained

$$r^* = f\left(i, \frac{VK}{P}, Y, \lambda, \sigma\right) \qquad (23)$$

More real wealth increases the demand for loans, but there would also be an increase in desired money holdings. Since these effects are mutually offsetting, the net change in the required rental rate from this source would be limited. Hence, with respect to the wealth term (23) would be closer to the basic model's determination of *r** in (15). However, the introduction of λ and σ provides additional effects. An increase in the loan to value ratio would eventually reduce the demand for loans, which requires a reduction in liquidity if it is to be met, and hence an increase in *r**. A higher σ in (23) increases the demand for loans but reduces the need for cash, and the rental rate will need to be lower to induce holding of the larger stock of cash generated from meeting the increased loan demand.

The above changes to the extended model require a reconsideration of the underlying balance-sheets. In Table 1a, the balance sheet for the non-banking sector is modified to allow for the separate valuation of capital. This enables rapid shifts in loan to value ratios.

Table 1a Balance Sheet for Non-Banking Sector

Assets	Liabilities
VK	L
M	Net Worth=W

To allow for potentially destabilizing activities of the banking sector the consolidated banking sector balance sheet shown earlier in Table 2 is broken down into separate balance sheets for the banking sector and the central bank. Table 2a presents the balance sheet for the commercial banks, which shows that part of its assets are held in the form of reserves R with the central bank. In Table 2b, the central bank is assumed to provide these reserves through discounting loans amounting to a total of αL, where α is a policy parameter. This decomposition facilitates drawing a distinction between the central bank interest rate, henceforth i, and the loan rate i^b that the commercial banks charge. Haavelmo's basic model assumes zero net worth for the banking sector but this is relaxed here to allow for non-performing loans.

Table 2a Balance Sheet for Commercial Banks

Assets	Liabilities
$(1-\alpha)L$	M
R	Net Worth

Table 2b Balance Sheet for the Central Bank

Assets	Liabilities
αL	R
	Net Worth

Distinguishing between the central bank and commercial banks implies that the rental rate r^* is set by reference to the loan rate i^b that commercial banks charge and not i.

$$r^* = f\left(i^b, \frac{VK}{P}, Y, \lambda, \sigma\right) \qquad (24)$$
$$\text{with } i^b = h(i, \alpha, \beta L, \gamma V)$$

The loan rate i^b is influenced by several factors of which four are included in the function stated in (24). These are the cost of funds *i*, the central bank's required reserve ratio α, the proportion β of loans that are non-performing, and the proportion γ of capital claim values held as collateral. These constitute additional channels of influence on *r** that operate via i^b. Deterioration in collateral values raises i^b as would increases in required reserve ratios. Balance sheet shocks involving an increase in non-performing loans also raise i^b until enough of the damaged capital has been replaced.

Extending the real side

Haavelmo noted that the net marginal product of capital *r* is affected by fluctuations in output, and could therefore be amenable to fiscal policies that impact on output. To bring out more explicitly this role for fiscal policy, restate equation (1) as

$$Y = C_p + I_p + G \qquad (25)$$

The subscript *p* refers to the private sector, and *g* to the public sector. Government expenditure components are $G = C_g + I_g$, while those of private investment are $I_p = I_1 + I_2$.

The private sector's consumption function - *g(R)* in (2) - is presented here as a linear relation whose coefficient with respect to disposable income is the consumption ratio

$$C_p = c(\lambda,\sigma)\left[Y - \delta K - T\right] \qquad (26)$$

The parameter λ is incorporated in the consumption ratio to indicate that consumption could be affected by the size of the loan to value ratio. The higher λ the more concerned are households with their balance sheets, which would induce them to increase their savings.[23] The parameter σ features in the consumption ratio to indicate that changes in perceptions regarding the future and related optimism can affect consumption.

Introduce next a tax function $T = tY$ into (26) to yield

$$C_p = c(\lambda,\sigma)(1 - tY) - c(\lambda,\sigma)\delta K \qquad (27)$$

The next step is to incorporate the above variant of Haavelmo's private sector consumption function into the basic model, which gives rise to two possibilities. Under *Alternative A*, where output is input constrained and firms act as quantity producers, the fixed output that is determined is distributed among the aggregate demand components in the manner shown in (28), with I_1 as residual.

[23] In the event their balance sheet situation becomes catastrophic even this simple consumption function may no longer be tenable as households demand a minimal subsistence amount so as to maximise saving. On the other hand, during comfortable times with greater income predictability households are more likely to engage in longer term planning and consume in accordance with the Euler conditions of standard macroeconomics.

$$Y = c(\lambda,\sigma)\big((1-t)Y\big) - c(\lambda,\sigma)\delta K + I_1 + I_2 + G \qquad (28)$$

It follows that any changes in government expenditures, the tax ratio, or the amount of consumption will be offset by a corresponding adjustment in I_1. Fiscal multipliers e.g. the government expenditure multiplier, are zero.

However, under A*lternative B*, output is determined by the order book i.e. by aggregate demand as shown in (29). In the basic model demand is deficient because $I_1 = 0$, but other components such as consumption could also be contributory.

$$Y = c(\lambda,\sigma)\big((1-t)Y\big) - c(\lambda,\sigma)\delta K_1 + I_2 + G \qquad (29)$$

Unlike with (28), equation (29) yields a reduced form expression for output indicating that fiscal multipliers need not be zero.

$$\begin{aligned} Y &= \alpha\big(I_2 + G - c(\lambda,\sigma)\delta K\big) \\ \alpha &= \frac{1}{1-c(\lambda,\sigma)(1-t)} \end{aligned} \qquad (30)$$

Here α corresponds to the standard Keynesian multiplier.

Under *Alternative B*, increasing aggregate demand through fiscal means raises the marginal product of capital *r*, since the given stock of capital is now combined with more labour to produce an increased level of output.

Extending the basic model's policy implications

The basic model emphasised fluctuations in investment attributable to changes in (*r*-*r**) as a major source of output instability. Policy interventions should therefore be directed to managing *r* and *r**. For example, in order to reverse a drop in investment, stimulative fiscal policies may be needed to raise *r* together with monetary easing to lower *r**.

The extended model adds scope for balance sheet shocks affecting both the private non-bank sector and the banking sector, and provides additional channels for influencing *r**. Thus a period of sub-par output could be a consequence of overriding balance sheet constraints that induces deleveraging and falls in *V*, which raises *r**. This reduces investment and output. In addition, balance sheet problems may increase saving and raise the required rental rate for an extended period of time to offset a deteriorating cash flow so as to provide resources for rehabilitating balance sheets. Depending on the severity of the balance sheet constraint, an ensuing excess supply of capital could require a prolonged period of low investment before it is eliminated.

The balance sheets of financial intermediaries are vulnerable if they have engaged in highly leveraged lending to bolster declining profits, and an increasing proportion of the loans made become non-performing. This creates a potential for crashes when more loans become non-performing. With wide-spread inter-bank borrowing and lending, all banks would feel the effects of a crash even though it may have affected only one bank initially. This concern feeds mutual suspicions between banks as to the "toxicity" of their assets, resulting in a freeze on inter-bank lending. The central bank may lower interest rates and provide liquidity to the banks, but this may have limited impact as long as uncertainties persist.

While monetary easing is needed, a policy of lowering central bank interest rates and providing liquidity may be insufficient. Banks may be engaged in covering their own recapitalization requirements and find it expedient not to respond with easier lending conditions for their customers so as to improve their own cash flows. Likewise, lowering taxes may not be adequate, if households and firms whose balance sheets are badly damaged save the proceeds. Thus extending Haavelmo's basic model, points to the need for additional policies to induce spending behaviour that will counteract steep declines in output. Such policies will need to directly address balance sheet constraints for which one strategy would be to intervene to raise security prices. Policies of a more specific and directed kind may also be required to bolster spending and to ensure that adequate credit is available.

4. Policy inferences and the contemporary predicament

Haavelmo's model, and its extension above, is used here to briefly view aspects of the crises that the G-7 countries recently experienced. To place matters in perspective, a stylized scenario is first set up.

A scenario

Suppose an initially optimistic economy. The required rental rate on capital is r^*, which is well below the marginal product of capital r so that $(r-r^*)$ is positive, and balance sheets exhibit satisfactory loan to value ratios. Wealth owners and firms will then wish to expand their capital stock, which in the aggregate can only be undertaken through more investment. This characterises Haavelmo's *Alternative A*. The economy booms, profits grow, unemployment declines, while inflationary pressures build up. Wealth owners wish to acquire more capital claims, and bid V up.

Feeling richer, capital owners increase their borrowing from the financial sector. Part of this finances increased consumption, while part is for the acquisition of more capital claims, and V is further bid up. As the stock of loans increases, the required flow of interest

payments to service it also increases. Eventually the proceeds from an unchanged rental rate become inadequate to cover the growing loan service requirements. At first, this may not hamper speculative activity, especially if it takes the form of flipping over assets whose prices continue to increase thereby generating capital gains which both finances borrowing costs and provides a net profit. However, the rate of asset price increase eventually slows down, and the loan to value ratio increases, especially if borrowers at the margin obtain loans that form a higher proportion of asset values. As more borrowers become highly leveraged the greater is the risk that some will be unable to meet their loan service requirements. An event could force asset sales, which triggers a general markdown in asset prices *V*, and balance sheets start to deteriorate.[24] Further asset sales lead to a downward spiral in asset values, and eventually bankruptcy for some. History provides several examples of such a process, recent cases being the dotcom bubble and the housing bubble.[25]

In a familiar story banks find that a growing proportion of their loans are non-performing. This increases their costs, and they raise lending charges and fees. To avoid taking an immediate hit on their capital they add overdue interest payments to loan values, while extending the maturity of loans. However, the failure of the banks to extinguish non-performing loans compromises their lending capabilities. It could also lead to a freeze on inter-bank lending. Fewer loans, and at higher cost, forces capital owners to demand a higher rental rate for their capital, resulting in an excess supply of *K*, and the economy enters Haavelmo's *Alternative B.*

Viewing the G-7 experience

It is convenient to divide the data into two periods of 2005-2008 and 2009-2011. [26]

Table 3 presents data on the output gap. For the first period these gaps were positive for all the G-7 countries indicating that the actual outputs exceeded potential levels. Hence, this period would correspond to Haavelmo's *Alternative A.* A small caveat would be that some of the countries were experiencing high rates of unemployment during this period, but this cannot be attributed to deficient demands, given the state of the output gaps. As noted in Section 2, they are more likely the result of wage demands exceeding full employment marginal products of labour. In contrast, the second or crisis period reveals a consistently

[24] This has been described as a "Minsky moment" after the author who did much to develop the thesis. See Minsky (1986).

[25] See Reinhart and Rogoff (2009) for an overview covering several centuries.

[26] The averages for 2009-2011 are either based on the latest (WEO September, 2011) revised forecast for 2011, or the latest OECD economic outlook forecasts for 2011.

different pattern of negative output gaps with actual output falling below their potential levels. The G-7 countries would now be operating in Haavelmo's *Alternative B.*

Table 3 G-7 Countries: Output Gaps and Haavelmo's Classification
(In percent)

	Output Gaps	***H***	**Output Gaps**	***H***
	Averages 2005-2008		*Averages 2009-2011*	
USA	0.8	*A*	-4.0	*B*
Japan	0.9	*A*	-5.2	*B*
Germany	0.3	*A*	-2.6	*B*
France	0.1	*A*	-3.9	*B*
UK	1.8	*A*	-3.7	*B*
Italy	1.1	*A*	-3.8	*B*
Canada	1.6	*A*	-1.8	*B*

H =Haavelmo; *A*=full employment regime; *B* = under-employment regime
Source: OECD Economic Outlook Database.

Table 4 G-7 Countries: Investment and Unemployment

	Investment (percent of GDP)		**Unemployment** (percent ratio)	
	Averages 2005-2008	*Averages 2009-2011*	*Averages 2005-2008*	*Averages 2009-2011*
USA	19.6	15.6	5.0	9.3
Japan	23.7	20.8	4.1	5.0
Germany	17.8	17.0	9.5	6.9
France	21.4	19.5	8.7	9.6
UK	17.4	14.6	5.3	7.7
Italy	21.4	19.7	6.9	8.1
Canada	22.9	21.6	6.4	8.0

Sources: IMF, World Economic Outlook Database September 2011;
OECD Economic Outlook Database.

It is of interest to see the extent to which Haavelmo's predictions regarding investment are borne out. Table 4 exhibits investment behaviour during these two periods, and they appear to be consistent with Haavelmo's hypothesis. Under *Alternative B* investment would be reduced, and the averages show that this occurred for all the G-7 countries. For the US and the UK the decline was steep, but only slightly so for Germany. Falling investment ratios contribute to demand induced declining output. Furthermore, less labour would be needed to produce the lower output and this is reflected in the higher unemployment ratios (Table 4), especially for the US and the UK. Germany is the sole exception, exhibiting a significant decline in its unemployment ratio.

Table 5 G-7 Countries: Long Term Interest Rates

	Long Term Interest (percent)		**GDP Deflator** (percent change)	
	Averages 2005-2008	*Averages 2009-2011*	*Averages 2005-2008*	*Averages 2009-2011*
USA	4.3 (1.4)	3.3 (1.9)	2.9	1.1
Japan	1.6 (2.6)	1.3 (2.6)	-1.1	-1.3
Germany	3.8 (2.8)	3.1 (2.1)	1.0	0.9
France	3.9 (1.5)	3.5 (2.5)	2.4	1.0
UK	4.6 (1.8)	3.7 (0.9)	2.8	2.6
Italy	4.2 (1.9)	4.4 (3.0)	2.3	1.4
Canada	4.0 (0.7)	4.3 (3.2)	3.3	1.1

Real long term interest, in parentheses, is calculated as the difference between the nominal rate and GDP deflator rate of change.
Sources: IMF, World Economic Outlook Database September 2011; OECD Economic Outlook Database.

It is beyond the scope of this paper to examine the detailed origins of the crisis (see IMF, 2009), which originated in the financial sector and adversely impacted on output. The focus here is on the linkages between the financial and real sectors that operate through r^* and r. In Haavelmo's model the fall in investment ratios would be the result of a mismatch between these two rates. Information on these variables is not readily available and their

behaviour will have to be inferred. One could look at real long-term interest rates on government bonds as approximating the lower limit for r^*. Table 5 shows that, with the exception of Italy and Canada, all the other countries experienced significant declines in nominal long-term rates. In determining the corresponding real interest behaviour, an appropriate price deflator is required. Here the simplest solution is adopted, which is to employ the corresponding contemporaneous period deflator i.e. to assume static expectations. This indicates that in contrast to nominal rates, real long-term interest rates rose for all of the countries, except Germany and the UK, for whom there were significant declines. The hypothesis of a higher implied r^* is reinforced when account is taken of the balance sheet problems and the resulting sharp increases in the loan to value ratios, together with survey based evidence of pessimistic expectations. At the same time, declining output would pull down the marginal product of capital so that the desired stock of capital is reduced. For Germany, in contrast to the other G-7 countries, Table 5 suggests there might even have been a fall in the real rental rate (the fall indicated for the UK is likely to be anomalous).

Table 6 G-7 Countries: Key Macroeconomic Balances
(In percent of GDP)

	S-I	**S-I**	**T-G**	**T-G**	**X-IM**	**X-IM**
	Averages 2005-2008	*Averages 2009-2011*	*Averages 2005-2008*	*Averages 2009-2011*	*Averages 2005-2008*	*Averages 2009-2011*
USA	-1.7	7.5	-3.7	-10.7	-5.4	-3.2
Japan	7.1	11.6	-3.2	-8.6	3.9	3.0
Germany	7.3	8.4	-1.1	-2.8	6.2	5.6
France	1.8	4.4	-2.8	-6.7	-1.0	-2.3
UK	0.8	8.1	-3.4	-10.0	-2.6	-1.9
Italy	0.6	1.4	-3.0	-4.6	-2.4	-3.2
Canada	0.0	2.5	1.1	-5.3	1.1	-2.8

(S-I) is private net savings, (T-G) is the general government fiscal deficit, and (X-IM) is the current account of the balance of payments.
Source: OECD Economic Outlook Database.

The extended model provides for adverse balance sheets, and a general loss of confidence, to increase saving which would contribute to a decline in output. Table 6 shows

that private sector net saving balance improved for the whole sample, and that this exceeded by a large amount the fall in investment ratios, indicating steep falls in consumption, especially for the US and UK. Not surprisingly these were also the two countries that experienced the biggest increase in unemployment rates. However, for Germany the limited improvement in the savings-investment and the small fall in its investment are compatible with only a slight retrenchment in consumption. This would explain why German unemployment was less adversely impacted. Table 6 also indicates that swings in the private sector net savings balance were largely offset by swings in the government budget balance. [27]

Table 7 G-7 Countries: Equity Market Indices
(Percent change)

	End-2007 (percent change from 2004)	*End-2010 (percent change from 2007)*
USA	33.1	-13.7
Japan	47.5	-17.7
Germany	87.2	-32.1
France	90.6	-34.4
UK	42.4	-28.6
Italy	44.1	-51.6
Canada	72.7	-3.6

Source: IMF Global Financial Stability Report

Table 7 presents equity market indices as a proxy for the capital valuation term *V* in the extended model. The impact of the financial crisis and forced asset sales is reflected in the declines in equity values over the period 2007 to end-2010. This would imply, referring to the balance sheet of Table 1a that real net worths fell well below the peak levels recorded during the first period. Such a finding is buttressed by developments in real estate prices, which exhibited a pronounced decline in most G-7 countries, with no recovery as yet in sight.

[27] Changes in the external balance were relatively limited. In addition, the concerned economies operated flexible exchange rates (some through the euro) suggesting that the closed economy assumption of Haavelmo's basic model may not be too limiting as a first approximation.

Stabilization policies pursued

The broad evidence adduced so far is suggestive of an increase in required rental rates of ultimate capital owners attributable to a number of factors. Such developments will reduce the desired amount of capital stock, in turn depressing the rate of investment. The latter recessionary effects are reinforced by balance sheet problems that require an increase in savings for their resolution.

Table 8 G-7 Countries: Use of Stabilization Instruments

	Short-term Interest (percent)		**Structural Budget Balance** (percent of potential GDP)	
	Averages 2005-08	*Averages 2009-11*	*Averages 2005-08*	*Averages 2009-11*
USA	4.3 (1.4)	0.8 (-0.3)	-4.0	-8.9
Japan	0.4 (-1.5)	0.3 (1.0)	-3.5	-6.8
Germany	3.5 (2.5)	1.1 (0.2)	-1.1	-2.0
France	3.5 (1.1)	1.1 (0.1)	-2.9	-4.8
UK	5.2 (2.4)	0.9 (-1.7)	-4.2	-8.1
Italy	3.5 (1.2)	1.1 (-0.3)	-3.5	-2.5
Canada	3.8 (0.5)	1.1 (0.0)	1.0	-3.7

Items in parentheses are real interest rates using GDP deflators from Table 5.
Sources: IMF, World Economic Outlook Database September 2011;
OECD Economic Outlook Database.

In light of these developments it is of interest to examine the stabilization policies pursued. Table 8 indicates recourse to two major sets of measures that were undertaken to stabilize the situation. On the monetary side central bank determined interest rates were sharply lowered. Fiscal policy was also expansionary, with most countries, and especially the US and UK, showing very large increases in their structural budget deficits. Nonetheless, for the latter, despite increases of 4 to 5 percentage points of potential output, which matches the investment fall, output still declined by a large amount. The explanation rests with the private

sector's substantial increase in savings (Table 6). It would seem that German households were less exposed to the damaging balance sheet problems of some of the other countries, since consumption levels were better maintained. For Germany, the modest structural budget deficit increase matched the decline in investment, which may have been sufficient to restrain the fall in output.

Although the central banks pursued an aggressive policy of reducing the short-term interest rates which they control, this may not have been adequate for reducing required rental rates for capital. There could be several reasons for this lack of transmission, but an important one is likely to be the needs of the financial intermediaries for improving their cash flows and, hence, for not passing on the reductions to i^b. This could explain why lowering central bank interest rates for turning around the crisis have had limited effect so far. In contrast, the innovative recourse to quantitative easing (QE), involving central bank purchases of large amounts of government backed securities, appears to have made a significant contribution in lowering long-term interest rates and promoting some recovery in stock market valuations *V*. These effects would have contributed to restraining the rise in *r**.

***Appropriate policy interventions*?**

A persistent state of high unemployment, low or negative growth, and financial impairment are clearly unacceptable. But what are the policy options that would help ameliorate these conditions? One approach, which hard-core neoclassical economists such as those of the Real Business Cycle (RBC) persuasion would counsel would be to do nothing, and wait for the economy to right itself. They may have a point if the policy interventions that are applied make the situation worse, and there is little doubt that certain of the policy interventions advocated have this character.

For example, one could apply the traditional Keynesian remedy of an expansionary fiscal policy. This policy involves boosting private sector incomes in the hope of jump starting their spending. It is best applied on a temporary basis when pump-priming is all that is needed. However, as observed earlier in Section 3, the application of a stimulative fiscal policy may not succeed in boosting private sector expenditures if it has serious balance-sheet problems to resolve. High values of λ, and low values of σ, would lower the consumption ratio and hence the size of the fiscal multipliers. The latter outcome could be compounded by an expansionary fiscal policy over an extended period that adds to anxieties, especially through large increases in public debt that are inevitable. The public sector would eventually

face a balance sheet crisis, with sovereign debt markdowns and serious cash flow problems of its own, and the need for fiscal retrenchment.

However, fiscal retrenchment also raises serious political economy issues such as those of burden sharing, which were of concern to Haavelmo. They will need to be properly and imaginatively handled, if confidence, both on the part of entrepreneurs and consumers is not to be further eroded. A government that seeks excessively bureaucratic solutions, especially in areas such as taxation and regulatory control, is likely to prolong the downturn. RBC adherents could then be proven right that the intervention only made the situation worse.

Another policy, much espoused by the "new neo classical" DSGE movement, is to rely on the monetary instrument of interest rates, either alone or increasingly in tandem with an expansionary fiscal policy which it finances though the latter does not generally operate via aggregate demand. As was noted in connection with the G-7 countries there has been a dramatic reduction in short-term interest rates, but this too, even when combined with more stimulative fiscal policies, has not turned the situation around. Very low short-term interest rates have helped the banking sector cope with their cash flow problems, but this has not contributed to a lowering in the loan rates applicable to borrowings for the purpose of accumulating capital. Nor have they fully resolved immediate balance sheet problems, and several banks have had to be recapitalized, usually at considerable fiscal cost. However, low short-term interest rates will have helped those with access to cheap funding to boost stock exchange values, which should help with balance sheet restoration.

Some have concluded that the present crisis indicates severe structural problems and there is some validity to this view. However, the argument that overcoming it will require massive bail outs of firms important for the overall economy needs is controversial. The Haavelmo framework can be helpful here. A distinction needs to be drawn between a banking sector that suffers a collective increase in non –performing loans and has its capital wiped out, and the non-banking sector that experiences an adverse shock to its balance sheets. Collectively, at any rate in the closed economy setting of the basic model, the non-banking sector will continue to have a positive net worth, even if it is reduced. For the sector as a whole, unlike with the banking sector, the problems concern more the impairment of their cash flows as a consequence of having to service higher debt levels with dwindling income. While stimulating the economy will help with this problem, this is a temporary fix, and a more enduring solution is needed. This would not have been needed if those who gained, or suffered less of a hit on their net worths, were to acquire the bankrupt firms, at any rate those

that are salvageable. The appropriate policy would be to encourage forced mergers and acquisitions as part of "creative destruction", since this is more likely to restore the sector to earlier health, remove the deadwood off the books of the banks, and impart confidence to those who survive. Risk taking is inherent to capitalism but if this is to be preserved those who took risk, and failed, have to pay the price, otherwise moral hazard results.

In the case of the banks, given their central intermediation role, they will need to be made functional again, otherwise capital accumulation suffers and the crisis is prolonged. Re-capitalization of the banks will be needed but its effects should not be dissipated by banks who are so concerned with their balance sheets and with generating a positive cash flow that they refrain from fresh lending. A solution here would be to set up "bad" banks on to whom the non-performing loans are pushed, while "good" banks retain the better quality loans and are re-capitalized.[28] With clean books, the "good" banks would be encouraged to lend to potentially profitable clients rather than concentrate on minimizing losses on old zombie loans.

Taking appropriate structural measures to promote the soundness of the banks and of the non-banking sector would go a long way towards ensuring that spreads between the marginal product of capital r and the required rental rate r*are appropriate. Together with easier monetary policies and stimulative fiscal policies that are well directed to reducing the spreads in favour of physical capital acquisition, confidence would gradually be restored, with the result that more capital stock will be demanded of obvious benefit to investment and employment.

Haavelmo (1987) counselled that destabilizing crises could be mitigated, if not avoided, provided the banking system engaged in prudent lending. He regarded the key role of the central bank as that of restraining excessive lending both to and by the banks. In this regard he shared Wicksell's view that there was little to restrain leveraged bank lending in a credit economy. The extension to his model here would add that restraints on bank lending should also be accompanied by measures that would help prevent more generalised excessive leveraging that underlies balance sheet problems. Haavelmo was critical of frequent changes in central bank determined interest rates and fine-tuning attempts. One of his grounds would be that seemingly small interest rate changes could induce big jumps in the excess demand for capital, resulting in excessive investment volatility. To this he would have added the

[28] However, the scope for this will depend on the structural environment including the legal system. If, as in Spain currently, bankruptcy laws are so draconian as to inhibit anyone from declaring bankruptcy there will be strong pressure not to recognize any bad loans, and the needed reorganization and renewal will be hampered. Secular stagnation is then inevitable.

difficulty in specifying the precise level of interest rate needed. The only prescription one could make with confidence is that interest rates should ensure some correspondence between r and r^*.

5. Conclusion

Haavelmo was profoundly interested in macroeconomics which he viewed very broadly as the study of the economics of a society that caters to the well being of its people. As he put it, 'Society' is of critical importance for without it "we would probably all be dead in a few weeks" (Nobel lecture, 1990). By society he meant an arrangement of rules and regulations that governs interactions between individual entities, with the distinctive characteristic that the rules are manmade, and are subject to an inherent dynamic: they change when people are dissatisfied with perceived outcomes (either because preferences have changed or outcomes have deviated from intended ones or because they sense scope for improvement) and use their influence in the political arrangements to modify them. This is an incessant activity which generates feedback effects on the economic system. Therefore, he argued, one has to be very careful when theorizing about macroeconomics, since its relationships are not immutable. However, this very fact could also be used to advantage, since it presents opportunities for modifications so as to better achieve societal goals.

Haavelmo claimed that an adequate macroeconomic theory is one that realistically describes and simulates an economic society that would be feasible under some economic policy. Econometrics is needed to help quantify the magnitude and net effect of forces that generate a set of economic observations but it can only function properly if the underlying economic theory is adequate. He lamented the limited progress of macroeconomic theory and worked to improve it. While emphasising the importance of models for organized thinking and improved analysis, and the desirability for axiomitization as an aid to rigorous analysis, he cautioned against premature axiomitization. In particular, he was concerned that the micro-foundations of neoclassical theory implied a macro economy that bore little resembalance to the real world. Instead he wondered if it might not be better to start with a realistic conception of the macro economy and ask what sort of micro-foundations would support it. Achieving the latter would then provide the basis for an appropriate axiomitization.

Haavelmo's macroeconomic theorizing thus starts from a different point than what is customary with, say, DSGE. His criticism with starting from the full blown neoclassical conception, to which limitations are then added so as to better approximate reality, is that it lacks a natural motive force to explain the limitations and frictions. In particular it misses out

on the inherent dynamics and the striving, some of which may be directed to realizing some of the optimal fruits that the neoclassical mode of organization promises. Thus the same specific macroeconomic outcome, with its deviations from neoclassical optimality, can be viewed as a fall from grace – the neoclassical position – or, in accordance with Haavelmo's approach, as the outcome of interacting motive forces and the current state of play in the evolutionary development of institutions.

Which starting point one adopts has profound implications for the conduct of macroeconomic policy, and for the exercise of surveillance. From a neoclassical vantage point, macroeconomic policies should be directed at removing impediments to attaining the neoclassical optimum, while surveillance would consist of identifying and anticipating possible deviations from that optimum. The neoclassical assumption is that, if not impeded, primal motive forces would lead in a beneficial manner to the neoclassical welfare optimum. However, from Haavelmo's vantage point surveillance should try to identify possible disruptions and innovations to the present state, which is where we are in; the reactions of primal forces to them; and whether or not these would bring about a better or worse outcome. This is a more realistic conception, since it views the role of macroeconomic policy as that of preventing deterioration in current and prospective outcomes, while working towards future improvements. His overriding quest was that of seeking good or better explanations of economic phenomena that would help support realistic interventions so as to improve economic outcomes. Haavelmo was much aware of the highly simplified nature of his model and its limitations, and its need for further elaboration and extensions. His concern was with formulating a good starting point from which generalizations would flow naturally, rather than being grafted on in an ad hoc manner. The contention of this paper is that he was successful in this regard.

It is fitting to conclude with Haavelmo's concern over fashions in macro theorizing and the tendency to accept uncritically whatever happens to be the dominant theory. As he put it (p. 14 of SMT, my translation) "....the best models of the day will be viewed as a hopeless joke in the not too distant future. Every author will obviously try as hard as he can to give the reader the impression that his conceptual apparatus and analysis is the best possible, which applies also to the present author ...However, these remarks are not the author's attempt to show appropriate modesty but an urgent appeal to students to quickly contribute to making existing models obsolete."

His exhortation applies to the models set out here.

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