Keynes's 'revolving fund of finance' and transactions in the Circuit

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Introduction

Minsky (1977), emphasising investment under uncertainty, highlights Keynes (1937a) as the primary statement of what was novel in the *General Theory* (1936). But in those "other" 1937 papers, "Alternative theories of the rate of interest" and "The "ex-ante" theory of the rate of interest", (Keynes 1937b & 1937c respectively) Keynes also gave great weight to the financial basis for his differences with conventional theory. In particular he observed that "It is, to an important extent, the 'financial' facilities which regulate the pace of new investment" (Keynes 1937b: 248). His comment that "If investment is proceeding at a steady rate,… finance … can be supplied from a revolving fund of a more or less constant amount", can be seen to predate the Circuitist focus on the transactional dynamics of capitalism—but to reach a very different conclusion about monetary dynamics than some Circuitist authors. A dynamic model establishes that Keynes was correct that "Credit … is a revolving fund which can be used over and over again" (Keynes 1937b: 247), and this circulation solves the Circuitist dilemma of the origin of profits in the monetary circuit.

The finance demand for money

Keynes's primary motivation in writing "Alternative theories of the rate of Interest" and "The "ex-ante" theory of the rate of interest" was to counter attempts by Ohlin, Hicks, Pigou, Robertson, & Hawtrey to recast his liquidity preference theory as no more than a supply and demand model of the determination of the rate of interest. However this rearguard action[1] also had a positive outcome, as tussling with Ohlin's arguments led Keynes to propose that investment finance was "an additional demand for money" (Keynes 1937b: 247) to the *General Theory*'s triumvirate of transactions, precautionary and speculative demands. Its importance to Keynes as an elaboration of the *GT* is evident in the statement that

> Investment finance in this sense is, of course, only a special case of the finance required by any productive process; but since it is subject to special fluctuations of its own, I should (I now think) have done well to have emphasised it when I analysed the various sources of the demand for money. (Keynes 1937b: 247)

Keynes's musings on the interplay between firms who wish to borrow to finance investment, and banks that provide that finance, is prescient of, and of course partly inspired, the Circuitist School's later contribution. But Keynes's less formal logic also reached some conclusions contrary to current Circuitist belief. Keynes was correct on these points and recent Circuitist literature is in error; notwithstanding this however, the

[1] This was ultimately unsuccessful, given the profession's ultimate acceptance of IS-LM analysis as a summary of the General Theory.

contributions of Graziani et al. on the nature of a monetary economy are essential to the development of a proper model of Keynes's "revolving fund of liquid finance" (Keynes 1937c: 666).

The Revolving Fund

Keynes's first proposition was that only *rising* investment levels led to a demand for money; if investment was "proceeding at a steady rate", then the finance required:

> can be supplied from a revolving fund of a more or less constant amount, one entrepreneur having his finance replenished for the purpose of a projected investment as another exhausts his on paying for his completed investment. (Keynes 1937b: 247)

This insight led Keynes to distinguish between finance as a stock, and investment and savings as independent but related flows from the income that investment later generated. "'Finance'", he emphatically declared,

> has nothing to do with saving. At the 'financial' stage of the proceedings no net saving has taken place on anyone's part, just as there has been no net investment. 'Finance' and 'commitments to finance' are mere credit and debit book entries, which allow entrepreneurs to go ahead with assurance. (Keynes 1937b: 247).

Keynes's conjecture that confusion between finance and savings was the source of important errors in monetary theory is worth quoting at length:

> It is possible, then, that confusion has arisen between credit in the sense of 'finance,' credit in the sense of 'bank loans' and credit in the sense of 'saving.' I have not attempted to deal here with the second. *It should be observed that a confusion between the first and the last would be one between a flow and a stock*. Credit, in the sense of 'finance,' looks after a flow of investment. It is a revolving fund which can be used over and over again. It does not absorb or exhaust any resources. The same 'finance' can tackle one investment after another. But credit, in Prof. Ohlin's sense of 'saving,' relates to a stock. Each new net investment has new net saving attached to it. The saving can be used once only. It relates to the net addition to the stock of actual assets. (Keynes 1937b: 247; emphasis added)

This error of confusing a stock with a flow recurs in Graziani's otherwise brilliant formalisation of the concepts of money and credit, and echoes through the subsequent Circuitist literature on the vexed issues of whether a continuous supply of new money is needed to sustain economic activity, and whether capitalists can make a profit. Whereas the accepted Circuitist answers to these questions are "Yes" and "No", when the distinction is treated properly in a dynamic model, the correct answers were the ones Keynes gave: "No" and "Yes". To show this, I first need to formalise Graziani's non-commodity three-sided analysis of exchange.

The monetary circuit of production

The simple but profound Circuitist insight that "A true monetary economy *must therefore be using a token money*", and the deduction that "any monetary payment must

therefore be a triangular transaction, involving at least three agents, the payer, the payee, and the bank" (Graziani 1989: 3), were major advances in the development of a monetary theory of production. However attempts by Graziani and others to turn these insights into a formal model have confused stocks and flows.

The first step in Graziani's model was "the decision taken by banks of granting credit to firms in order to enable them to start production" (Graziani 1989: 4). This is a *stock* decision. Yet Graziani next argues that the "initial credit requirements" are "equal to the wage bill", when wages are a *flow* of income generated from the production that the firms undertake. Next, Graziani argues that the credit raised by firms is *instantly* handed over to workers as wages: this is not a flow, but an instantaneous transfer of a stock. Finally he asserts that money is only in existence while this stock is still in workers' bank accounts: once this stock of money is spent on commodities—and thus returned to firms who then repay their debt to banks—it is destroyed:

> Money which is spent on the commodities market, as well as money spent on securities issued by firms, goes back to firms, and will be available for repaying debts to the banking system. *As soon as firms repay their debt to the banks, the money initially created is destroyed*. (Graziani 1989: 5; emphasis added)

In contrast to Keynes's vision of a "revolving fund", this is reflux with destruction. With money destroyed, each new investment requires a new creation of money, and production cannot continue unless this is forthcoming: "With the destruction of money, the circuit is closed. Money will be created again if banks grant a new credit for a new production cycle…" (Graziani 1989: 5).

This is a confusion, not only of stock with flow, but also of transactions with income. When Graziani argues that capitalists will only be able to repay their debt to banks if workers spend all their wages, he is arguing that the initial stock of money in workers' bank accounts is both their total wage income, and the limit of the transactions they can undertake with it. This error has been maintained in subsequent Circuitist literature (for example. Bellofiore et al. 2000 p. 10 footnote 9),[2] which I see as the reason that Circuitists have shied away from attempting to model the interest spread that bankers charge capitalists: if capitalists can only repay debt if all wages are spent, then any interest at all necessarily makes borrowing money a "negative sum game" for capitalists.

These confusions are the source of the failure of what Fontana calls "single-period accommodationist analysis" (Fontana 2000: 307) to develop a viable model of endogenous money, and to find a theoretical answer for what is empirically obvious: that capitalists can and do borrow money, repay their debts, and make a profit. The empirically obvious can only be theoretically revealed by an analysis that clearly distinguishes between stocks and flows, and transactions and incomes.

The following model implements the Circuitist vision of monetary production, and confirms Keynes's propositions about a revolving fund of finance.

[2] See Rochon 2005 for a detailed discussion of this dilemma.

Modelling the Circuit in continuous time

Following Graziani, I construct a model of a pure credit economy with three classes (capitalists, bankers and workers), in which all transactions are mediated by transfers between bank accounts.[3] At this stage the model only tracks financial flows between bank accounts for each class: production and the flow of commodities it generates are omitted. Implicitly however, physical transfers mirror the financial flows: labor flows from workers to capitalists in return for wages, and commodities flow to workers (and bankers) from capitalists in return for expenditure from wages (and net interest income).

The circuit begins with bankers extending a loan $K_D(0)$ to capitalists that enables them to hire workers, buy intermediate goods, produce and sell output.[4]. I use $K_D(0)$ to signify that this is the initial debt owed by capitalists to the bank. As Keynes observes, this is the "debit book entry" that is simultaneously created with the money that is recorded in the bank's "credit book entry" K_C. Both accounts thus begin with the same initial amount recorded in them. The bank then charges the interest rate r_d on the debit balance, and pays the lower rate r_c on the credit balance. At this simple level of analysis, I treat r_d and r_c as fixed, corresponding to Keynes's argument that there is no pressure on the rate of interest (or the spread between deposit and loan rates) when the level of investment is constant.

A loan necessarily includes not merely the obligation to pay interest, but also to repay principal. Repayment agreements can take many forms; for simplicity here I assume that capitalists attempt to reduce their debt to the some proportion X of its original level, where $X<1$, at some target time T years from when the initial debt was entered into. This gives us the relation:

$$K_D(T) = K_D(0)\,X \tag{1}$$

Again for simplicity, I assume that capitalists attempt to meet their principal and interest repayment obligations by paying a fixed proportion R *p.a.* of the outstanding debt. Part of R reflects repayment of the principal only; part reflects payment of interest on the debt. Calling the former R_P, [5] the basic equation for the dynamics of the debt account is:

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[3] There is no central bank, however the framework can serve as a basis for introducing fiat money at a later stage. Fiat money differs from credit money in that it causes an injection into the relevant credit account with no corresponding entry in a debit account.

[4] I use plurals throughout because the model aggregates the outcome of multiple agents, without at this stage considering dynamics between agents of the same type. The model could with effort be extended to consider multiple sectors—though not multiple agents, which would require a disaggregated multi-agent "bottoms up" approach to modelling—and hence transfer between agents of the same type but in different sectors.

[5] $R_P = -\frac{\ln X}{T} > 0$ since $X<1$.

$$\frac{d}{dt}K_D = r_d K_D - (r_d + R_P)K_D \quad (2)$$

where the initial level of the account is $K_D(0)$.

Matching this "debit book entry" is the credit account K_C, where the money created by the loan is recorded, and from which all capitalist payments are made—including the repayments of debt. The amount $(r_d + R_P)K_D$ therefore has to be deducted from it; but at the same time, the bank is obliged to pay $r_C K_C$ in interest into the account. Its basic dynamic equation is thus:

$$\frac{d}{dt}K_C = r_C K_C - (r_d + R_P)K_D \quad (3)$$

Finally, accounts are needed to record the banks' transactions. Here I incorporate Graziani's important stricture that, in a properly functioning monetary system, the bank cannot spend the money it endogenously creates. I therefore model two accounts for banks: a principal account B_P, which receives the repayment of principal, and an income account B_Y into which the interest on debt is paid, and from which it pays interest on deposits. Thus $R_P K_D$ flows into the principal account:

$$\frac{d}{dt}B_P = R_P K_D \quad (4)$$

and the net difference between $r_d \cdot K_D$ and $r_C \cdot K_C$ flows into the income account:

$$\frac{d}{dt}B_Y = r_d \cdot K_D - r_c \cdot K_C \quad (5)$$

Equations (2) to (5) complete the model at this stage, and Figure 1 shows a run of the model with an initial loan of $1 million, a repayment target X of 10%, a target time T of 5 years, debit interest rate r_d of 5% and a credit rate r_c of 3%.[6]

[6] The graphic shows the execution of this model in the mathematical simulation program Mathcad.. Any of several other packages could have been used—including Mathematica, Maple, Matlab, Scientific Workplace—but I believe Mathcad has the most intuitive user interface.

$X := 10\%$ $T := 5$ $r_d := 5\%$ $r_c := 3\%$ $D_0 := 10^6$ $R_P := \frac{-\ln(X)}{T}$ $y := 10$ $points := 1000$

Given

$$\frac{d}{dt}K_D(t) = r_d \cdot K_D(t) - (r_d + R_P)\cdot K_D(t) \qquad K_D(0) = D_0$$

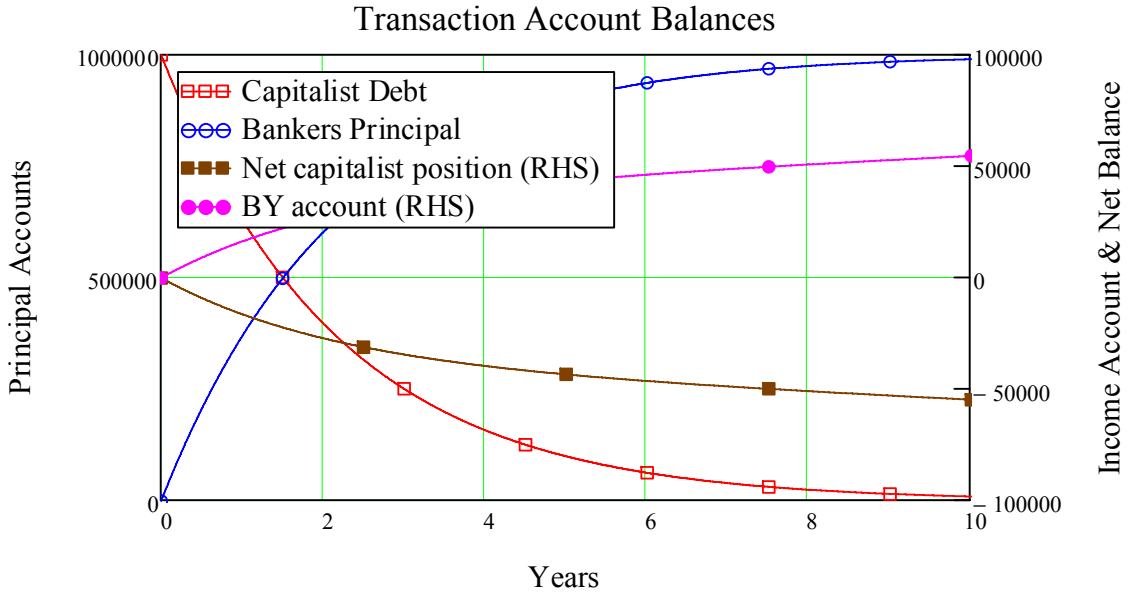
$$\frac{d}{dt}K_C(t) = r_c \cdot K_C(t) - \left[(r_d + R_P)\cdot K_D(t)\right] \qquad K_C(0) = D_0$$

$$\frac{d}{dt}B_P(t) = R_P \cdot K_D(t) \qquad B_P(0) = 0$$

$$\frac{d}{dt}B_Y(t) = r_d \cdot K_D(t) - r_c \cdot K_C(t) \qquad B_Y(0) = 0$$

$$\begin{pmatrix} K_D \\ K_C \\ B_P \\ B_Y \end{pmatrix} := \text{Odesolve}\left[\begin{pmatrix} K_D \\ K_C \\ B_P \\ B_Y \end{pmatrix}, t, y, points\right]$$

$\tau := 0, \frac{y}{points} .. y$



$B_P(5) = 900000$ $K_D(5) = 100000$ $K_C(5) = 56706$ $K_C(5) - K_D(5) = -43294$ $B_Y(5) = 43294$

$B_P(10) = 990000$ $K_D(10) = 10000$ $K_C(10) = -44630$ $K_C(10) - K_D(10) = -54630$ $B_Y(10) = 54630$

Figure 1: Basic circuit without production or exchange

The model is incomplete at this stage, since all capitalists are doing is borrowing money and paying it back later—thus obviously accumulating a loss on the spread between debit and credit interest rates. However, even at this incomplete level, it enables the rejection an accepted Circuitist proposition, that endogenously created credit money is destroyed when debt is repaid.

As noted earlier, Graziani states that "As soon as firms repay their debt to the banks, the money initially created is destroyed" (Graziani 1989: 5). This belief is echoed in many subsequent Circuitist works, as Rochon documented (Rochon 2005: 126, 127, 128). It is implicit in the "Kaldor-Trevithick reflux principle" (Lavoie 1999), and accepted widely in Post Keynesian analysis (see for example Lavoie 1992, p. 130, cited in Rochon 2005 p. 130).

This accepted proposition is false. It arises, I suspect, from a confusion of credit with money. Consider goods being purchased on trade credit, with the seller offering a 30 day payment period by the buyer. That trade credit is destroyed when the buyer meets the payment obligation by giving the seller money.

However, money is *not* destroyed when a debt is repaid, even when no income is generated from the borrowed money. The essential differences between money and credit are (a) that the former is accepted as a means of final payment and (b) that the latter is specific to a particular pair of transactors only, whereas money is generic. Credit is thus destroyed by the payment of money; but money is not destroyed by the repayment of debt.

Instead, when a debt repayment is made, an amount is debited from the capitalist's bank account and credited to the banker's principal account, and an equivalent amount is deducted from the record of the outstanding debt between the capitalist and banker. As this process continues, debt is paid down towards zero, while the money that was simultaneously created with it flows into the bankers' principal account as an unencumbered asset. [7]

In this pure credit model, money is an asset of the banking system, which is either the debt firms owe to banks, or the debt that has already been repaid. Only the failure to repay debt fully can destroy money, because then the flow back to B_P is less than the principal repayment required by the debt contract.

The total amount of money is thus conserved in this simple instance of a single injection of endogenous money without bankruptcy, and equals (at this stage) $K_D + B_P$. As we shall see, it is not money that is destroyed by debt repayment, but deposits. That is best illustrated when the model is closed, at this still schematic level, by the introduction of production.

Hammering the distinction between stocks and flows once more, the loan is a stock that enables flows to occur—in this crucial instance, the flows are the purchases of intermediate goods and labour needed to enable production, which in turn generates a flow of incomes for both workers and capitalists. The flow of profit from production is what allows capitalists to pay the interest on outstanding debt, and over time to repay the principal of the loan.

Production and profit

To finance production, an outflow must occur from the capitalist working capital account. Here I use the systems engineering concept of a *time lag*, as a measure of the rate at which money out of the working capital account K_C. The faster this flow is, the

[7] If this is hard to grasp when thinking in terms of pure bank accounts, imagine instead that the initial money was issued as paper notes by the bank—call these "Bank Notes". The debt that was created simultaneously with this money is a book entry recorded by the bank—call it a "Debt Book". When a payment is made by returning some Bank Notes to the bank, they are stored by the bank in its "Principal Vault" (rather than the "Income Piggybank"), and the fact that these notes have been received is then noted by a deduction on the Debt Book. For money to be destroyed, the bank would actually need to rip up the Bank Notes.

more rapidly money finances production, which in turn generates income for capitalists and workers. In a more complex model, the lag would be a function of behavioural variables—expectations of profit, propensities to consume, etc. I use a constant lag here to simplify my illustration of the correctness of Keynes's concept of a "revolving fund of finance".

For technical reasons, a time lag is expressed as a fraction of the time unit of the model—in this case, years—and shown as an inverse. The time lag τ_{KC} represents the delay between production and the profit resulting from sales, and the outflow from the account is $\frac{1}{\tau_{KC}} K_C$.

The outflow hires workers and buys intermediate goods from other capitalists to enable the production of commodities, which are then sold to capitalists, workers and bankers. In this simple one-commodity model, all intermediate goods purchases resolve themselves into wages and profits for workers and capitalists. Thus, given production and the sale of output, the outflow $\frac{1}{\tau_{KC}} K_C$ generates income flows that resolve exclusively into either profits or wages. The ratio of one to the other is, in Marx's notation, the ratio of *s* to *v*, or the rate of surplus value—though this only represents a division of income and not a proposition about the source of profit.[8] Since *s* and *v* are fractions of a flow that must sum to 1, I express them as $\frac{s}{v} = \frac{s}{1-s}$, so that $s = \frac{rsv}{1+rsv}$ where *rsv* is Marx's rate of surplus value. $\frac{1-s}{\tau_{KC}} K_C$ is the flow of wages and $\frac{s}{\tau_{KC}} K_C$ is the flow of profits (time lags between the financing of production and the sale of proceeds are ignored in this paper, but easily incorporated at a later stage).[9]

An account for workers' wages W_Y is now required, with a wages inflow term of $\frac{1-s}{\tau_{KC}} K_C$. Workers earn interest on the balance in this account, giving a second inflow $r_c W_Y$ which in turn requires a matching outflow from the bankers' income account B_Y.

Transactions and Income

To complete the modelling of financial transactions, we must introduce expenditure by bankers and workers, with time lags that reflect how rapidly each class draws on its transaction account balances to fund consumption. Bankers' and workers' consumption spending is modelled as being proportional to their account balances, with the ratios τ_B and τ_W respectively. There is thus an outflow from workers' account of

[8] My analysis of Marx's theory of value is detailed in Keen 2003a, 2003b, & 2001

[9] In a previous paper (Keen & Chapman 2006) this was treated as a flow of finance into a factory system, and the lagged flow out of this was profit; this extension is omitted here to simplify the exposition. I have also built an extended model with production and commodity pricing, which is not considered here.

$\frac{1}{\tau_W}W_Y$ and bankers' account of $\frac{1}{\tau_B}B_Y$, with matching inflows into the capitalists' account.

Though transactions are essential if income is to be earned, they are nonetheless different concepts that have been confused frequently in economics literature, including some Circuitist contributions. The flows $\frac{1}{\tau_{BY}}B_Y$ and $\frac{1}{\tau_W}W_Y$ from bankers and workers respectively to capitalists are transactional flows, resulting from the sale of commodities. Without these flows, capitalists could not realise a profit; but gross profit itself is the flow $\frac{s}{\tau_{KC}}K_C$. This flow, as we shall see, exceeds the transactional flow of $(r_d + R_P)K_D$ needed to finance the loan.

The complete model is (with transactional flows from commodity sales bracketed in the capitalists account, and new corresponding inflows and outflows in all accounts highlighted in matching brackets):

$$\frac{d}{dt}K_D = -R_P K_D$$

$$\frac{d}{dt}K_C = r_C K_C - (r_d + R_P)K_D - \left\{\frac{1}{\tau_{KC}}K_C\right\} + \left[\left\{\frac{s}{\tau_{KC}}K_C\right\} + \left[\frac{1}{\tau_W}W_Y\right] + \left\langle\frac{1}{\tau_B}B_Y\right\rangle\right]$$

$$\frac{d}{dt}W_Y = \left\{\frac{1-s}{\tau_{KC}}K_C\right\} + \lfloor r_c W_Y \rfloor - \left[\frac{1}{\tau_W}W_Y\right] \qquad (7)$$

$$\frac{d}{dt}B_P = R_P K_D$$

$$\frac{d}{dt}B_Y = r_d \cdot K_D - r_c \cdot K_C + \lfloor r_c W_Y \rfloor - \left\langle\frac{1}{\tau_B}B_Y\right\rangle$$

Figures 2 and 3 show the results of a simulation of this model over a 20 year time period, with the additional parameter values of $\tau_{KC} = \frac{1}{4}, \tau_B = 2$, $\tau_W = \frac{1}{26}$ and $rsv = 200\%$ (corresponding to an *s* value of *0.667*). The top graph in Figure 2 shows the account dynamics over the full twenty years; the bottom graph highlights the second order dynamics that occur in the first three years of the simulation. In contrast to the previous incomplete model, capitalist indebtedness tapers to zero—as do all income accounts. Capitalists have been able to borrow money, produce output, sell it, repay debt, and make a profit.

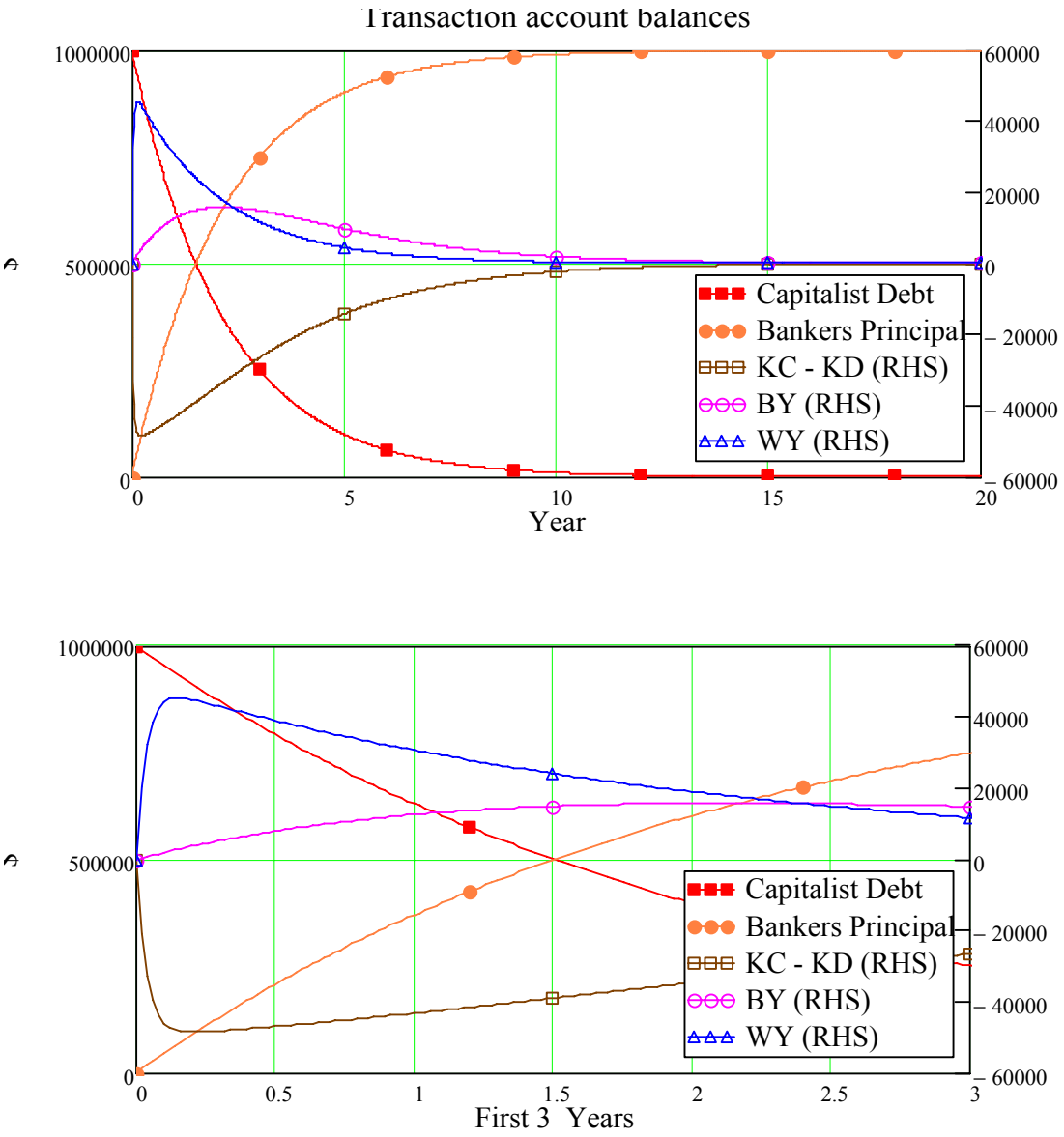


Figure 2: Transaction account dynamics without relending

Figure 3 shows the associated income flows, and the aggregate income levels generated by the model. These are, respectively:

$$\text{Net Profit: } \int_0^y \left(\frac{1}{\tau_K} K_C - r_d \cdot K_D \right) \cdot dt$$

$$\text{Wages: } \int_0^y \frac{1-s}{\tau_{KC}} K_C \cdot dt \qquad (8)$$

$$\text{Interest: } \int_0^y r_d \cdot K_D \cdot dt$$

The first two are the Circuitist versions of Kalecki's classic aphorism that "capitalists get what they spend, workers spend what they get". The third adds the

component that neither Keynes nor Kalecki properly incorporated, bank earnings from finance—"bankers interest what they lend". Total income equals the sum of capitalists profits and workers wages—indicating that bankers income represents a share of the surplus and not an independent source of net income.

In the incomplete model, bankers were the clear winners and capitalists the losers. In this complete model, however, "everybody wins", though capitalists more so than workers (given the assumed rate of surplus value), and bankers least of all.

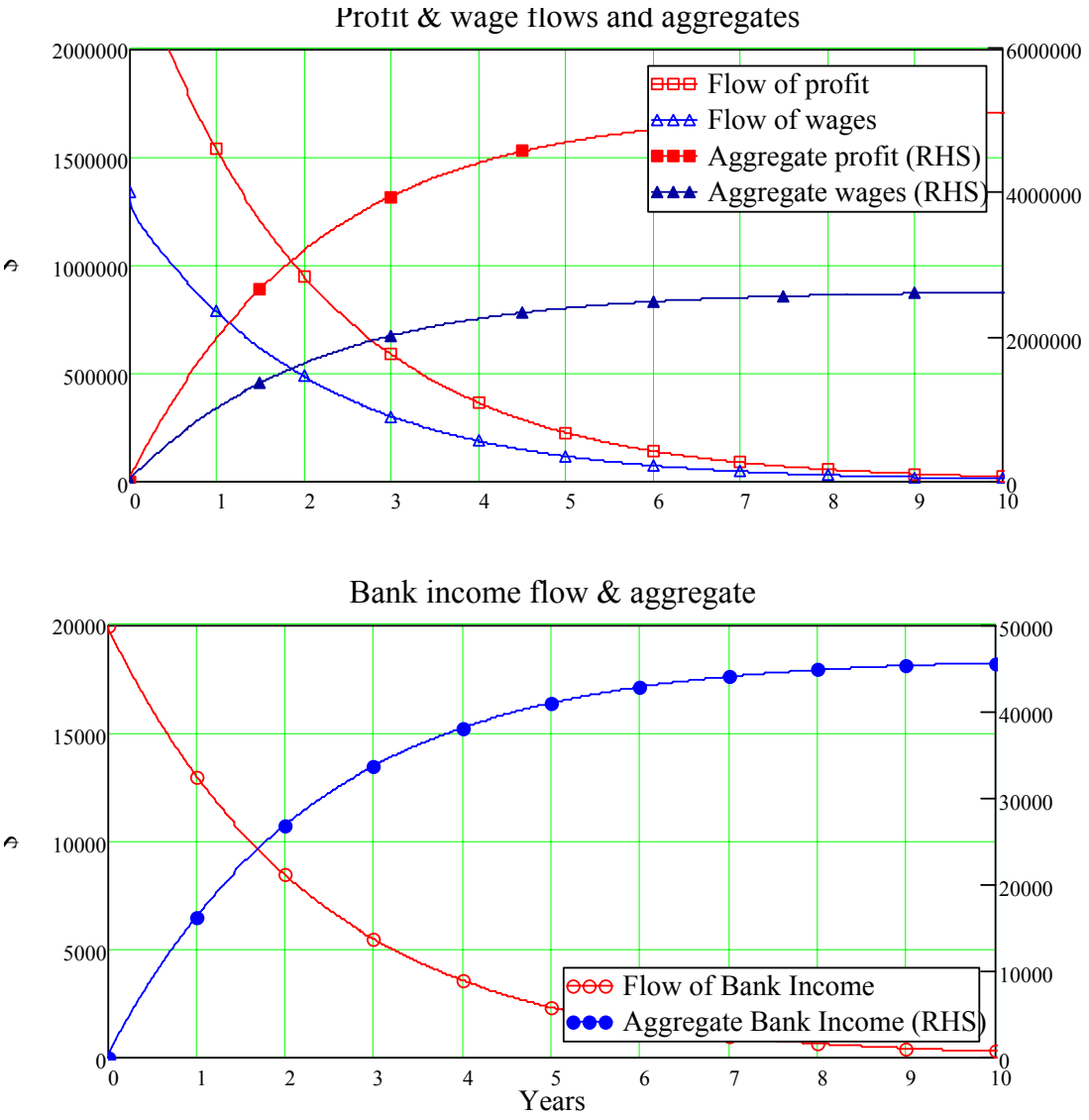


Figure 3: Income dynamics without relending

Table 1 shows the aggregate values of these flows after 20 years. It is obvious that, contrary to Circuitist literature to date—but consistent with Keynes's expectations—capitalists can make profits that far exceed the size of the initial loan: the size of the stock does not limit the magnitude of the flows it enables. Given the hypothetical values in this

simulation, a $1 million loan finances almost $8 million in incomes, including more than $5 million in profits—even in the absence of re-lending of the principal.

Variable	Aggregate value at end of simulation
Gross Profit	5273120
Interest	108563
Principal Repayments	999900
Wages	2636560
Net Profit	5164557
Capitalist Income	5223880
Worker Income	2639605
Bank Income	46195

Table 1: Value of aggregate flows after 20 years

Time Lags and Profits

There is, however, a relationship between the time lags and interest rates in the model and the feasibility of making a profit. Figure 4 shows the results of simulations with a higher interest rate spread (a loan rate of 10% and a deposit rate of 2%), and varying time lags in production from 2 months to ten years. Clearly it is possible for interest and principal payments to exceed profits, but that outcome requires a combination of extreme time lags between the financing of and the receipt of profits from production, and high interest rate spreads (altering consumption time lags also alters the level of profits). Of course, in an actual financial system, such a combination might well be the outcome of a succession of Minskian crises.

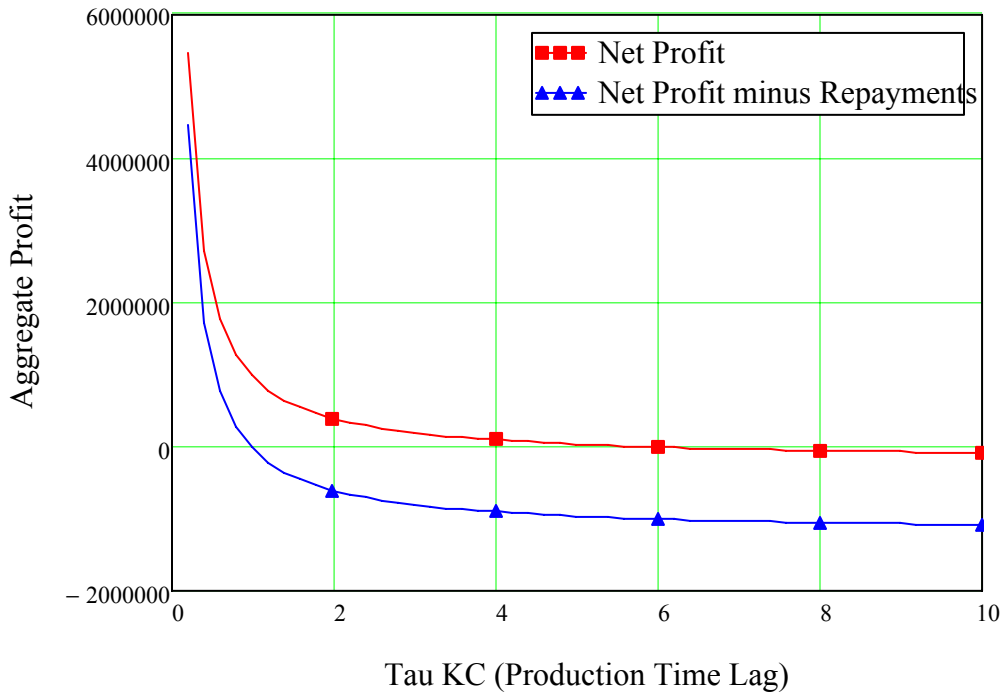


Figure 4: Relation between production time lags and net profit

The non-destruction of money

One final point deserves reiteration here before we consider re-lending of principal: the conservation of money in this simple model, and, in capitalism in general, the non-destruction of money except via bankruptcy. The top graph in Figure 5 plots the sum of all income accounts plus bankers' principal: this is identically equal to the original injection of endogenous money, and remains so throughout the simulation. As argued previously, money is not destroyed by repayment, but simply circulates between the money accounts (in this simple model, the capitalist credit account K_C, Bankers principal account B_P and income account B_Y, and Workers income account W_Y).

The second graph shows the sum of all income accounts (*KC*, *WY* and *BY*), and the outstanding level of debt; these are also identical. Debt is repaid from the capitalists income account, and when this happens the income side of the financial system falls by precisely the amount of the repayment: deposits in income accounts are what are "destroyed" by the repayment of loans—not money. The money itself is not destroyed, but accumulates in the principal side of the financial system. This is illustrated, in this simple model without re-lending, by the third graph in Figure 5: the sum in the bankers' principal account starts at zero and rises to the level of the initial sum of endogenously created money over time. As the impulse from the original injection of endogenous money dies out, all the endogenously created money accumulates in the bankers' principal account, while capitalist debt is paid down to zero.

The final graph in Figure 5 establishes another identity: the sum of bankers' principal and capitalist debt represents the net assets of bankers, which is identical to the initial creation of endogenous money.

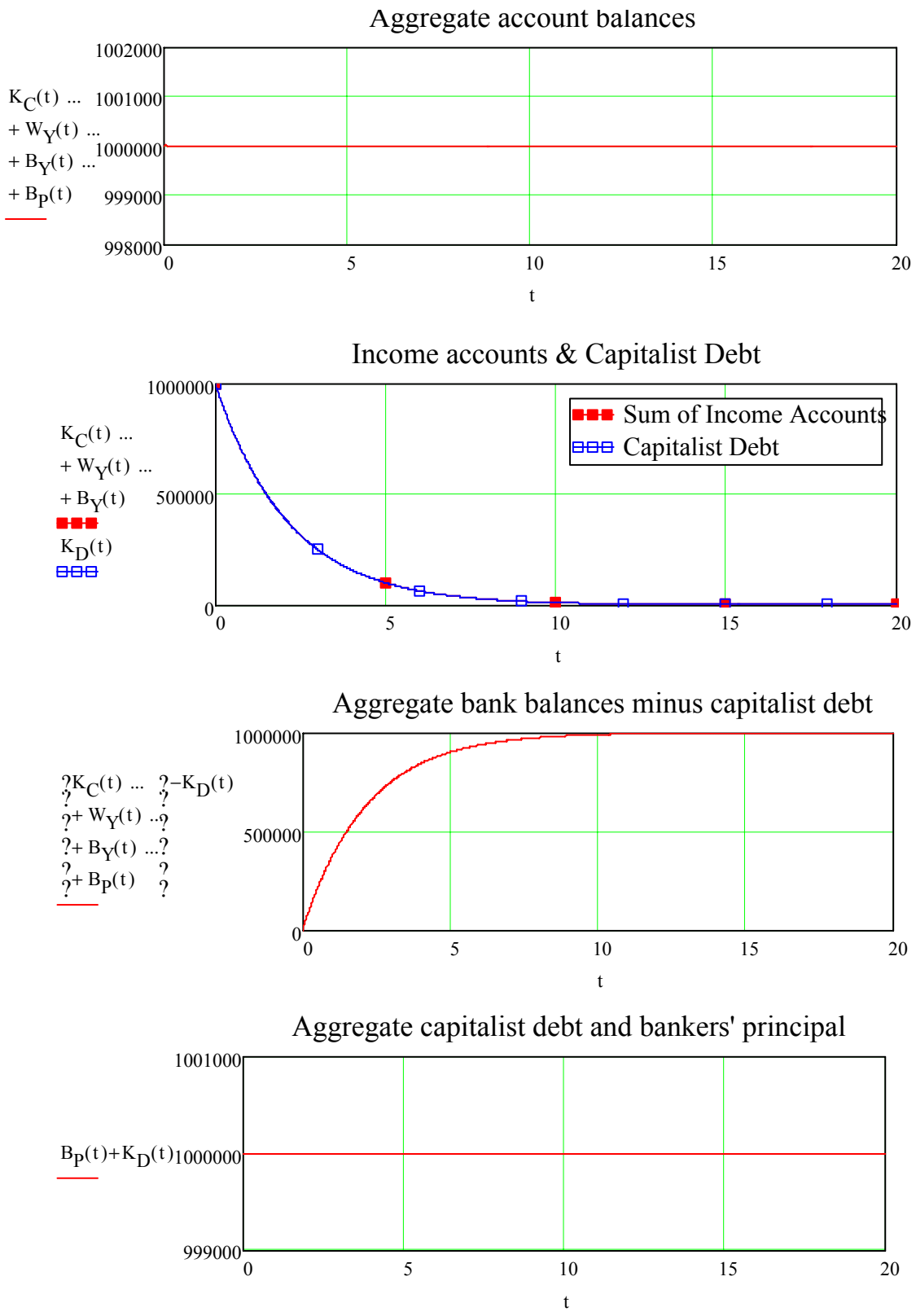


Figure 5: the non-destruction of money

The revolving fund: re-lending of bankers' principal

Keynes's vision of a "revolving fund of finance" is as bankers re-lending from the the principal account B_P with a time lag τ_{BP}—where in this simulation $\tau_{BP} = 3/2$, or one and a half years This is added as new debt to the capitalists' debit account, and new working capital to the credit account. The complete model of financial flows is thus (with the new elements highlighted by matching brackets):

$$\frac{d}{dt}K_D = -R_P K_D + \left\{\frac{1}{\tau_{BP}} B_P\right\}$$

$$\frac{d}{dt}K_C = r_C K_C - (r_d + R_P) K_D - \frac{1}{\tau_{KC}} K_C + \frac{s}{\tau_{KC}} K_C + \frac{1}{\tau_W} W_Y + \frac{1}{\tau_B} B_Y + \left\{\frac{1}{\tau_{BP}} B_P\right\}$$

$$\frac{d}{dt}W_Y = \frac{1-s}{\tau_{KC}} K_C + r_c W_Y - \frac{1}{\tau_W} W_Y \qquad (9)$$

$$\frac{d}{dt}B_P = R_P K_D - \left\{\frac{1}{\tau_{BP}} B_P\right\}$$

$$\frac{d}{dt}B_Y = r_d \cdot K_D - r_c \cdot K_C + r_c W_Y - \frac{1}{\tau_B} B_Y$$

Contrary to the prevalent Circuitist assertion that new money has to be created to enable new commerce to occur (Graziani 1989; Fontana 2000), and consistent with Keynes 1937, this model economy can function at a sustained level with only a single injection of endogenous money. Economic activity continues because, rather than all the money accumulating in the bankers' principal account, a proportion of it continues to be lent, renewing the supply of circulating money, and hence production and the generation of income. As Figure 6 indicates, all accounts reach equilibrium levels where inflows equal outflows, and income generation continues indefinitely.

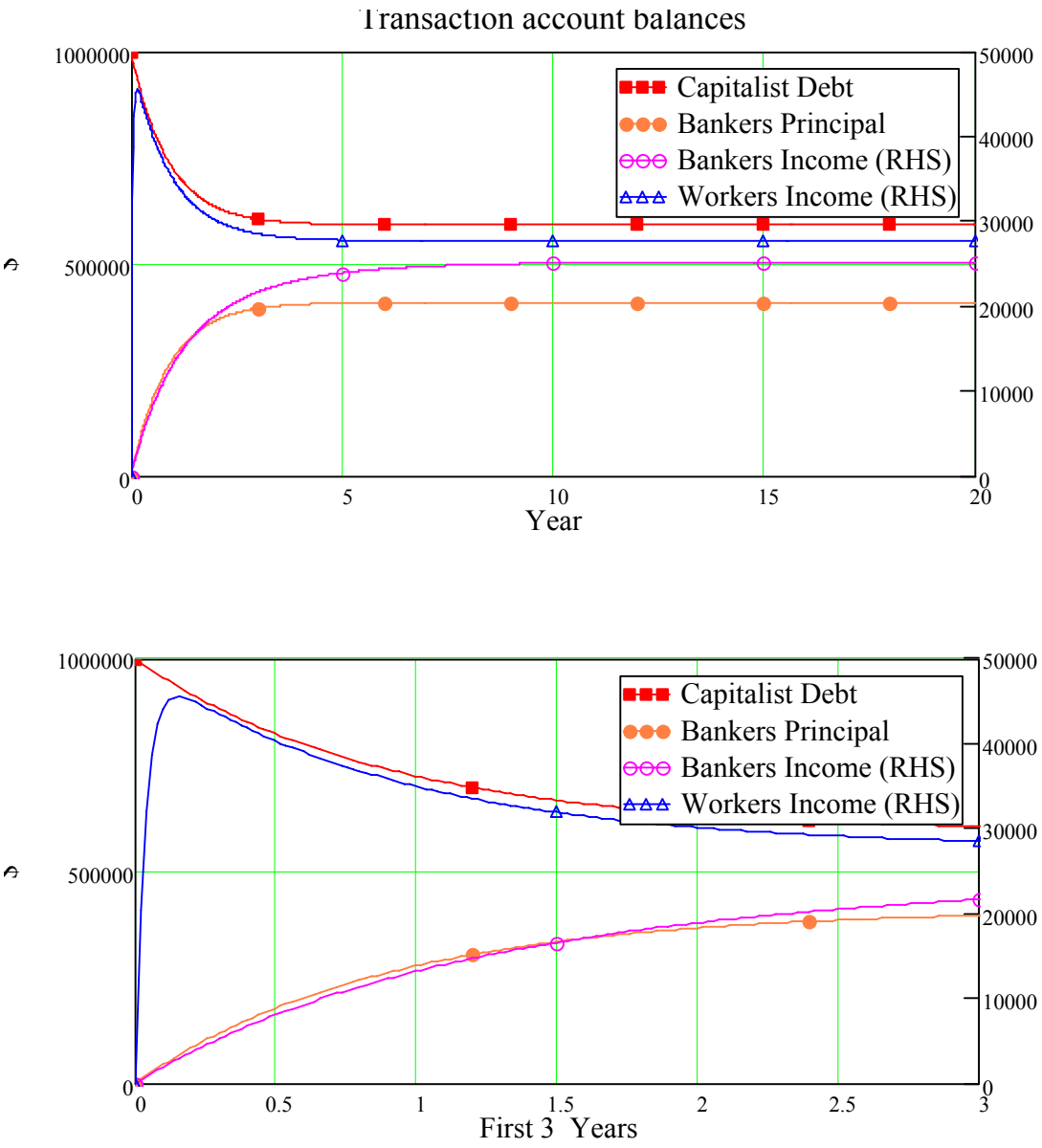


Figure 6: Sustained economic activity with relending of bank principal

Figure 7 confirms that the circulation of this fixed amount of money generates a continuous stream of income for all three classes in the model:

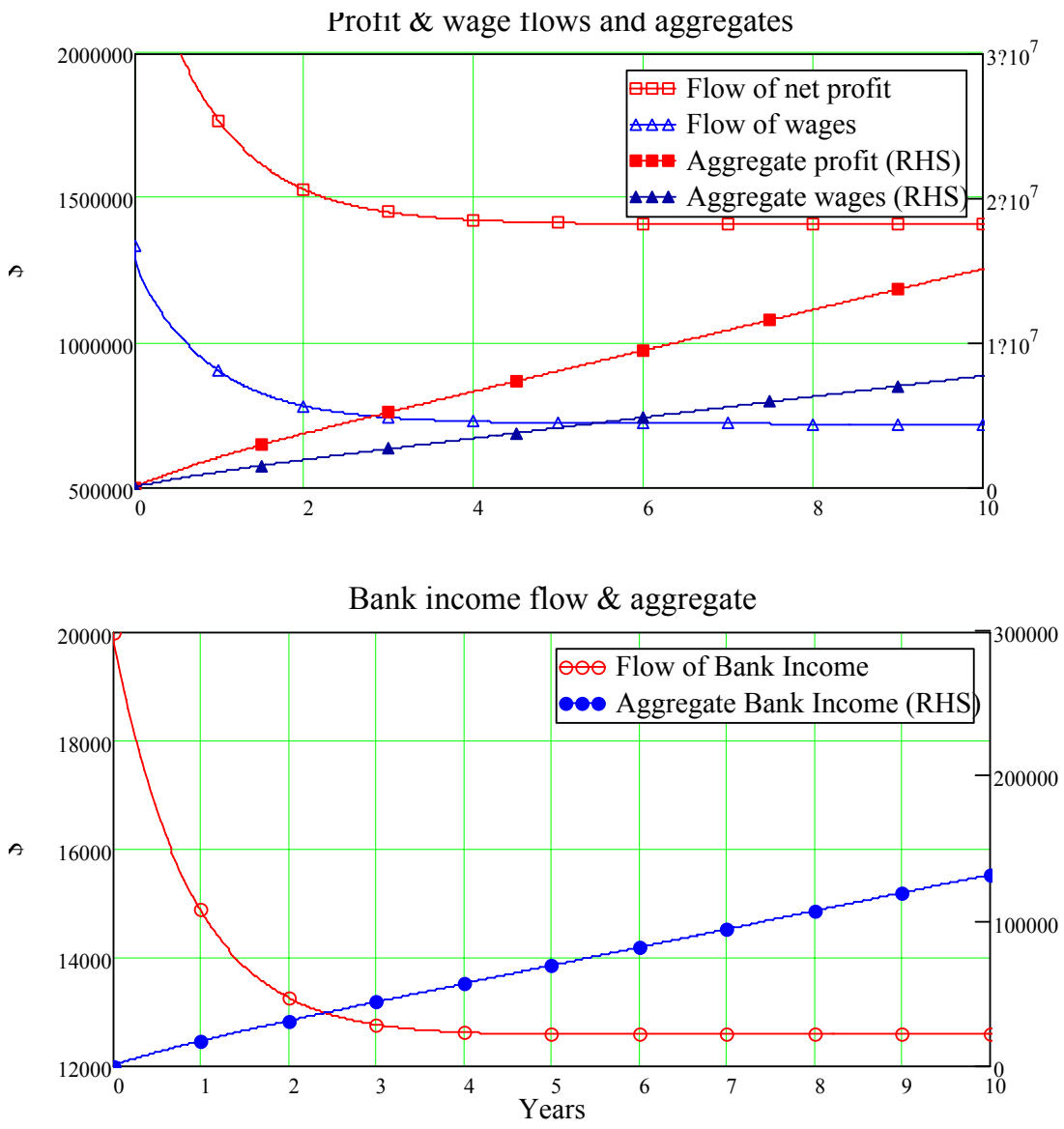


Figure 7: Sustained income flows with re-lending

Conclusion

Keynes was correct that a "revolving fund of finance" can initiate an indefinite stream of production, and that the fund is a necessary prelude to production itself in a monetary economy. The Circuitist formalisation of the concept of credit money plays an essential role in converting Keynes's vision from a verbal to a dynamic model, but at the same time, some prevalent Circuitist concepts must be abandoned in favour of Keynes's accurate insights from 1937.

As Dow argued, Keynes of *The General Theory* was unclear on the issue of whether the money supply was exogenous or endogenous (Dow 1997), and this ambiguity was one of many that led to the confused hobgoblin that became associated

with his name. Keynes's 1937 papers, on the other hand, clearly treated money and credit as endogenous phenomena in capitalism, and their insights provide a better basis for what the General Theory originally aimed to be: a monetary model of production. In the context of this conference, though 1936 was Keynes's most prominent year, it could be argued that 1937 was his most insightful (and succinct). Perhaps we should devote next year's conference to these seminal but comparatively neglected contributions.

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