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Simulating the Global Economy in a Sequential and Non-Dualistic Value Theoretical Framework: A First Attempt

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Abstract

Previously we have considered how rentiers can be integrated with an aggregate one-commodity model of the productive economy, ignoring the complexity of different goods and different countries. We employ a high level of abstraction in recognition of the original and complex nature of our work. Sequential and non-dualistic determination of value by labour time ensures that value magnitudes systematically deviate from physical/'real' magnitudes, questioning the usefulness of endogenously modelling behaviour on 'real' terms. For simplicity we choose to abstractly simulate 'reasonable' surface patterns of behaviour for our economy to reveal how underlying value magnitudes are likely to behave, revealing agents 'value-motives'. To focus on rentiers as 'monied-capitalists' we imagine ongoing lending/an affective diversity of 'ownership' of the productive economy between productive capitalists and rentiers. We assume two countries and two commodities to focus on the division between the technologically advanced and the rest of the world. Initially we imagine our countries are only linked through trade, approximating the Golden Age. Then we simulate the 'new' global economy, joining our economies in a single world economy. We explore how the rate of growth and changes to 'competitiveness' affect the relative value fortunes of each countries productive capitalists and 'cosmopolitan' rentiers.

Keywords: Globalisation, Value-Theory, Rentiers, Golden-Age, New-Economy

SIMULATING THE GLOBAL ECONOMY IN A SEQUENTIAL AND NON-DUALISTIC VALUE THEORETICAL FRAMEWORK: A FIRST ATTEMPT

Introduction

Up to now we have concentrated on modelling how rentiers/finance capital can be integrated with an aggregate one-commodity model of the productive economy (Potts, 2004, 2005A and 2005B), ignoring the complexity of different goods and different countries. We have employed a high level of abstraction in recognition of the original and complex nature of our task. Sequential and non-dualistic determination of value by labour time ensures that value magnitudes are likely to systematically deviate from physical/'real' magnitudes (Freeman and Kliman, 2000), questioning the usefulness of endogenously modelling behaviour based on 'real' terms. Alternatively to model behaviour based on value terms would require us to address precisely how value terms influence behaviour/manifest at the 'surface' level of the economy. For simplicity we have consequently chosen to abstractly simulate 'reasonable' surface patterns of behaviour for our economy to reveal how underlying value magnitudes are likely to behave, to reveal agents potentially contrasting 'value-motives' as to how the economy should ideally behave. To focus on rentiers as wealth holders/'monied-capitalists' we have abstracted from banking and money's role in facilitating circulation.[1] We concentrate on how ongoing lending (less abstractly including share ownership) from rentiers to productive capitalists represents an affective diversity of 'ownership' of the productive economy between productive capitalists and rentiers.

Our model is complicated enough with one country and one commodity, but to address the reality of a clear diversity between countries (producing different goods, or rather producing goods at different levels of technology) we must extend our analysis. Ideally with many countries and commodities we could simulate a scenario of groups of countries at different levels of development. We could investigate how different groups converged/ diverged over time and relations between countries in the same group (sharing the same general level of technology/development). Such an approach, although potentially very useful, is, in our opinion, too large as a first step. Alternatively we shall simply assume two countries and two commodities to focus on the central feature of the world economy as we see it: the division between the technologically advanced and the rest of the world. Advanced Country A uniquely produces commodity 1 and less developed Country B uniquely produces commodity 2, with both commodities being used for inputs and consumption in both countries (thus assuming trade between countries). Commodity 1 proxies commodities in general produced in A, all at a higher level of technology than the group of commodities produced in B, proxied by commodity 2. Initially we shall imagine that our countries are only linked through trade, i.e. they are separate economies, with their own productive capitalists and rentiers. We suggest this scenario approximates the Golden Age, with trade, but limited capital mobility. We move on to simulate the 'new' global economy by imagining our two countries are linked into a single world economy with rentiers exclusively operating in the currency of the most developed country (proxying capital/wealth flight from poor countries to a 'universal' financial system). Although our assumptions/scenarios are abstract and extreme we hope to capture the essence of how globalisation may be affecting productive capitalists and workers in developed and less developed countries, while additionally shedding light on how wealth holders/rentiers are affected by/may effect globalisation.

ECONOMIES ONLY LINKED THROUGH TRADE

Our Model

A and B have different currencies, related by ε_t, the price of a unit of B money in A money (the price of foreign currency for A). We assume in both A and B we have workers, productive capitalists and rentiers (rolling over/lending ongoing loans to productive capitalists, but not consuming or lending to workers), abstracting from any state, or banking system to facilitate circulation. We assume no international capital mobility and the market in each country clears at the end of each period, thus assuming no stocks (or crisis) and additionally no fixed capital, all for simplicity. Although we consider productive capitalists in each country collectively, effectively assuming two aggregate productive capitalists, to reflect the existence of many productive capitalists in each country we assume that all output must sold in the market (productive capitalists can not directly use their own output as input). To reflect A's higher level of development we assume trade is dictated by A, so, assuming away the complexity of trade imbalances, at the end of a each period A's imports (in A money) defines B's exports (in A money). Trade is thus balanced and dictated by A. To clearly identify variables by unit, commodity and country, superscripts will be annoyingly long! $^{£}$ will represent money, ^{o} physical terms with intrinsic end-period values having no superscript and end-period exchange values having * superscript. ^{A} will represents pertaining to/in country A, and ^{B} country B, while ^{1} represents commodity 1 and ^{2} commodity 2. Productive capitalist in A advance $M^{£A}_{t}$ in A money terms at the beginning of production at t:

(1) $$M^{£A}_{t} = P^{£A1}_{t-1}C^{oA1}_{t} + P^{£A2}_{t-1}C^{oA2}_{t} + P^{£A1}_{t-1}V^{oA1}_{t} + P^{£A2}_{t-1}V^{oA2}_{t}$$

P represents price, C constant capital and V variable capital, for example C^{oA1}_{t} represents the physical quantity of commodity 1 applied by productive capitalists in A. Prices relate to period t-1, to be precise are formed at the end of production at t-1, before commodities are traded in circulation at the end of period t-1. We abstractly assume for simplicity that circulation is instantaneous to ensure production and circulation periods do not overlap. For simplicity we shall simply assume $C^{£A2}_{t} = \delta C^{£A}_{t}$ and $V^{£A2}_{t} = \alpha V^{£A}_{t}$, thus defining the precise pattern of inputs. As Freeman (1996A and 1996B) and Kliman and McGlone (1999) make clear, by the Temporal Single System Interpretation (TSSI) of Marx, the value embodied in advanced capital simply equals the monetary expression of that capital, divided by the monetary expression of labour time (the nominal money expression of an hour of abstract social labour) pertaining to when that capital was advanced.[2] Given $M^{£A}_t$ is determined in circulation at t-1, period t-1's monetary expression of labour time (MELT) for A x^A_{t-1}, established with price (and interest) determination at the end of production at t-1 is the appropriate MELT to apply to $M^{£A}_t$:

(2) $M^A_t = M^{£A}_t / x^A_{t-1}$

$L^A_t = S^A_t + V^A_t, \quad V^A_t = V^{£A}_t / x^A_{t-1}, \quad r^A t = S^A_t / V^A_t$

(3) $Y^A_t = M^A_t + S^A_t$

(4) $\rho^A_t = S^A_t / M^A_t$

A productive capitalists secure L^A_t labour power for V^A_t so extract S^A_t surplus value in production, determining the total end-production intrinsic value of productive capital in A Y^A_t, and the intrinsic end-production value profit rate in A ρ^A_t. The question of production in physical terms is less straightforward. Production somehow combines heterogeneous physical objects with living labour to produce, not static but changing in nature, physical objects. Firstly we suggest that it is both complex and perhaps ultimately futile to define particular physical production functions, accounting for how physical objects and labour transform to physical objects. As we wish to exogenously control the surface behaviour of our scenarios we would be picking a particular production function to produce the particular result we wanted anyway. So why not, as we will choose to do, simply enter the result, the physical profit rate, and work backwards to determine output, leaving the black box of production alone? Secondly, outside of a one-commodity setting, notions of physical/'real' terms would appear to be as abstract as the notion of abstract social labour. As we can't aggregate heterogeneous physical objects directly we must work from nominal money terms (monetary expressions), adjusting for price inflation to arrive at 'real' terms. For example if we adjust to 'real' terms by pricing output at the same price as inputs (as we shall choose to do, see equation

(5)), we are working through money, just as we determine exchange values through adjusting monetary expressions alternatively by the MELT. Finally, given that commodities actually change in physical/use-value nature over time, we must question the accuracy of attempts to calculate price indices; accurate 'real' terms may simply not exist outside of constrained economic models:

(5) $\rho^{oA}{}_{t}$ 'real' $= (P^{£A1}{}_{t-1}Q^{oA1}{}_{t} - M^{£A}{}_{t}) / M^{£A}{}_{t}$ Enter exogenously so,

(6) $Q^{oA1}{}_{t} = (1+\rho^{oA}{}_{t})M^{£A}{}_{t}/P^{£A1}{}_{t-1}$ so

(7) $v^{1}{}_{t} = Y^{A}{}_{t} / Q^{oA1}{}_{t}$

Where $Q^{oA1}{}_{t}$ represents output of commodity 1 in A (total 1 output as A exclusively makes commodity 1), $\rho^{oA}{}_{t}$ represents the physical profit rate and $v^{1}{}_{t}$ represents the end-production intrinsic unit value of commodity 1. With the end-production situation in A defined in intrinsic value and physical terms we can move on to exogenously setting price (at the end of production) to reveal monetary expressions and variables end-period exchange values. As we assume no stocks or crisis, the market must clear, note K_t stands for capitalist consumption:

$$Q^{oA1}{}_{t} = K^{oA1}{}_{t} + K^{oB1}{}_{t} + C^{oA1}{}_{t+1} + C^{oB1}{}_{t+1} + V^{oA1}{}_{t+1} + V^{oB1}{}_{t+1}$$

$$M'^{£A}{}_{t} = P^{£A1}{}_{t}Q^{oA1}{}_{t}$$

(8) $\rho^{£A}{}_{t} = (M'^{£A}{}_{t} - M^{£A}{}_{t}) / M^{£A}{}_{t}$

To clear the market A productive capitalists must simultaneously spend (directly and indirectly by advancing wages, which we assume workers immediately spend) and realise $M'^{£A}{}_{t}$ as B productive capitalists must likewise simultaneously spend and realise $M'^{£B}{}_{t}$, to ensure the market clears in both countries (remember we assume rentiers in both countries do not consume). Productive capitalists in A earn a $\rho^{£A}{}_{t}$ nominal money profit rate. Assuming balanced trade ensures that the post-circulation distribution of commodities between A and B will not effect $M'^{£A}{}_{t}$ or $M'^{£B}{}_{t}$. So to clear the market productive capitalists must spend all they realise, but we assume that they are in an ongoing situation of borrowing from rentiers. We assume at the end of production at t A productive capitalists must pay their due loans to A rentiers $\lambda^{D£A}_t$, equal to the loan lent by A rentiers at the end of production at t-1 plus interest $\lambda^{D£A}_t = (1+i^{£A}_t)\lambda^{L£A}_{t-1}$. They are precisely $\lambda^{D£A}_t$ short of being able to clear the market. The solution is simple, A rentiers must simply rollover A productive capitalist loans plus interest, $\lambda^{L£A}_t = \lambda^{D£A}_t$. Rentiers, abstaining from consumption, simply concentrate on growing their money stocks/deposits by expanding their lending. Abstractly we can imagine in both countries that rentiers permanently hold their money deposits, except for an instant each period when productive capitalists borrow money deposits from rentiers precisely to instantaneously return them to rentiers. We suggest that our concept of lending/rentiers represents an effective diversity of 'ownership' of the productive economy between productive capitalists and rentiers. We assume away the complexity of money's role in facilitating circulation by assuming a 100% coverage of transactions, cost-less, deposit credit money system facilitates circulation in each country, thus abstracting for the need for a banking system or a Central Bank in either country. As $M'^{£A}_t$ and $M'^{£B}_t$ are simultaneously spent and realised in circulation, assuming balanced trade, A and B productive capitalists and workers deposits, start balanced at zero, then simultaneously flash into matching debits and credits and then back to zero when circulation is complete. It is only rentiers who hold lasting money deposits (wealth in money form) in our model.

We must now calculate end-production exchange values. Freeman (1996B) explains how it is the formation of price (and additionally in our model the determination of rentiers' money deposits in nominal terms) at the end of production at t, and not the precise pattern of trade in circulation, which determines exchange values. If we did allow stocks of unsold output instead of assuming that the market clears, stocks would have equal unit monetary expression and value to sold output, thus equally contributing to productive capitalists balance sheets.

Monetary expressions $M'^{£A}_t$ and $Z^{£A}_t = Z^{£A}_{t-1} - \lambda^{L£A}_{t-1} + \lambda^{D£A}_t = Z^{£A}_{t-1} + i^{£A}_t \lambda^{L£A}_{t-1}$ are known at the end of production at t, where $Z^{£A}_t$ represents A rentiers total nominal money deposits. To determine exchange values we must simply calculate the MELT established at the end of production at t, but how? We could, as suggested by Kliman (1999), only include the productive economy in our calculation, arriving at an 'output' MELT for Country A:

$$x^A_t \text{ 'Kliman'} = M'^{£A}_t / Y^A_t$$
$$Y^{A*}_t = M'^{£A}_t / x^A_t = M'^{£A}_t / M'^{£A}_t / Y^A_t = Y^A_t$$
$$v^{1*}_t = P^{£A1}{}_t / x^A_t = P^{£A1}{}_t / P^{£A1}{}_t Q^{oA1}_t / Y^A_t = Y^A_t / Q^{oA1}_t = v^1_t$$
$$\rho^{A*}_t = (M'^{£A}_t/x^A_t - M^{£A}_t/x^A_{t-1}) / (M^{£A}_t/x^A_{t-1}) = (Y^A_t - M^A_t) / M^A_t = \rho^A_t$$
$$(9) \qquad Z^A_t = Z^{£A}_t / x^A_t$$

We divide the monetary expression of total capital in A's productive economy (the monetary expression of A's total output of commodity 1 in our circulating capital model) by the intrinsic value embodied in that total capital at the end of production at t, to establish A's output MELT, x^A_t 'Kliman'. The exchange value of A's total capital Y^{A*}_t, the unit exchange value of commodity 1 v^{1*}_t and A's exchange value (final/actual) profit rate ρ^{A*}_t, equal their monetary expressions divided by appropriate MELTS (relating to when the monetary expressions were determined, at t or t-1). As we examine A and B as separate, only linked through trade, aggregate economies the fact that $Y^{A*}_t = Y^A_t$ simply confirms Marx's first equality: price formation at the end of production and subsequent circulation can not alter the total exchange value embodied in the economy (total capital) from its total intrinsic value at the end of production. Exchange values equal intrinsic values in general. We would simply infer the value represented by A rentiers' money deposits by dividing their monetary expression by A's 'output' MELT.

Alternatively we shall choose to include rentiers' money deposits with the productive economy in our definition of total capital in A.[3] The monetary expression of A's total capital at the end of production at t becomes

$M'^{£A}_t+Z^{£A}_t$, with total intrinsic value at the end of production at t equal to $Y^A_t+Z^A_{t-1}$. Z^A_{t-1} equals the value embodied in A rentier money deposits at the end of production at t-1. Z^A_{t-1} is carried forward to, and through, production at t to form part of the total intrinsic value of total capital at the end of production at t to be unaltered by price formation at the end of production at t and subsequent circulation. We now satisfy a modified 'with-money' form of Marx's first equality, $Y^{A*}_t+Z^A_t = Y^A_t+Z^A_{t-1}$:[4]

(10) $x^A_t = (M'^{£A}_t + Z^{£A}_t) / (Y^A_t + Z^A_{t-1})$

(11) $Y^{A*}_t = M'^{£A}_t / x^A_t$

(12) $v^{1*}_t = P^{£A1}_t / x^A_t$

(13) $\rho^{A*}_t = (M'^{£A}_t/x^A_t - M^{£A}_t/x^A_{t-1}) / (M^{£A}_t/x^A_{t-1})$

(9) $Z^A_t = Z^{£A}_t / x^A_t$

Exchange values no longer equal intrinsic values, unless:

(14) $P^{£A1}_t/v^1_t = Z^{£A}_t/Z^A_{t-1} = x^A_t$, as $x^A_t = P^{£A1}_t/v^1_t$ equation (11) becomes,
$v^{1*}_t = P^{£A1}_t / (P^{£A1}_t / v^1_t) = v^1_t$

But if:

(15) $P^{£A1}_t/v^1_t > x^A_t > Z^{£A}_t/Z^A_{t-1}$ $v^{1*}_t > v^1_t$, $Y^{A*}_t > Y^A_t$, $\rho^{A*}_t > \rho^A_t$ and $Z^A_t < Z^A_{t-1}$,

(16) $P^{£A1}_t/v^1_t < x^A_t < Z^{£A}_t/Z^A_{t-1}$ $v^{1*}_t < v^1_t$, $Y^{A*}_t < Y^A_t$, $\rho^{A*}_t < \rho^A_t$ and $Z^A_t > Z^A_{t-1}$,

We have a potential value transfer, at the end of production at t when price and interest are established, either from the exchange value embodied in A rentiers' money deposits to the exchange value embodied in A's productive economy, or from the productive economy to money deposits. If the value transfer is in favour of A productive capitalists, equation (15) holds, exchange values in A's productive economy will be boosted above their intrinsic values. If alternatively the value transfer is in favour of A rentiers, equation (16) holds, exchange values in A's productive economy will be depressed below their intrinsic values.

End period t physical, nominal and exchange values are now fully determined for A, and through our assumption of balanced trade between separate economies, are independent of the distribution of commodities between countries at the end of t. To explain we must establish the distribution of output at the end of t. Let us assume A productive capitalists purchase at the end of t output for their own personal consumption embodying $K^{A}_{t} = \beta S^{A}_{t}$ value, determining the scale of reproduction in A for period t+1 ($\beta = 0$ would produce maximum extended reproduction). $K^{£A}_{t} = x^{A}_{t}K^{A}_{t}$, so if we assume $K^{£A2}_{t} = \theta K^{£A}_{t}$ we reveal $K^{£A1}_{t}$, K^{oA1}_{t} and K^{oA2}_{t}, given we know/have exogenously set $P^{£A2}{}_{t}$ and $\varepsilon_t P^{£B2}{}_{t}$ (the price of commodity 2 in A money). For A we assume in general $C^{£A2}_{t} = \delta C^{£A}_{t}$ and $V^{£A2}_{t} = \alpha V^{£A}_{t}$. So once we exogenously set L^{A}_{t+1} and r^{A}_{t+1}, determining $V^{£A}_{t+1}$ and $C^{£A}_{t+1}$ (given $K^{£A}_{t}$), for t+1 $C^{£A2}_{t+1} = \delta C^{£A}_{t+1}$ and $V^{£A2}_{t+1} = \alpha V^{£A}_{t+1}$, we determine C^{oA1}_{t+1}, C^{oA2}_{t+1},V^{oA1}_{t+1} and V^{oA2}_{t+1}. We must also establish the distribution of commodities in B to fully account for the distribution of output at the end of t. At the end of t we assume B productive capitalists purchase output for consumption embodying $K^{B}_{t} = \Phi S^{B}_{t}$ value. $K^{£B}_{t} = x^{B}_{t}K^{B}_{t}$, so assuming $K^{£B1}_{t} = \psi K^{£B}_{t}$ reveals $K^{£B2}_{t}$, K^{oB1}_{t} and K^{oB2}_{t} (given $P^{£B2}{}_{t}$ and $P^{£A1}{}_{t}/\varepsilon_t$, the price of commodity 1 in B money). We assume in general in B that $V^{£B1}_{t} = \varphi V^{£B}_{t}$, so by setting L^{B}_{t+1} and r^{B}_{t+1} we determine $V^{£B}_{t+1}$, V^{oB1}_{t+1} and V^{oB2}_{t+1}. As in A, expenditure on constant capital input is a residual, for B $C^{£B}_{t+1} = M'^{£A}_{t} - K^{£A}_{t} - V^{£A}_{t+1}$. However unlike in A (through assuming $C^{£A2}_{t} = \delta C^{£A}_{t}$), B productive capitalists can not choose their desired distribution of $C^{£B}_{t+1}$ between C^{oB1}_{t+1} and C^{oB2}_{t+1}; it is dictated by trade/all other assumed patterns and levels of expenditure. A's imports will dictate B's exports, and as trade is balanced B's imports. At the end of t, in A money, A's imports equal B's imports:

(17) $\theta K^{£A}_{t} + \delta C^{£A}_{t+1} + \alpha V^{£A}_{t+1} = \varepsilon_t(\psi K^{£B}_{t} + \varphi V^{£B}_{t+1}) + P^{£A1}{}_{t}C^{oB1}_{t+1}$

(18) $C^{oB1}_{t+1} = [\theta K^{£A}_{t} + \delta C^{£A}_{t+1} + \alpha V^{£A}_{t+1} - \varepsilon_t(\psi K^{£B}_{t} + \varphi V^{£B}_{t+1})] / P^{£A1}{}_{t}$

C^{oB1}_{t+1} is thus in our model a residual, dependent on the consumption patterns of both productive capitalists and workers in A and B (but not on A and B rentiers as we assume they do not consume). The end period t distribution of commodities is fully determined. Trade is balanced in money terms but what of value? The value embodied in A's imports and exports (B's imports), is determined by dividing their monetary expression in A money by A's MELT:

$$(K^{£A2}_t + C^{£A2}_{t+1} + V^{£A2}_{t+1}) \,/\, x^A_t \;=\; [\varepsilon_t(K^{£B1}_t + C^{£B1}_{t+1} + V^{£B1}_{t+1}] \,/\, x^A_t$$

As the sums are equal in monetary expression and divided by the same MELT they must be equal in value terms. The same is true for B, but now we consider monetary expressions in B money and divide by B's MELT:

$$(K^{£B1}_t + C^{£B1}_{t+1} + V^{£B1}_{t+1}) \,/\, x^B_t \;=\; [(K^{£A2}_t + C^{£A2}_{t+1} + V^{£A2}_{t+1}) \,/\, \varepsilon_t] \,/\, x^B_t$$

In A, in A value terms, so much value is 'exported' in return for an equal 'import' of value in A value terms. Likewise in B, in B value terms, the value of total imports equals the value of total exports. Quite simply it is commodities that have exchanged between systems and not value; our separate economies are not linked in value terms, just trade i.e. physical exchange.[5] x^A_t and x^B_t are not 'usefully' comparable, but separate measures of value for separate economies. If x^A_t is higher than $\varepsilon_t x^B_t$, as we assume it is, through assuming A is more developed than B, in 'human' terms more B hours would be swapped for A hours. However this has no effect on the end period t situation in either country, including all measures of profit and rentiers' money deposits. Let us complete our model/definition of B. B productive capitalists advance $M^{£B}_t$ money capital at the start of t (with its distribution between constant and variable capital and commodity 1 and 2 determined as we have described above):

(19) $M^{£B}_t = P^{£B1}_{t-1}C^{oB1}_t + P^{£B2}_{t-1}C^{oB2}_t + P^{£B1}_{t-1}V^{oB1}_t + P^{£B2}_{t-1}V^{oB2}_t$

(20) $M^B_t = M^{£B}_t \,/\, x^B_{t-1}$

$L^B_t = S^B_t + V^B_t, \qquad V^B_t = V^{£B}_t \,/\, x^A_{t-1}, \qquad r^Bt = S^B_t \,/\, V^B_t$

(21) $Y^B_t = M^B_t + S^B_t$

(22) $\rho^B{}_t = S^B{}_t / M^B{}_t$

We shall determine $Q^{oB2}{}_t$ by setting exogenously B's initial physical profit rate and subsequently relating $\rho^{oB}{}_t$ to $C^{oB1}{}_t/C^{oB2}{}_t$; B's level of productive development:

(23) $\rho^{oB}{}_t = \rho^{oB}{}_{t-1}(1 + \Omega(C^{oB1}{}_t/C^{oB2}{}_t - C^{oB1}{}_{t-1}/C^{oB2}{}_{t-1}))$ Ω = a constant

(24) $Q^{oB2}{}_t = (1 + \rho^{oB}{}_t)M^{£B}{}_t / P^{£B2}{}_{t-1}$

(25) $v^2{}_t = Y^B{}_t / Q^{oB2}{}_t$

We exogenously set end-period price, assuming the market (both markets) clear:

$Q^{oB2}{}_t = K^{oA2}{}_t + K^{oB2}{}_t + C^{oA2}{}_{t+1} + C^{oB2}{}_{t+1} + V^{oA2}{}_{t+1} + V^{oB2}{}_{t+1}$

$M'^{£B}{}_t = P^{£B2}{}_t Q^{oB2}{}_t$

(26) $\rho^{£B}{}_t = (M'^{£B}{}_t - M^{£B}{}_t) / M^{£B}{}_t$

Any existing loans are rolled over with interest $\lambda^{L£B}{}_t = \lambda^{D£B}{}_t = (1+i^{£B}{}_t)\lambda^{L£B}{}_{t-1}$, with $Z^{£B}{}_t = Z^{£B}{}_{t-1}+i^{£B}{}_t\lambda^{L£B}{}_{t-1}$. Turning to exchange values:

(27) $x^B{}_t = (M'^{£B}{}_t + Z^{£B}{}_t) / (Y^B{}_t + Z^B{}_{t-1})$

(28) $Y^{B*}{}_t = M'^{£B}{}_t / x^B{}_t$

(29) $v^{2*}{}_t = P^{£B2}{}_t / x^B{}_t$

(30) $\rho^{B*}{}_t = (M'^{£B}{}_t/x^B{}_t - M^{£B}{}_t/x^B{}_{t-1}) / (M^{£B}{}_t/x^B{}_{t-1})$

(31) $Z^B{}_t = Z^{£B}{}_t / x^B{}_t$

Just as for A, exchange values in B no longer equal intrinsic values, unless equation (32) is fulfilled:

(32) $P^{£B2}{}_t/ v^2{}_t = Z^{£B}{}_t/Z^B{}_{t-1} = x^B{}_t$

(33) $P^{£B2}{}_t/ v^2{}_t > x^B{}_t > Z^{£B}{}_t/Z^B{}_{t-1}$ $v^{2*}{}_t > v^2{}_t$, $Y^{B*}{}_t > Y^B{}_t$, $\rho^{B*}{}_t > \rho^B{}_t$ and $Z^B{}_t < Z^B{}_{t-1}$,

(34) $P^{£B2}{}_t/ v^2{}_t < x^B{}_t < Z^{£B}{}_t/Z^B{}_{t-1}$ $v^{2*}{}_t < v^2{}_t$, $Y^{B*}{}_t < Y^B{}_t$, $\rho^{B*}{}_t < \rho^B{}_t$ and $Z^B{}_t > Z^B{}_{t-1}$,

In B, in the same manner as for A, value can either transfer, at the end of production at t when price and interest are established, from Z^B_{t-1} to Y^{B*}_t, or from Y^B_t to Z^B_t, depending on whether equation (33) or equation (34) holds (B's value transfer conditions). End-period monetary expressions and exchange values are now fully determined for B, and just as for A, are independent of trade/the end-period t distribution of commodities 1 and 2 between A and B (which we detail above).

Our model is now fully defined. To conclude we have modelled two countries, assuming more developed A dictates trade with B, determining (with the consumption pattern of workers and productive capitalists in B) B's level of productive development/physical profit rate. A and B are only linked through trade, with separate measures of value applying to their separate economies. Let us bring our model to life through simulation.

Only Linked By Trade Simulations

We choose to start our analysis from a 'well-behaved' static initial period 0, and to then introduce growth, technological change, inflation and interest in periods 1 and 2. By static we mean all inputs and outputs and rentiers' money deposits would be identical in all terms, with intrinsic values equalling exchange values, however many times we repeated this period. We must assume a state of simple reproduction, with productive capitalists in each country consuming that countries total surplus value each period. Furthermore, as indicated above, interest increases rentiers' money deposits, causing MELT to change and value to transfer, breaking the equality of intrinsic and exchange values, preventing identical simple reproduction. As we wish to assume an ongoing process of lending we do not simply want to introduce lending in period 1. Alternatively, abstractly (like the very notion of perfect simple reproduction), we shall assume ongoing lending exists in our initial period, but at zero interest. All variables in all terms can now simply statically repeat themselves. Table 1 summarises our initial period 0 for both countries. Note for A $x^A_t = x^A_{t-1} = 1$, $P^{£A1}_t = P^{£A1}_{t-1} = 1$ and for B $x^B_t = x^B_{t-1} = 1$, $P^{£B2}_t = P^{£B2}_{t-1} = 1$, with $\varepsilon_t = \varepsilon_{t-1} = 0.5$.

Table 1 –Only Linked By Trade Period 0.

C^A_t £=h	C^{oA1}_t	C^{oA2}_t	L^A_t	V^A_t £=h	V^{oA1}_t	V^{oA2}_t	M^A_t £=h	S^A_t	$Y^A_t = Y^{A*}_t$
90	67.5	45	20	10	5	10	100	10	110
Q^{oA1}_t	$v^1_t = v^{1*}_t$	$\lambda^{D£A}_t = \lambda^{L£A}_t$	$M'^{£A}_t$	ρ^A_t % universal	K^A_t £=h	K^{oA1}_t	K^{oA2}_t	Ex^{oA1}_t	Im^{oA2}_t
110	1	95	110	10.0	10	6.667	6.667	30.833	61.667
C^B_t £=h	C^{oB1}_t	C^{oB2}_t	L^B_t	V^B_t £=h	V^{oB1}_t	V^{oB2}_t	M^B_t £=h	S^B_t	$Y^B_t = Y^{B*}_t$
160	19.83	120.33	80	40	1	38	200	40	240
Q^{oB2}_t	$v^2_t = v^{2*}_t$	$\lambda^{D£B}_t = \lambda^{L£B}_t$	$M'^{£B}_t$	ρ^B_t % universal	K^B_t £=h	K^{oB1}_t	K^{oB2}_t	Ex^{oB2}_t	Im^{oB1}_t
240	1	100	240	20.0	40	10	20	61.667	30.833

As we assume $\varepsilon_t = \varepsilon_{t-1} = 0.5$ the A money expression of B variables is simply half their B money expression. Our terms of trade exchange 1 physical unit of commodity 1 for 2 physical units of commodity 2. Consumption patterns derive from assuming,

$\delta = 0.25$, A productive capitalists spend 25% of $C^{£A}_t$ on commodity 2.
$\alpha = 0.5$, A workers spend 50% of $V^{£A}_t$ on commodity 2.
$\theta = 0.33$, A productive capitalist spend 33% of $K^{£A}_t$ on commodity 2.
$\varphi = 0.05$, B workers spend 5% of $V^{£B}_t$ on commodity 1.
$\psi = 0.5$, B productive capitalists spend 50% of $K^{£B}_t$ on commodity 1.

We assume these consumption patterns stay constant throughout our simulation. To facilitate simple reproduction for period 0 we assume $\beta = 1$ ($K^A_t = \beta S^A_t$) and $\Phi = 1$ ($K^B_t = \Phi S^B_t$). We assume both A and B rentiers lend/rollover 100% of their money deposits, $\lambda^{L£A}_t = Z^{£A}_t$ and $\lambda^{L£B}_t = Z^{£B}_t$, at zero interest. Country A is more developed/has a higher organic composition than B, with a higher proportion of the productive economy effectively 'owned' by rentiers, $\lambda^{D£A}_t/M'^{£A}_t = 86.4\% > \lambda^{D£B}_t/M'^{£B}_t = 41.7\%$ (A has a more 'mature' financial system).

Period 1 inputs and outputs are identical to period 0, and we keep prices constant, but let us assume interest is charged/rolled-over for the first time. From the end of period 0, and henceforth throughout our simulation, let us assume both A and B rentiers charge a interest rate of 2% plus inflation from the end of the last period to the end of the current period (commodity 1 inflation in A and commodity 2 inflation in B).[6] End-period 1 $\lambda^{D£A}{}_t = \lambda^{L£A}{}_t = Z^{£A}{}_t = 96.9$ and $\lambda^{D£B}{}_t = \lambda^{L£B}{}_t = Z^{£B}{}_t = 102$, with $Z^A{}_{t-1} = 95$ and $Z^B{}_{t-1} = 100$, while constant technology and price ensures $P^{£A1}{}_t/v^1{}_t = 1$ and $P^{£B2}{}_t/v^2{}_t = 1$. With only rentiers responsible for undermining the value of money in both countries they enjoy a value transfer in favour of their money deposits from the productive economy in each country, of 1.01 hours in A and 1.4 hours in B:

(16) $P^{£A1}{}_t/v^1{}_t < x^A{}_t < Z^{£A}{}_t/Z^A{}_{t-1} \quad v^{1*}{}_t < v^1{}_t$, $Y^{A*}{}_t < Y^A{}_t$, $\rho^{A*}{}_t < \rho^A{}_t$ and $Z^A{}_t > Z^A{}_{t-1}$,

(34) $P^{£B2}{}_t/v^2{}_t < x^B{}_t < Z^{£B}{}_t/Z^B{}_{t-1} \quad v^{2*}{}_t < v^2{}_t$, $Y^{B*}{}_t < Y^B{}_t$, $\rho^{B*}{}_t < \rho^B{}_t$ and $Z^B{}_t > Z^B{}_{t-1}$,

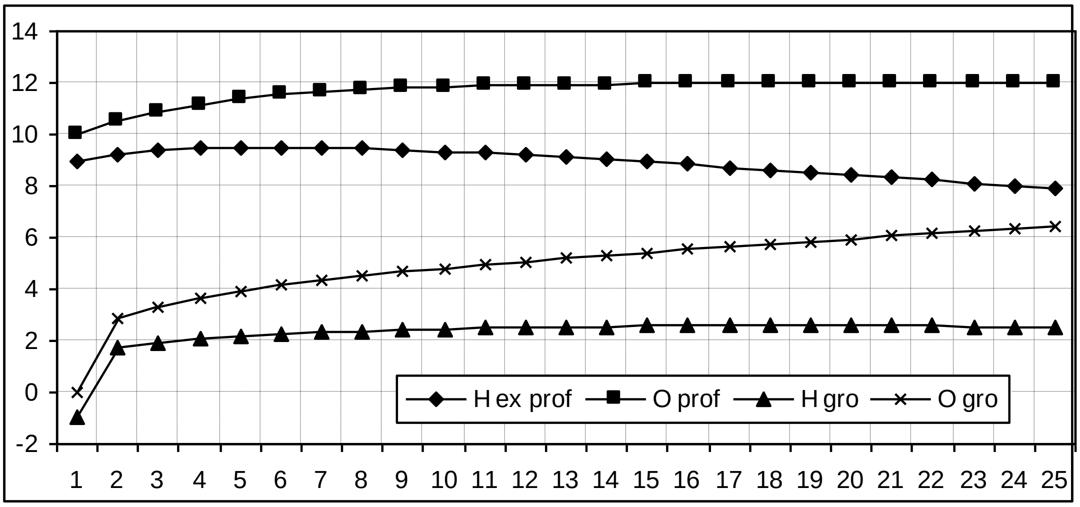
Let us introduce growth from period 2 by reducing β and Φ to 0.75 from the end of period 1 to the end of our simulation, boosting period 2 inputs above period 1 inputs (note the distribution of end-period 1 output does not effect end-period 1 values). From period 2 we assume $L^A{}_t$ rises 1% a period and $L^B{}_t$ rises 2% a period, assuming constant exploitation in both countries. From period 2 $\rho^{oB}{}_t$ (determining $Q^{oB2}{}_t$) will be endogenously determined by equation (23), assuming $\Omega = 3$, while $\rho^{oA}{}_t$ (determining $Q^{oA1}{}_t$) is given by equation (35):

(23) $\rho^{oB}{}_t = \rho^{oB}{}_{t-1}(1 + \Omega(C^{oB1}{}_t/C^{oB2}{}_t - C^{oB1}{}_{t-1}/C^{oB2}{}_{t-1}))$

(35) $\rho^{oA}{}_2 = \rho^{oA}{}_1 + 0.005$ from period 3 $\rho^{oA}{}_t = \rho^{oA}{}_{t-1} + 0.75(\rho^{oA}{}_{t-1} - \rho^{oA}{}_{t-2})$

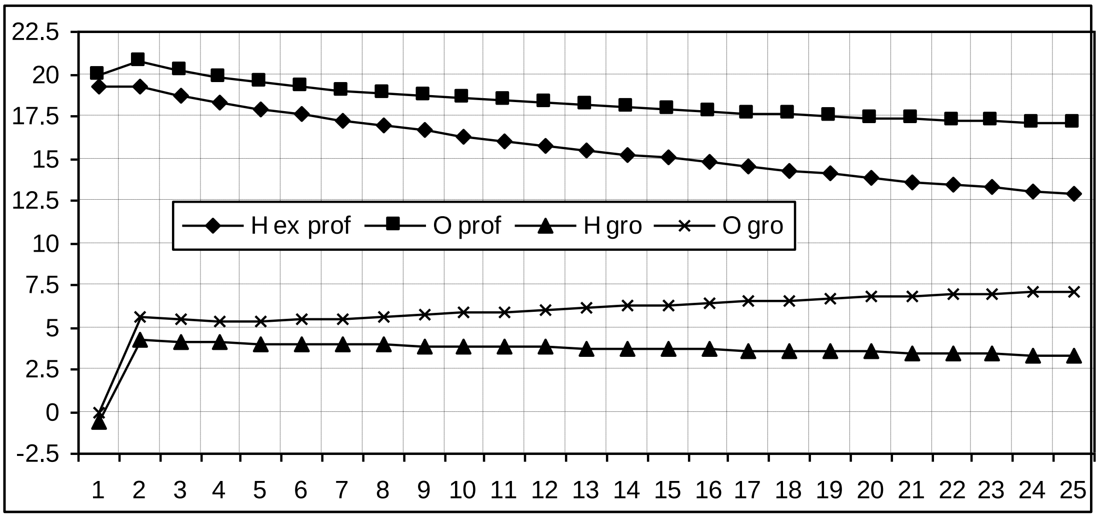
Equation (35) produces a gradually rising, at a decreasing pace, physical/'real' profit rate in A to accompany fast growth. We assume 5% commodity 1 inflation a period from period 2 and 8% commodity 2 inflation a period from period 2, with ε_t adjusting ($\varepsilon_t = (1.05/1.08)\varepsilon_{t-1}$) to maintain relative prices i.e. $P^{£A1}_t = 2P^{£A2}_t$ and $P^{£B1}_t = 2P^{£B2}_t$. Our economies now grow at a fast pace from period 2 to 25, see Graphs 1 and 2.

Graph 1 – A Profit and Growth Rates, %.

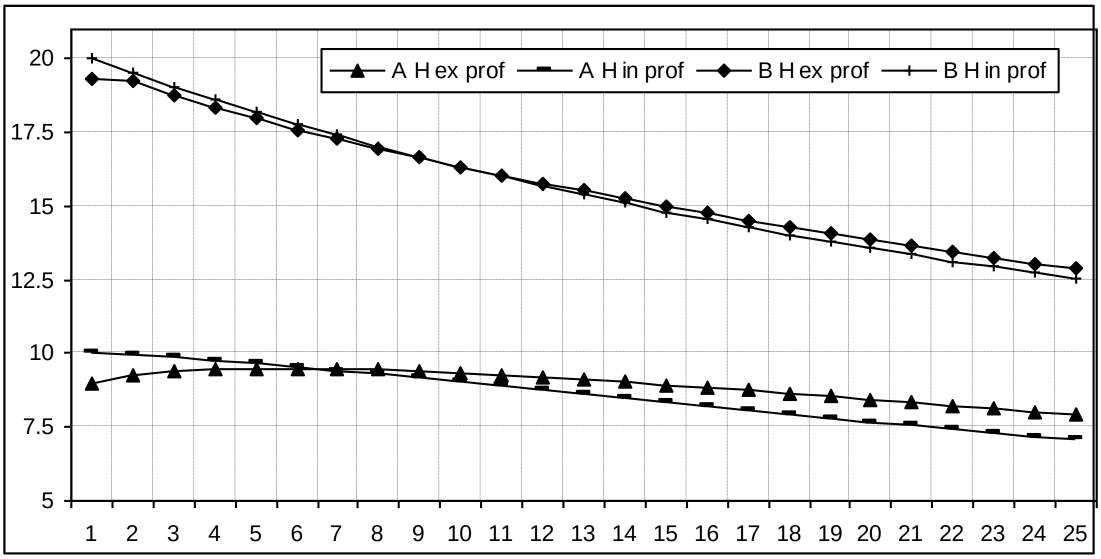


Graph 1 shows how despite rising physical growth and profitability in A, exchange value profitability, although initially rising, falls into a downward trend (note $\rho^{A^*}_t$ and ρ^{oA}_t are not directly connected; but are indirectly connected through technological change affecting value transfer). Graph 2 shows how in B physical growth escalates, but ρ^{oB}_t declines as C^{oB1}_t/C^{oB2}_t falls to 11.2% by period 25 (from 16.5% in period 0) due to A's dictated level of trade. B's exchange value profit rate steadily falls.

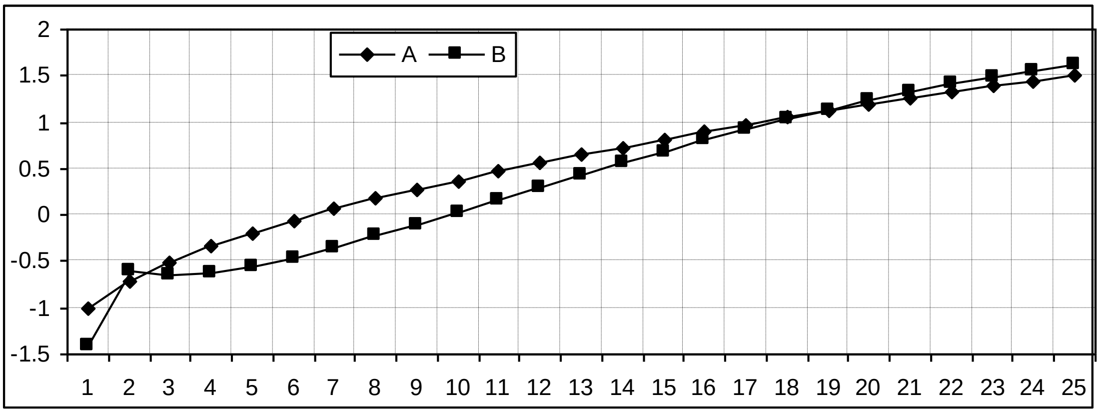
Graph 2 – B Profit and Growth Rates, %.



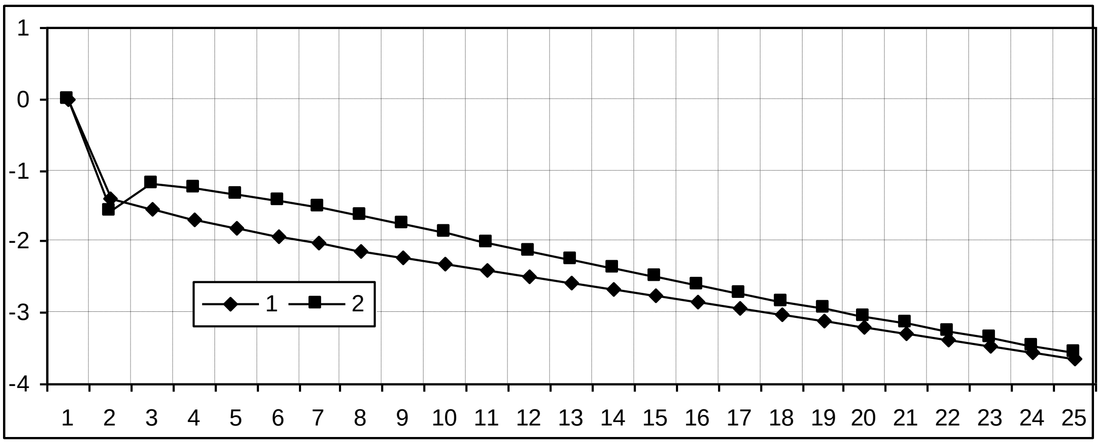
Graph 3 – Exchange Value and Intrinsic Value Profit Rates for A and B, %.



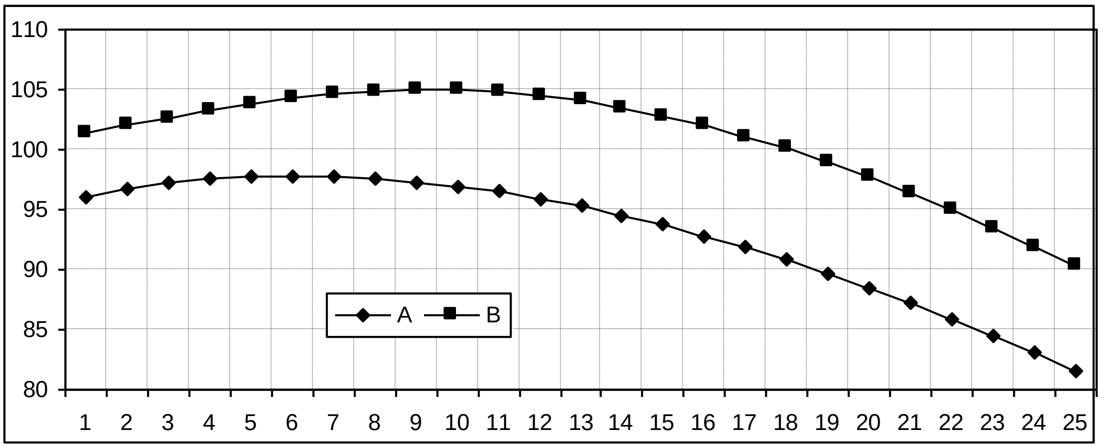
Graph 4 – Value Transfer for A and B, Z_t to Y^*_t, Hours.



Graph 5 – Commodity 1 and 2 % Change Intrinsic Unit Value.



Graph 6 – Value of A and B Rentier Money Deposits, Hours.



Graph 3 provides further insight into the behaviour of value profitability. While value transfers, see Graph 4, are in favour of rentiers, up to period 6 in A and 9 in B, the exchange value profit rate is depressed below the intrinsic value profit rate. Once value transfers are in favour of productive capitalists the exchange value profit rate is boosted above the intrinsic value profit rate. As C_t growth exceeds V_t growth in both countries from period 2 their intrinsic value profit rates continually decline. In A value transfer is sufficiently strong, firstly in favour of rentiers and then productive capitalists, to ensure the exchange value profit rate at first rises before falling:

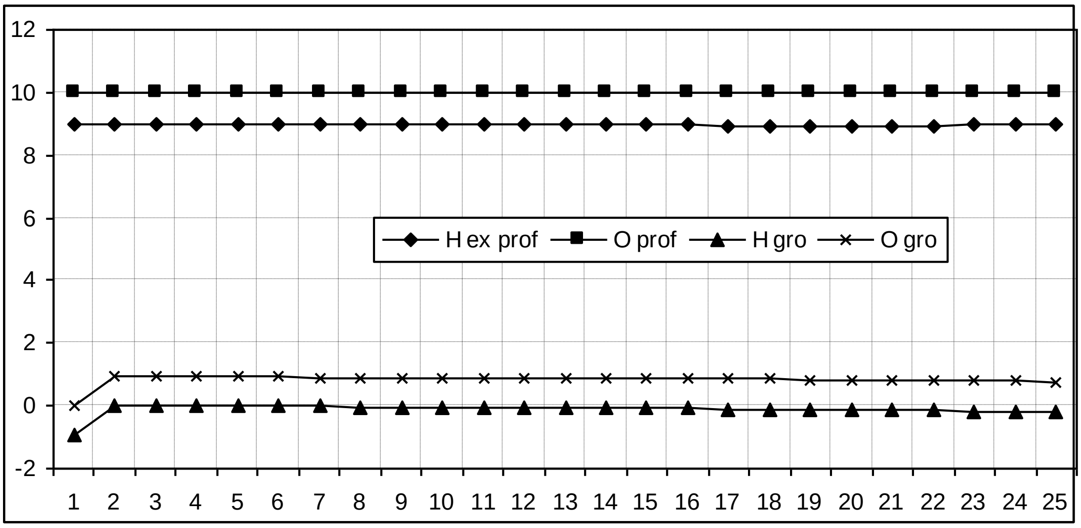
(15) $P^{£A1}_t/v^1_t > x^A_t > Z^{£A}_t/Z^A_{t-1}$ $\quad v^{1*}_t > v^1_t$, $Y^{A*}_t > Y^A_t$, $\rho^{A*}_t > \rho^A_t$ and $Z^A_t < Z^A_{t-1}$,

(33) $P^{£B2}_t/ v^2_t > x^B_t > Z^{£B}_t/Z^B_{t-1}$ $\quad v^{2*}_t > v^2_t$, $Y^{B*}_t > Y^B_t$, $\rho^{B*}_t > \rho^B_t$ and $Z^B_t < Z^B_{t-1}$,

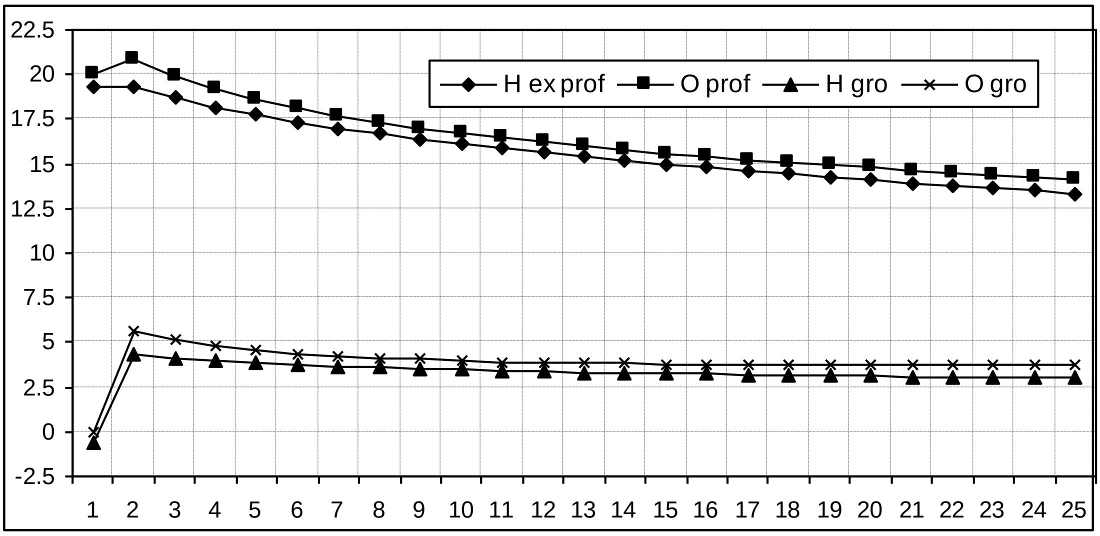
Equations (15) and (33) are fulfilled from period 7 in A and 10 in B, as escalating technological change reduces the intrinsic unit values of commodities 1 and 2 (v^1_t and v^2_t) acts to turn value transfers in favour of productive capitalists.[7] The overall situation is clear, fast growth in both countries is accompanied by declining value profitability and eventual erosion of the value of rentier money deposits. Value transfers to productive capital act as a counter-tendency to falling value profitability, but are insufficient to overcome the tendency for value profitability to decline through accumulation in value terms tendentially increasing the organic composition of capital (as to why capitalist accumulation is associated with a rising organic composition of capital see Marx, 1981 pages 325-26 and 373-74, summarised in Potts, 2005C). Note how our separate economies illustrate that the tendency for value profitability to fall applies whether physical profitability is rising, as in A, or falling, as in B.

Let us now see how our simulation is altered by slowing growth in A, as we shall see, to less than simple reproduction in value terms, by setting $\beta = 0.9$ from the end of period 1, while still assuming fast growth in B ($\Phi = 0.75$). To accompany 'slower growth' in A we assume constant L^A_t, 2% commodity 1 inflation (from period 2) and a constant 10% physical/'real' profit rate. We retain the same initial period 0 and fixed consumption coefficients for both A and B. We retain for B 8% commodity 2 inflation (with ε_t adjusting to maintain relative prices as before, $P^{£A1}_t = 2P^{£A2}_t$ and $P^{£B1}_t = 2P^{£B2}_t$) and 2% increase in L^B_t per period. We retain a 2% 'real' interest rate in A and B (nominal interest equals 2% plus that country's commodity inflation).

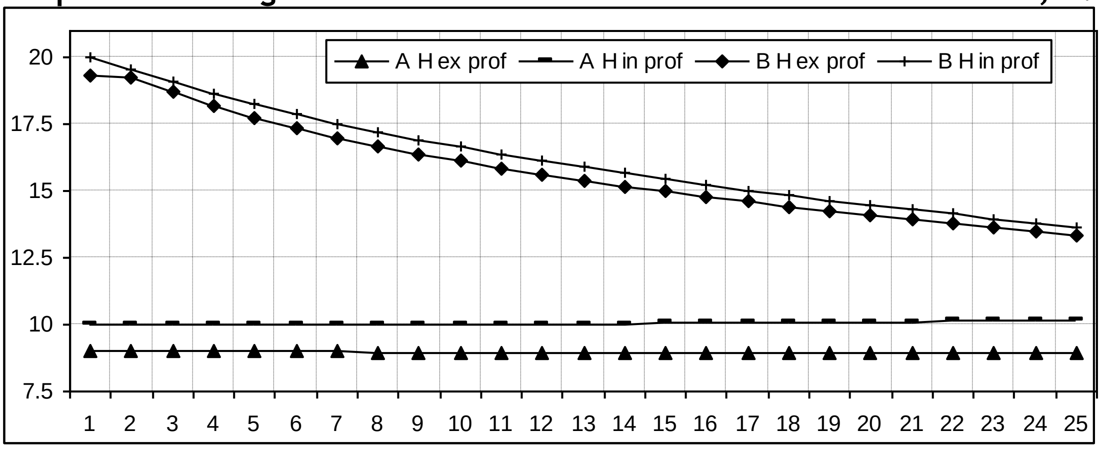
Graph 7 – A Profit and Growth Rates, %.



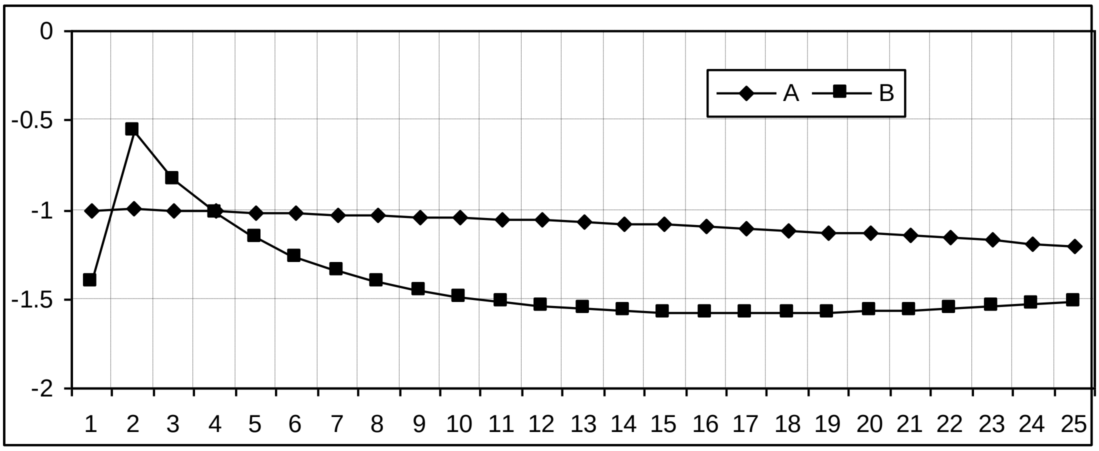
Graph 8 - B Profit and Growth Rates, %.



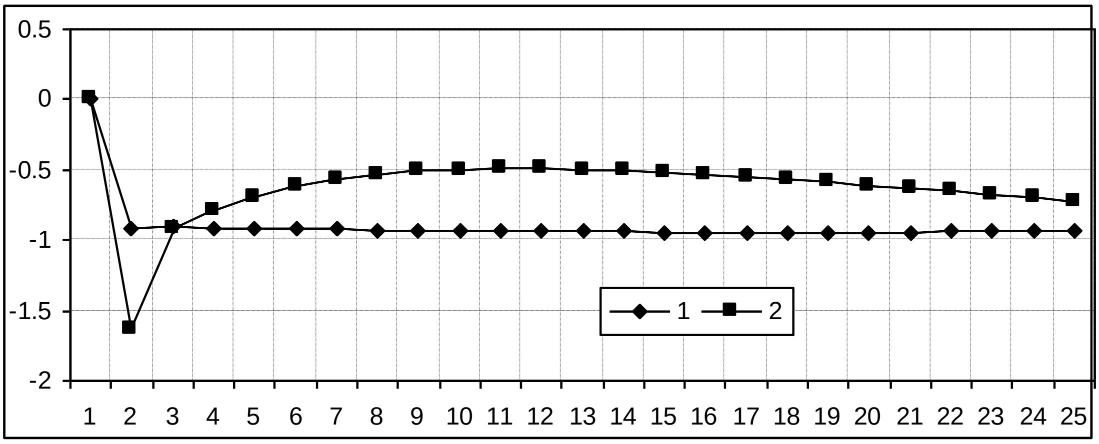
Graph 9 - Exchange Value and Intrinsic Value Profit Rates for A and B, %.



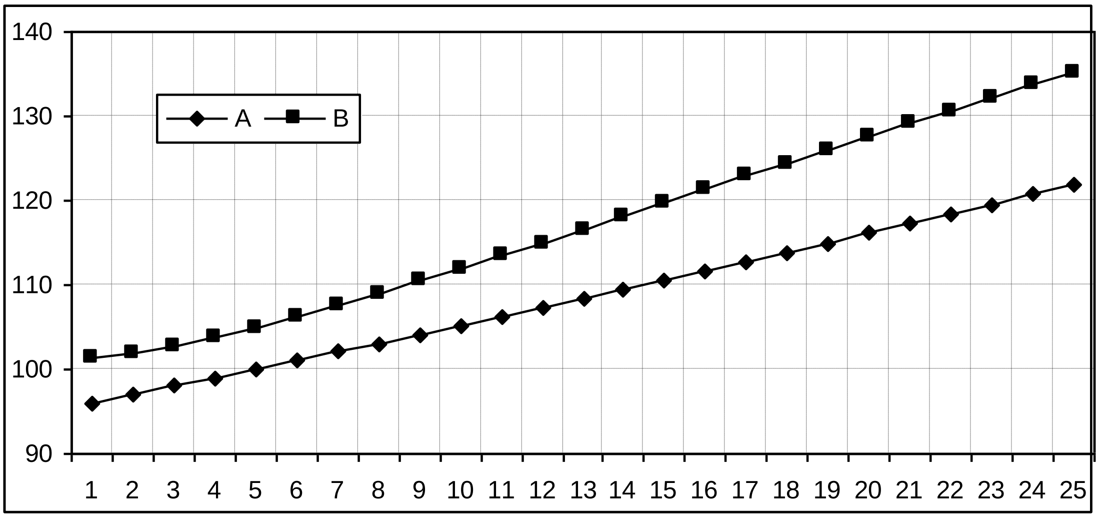
Graph 10 - Value Transfer for A and B, Z_t to Y^*_t, Hours.



Graph 11 – Commodity 1 and 2 % Change Intrinsic Unit Value.



Graph 12 – Value of A and B Rentier Money Deposits, Hours.



Graph 7 shows growth in value terms is slightly less than simple reproduction in A, in period 1 due to value transfer to Z^A_t from Y^A_t, with $Y^A_t = Y^A_{t-1}$. Thereafter A productive capitalists try to increase the value they put forward as inputs by 1 hour each period ($\beta = 0.9$), but value transfers (VT^A_t) exceed 1 hour so:

$$C^A_{t+1} + V^A_{t+1} = Y^{A*}_t - \beta S^A_t = C^A_{t+1} + V^A_t + S^A_t + VT^A_t - \beta S^A_t$$

$$C^A_{t+1} + V^A_{t+1} < C^A_t + V^A_t \quad \text{if} \quad (S^A_t - \beta S^A_t) + VT^A_t < 0$$

Technological progress (through assuming $\rho^{oA}_t = 10\%$) ensures that, despite near simple reproduction in value terms, physical growth is positive, around 1%. Growth in value terms in A at slightly less than simple reproduction ensures, with S^A_t fixed at 10 hours each period, A's intrinsic value profit rate slightly rises, see Graph 9. Gradually rising value transfers to A rentiers, see Graph 10, keeps A's exchange value profit rate at approximately 9% throughout. Graph 12 illustrates how the value embodied in A rentier money deposits grows, now the rate of technological change, v^1_t decline presented in graph 11, is too slow to prevent value transfers in favour of A rentiers each period. Compared to when A grew fast A rentiers are much better off in value terms, while the productive economy in A is stable but undynamic. Value profitability does not fall, but total profit in value terms is lower as L^A_t fails to expand. Workers in A are comparatively worse off, lower technological change reduces 'real' wage growth, while employment fails to expand.

The situation in B, although only linked through trade with A, is significantly altered by A's switch to very slow growth. In physical terms trade only grows by 23.2% in total from period 0 to 25, equal to the increase in physical output of commodity 1 in A between periods 0 and 25. A's failure to match B's growth thus comparatively starves B of commodity 1, C^{oB1}_t/C^{oB2}_t declines from 16.5% in period 0 to 5.2% by period 25 (as opposed to 11.2% with fast growth also in A). Equation (23) ensures B's physical profit rate, see Graph 8, declines at a significantly faster pace than when we assumed fast growth in A (by period 12 it is 2% lower, finishing 2.9% lower by period 25). Note we could easily assume (so exogenously set) that such a sharp fall in C^{oB1}_t/C^{oB2}_t, would cause ρ^{oB}_t to fall more dramatically, but our comparative moderate decline is sufficient to change rentiers' fortunes in B, see Graph 12. Lower physical profitability ensures substantially slower growth in physical output, by period 25 $Q^{oB2}_t = 625$, as opposed to 1014 with fast growth in A. Although B's physical growth is held back, the size of B's total economy in value terms, $Y^{B^*}_t+Z^B_t$, is identical each period to when A also grew fast. Graph 11 shows how lower physical profitability reduces technological change in B, the rate of v^2_t fall, sufficiently to deliver continual value transfer each period in favour of B rentier money stocks, see Graph 10. Such value transfers reduce $Y^{B^*}_t$ below Y^B_t each period, but the reduction in $Y^{B^*}{}_t$ is small as compared to the reduction in $Q^{oB2}{}_t$, thus explaining the slower fall in $v^2{}_t$.

Quite simply A's change in direction has knocked onto B, causing value transfers to switch from being in favour of B productive capitalists from period 10, when A grew fast, to now being permanently in favour of B rentiers. $\rho^{B^*}{}_t$ is now permanently depressed below $\rho^B{}_t$, see Graph 8. In value terms B productive capitalists are comparatively worse off to the comparative advantage of B rentiers. Workers in B still enjoy expanding employment, but lower technological change holds back 'real' wage growth.

To conclude, even if we assume economies are only linked by trade, with separate measures of value, as long as we assume developed countries dictate the level of trade with underdeveloped countries, then the performance, and distribution of value, in underdeveloped countries will depend on the level of trade dictated by the developed countries. Let us consider if B would fare better or worse in a joined/global economy with A.

GLOBAL ECONOMY

Adjusting Our Model

We shall still assume that A is dominant i.e. is more developed and dictates the level of trade by its demand for imports. Additionally we shall assume A, or rather A money, is now the sole 'home' for rentiers' money deposits/source of lending to both economies (simulating capital flight to the west and direct and indirect, through capitalising say a local bank, lending to firms in B as well as A). Centrally rather than imagining two distinct economies, with separate money and value systems, simply swapping physical goods, while leaving local value magnitudes unchanged, we shall imagine the economy as a single entity with a single unit of value. A, producing commodity 1, and B, producing commodity 2, are simply sectors of a now larger economy.[8] Crucially an hour of living labour input is equivalent, no matter which country it is applied in, with the system's overall total capital, in hours and money, determining the universal monetary expression of labour time, which establishes the value of money magnitudes in both countries. We retain separate currencies/an exchange rate, but A money dominants, with B money being nothing but a token of A money, through the exchange rate. As such we calculate the system's total capital in terms of A money i.e. by adjusting all nominal sums in B money to A money by the exchange rate, ε_t, the price in A money of a unit of B money. Y^A_t and Y^B_t are now in the same units; the overall system's unified concept of abstract social labour, with x_t representing the monetary expression (in A money) of an hour of the system's unified concept of abstract social labour. The value of inputs, of C and V, in both countries will be determined by their money expression (in A money) divided by x_{t-1}, with end-period exchange values determined by end-period money magnitudes (in A money) divided by x_t. We again present Kliman's output MELT and our own, with-money deposits, definition, which we will subsequently employ. Note rentier money deposits now have no country superscript, as unified rentiers, working in A money, can be considered as truly cosmopolitan (an international financial system):

$$x_t \text{ 'Kliman'} = (M'^{£A}_t + \varepsilon_t M'^{£B}_t) \;/\; (Y^A_t + Y^B_t)$$

(36) $$x_t = (M'^{£A}_t + \varepsilon_t M'^{£B}_t + Z^{£}_t) \;/\; (Y^A_t + Y^B_t + Z_{t-1})$$

With a unified economy the transformation problem becomes relevant, what would be the appropriate prices of production to equalise each countries exchange value profit rate to the systems overall intrinsic value profit rate? This question is further complicated by the process of value transfer our calculation of MELT produces; exchange value profit rates, although equal, may due to value transfer not equal the systems overall intrinsic value profit rate. We could remove this 'problem' by employing Kliman's output MELT to remove the complexity of value transfer. However, to retain our concept/focus on value transfer/distribution between productive capitalists and rentiers we contend in our model the transformation problem is fulfilled as long as exchange value profit rates are equalised.

Just as for our only linked through trade simulations we wish to start our global economy simulations from a 'well-behaved' infinitely repeating initial period of static simple reproduction with no value transfers between productive capitalists and rentiers. To create such a period we must assume, as before, static technology, constant price, productive capitalists consume all surplus value and that loans are rolled over at zero interest. Furthermore prices must now equal prices of production, which as our countries differ in organic composition, ensures that productive capitalists will not realise the surplus value they extract, but an amount sufficient to equalise exchange value profit rates. With separate economies we simply assumed productive capitalists consumed proportions β and Φ, in A and B respectively, of the surplus value each had actually extracted in production in their separate economies ($S^A{}_t$ and $S^B{}_t$). We must thus modify our productive capitalist consumption rules:[9]

(37) $K^A{}_t = \beta S^{A*}{}_t = \beta(Y^{A*}{}_t - M^A{}_t)$

(38) $K^B{}_t = \Phi S^{A*}{}_t = \Phi(Y^{B*}{}_t - M^B{}_t)$

In our static initial period productive capitalists consume 100% of $S^{A*}{}_t$ and $S^{B*}{}_t$ ($\beta = \Phi = 1$), with an absence of value transfer ensuring $S^{A*}{}_t + S^{B*}{}_t = S^A{}_t + S^B{}_t$. To find initial period 0 prices of production we shall work backwards, taking advantage of the static nature of our initial period. Assuming tranquil simple reproduction ensures period 0 inputs and end-period 0-1 output, productive capitalist consumption and trade, are identical in all terms to period 1 inputs and end-period 0 output, productive capitalist consumption and trade. We shall simply exogenously set period 0 C_t, V_t, M_t, S_t and $Q^o{}_t$ for each country, find appropriate end-period 0 prices of production and work backwards to reveal period 0 inputs in detail (which, given tranquil simple reproduction must equal period 1 inputs). We exogenously set, presenting in bold in Table 2, for A $C^A{}_t = 90$, $V^A{}_t = 10$, $M^A{}_t =$

100, L^A_t = 20, r^A_t = 100%, S^A_t = 90, Y^A_t = 110, Q^{oA1}_t = 110,and for B C^B_t = 80, V^B_t = 20, M^B_t = 100, L^B_t = 60, r^B_t = 200%, S^B_t = 40, Y^B_t = 140, Q^{oB2}_t = 320.

Table 2 – Global Economy Period 0, in A Money.

C^A_t £=h	C^{oA1}_t	C^{oA2}_t	V^A_t £=h	V^{oA1}_t	V^{oA2}_t	M^A_t £=h	S^A_t	Y^A_t	Q^{oA1}_t	v^1_t	ρ^A_t %
90	59.4	57.6	**10**	4.4	12.8	**100**	**10**	110	**110**	1	10
C^B_t £=h	C^{oB1}_t	C^{oB2}_t	V^B_t £=h	V^{oB1}_t	V^{oB2}_t	M^B_t £=h	S^B_t	Y^B_t	Q^{oB1}_t	v^2_t	ρ^B_t %
80	19.65	147.6	**20**	0.88	48.64	**100**	**40**	140	**320**	0.438	40

ρ_t %	$S^{A^*}_t$	$S^{B^*}_t$	$PP^{£A1}_t = P^{£A1}_t = v^{1^*}_t$	$PP^{£A2}_t = P^{£A2}_t = v^{2^*}_t$	$M'^{£A}_t = Y^{A^*}_t$	$M'^{£B}_t = Y^{B^*}_t$	$\rho^{A^*}_t = \rho^{£A}_t = \rho^{oA}_t$ %	$\rho^{B^*}_t = \rho^{£B}_t = \rho^{oB}_t$ %	$Z^£_t = Z_t$
25	25	25	1.13636	0.390625	125	125	25	25	175

$\lambda^{DA£A}_t = \lambda^{LA£A}_t$	$\lambda^{DA£B}_t = \lambda^{LA£B}_t$	K^A_t £=h	K^{oA1}_t	K^{oA2}_t	K^B_t £=h	K^{oB1}_t	K^{oB2}_t	$Ex^{oA1}_t = Im^{oB1}_t$	$Im^{oA2}_t = Ex^{oB2}_t$	$Ex^{A1}_t = Im^{B1}_t = Im^{A2}_t = Ex^{B2}_t$
95	80	25	14.7	21.3	25	11	32	31.53	91.73	35.83

The overall period 0 intrinsic value profit rate ρ_t and prices of production $PP^£_t$ (with A or B superscript standing for which money they are in) to equalise both countries exchange value profit rates to ρ_t (remember we assume period 0 and 0-1 x_t = 1 and ε_t = 0.5) are given by:

(39) $\rho_t = (S^A_t + S^B_t) / (M^A_t + M^B_t) = (10+40) / (100+100) = 25\%$

(40) $PP^{£A1}_t = x_{t-1}(1+\rho_t)M^A_t/Q^{oA1}_t = 1(1+0.25)100/110 = 1.123$

(41) $PP^{£A2}_t = x_{t-1}(1+\rho_t)M^B_t/Q^{oB2}_t = 1(1+0.25)100/320 = 0.3906$

(42) $PP^{£B2}_t = [x_{t-1}(1+\rho_t)M^B_t/Q^{oB2}_t]/\varepsilon_{t-1} = [1(1+0.25)100/320]/0.5 = 0.781$

In Table 2 all B money sums have been adjusted to A money by multiplying by ε_{t-1} for inputs and by ε_t for end-period magnitudes. Loan superscripts are more complex. The first A or B refers to which money, while the second identifies which productive capitalists e.g. $\lambda^{DA£B}_t$ is the due loan B productive capitalists face in A money. We assume consumption patterns are unchanged from our only linked through trade simulations; δ = 0.25 A productive capitalists spend 25% of $C^{£A}_t$ on commodity 2, α = 0.5 A workers spend 50% of $V^{£A}_t$ on commodity 2, θ = 0.33 A productive capitalists spend 33% of $K^{£A}_t$ on commodity 2, φ = 0.05 B workers spend 5% of $V^{£B}_t$ on commodity 1 and ψ = 0.5 B productive capitalists spend 50% of $K^{£B}_t$ on commodity 1. We have kept the essential differences between our economies, A is more developed/has a higher organic composition of capital, with a higher initial proportion of the productive economy 'effectively' owned by rentiers ($\lambda^{DA£A}{}_t/M'^{£A}{}_t$ = 95/125 > $\lambda^{DA£B}{}_t/\varepsilon_t M'^{£B}{}_t$ = 80/125). Exploitation is higher in B at 200% (100% in A) to ensure B workers are worse-off than A workers. Our new global economy period 0 can not be directly compared with our only linked by trade period 0, value as a concept differs, and is thus not comparable, across models.

We can already see how our definition of the physical profit rate in a two commodity setting, relying on constant price and money sums, produces the 'real' money profit rate, with physicality representing an elusive and troublesome concept. 110 units of commodity 1 are produced in A by 20 hours of living labour, 59.4 units of commodity 1 and 57.6 units of commodity 2. Productive capitalists in total consume 25.7 units of commodity 1, with only 84.3 units being applied as input in both countries. But this is sufficient with commodity 2 input of 266.7 units in total (productive capitalists consume 53.3 units) to ensure A can reproduce 110 units of commodity 1 and B can reproduce 320 units of commodity 2. Its all heterogeneous, with no choice but to go through money sums adjusted for constant price to arrive at 'real', which we contend is thus no less abstract than going from money sums to arrive at value.

Before we start our simulations we must address how we will relate prices to prices of production outside of our stationary period 0. If we continued to set prices directly at the prices of production given by equations (40) and (41), while assuming growth and technological change, prices/prices of production would continually fall, leaving rentiers permanently prospering, no matter the precise extent of growth or technological change. We simply need to introduce inflation without disturbing the ratio of nominal prices from the ratio of prices of production given each period by equations (40) and (41). Let us assume that from the end of period 1 that each period $P^{£A1}{}_t$ simply grows by a fixed inflation rate, ¢. Avoiding circularity we can use the ratio our two prices of production (which employ x_{t-1}, not x_t) to establish the nominal, in A money, price of commodity 2, $P^{£A2}_t$. We can now simply divide by the exchange rate to find the price of commodity 2 in B money, $P^{£B2}_t$. $P^{£B2}_t$ will reflect both nominal inflation in A and movements in prices of production, ensuring commodity 2 inflation will not necessarily equal commodity 1 inflation, even if we assume the exchange rate stays constant. We can boost nominal inflation in B by a given constant § by simply reducing the exchange rate by 1/(1+§) each period, thus further boosting $P^{£B2}_t$ by § a period. In summary from the end of period 1:

(43) $P^{£A1}_t = (1+¢)P^{£A1}_{t-1}$

(44) $P^{£A2}_t = P^{£A1}_t(PP^{£A2}_t/PP^{£A1}_t)$

(45) $P^{£B2}_t = P^{£A2}_t/\varepsilon_t$ with $\varepsilon_t = 1/(1+§)\varepsilon_{t-1}$

Loans to productive capitalists in both countries are simply rolled over, with interest first due at the end of period 1. We assume loans to B productive capitalists, in A money, are at the interest rate in A plus a potential ‘risk’ premium:

(46) $\lambda^{LA£A}_t = \lambda^{DA£A}_t = (1+i^{A£A}_t)\lambda^{LA£A}_{t-1}$ with $i^{A£A}_t$ = ‘real’$i^{A£A}_t + \pi^{A1}_t$

(47) $\lambda^{LA£B}_t = \lambda^{DA£B}_t = (1+i^{A£B}_t)\lambda^{LA£B}_{t-1}$ with $i^{A£B}_t = i^{A£A}_t$ + ‘premium’

$\lambda^{LB£B}_t = \lambda^{DB£B}_t = \lambda^{LA£B}_t/\varepsilon_t$

(48) $Z^{£}_t = Z^{£}_{t-1} - \lambda^{LA£A}_{t-1} - \lambda^{LA£B}_{t-1} + \lambda^{DA£A}_t + \lambda^{DA£B}_t$

We do not record how every equation in our global model changes. In general where previously in A we divided A money expressions by x^A_t or x^A_{t-1} we now divide by x_t or x_{t-1}. In B instead of dividing B money expressions by x^B_t or x^B_{t-1} we now multiply them by ε_t or ε_{t-1} to convert them to A money and then divide by x_t or x_{t-1}. Before proceeding to our first simulation let us focus on end-period exchange values. We calculate x_t to reveal exchange value magnitudes:

(36) $x_t = (M'^{£A}_t + \varepsilon_t M'^{£B}_t + Z^{£}_t) / (Y^A_t + Y^B_t + Z_{t-1})$

(49) $Y^{A*}_t = M'^{£A}_t / x_t$

(50) $v^{1*}_t = P^{£A1}{}_t / x_t$

(51) $\rho^{A*}_t = (M'^{£A}{}_t/x_t - M^{£A}{}_t/x_{t-1}) / (M^{£A}{}_t/x_{t-1})$

(52) $Y^{B*}_t = \varepsilon_t M'^{£B}{}_t / x_t$

(53) $v^{2*}_t = \varepsilon_t P^{£B2}{}_t / x_t$

(54) $\rho^{B*}_t = (\varepsilon_t M'^{£B}{}_t/x_t - \varepsilon_{t-1} M^{£B}{}_t/x_{t-1}) / (\varepsilon_t M^{£B}{}_t/x_{t-1})$

(56) $Z_t = Z^{£}{}_t / x_t$

We now have a three way pattern of value transfer/distribution of total capital, $Y^A{}_t+Y^B{}_t+Z_{t-1} = Y^{A*}{}_t+Y^{B*}{}_t+Z_t$, reflecting both the operation of the transformation problem and value transfers to/from rentier money deposits. Value transfer in favour/against A productive capitalists is given by $Y^{A*}{}_t-Y^A{}_t$, value transfer in favour/against B productive capitalists is given by $Y^{B*}{}_t-Y^B{}_t$ and value transfer in favour/against rentiers is given by Z_t-Z_{t-1}. Our global model is complete, let us move on to simulating it.

Global Economy Simulations

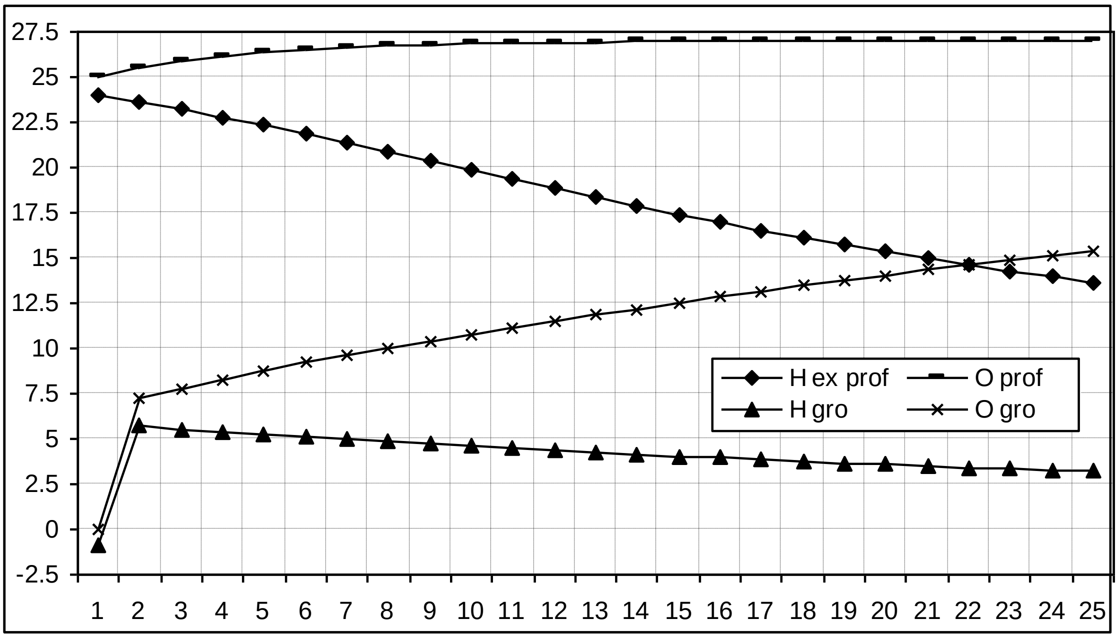
Let us first assume pricing in proportion to prices of production and fast growth in both A and B from period 2 (reducing β and Φ to 0.75 from the end of period 1) from the simply reproducing period 0 represented in Table 2. We assume all consumption coefficients between commodity 1 and 2 used in Table 2 remain constant throughout our simulation. Before growth commences in period 2 we assume interest is first due at the end of period 1, which is identical to the end of period 0 in intrinsic value, nominal and physical terms. Let rentiers charge, in A money, a 2% 'real' interest rate plus commodity 1 inflation from when the loan is lent to when it is due, with no additional 'risk' premium for B productive capitalist borrowers. Price is constant in period 1 so 2% interest is due (to be added to loans lent last period and relent/rolled-over), totalling £3.5, £1.9 from A productive capitalists and £1.5 from B productive capitalists (all in A money). As prices and technology are constant in period 1 only interest is responsible for undermining the value of money; ensuring rentiers enjoy a 2.0 hour boost to the value of their money deposits. A and B's equalised exchange value profit rates are thus depressed to 24.0%, below the overall intrinsic value profit rate of 25%. We assume productive capitalists reduce their consumption from the end of period 1 ($\beta = \Phi = 0.75$), initiating growth from period 2, with 'physical' profitability (determining 'physical' output) still, as in our only-linked by trade simulations, given for A and B by:

(23) $\rho^{oB}{}_t = \rho^{oB}{}_{t-1}(1 + \Omega(C^{oB1}{}_t/C^{oB2}{}_t - C^{oB1}{}_{t-1}/C^{oB2}{}_{t-1}))$ with $\Omega = 3$

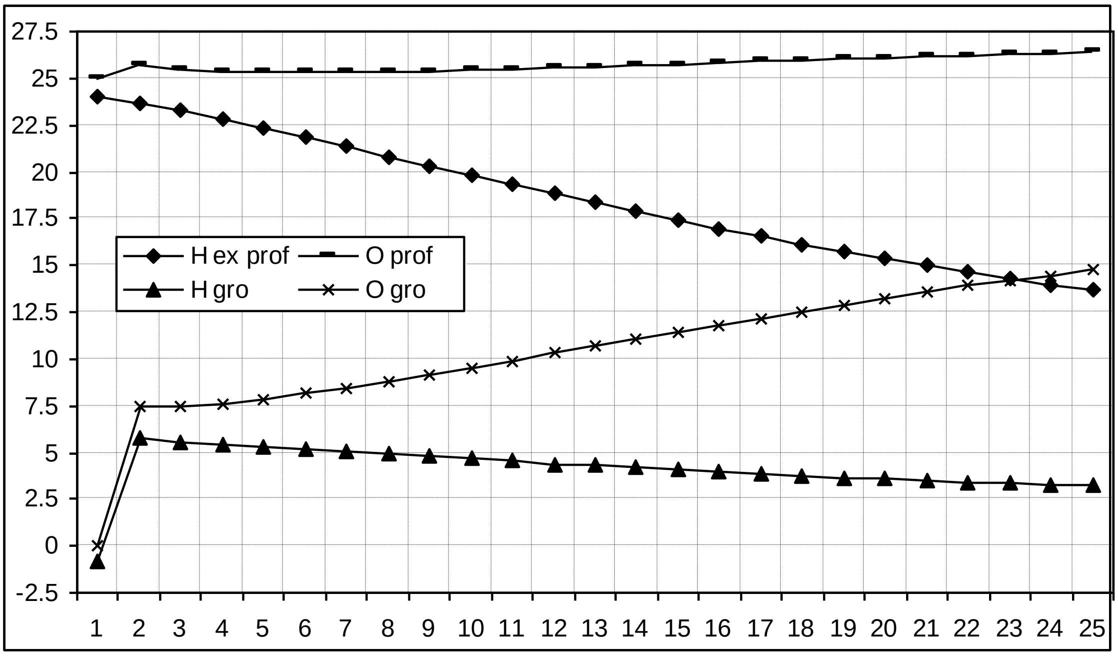
(35) $\rho^{oA}{}_2 = \rho^{oA}{}_1 + 0.005$ from period 3 $\rho^{oA}{}_t = \rho^{oA}{}_{t-1} + 0.75(\rho^{oA}{}_{t-1} - \rho^{oA}{}_{t-2})$

From period 2 we assume $L^A{}_t$ grows 1% a period, $L^B{}_t$ grows 2% a period, $P^{£A1}{}_t$ rises 5% a period (¢ = 0.05) with $P^{£B2}{}_t$ further boosted by 5% (§ = 0.05), $\varepsilon_t = 1/(1+§)\varepsilon_{t-1}$. Commodity 2 inflation starts at 10.1% in period 2, rising to 11.5% in period 9, then falling to 10.8% by period 25. Graphs 13 to 17 illustrate our fast growth in both A and B, pricing in proportion to prices of production, global economy simulation.

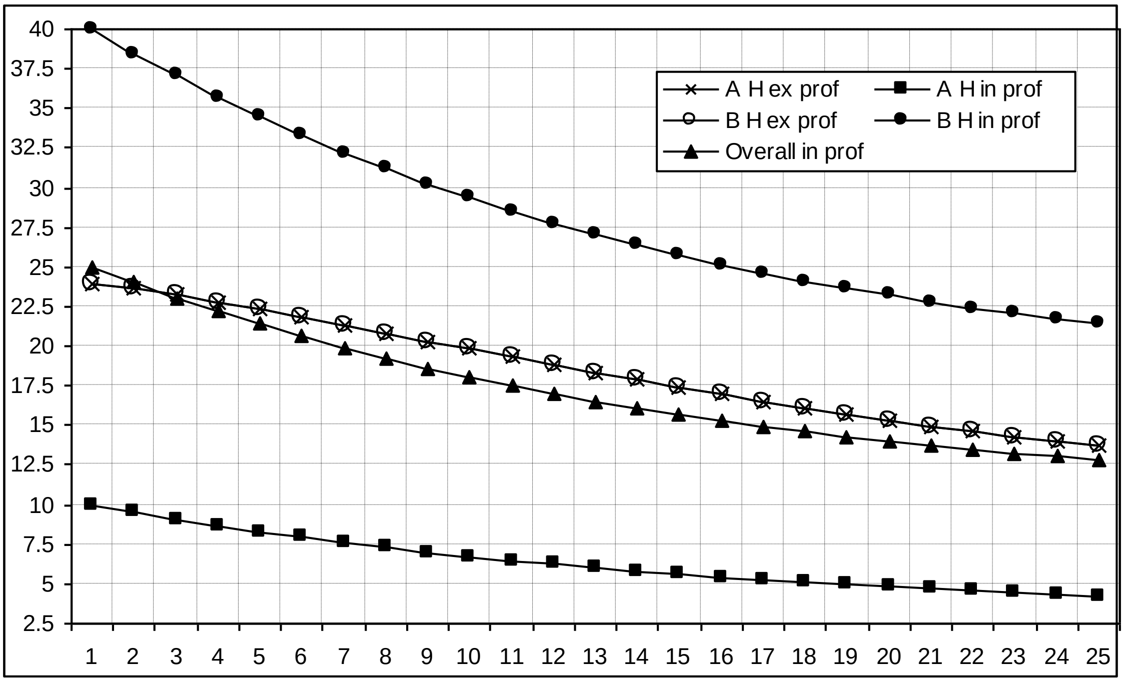
Graph 13 – A Profit and Growth Rates, %.



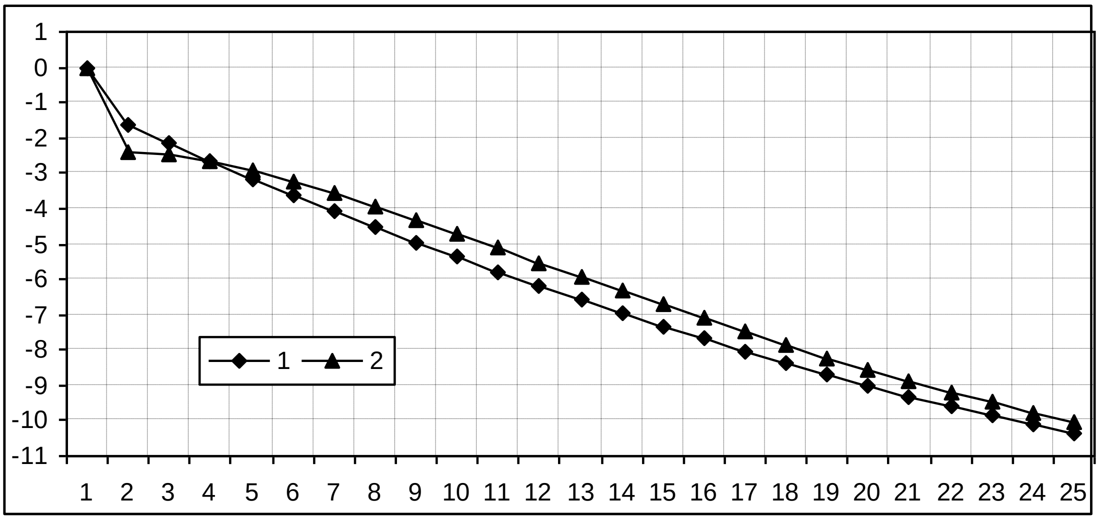
Graph 14 – B Profit and Growth Rates, %.



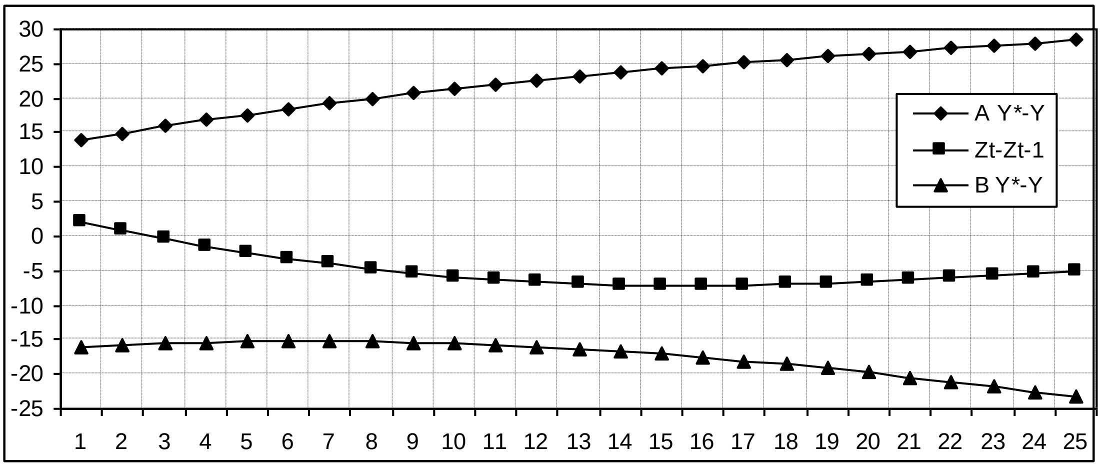
Graph 15 – Exchange Value and Intrinsic Value Profit Rates, %.



Graph 16 – Commodity 1 and 2 % Change Intrinsic Unit Value.



Graph 17 – Value Transfer, Hours.



Graph 15 shows how setting prices to the ratio of prices of production delivers equalised exchange value profit rates. Graphs 13 and 14 show how both countries grow strongly in value and physical terms. Growth is identical in value terms as $Y^{A*}_t = Y^{B*}_t$, $\beta = \Phi = 0.75$ and $M^A_t = M^B_t$ throughout. Except in period 2, when a sharp increase in C^{oB1}_t/C^{oB2}_t strongly boosts ρ^{oB}_t, both physical growth and profitability are lower in B than A, by approximately 0.3% to 1.3% and 0.4% to 1.4% respectively a period. C^{oB1}_t/C^{oB2}_t, following from A's dictated level of trade, gradually rises from 13.3% in period 1 to 15.1% by period 25, explaining the gradual rise in ρ^{oB}_t. Identical in value terms but less physically productive B (Graph 16 shows how v^1_t declines faster than v^2_t) is being treated very 'fairly' by pricing in proportion to the rising ratio of prices of production $PP^{£A2}_t/PP^{£A1}_t$ (rising from 0.344 in period 1 to 0.4166 in period 25). Commodity 2 is becoming more 'expensive'/'competitive'. We shall return to B's 'fair' treatment, overall fast growth in value terms ensures that the overall intrinsic value profit rate and the equalised exchange value profit rates continually decline, see Graph 15. Escalating technological change acts to transfer value each period, from period 3, from rentier money deposits to the productive economy, boosting A and B's equalised exchange value profit rates above the overall intrinsic value profit rate. Value transfer from money deposits increases $Y^{A^*}{}_t$ further above $Y^{A}{}_t$ by an amount equal to the narrowing of the gap between $Y^{B^*}{}_t$ and $Y^{B}{}_t$, i.e. to the equal advantage of A and B productive capitalists. The overall pattern of value transfer is shown in Graph 17. The largest value transfer is through pricing in proportion to prices of production to equalise exchange value profit rates, i.e. from B productive capitalists to A, with another value transfer between the aggregate productive economy and rentier money deposits. Cumulatively rentiers suffer badly, Z_t falls from a peak of 177.8 hours in period 2 to only 53.2 hours by period 25. It is hard to assess B productive capitalists' position. Although they transfer much value to A, trade is sufficient to ensure B gradually improves its productivity (physical profitability)/ development ($C^{oB1}{}_t/C^{oB2}{}_t$), while we can't compare this simulation directly with our only linked by trade fast growth simulation, as it has a different concept of value. A productive capitalists experience a favourable substantial value transfer each period, boosting their exchange value profit rate way above their intrinsic value profit rate; the global economy seems to be clearly benefiting A productive capitalists. However their 'competitiveness'/'terms-of trade', is gradually falling as $PP^{£A2}{}_t/PP^{£A1}{}_t$ gradually grows. Such movements in relative prices/equalised exchange value profit rates, assume a 'competitive'/'fair' system.

What if relative prices changed in favour of A reflecting its more advanced/dominant status? Let us start with the same initial period, and following exogenously set coefficients and rates of growth, as we have employed so far, but replace equation (44) with equation (57):

(43) $P^{£A1}_t = (1+¢)P^{£A1}_{t-1}$

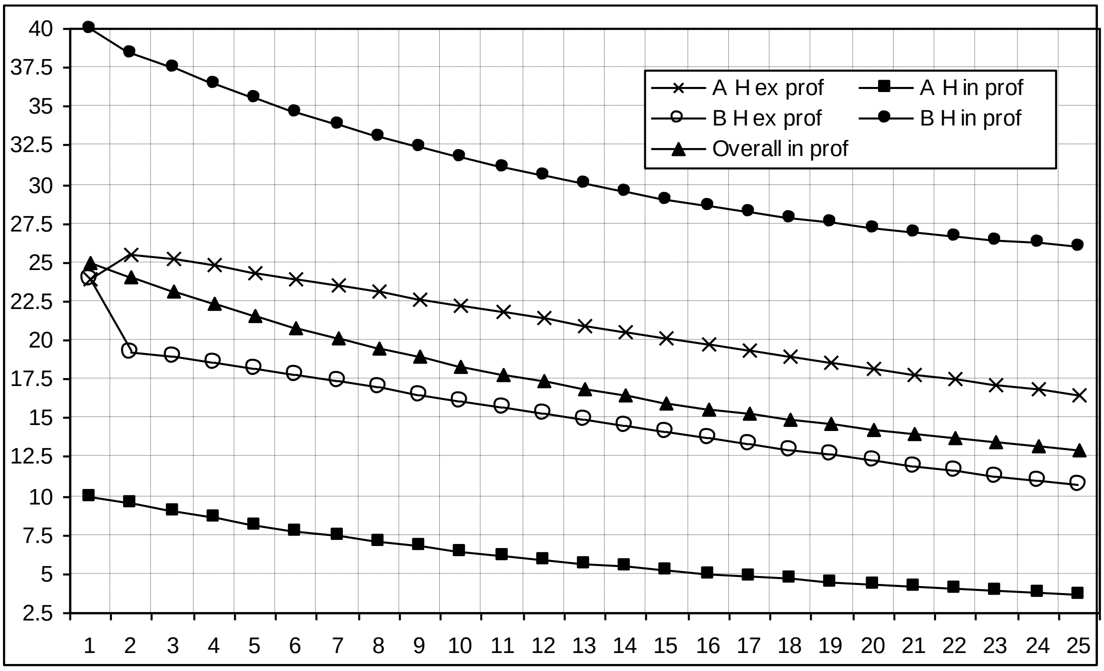
(57) $P^{£A2}_t = P^{£A1}_t(¤_t PP^{£A2}_t/PP^{£A1}_t)$

(45) $P^{£B2}_t = P^{£A2}_t/\varepsilon_t$ with $\varepsilon_t = 1/(1+§)\varepsilon_{t-1}$

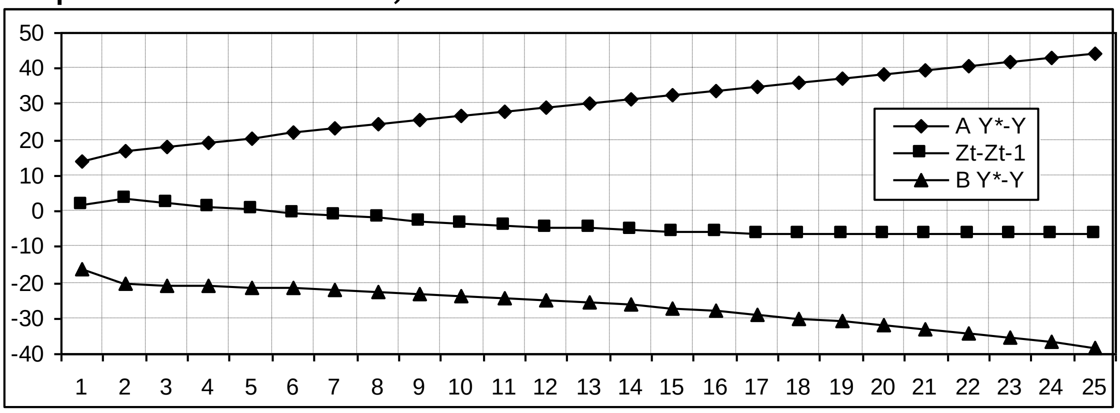
Let us set $¤_t$ constant at 0.95 from period 2 to ensure a continual 5% depression each period of commodity 2's price below that which would be required to price in proportion to prices of production. Note if we were to set $¤_t = 1$ in any period prices would immediately be in proportion to prices of production, equalising exchange value profit rates. In our new simulation A's 'terms of trade' improve ($P^{£A2}_t/P^{£A1}_t$ falls) from period 2, and stay 'ahead' henceforth. A productive capitalists still spend $\delta C^{£A}_{t+1}$ on C^{oA2}_{t+1} and $\theta K^{£A}_t$ on K^{oA2}_t, while A workers still spend $\alpha V^{£A}_{t+1}$ on V^{oA2}_{t+1}, but they all get a better deal! The lower relative price ensures they consume or input more of commodity 2 for their money. In B commodity 1 is conversely more expensive, so $\varphi V^{£B}_{t+1}$ and $\psi K^{£B}_t$ translate into less V^{oB1}_{t+1} and K^{oB1}_t, while C^{oB1}_{t+1} remains a trade and V^{oB1}_{t+1} and K^{oB1}_t dictated residual. However, following Freeman (1996), we should be clear that it is price formation (and in our model interest determination) which can cause value to transfer, not exchange of use-values i.e. trade. In value terms A imports/exports continue to equal B exports/imports.

B's deteriorating 'terms of trade' would create deflation for commodity 2 of between 5% and 2.5% a period if the price of commodity 1 remained constant and we assumed no boost to inflation in B through depreciating the exchange rate. Continuing to assume 5% nominal inflation for commodity 1 and that the B money price of commodity 2 is boosted 5% a period by depreciating ε_t by 1/(1+0.05) a period ensures commodity 2 inflation rises from 4.6% in period 2 to 7.4% by period 25. Loans to A and B productive capitalists are in A money at 7%, A productive capitalists face a 2% 'real' interest rate, but B productive capitalists must in B money pay an additional 5%, reflecting the drop in ε_t, creating an overall B money 12.12% interest rate, with commodity 2 inflation at most at 7.4%. We have no official 'risk premium' but changing 'terms of trade' is increasing the relative cost of borrowing for B productive capitalists (just as it slightly cheapened it in our first scenario, as commodity 2 inflation exceeded 10%, but less noticeably as commodity 2 inflation at most reached 11.5%). However, as the same initial loans in A money are again simply rolled-over at 7% interest each period, period 25 $Z^{£}_{t}$ is unchanged at £905.4 (A money). B productive capitalists comparative difficulty in B money terms simply translates into a tendency for $\lambda^{DB£B}{}_{t}/M'^{£B}{}_{t}$ (rentiers' effective 'ownership' of the productive economy in B) to increase, however fast growth ensures this tendency is overridden, $\lambda^{DB£B}{}_{t}/M'^{£B}{}_{t}$ still falls, but at a slower pace.

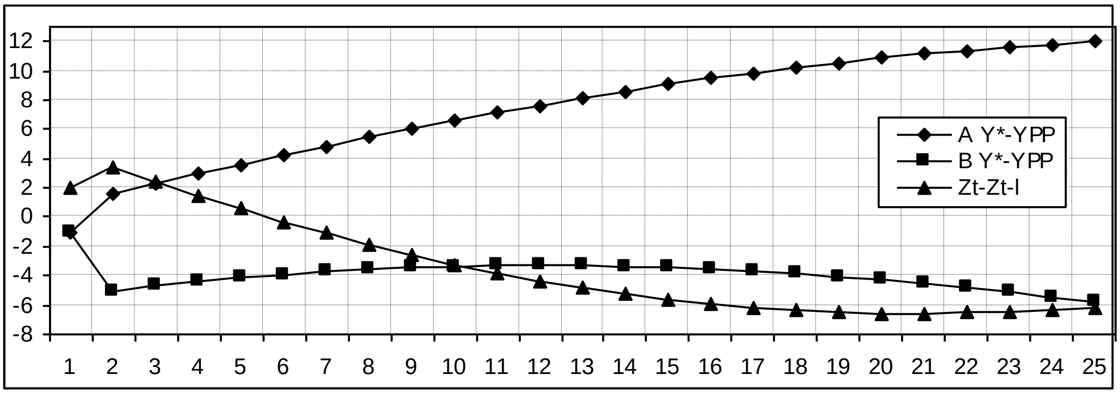
Graph 18 – Exchange Value and Intrinsic Value Profit Rates, %.



Graph 19 – Value Transfer, Hours.



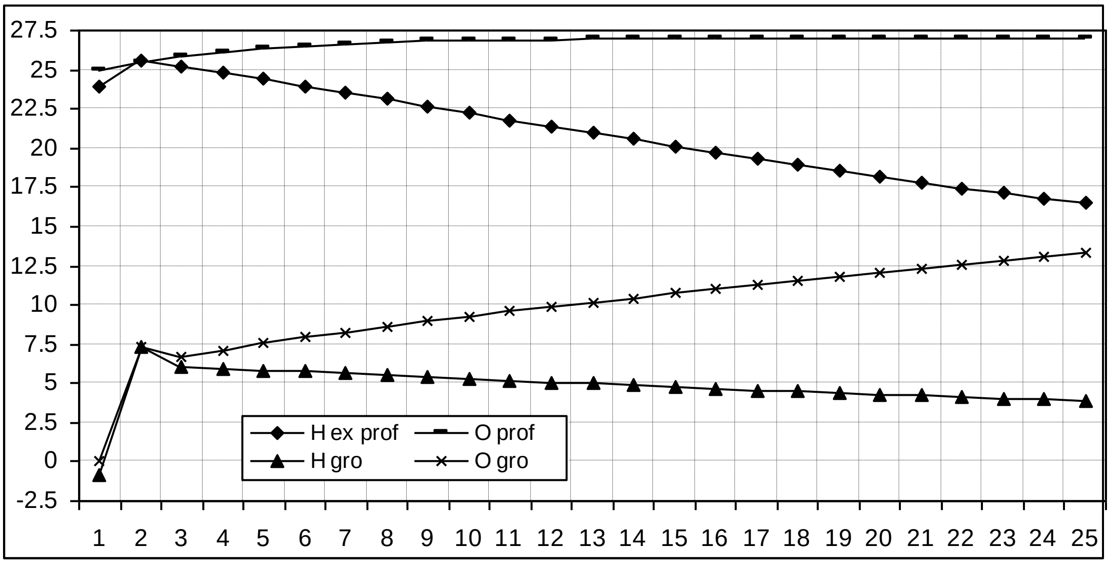
Graph 20 - Y^{A*}_t-Y^{A*PP}_t, Y^{B*}_t-Y^{B*PP}_t and Z_t-Z_{t-1}, hours.



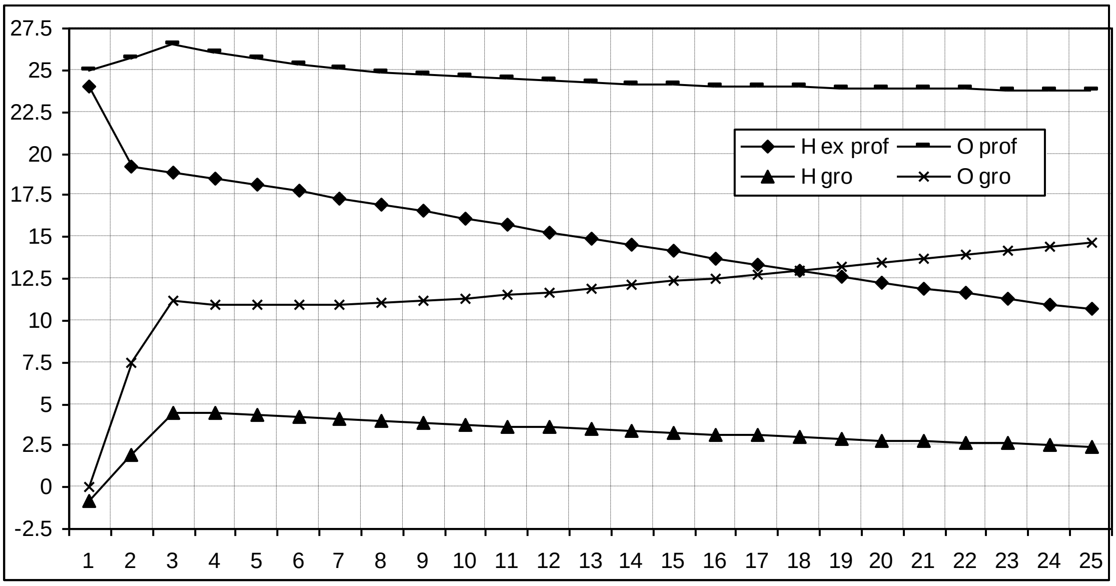
Our second simulation differs significantly from our first through the change in the distribution of value pricing away from proportionally with prices of production creates. Graph 18 shows how the exchange value profit rate in A is boosted approximately 6% higher than the exchange value profit rate in B throughout our new simulation. Graph 19 shows how rentiers still significantly suffer in value terms from fast growth/technological change, period 25 Z_t now stands at 88.4 hours, however this represents a comparative improvement from 53.2 hours when exchange value profit rates were equalised (both from an initial period 0 Z_t = 175 hours). In our first simulation equalised exchange value profit rates (and scale of M_t advance) ensured period 25 $Y^{A*}_t = Y^{B*}_t$ = 341.5 hours, now Y^{A*}_t = 401.5 hours and Y^{B*}_t = 273.4 hours. Graph 20 shows Y^{A*}_t-Y^{A*PP}_t, Y^{B*}_t-Y^{B*PP}_t and Z_t-Z_{t-1}, where Y^{A*PP}_t and Y^{B*PP}_t represent the exchange value of total productive capital in A and B if prices are in proportion to prices of production. Despite from period 6 value transfers from rentiers' money deposits to the productive economy, B's reduced 'terms of trade' ensures Y^{B*}_t remains below Y^{B*PP}_t, whereas Y^{A*}_t-Y^{A*PP}_t steadily rises. A productive capitalists clearly benefit in value terms at B's expense from their improving 'terms of trade'; it pays to stay ahead.

The situation is clear in value terms, but less straightforward in physical/ 'real terms', see Graphs 21, 22, 23, 24 and 25.

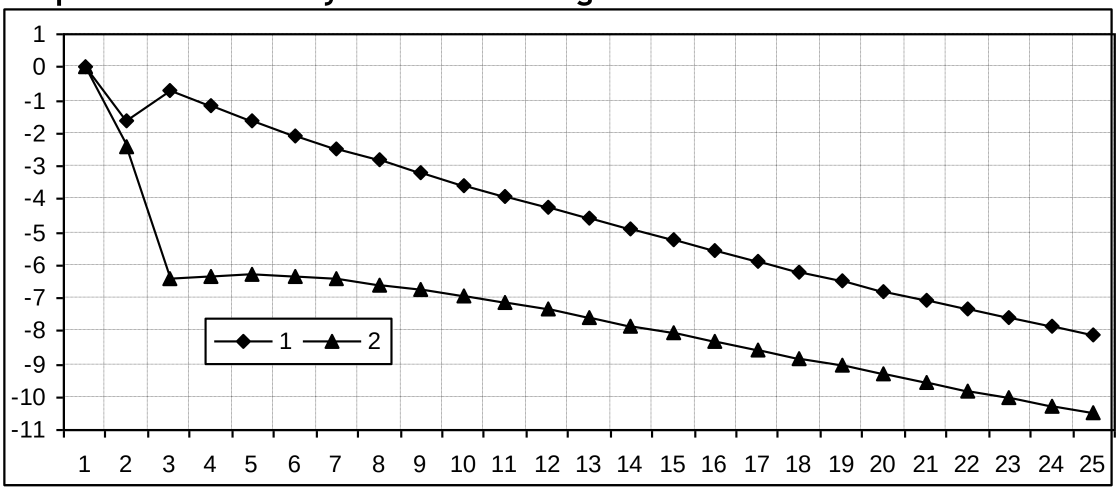
Graph 21 – A Profit and Growth Rates, %.



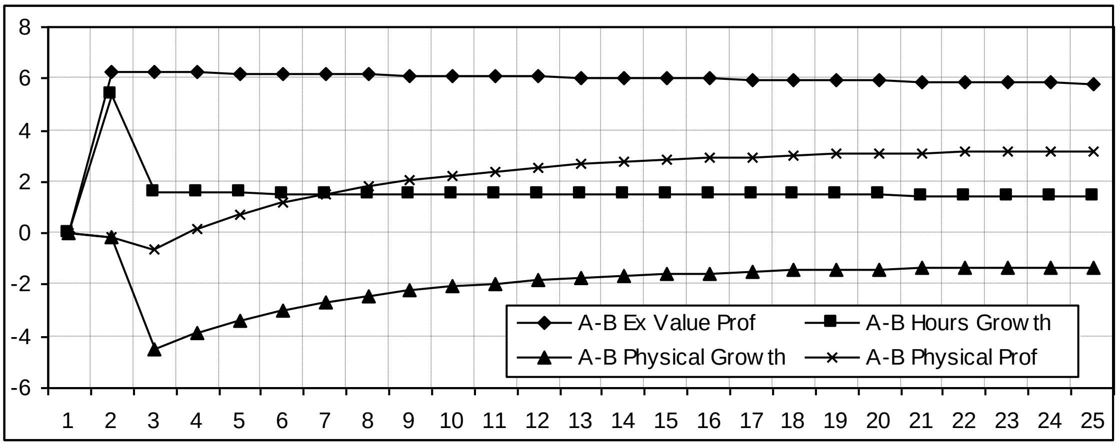
Graph 22 – B Profit and Growth Rates, %.



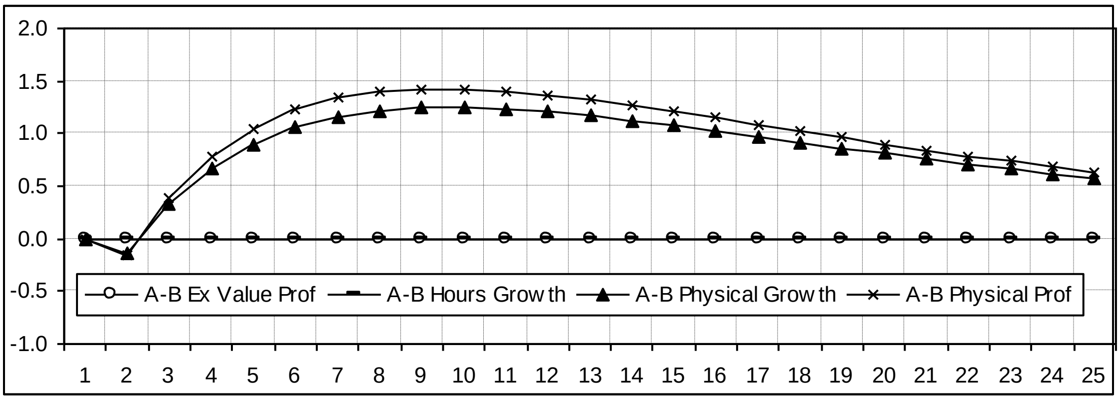
Graph 23 – Commodity 1 and 2 % Change Intrinsic Unit Value.



Graph 24 – A-B Profit and Growth Rates, A Improved Terms of Trade %.



Graph 25 - A-B Profit and Growth Rates, Equal Exchange Value Profit Rates %.



Graph 22 shows how after an initial upward dip $\rho^{oB}{}_t$ slowly declines, as $C^{oB1}{}_t/C^{oB2}{}_t$ rises from 13.3% in period 1 to a peak of 15.3% in period 3, then declines to 11.7% by period 25 (remember we simply assume A's physical output profit rate slowly rises). Graph 24 shows, as we would expect A grows faster in value terms than B, with higher exchange value and physical profitability, but unexpectedly now grows slightly slower in physical terms (as opposed to faster when we have equalised exchange value profit rates, see Graph 25). Graph 23 shows, as compared to when we have equalised exchange value profit rates in Graph 16, how technological change is now comparatively slower in A and faster in B. We have a physical distortion. As we set physical output through setting the physical/'real' profit rate, an improvement in A's terms of trade reduces the necessary physical output of commodity 1 to achieve a given physical/'real' rate of profit, while boosting the necessary physical output of commodity 2 to achieve a given physical/

'real' rate of profit. Period 25 output of commodity 1 falls to 1123, from 1586 when prices are in proportion to prices of production, while commodity 2 output rises to 4990 from 3808. Alternatively trying to exogenously enter physical output at its level when prices are in proportion to prices of production would not work as inputs vary. We could specify the black box of 'physical' production differently to remove this 'distortion', however such a step would in our opinion add little theoretically, but further complicate our model.

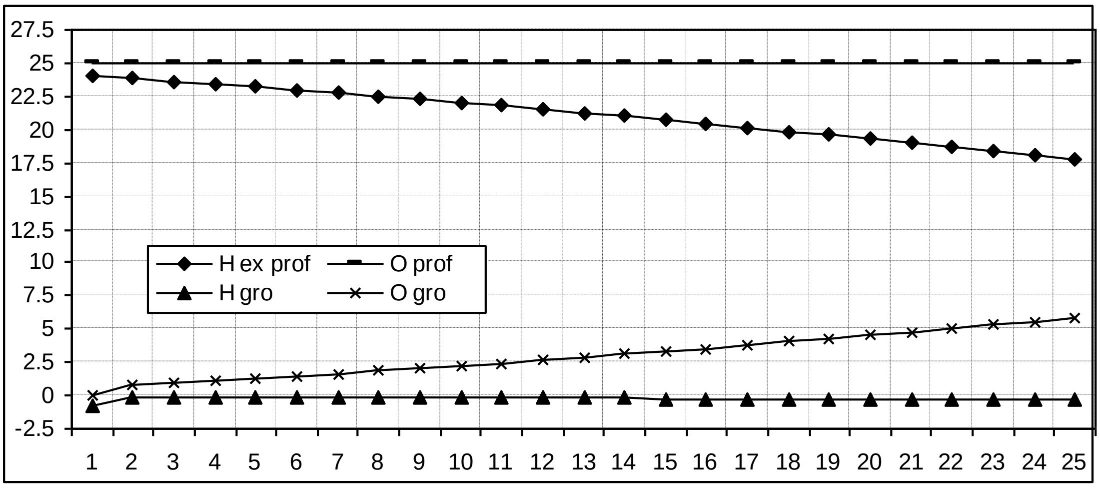
The problem ultimately is the whole notion of 'physicality'. Such confusion from changing the terms of trade inevitably occurs when we have more than one good. We have to travel from physical to nominal and back to 'real' to relate different physical goods as input to a quantity of a unique physical good as output to calculate the physical/'real' rate of profit (in our case calculating physical output by applying each countries physical profit rates to their 'real' quantity of inputs). Physicality, like value, is not a direct/concrete concept, and we have not even added the reality that physical objects change nature (is a 1960s family car physically comparable to a family car of today in any meaningful sense, what do you put in your price index?). Perhaps the best way to remove 'physical' distortion is to simply develop our analysis to purely consider nominal and value terms. As we would all agree nominal money terms exist, and if, as we must, go beyond nominal money terms, we suggest value is easier to model/estimate than 'physical' terms, with the essential advantage, following Marx, that value is predictive/best summarises the relative positions of agents in the economy. In contrast the proliferation of physical objects is less relevant/simply a by-product of capital accumulation in value terms (Marx, 1976).

To conclude, assuming fast growth in both countries causes value profitability to decline, in response to fast accumulation of value (growth in Y^{A*}_t and Y^{B*}_t), and the value of rentier money deposits to be eroded. If we assume A's 'terms of trade' improve A productive capitalists clearly gain at

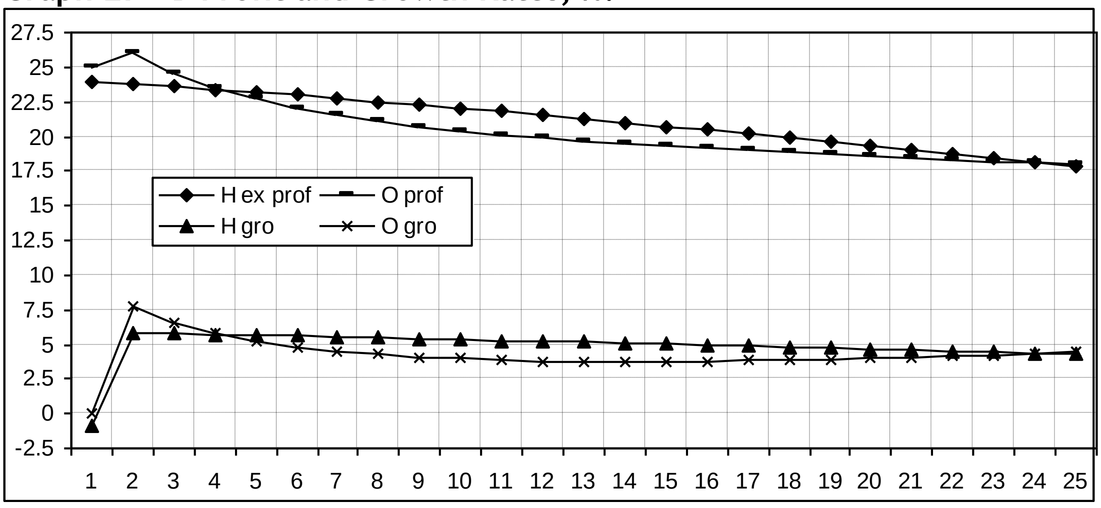
B productive capitalists' expense in value terms. Rentiers suffer a little less, period 25 Z_t drops to 88.4 hours from 175 hours in period 0, as opposed to 53.2 hours when prices are in proportion to prices of production.

Let us return to setting prices such as to equalise exchange value profitability between A and B, but assume simple reproduction in A while maintaining fast growth in B ($\Phi = 0.75$), with L^B_t rising 2% a period. By simple reproduction for A we mean constant C^A_t, V^A_t, M^A_t, L^A_t (no longer growing by 1% a period) S^A_t ($r^A_t = 1$) and Y^A_t, each period at their period 0 levels, with $K^A_t = Y^{A*}_t - M^A_t$ ($\beta = 1$). Let us set commodity 1 inflation at 2% from period 1, retaining a 2% 'real' interest rate in A money terms, and assume A's physical profit rate stays constant at 25%. See Graphs 26 to 31.

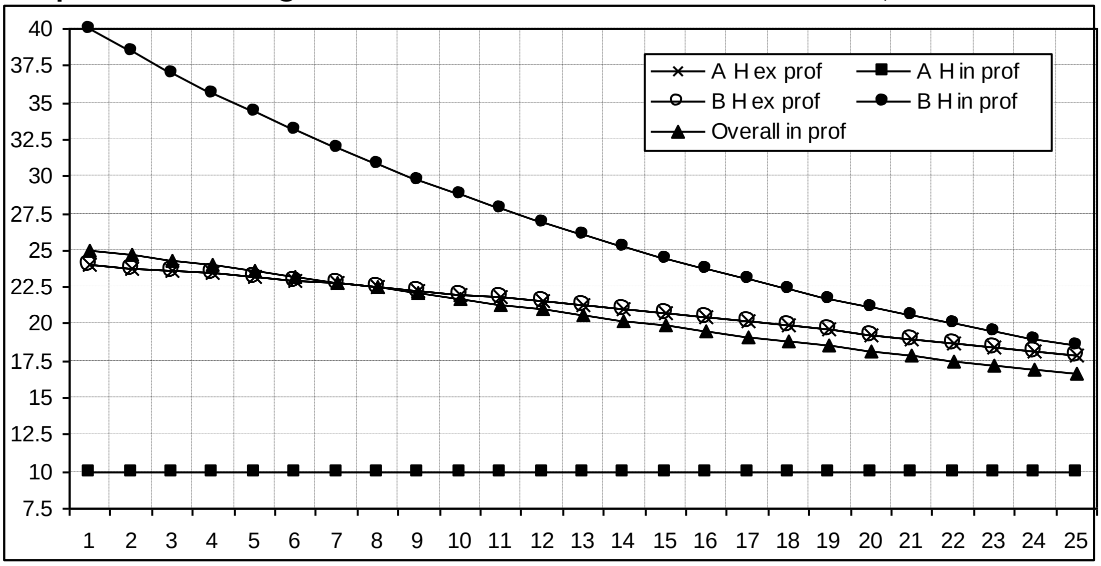
Graph 26 – A Profit and Growth Rates, %.



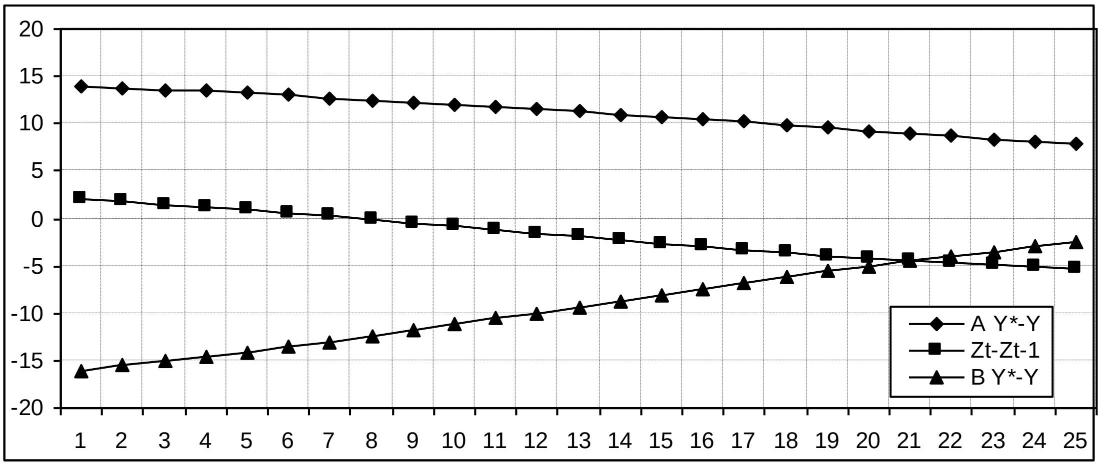
Graph 27 – B Profit and Growth Rates, %.



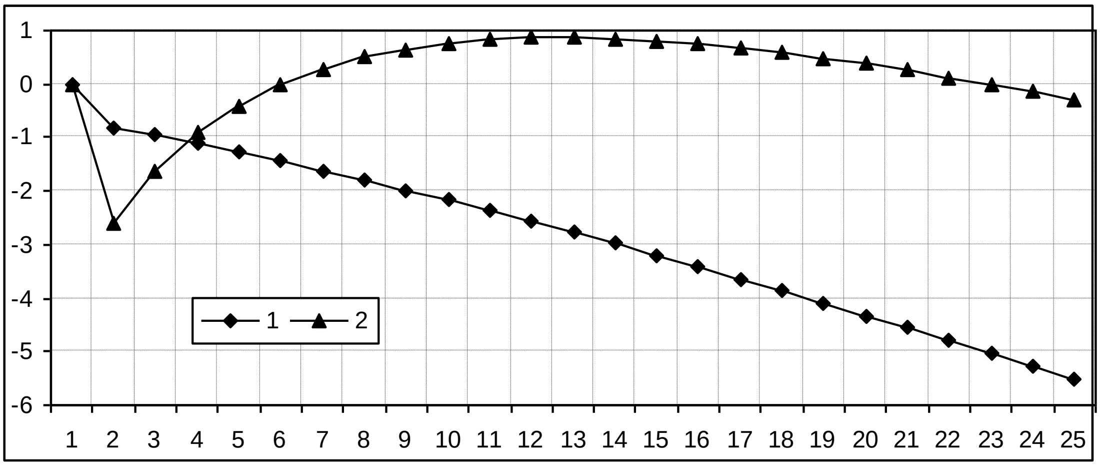
Graph 28 – Exchange Value and Intrinsic Value Profit Rates, %.



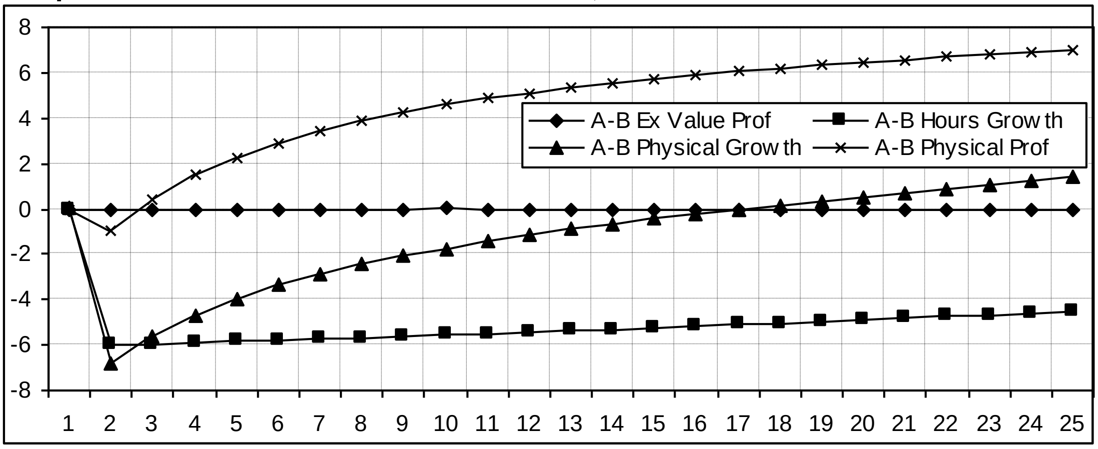
Graph 29 – Value Transfer, Hours.



Graph 30 – Commodity 1 and 2 % Change Intrinsic Unit Value.



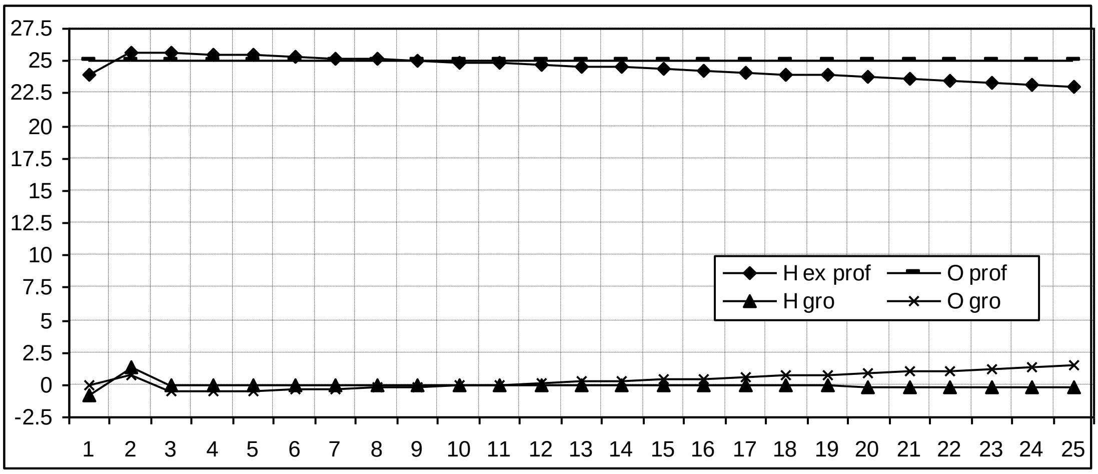
Graph 31 – A-B Profit and Growth Rates, %.



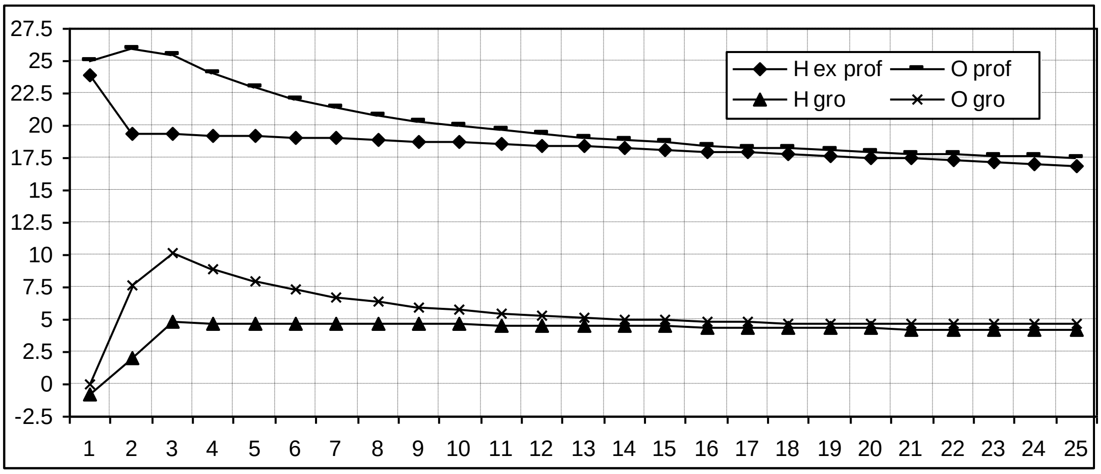
Assuming such a growth pattern and equalisation of exchange value profitability, see Graph 28, produces a strange result. Expectedly A's slow growth progressively starves B of imports of good 1, causing $C^{oB1}{}_t/C^{oB2}{}_t$ to fall (from an initial 13.3%, rising to a peak of 14.6% in period 2, to 2.5% by period 25) thus causing physical profitability to continually decline in B from period 3, see Graph 27. Note we could 'more realistically' ensure a further reduction in $\rho^{oB}{}_t$ by increasing Ω in equation (23) relating $C^{oB1}{}_t/C^{oB2}{}_t$ to $\rho^{oB}{}_t$. Graph 30 shows how we now have technological regression in B from period 7 to period 22 (period 25 $v^2{}_t$ at 0.45 hours is higher than period 1 $v^2{}_t$ at 0.44 hours), but escalating technological progress in A (where we simply assume a constant 25% physical profit rate). Physical growth in simply reproducing (in value terms) A escalates to 5.8% by period 25, overtaking physical growth in fast growing (in value terms) B from period 18 onwards. 'Physically' A is outperforming B. The ratio of prices of production $PP^{£A2}{}_t/PP^{£A1}{}_t$ rises from 0.34 in period 1 to 0.87 in period 25. Pricing to equalise exchange value profitability, in contrast to the physical situation, is improving B relative position in value terms. Graph 29 shows how as $PP^{£A2}{}_t/PP^{£A1}{}_t$ rises value transfers against B fall as value transfers to A decline. Overall growth/technological change/movement in relative prices is sufficient to erode the value of rentiers money stocks from period 8 (peaking at 183.2 hours in period 7 from 175 hours in period 0, to fall to 129.3 hours by period 25). In A $Y^{A*}{}_t$ falls from 125 hours in period 0 to 117.8 hours in period 25 (with $M^A{}_t$ constant at 100), while $Y^{B*}{}_t$ rises from 125 hours in period 0 to 408.5 hours in period 25 (as opposed to 341.5 hours with fast growth and equalised exchange value profit rates). This scenario seems to be in value terms, although 'fair'/'competitive' in equalising value profitability, clearly to the comparative advantage of B productive capitalists, our assumed less developed capitalists!

To improve A productive capitalist fortunes let us again set ¤$_t$ constant in equation (57) at 0.95 from period 2 onwards to boost A's 'competitiveness' i.e. depress commodity 2's price 5% below that required to equalise exchange value profit rates each period. We keep all other exogenously set variables and coefficients the same as when we assumed equalisation of exchange value profit rates between in value terms simply reproducing A and fast growing B. B's 'terms of trade' $P^{£A2}{}_t/P^{£A1}{}_t$ falls from 0.344 in period 0 to 0.269 in period 10, to then gradually rise to 0.287 by period 25.

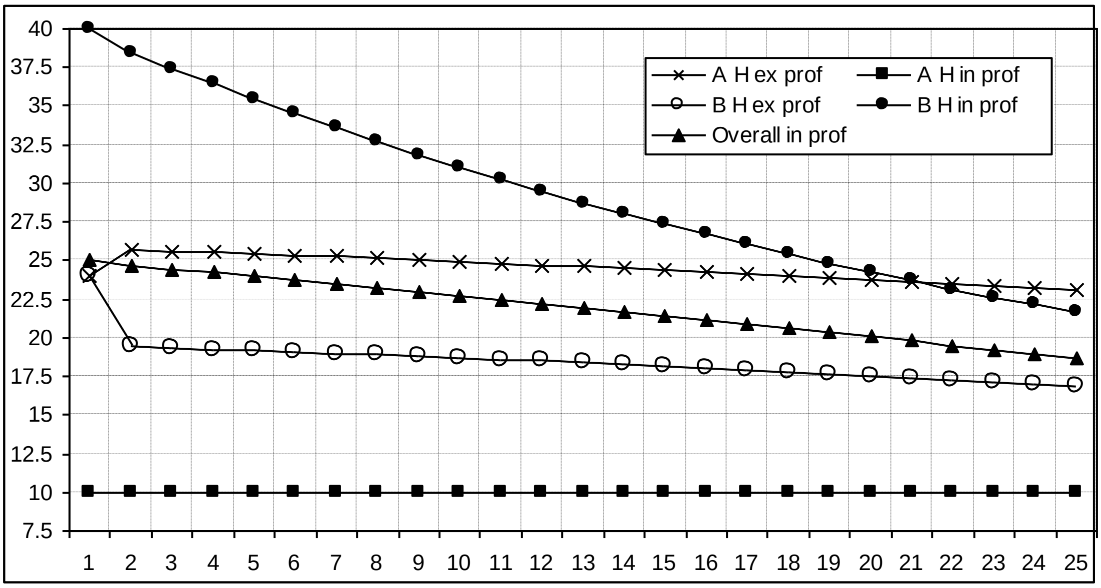
Graph 32 – A Profit and Growth Rates, %.



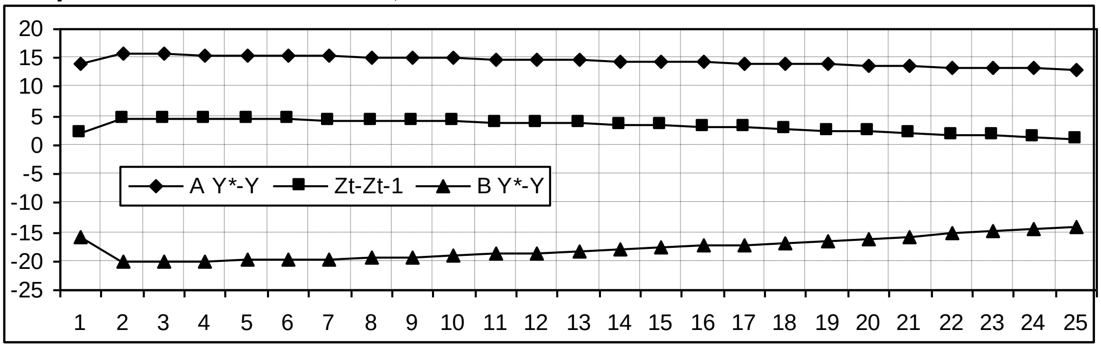
Graph 33 – B Profit and Growth Rates, %.



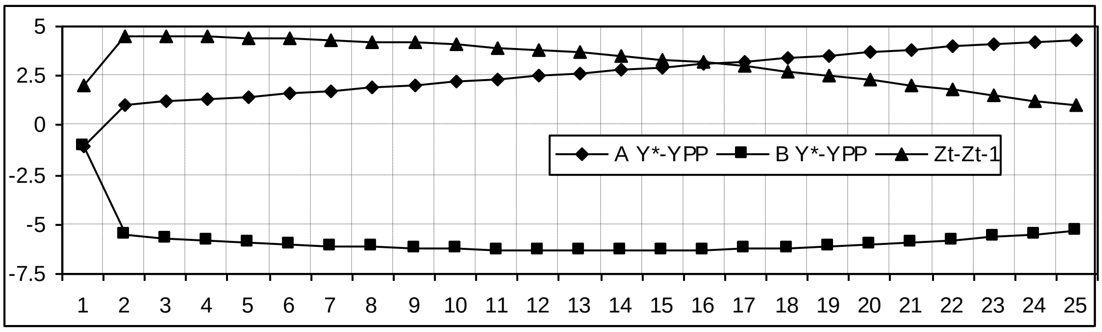
Graph 34 – Exchange Value and Intrinsic Value Profit Rates, %.



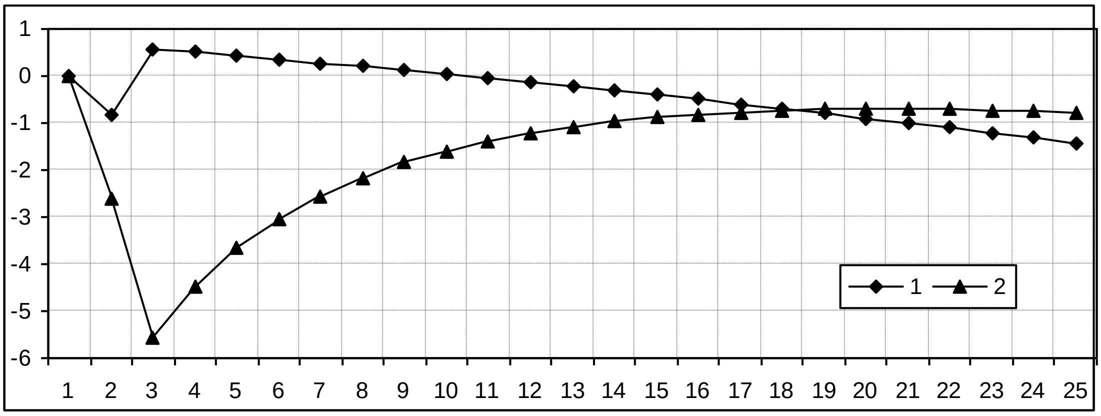
Graph 35 – Value Transfer, Hours.



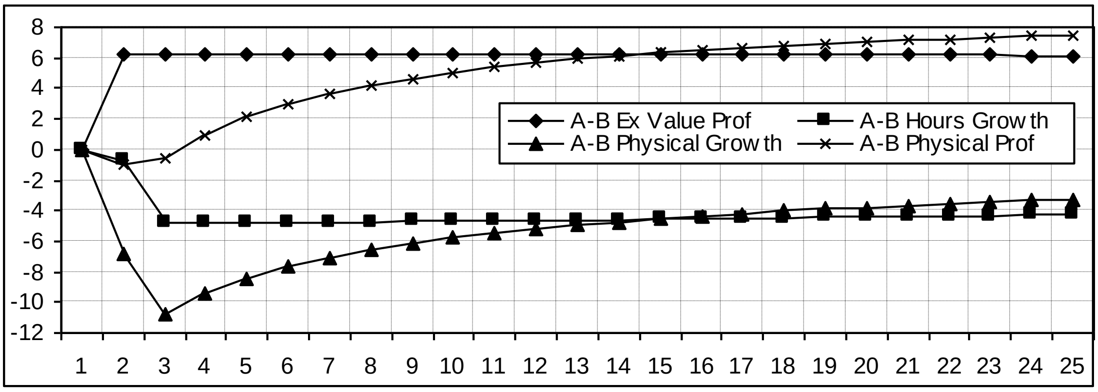
Graph 36 – Y^{A*}_t-Y^{A*PP}_t, Y^{B*}_t-Y^{B*PP}_t and Z_t-Z_{t-1}, Hours.



Graph 37 – Commodity 1 and 2 % Change Intrinsic Unit Value.



Graph 38 – A-B Profit and Growth Rates, %.



Graph 32 shows how $Y^{A^*}{}_t$ slightly shrinks each period from period 2 (while $C^A{}_t$, $V^A{}_t$ and $M^A{}_t$ remain constant). After being depressed to 24.0% by value transfer in period 1, $\rho^{A^*}{}_t$ rises in period 2 as the boost to A's 'competitiveness' first occurs, and then very slowly declines to 23.1% by period 25. In contrast Graph 33 shows how B grows in value terms, from period 3 at approximately 5%, with falling $\rho^{B^*}{}_t$ from equalised 24.0% in period 1 to 19.4% in period 2, and then gradually to 17.5% by period 25. Graph 34 shows how $\rho^{A^*}{}_t$ increasingly exceeds the systems overall intrinsic value profit rate, while $\rho^{B^*}{}_t$ gradually catches this rate up (primarily through the relative change in size in value terms of simply reproducing A and fast growing B). Strikingly $\rho^{A^*}{}_t$ exceeds, not only the systems overall intrinsic value profit rate, but even $\rho^B{}_t$ by period 22. Graph 38 confirms that from period 2 $\rho^{A^*}{}_t$ is consistently boosted by approximately 6% above $\rho^{B^*}{}_t$. Graph 35 shows how value transfers to $Y^{A^*}{}_t$ now remain consistently higher than when exchange value profitability was equalised, with Graph 36 indicating A productive capitalists' improving relative performance to if exchange value profitability were equalised i.e. continual Y^{A*}_t-Y^{A*PP}_t growth. Given (Y^{A*}_t-Y^{A*PP}_t) + (Y^{B*}_t-Y^{B*PP}_t) + (Z_t-Z_{t-1}) must equal zero to satisfy Marx's 'with money' first equality, as (Y^{A*}_t-Y^{A*PP}_t) is positive from period 2 and (Z_t-Z_{t-1}) is positive from period 1, (Y^{B*}_t-Y^{B*PP}_t) must be negative throughout, equal to - [(Y^{A*}_t-Y^{A*PP}_t) + (Z_t-Z_{t-1})]. Quite simply in value terms B productive capitalists subsidise both rentiers and A productive capitalists fortunes, beyond that required by 'competitive'/'fair' equalisation of exchange value profitability. Unsurprising A productive capitalists benefit from boosted 'competitiveness', while less predictably rentiers now for the first time in any of our scenarios experience positive value transfers throughout, with period 25 Z_t, at 255.9 hours, for the first time greater than period 0 Z_t equal to 175 hours.

We assume A still enjoys constant 25% physical/'real' profitability, while import starvation (C^{oB1}_t/C^{oB2}_t dropping to 1.7% by period 25) again ensures ρ^{oB}_t steadily drops, after an initial upward dip, to 17.5% by period 25 (as opposed to 18.0% when $¤_t$ = 1). Given ρ^{oA}_t and ρ^{oB}_t and changing 'terms of trade' in A's favour, less Q^{oA1}_t and more Q^{oB1}_t is comparatively required to satisfy our exogenously determined physical/'real' profit rates. Rather than technological regression in B and progression in A when $¤_t$ = 1, now $¤_t$ = 0.95 Graph 37 illustrates how technology now regresses in A from period 3 to period 10, while technology progresses in B throughout. As technological progress increases in A and slows in B, eventually from period 19 technological progress is faster in A than B. In A physical growth is at first negative, escalating to slight growth by period 11, while in B physical growth is initially very fast, and then declines to slightly above the rate of growth in value terms. A's 'competitiveness' boost thus ensures for A that greater value reward accompanies A's slower physical growth, while physically more productive B suffers in value terms. Such a result is dependent on our exogenous treatment of physical profitability, but we suggest may capture the essence of a country's relative 'advancement' in global terms, i.e. the need to do less for comparatively more.

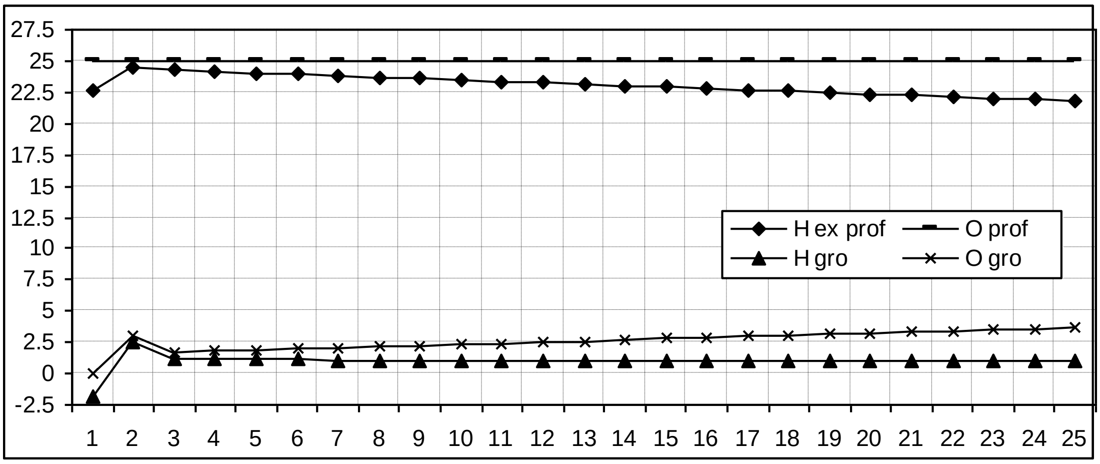
To sum up our global scenarios so far, although our model may be limited in physical definition, the value picture is clear. Fast growth in value terms in both countries inevitably leads to declining intrinsic and exchange value profitability. If A's 'competitiveness' is boosted A gains in value terms at B's expense, but all value profit rates still decline, while rentiers suffer in value terms if A's 'competitiveness' is boosted or not. If we assume in value terms simple reproduction in A and fast growth in B and equalised exchange value profit rates, value profitability still declines and rentiers still suffer (with the decline in value profitability being slower and rentiers suffering less, than if both A and B grow fast in value terms). With B still growing fast in value terms, we must assume improved 'competitiveness' for simply reproducing A for rentiers to finally improve their fortunes in value terms over our simulation. Both 'fair-trade', as represented by equalised exchange value profitability, and fast growth in value terms for advanced countries, appear to be clearly against rentier interests in value terms.

Finally let us consider a more 'realistic' scenario (accepting that the realism of all our scenarios is challenged by their abstract nature). Let us again keep L^A_t and r^A_t constant, assume 2% commodity 1 inflation and a 2% 'real' interest rate for A borrowers, and set ρ^{oA}_t at 25% throughout, but reduce β to 0.95 (determining A productive capitalist consumption) from the end of period 1. We continue to boost A's 'competitiveness' each period from period 2 by setting $\text{¤}_t = 0.95$ in equation (57). Let us continue to assume fast growth in value terms for B by continuing to assume $\Phi = 0.75$ (determining B productive capitalist consumption) from the end of period 1. We continue to assume L^B_t grows by 2% a period from period 2, but now assume r^B_t rises by 2.5% a period from period 2. To ensure ρ^{oB}_t is more sensitive to C^{oB1}_t/C^{oB2}_t let us replace equation (23) with:

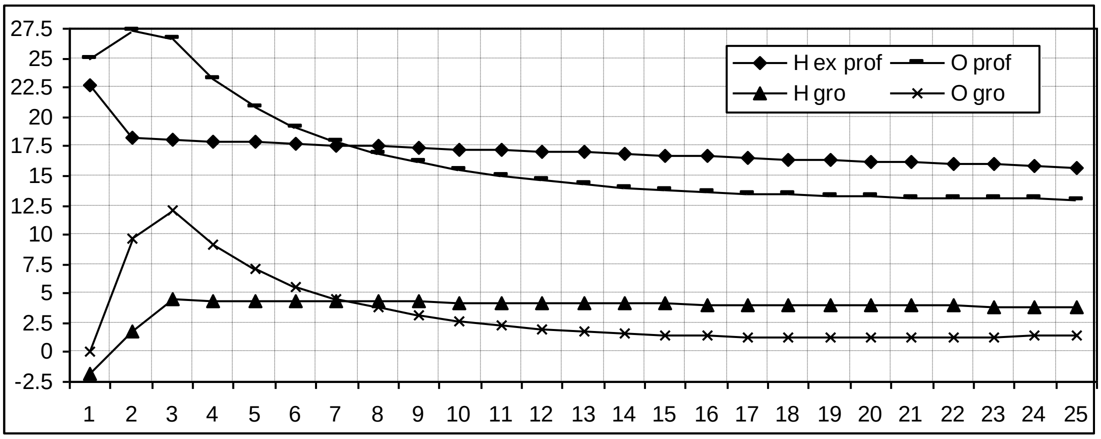
$$(58) \quad \rho^{oB}_t = \rho^{oB}_{t-1}[(C^{oB1}_t/C^{oB2}_t)/(C^{oB1}_{t-1}/C^{oB2}_{t-1})]$$

We continue to assume commodity 2 inflation in B money is boosted 5% a period, § = 0.05, with accompanying exchange rate adjustment, $\varepsilon_t = 1/(1+§)\varepsilon_{t-1}$, but shall now, in A money terms, introduce a 5.5% risk premium for B productive capitalist borrowers from period 1. We might ask why B productive capitalists face a A money risk-premium, and why should it be at 5.5%? Some degree of A money risk-premium would seem reasonable given developing countries have lower credit ratings (reflecting perceived higher country risk), while 5.5% is chosen to ensure rentiers 'capture' the entire productive economy in B by period 25.[10]

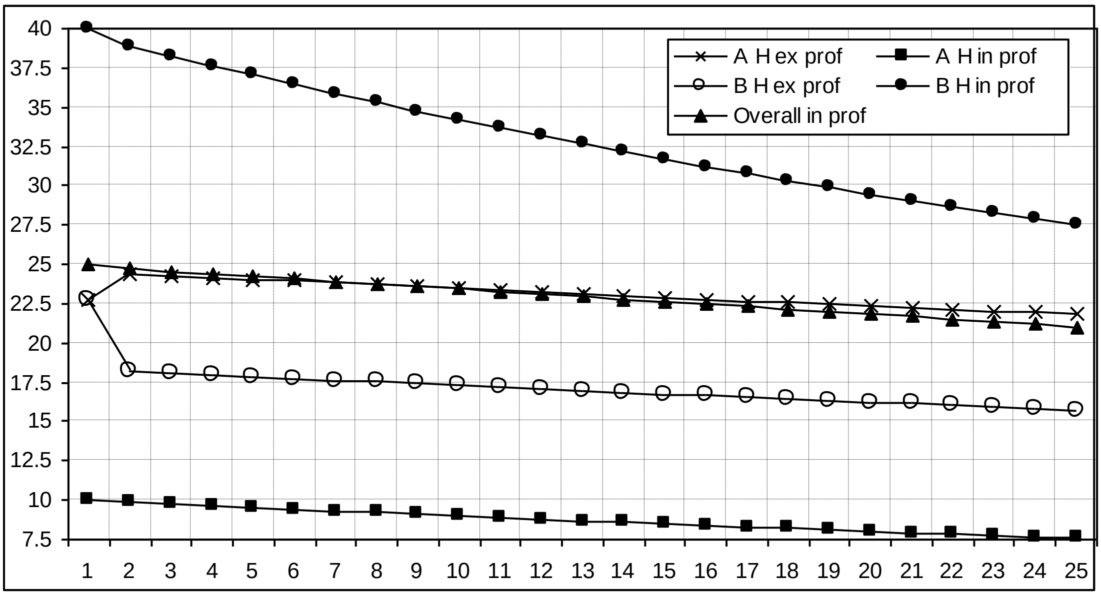
Graph 39 – A Profit and Growth Rates, %.



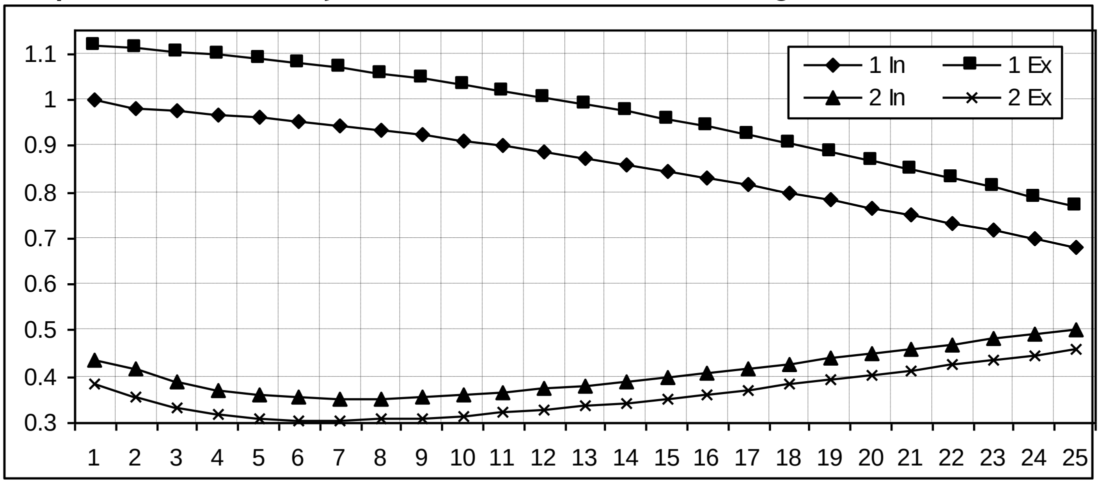
Graph 40 – B Profit and Growth Rates, %.



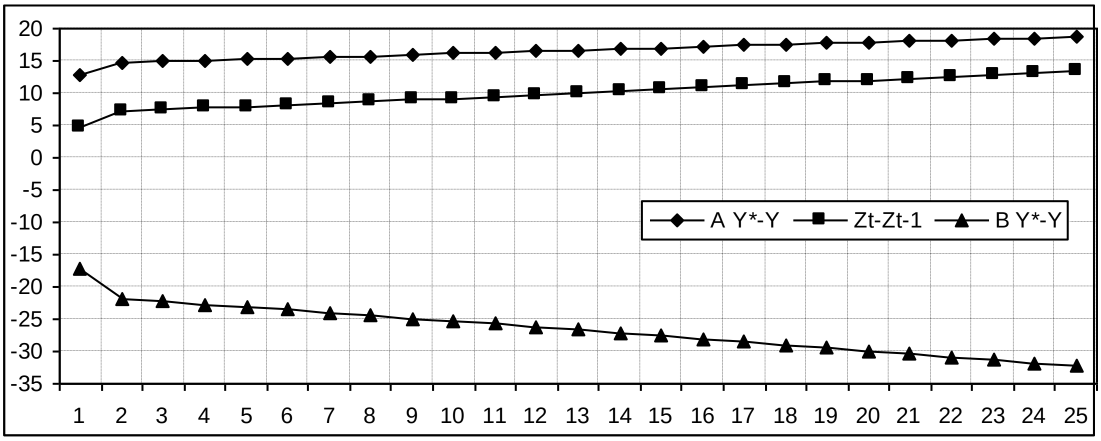
Graph 41 – Exchange Value and Intrinsic Value Profit Rates, %.



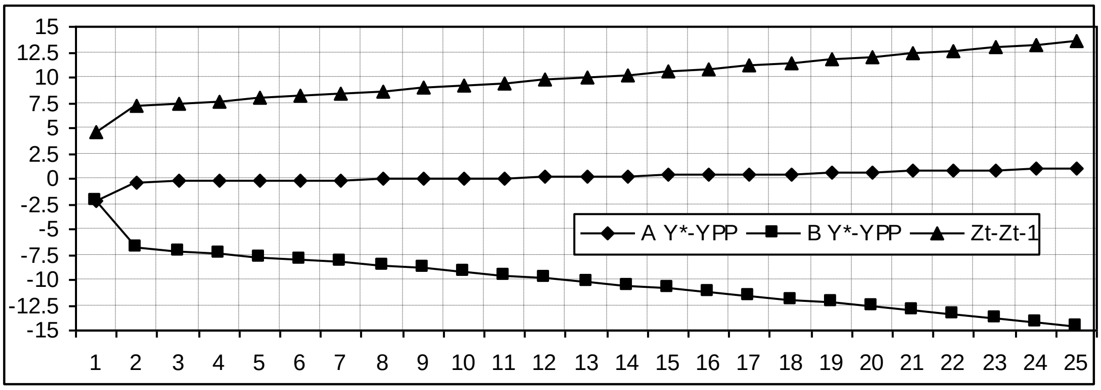
Graph 42 – Commodity 1 and 2 Intrinsic and Exchange Unit Values.



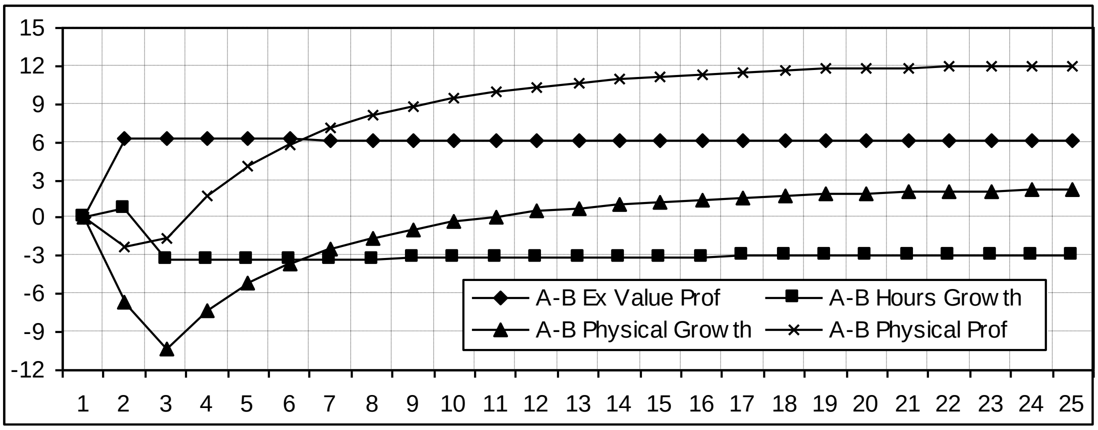
Graph 43 – Value Transfer, Hours.



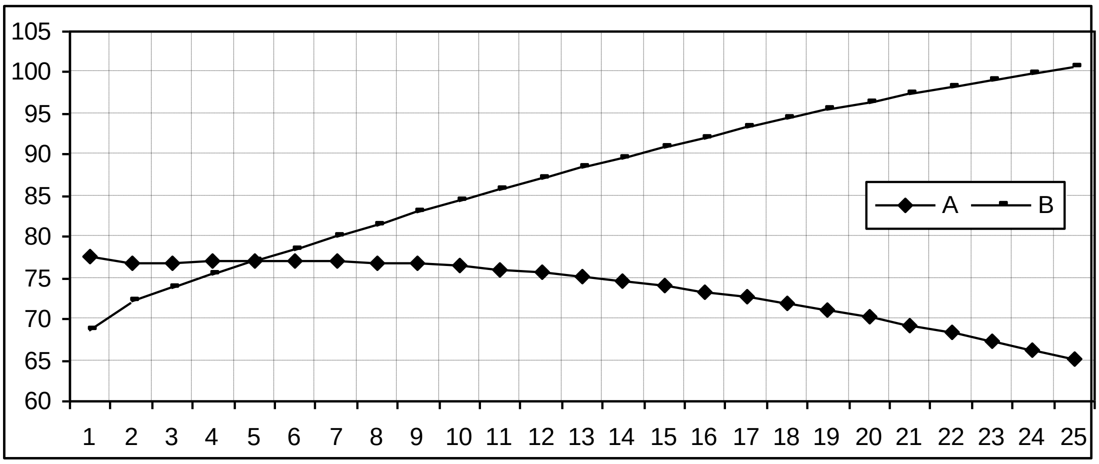
Graph 44 – Y^{A*}_t-Y^{A*PP}_t, Y^{B*}_t-Y^{B*PP}_t and Z_t-Z_{t-1}, Hours.



Graph 45 – A-B Profit and Growth Rates, %.



Graph 46 – $\lambda^{DA£A}_t/M'^{£A}_t$ and $\lambda^{DB£B}_t/M'^{£B}_t$, %.



Our new scenario is much more favourable to rentiers, Z_t consistently rises each period to finish at 424.9 hours by period 25 (as opposed to 255.9 hours when ¤$_t$ = 0.95, A simply reproduced and we had no risk premium). Graph 43 shows how B productive capitalists support large and growing value transfers to A productive capitalists and rentiers. Graph 44 shows how despite A's improved 'competitiveness' large value transfers to rentiers prevents A productive capitalists from realising significantly more value than if prices were proportional to prices of production and their was no value transfer to rentiers. ($Y^{A^*}_t$-$Y^{A^*PP}_t$) stands at -0.3 hours in period 2, then gradually rises, becoming positive in period 10, to finish at 1.05 hours in period 25. B productive capitalists almost entirely 'fund' value transfers to rentiers up to period 10, and then 'fund' value transfer to A productive capitalists beyond that required to equalise exchange value profit rates if their were no value transfer to rentiers, but most notably 'fund' increasing large value transfers to rentiers. Graph 45 shows how, from period 2 when A starts to improve its competitiveness, $\rho^{A^*}_t$ is boosted 6% above $\rho^{B^*}_t$, but Graph 41 shows how large value transfers to rentiers comparatively depresses $\rho^{A^*}_t$ and $\rho^{B^*}_t$ as compared to our previous simulation with no risk premium represented in Graph 34. The overall intrinsic value profit rate declines less than when we assumed simple reproduction in A! Although A now grows a little in value terms, the increased exploitation in B and most significantly the large value transfers against the productive economy, slowing accumulation in value terms, ensures a slower decline to the systems overall intrinsic value profit rate. A productive capitalists are hampered by rentiers' success as overall $Z^{£}_t$ growth is escalated by much faster growth in $\lambda^{LA£B}_t$, ensuring $Z^{£}_t$'s relative growth to $M'^{£A}_t$ and $M'^{£B}_t$ is higher than when we assumed no risk premium for B productive capitalists.

Graph 39 shows how the overall situation in A is stable, with declining but stable exchange value profitability, slow growth in value terms and still comparatively slow growth in physical terms. Graph 40 shows a deteriorating situation in B. In value terms $\rho^{B^*}_t$ is depressed from period 2 but subsequently only gradually declines, while growth in value terms is strong, near 5% from period 3. However increasing ρ^{oB}_t's sensitivity to C^{oB1}_t/C^{oB2}_t ensures physical profitability, after an initial upward dip when growth commences, declines much further, explaining B's increasingly poor physical growth. Graph 42 shows how, as B's comparative level of development C^{oB1}_t/C^{oB2}_t declines from period 3, initially fast technological development in B slows and then from period 8 is replaced by technological regression up to the end of our scenario. As exploitation and total labour power input in B rises, lack of advanced commodity 1 ensures that an hour of B labour is increasingly less productive in 'real'/ physical terms. Country B appears to be in developmental terms going backwards, while as Graph 43 shows, transferring escalating sums of value to both A productive capitalists and rentiers. Furthermore such a high risk premium rapidly increases $\lambda^{DB£B}_t/M'^{£B}_t$, rentiers effective 'ownership of the productive economy in B. Graph 46 shows how $\lambda^{DA£A}_t/M'^{£A}_t$ in A is initially higher than $\lambda^{DB£B}_t/M'^{£B}_t$ in B, but for A $\lambda^{DA£A}_t/M'^{£A}_t$ is at first stable and then steadily declines. In contrast $\lambda^{DB£B}_t/M'^{£B}_t$ escalates until in period 25 $\lambda^{DB£B}_t > M'^{£B}_t$ i.e. in the context of our abstract model B productive capitalists have lost effective 'ownership' of the entire productive economy in B to rentiers.

In summary we have a slowly growing, but stable, advanced A, and an increasingly financially fragile and comparatively less developed B (rest of the world), as rentiers prosper. Contrived/abstract as our model may be such a 'realistic' scenario seems to the author to capture the essence/ nature of our troubled global world.

Conclusion

Our model is a first attempt to apply a sequential and non-dualistic value-theoretical approach, integrating rentiers value fortunes, to the question of globalisation. It can be 'improved'/'extended' in almost every way, particularly behaviourally (to address how value terms manifest on behaviour), productively (entering the black box of production) and financially (developing the financial system). However development would generate greater complexity, with physicality representing perhaps a barrier to progress rather than an aid. Our analysis would be considerably simplified if we purely focussed on nominal money and value terms ($M'^{£A}_t$, $M'^{£B}_t$, $\lambda^{DA£A}_t$, $\lambda^{DB£B}_t$, $Z^{£}_t$, Y^{A}_t, Y^{B}_t and Z_{t-1}) abstracting completely from physicality ($Q^{oA1}{}_t$ and $Q^{oB1}{}_t$). Physical terms are not needed to calculate exchange values, we just need nominal money and intrinsic value terms. Physical terms seem to simply act as a method to hold on to the conventional but elusive concept of 'real'/physical terms (a social rule of thumb/to the capitalist class's advantage?). We suggest that it is hard to assess the meaning of physicality in advanced countries, which unlike the struggling majority do not simply seek to command sufficient physical quantities of basic goods.

It is perhaps both too extreme and premature to abstract from physicality completely, but we suggest that to focus on physicality alone without value (or to simultaneously and dualistically collapse value onto physicality) is likely to lead us nowhere in our understanding of our human world. Our simulations unsurprisingly suggest that the human world suffers if growth in value terms is slower in more technologically advanced countries than the rest of the world, thus retarding the rest of the world's level of development. More unexpectedly we suggest for rentiers to prosper in value terms we require both slow growth in value terms in advanced countries and that those advanced countries need to continually improve their comparative 'advancement'/'competitiveness' against the rest of the world.

Endnotes

1. As Lapavitsas (1992) and Lapavitsas and Itoh (1999) explain productive capitalist hoarding and dishoarding of money stocks over the circuit (Marx, 1978) accounts for the historical development of the banking system and prevents us from imagining a clear 'class' of monied-capitalists supporting unmonied-productive capitalists (as Marx, 1981, supposes). We do not dispute Lapavitsas and Itoh's explanation of the development of the financial system but do feel that, increasingly, that a significant number of agents have a rentier interest (particularly if we, as Lapavitsas and Itoh, 1999, consider shares as a form of interest-bearing capital). Furthermore we feel that invested money, no matter its source (e.g. from pension or depreciation funds), will be invested with a rentier interest i.e. with no direct concern to the health of the productive economy, and only the concern to grow as much as possible in value terms itself (Potts, 2005A).

2. Space does not allow us to explain and illustrate how sequential and non-dualistic determination of value by labour time fundamentally differs from simultaneous and dualistic valuation/replacement cost valuation (Potts, 2005C). Briefly we support the TSSI of Marx's position (succinctly put in Freeman, 1996A) that simultaneous and dualistic valuation makes value redundant, a mere proxy to physicality (Steedman, 1977). Furthermore Marx's transformation problem (Marx, 1981) fails to add up, making 'Marx's' approach to value incoherent, and once 'corrected' (Bortkiewicz, 1952, 1984) inconsistent with his central results. Kliman (2002) explains how the TSSI of Marx is able to deduce all of Marx's key results (Kliman explicitly identifies 13) through their interpretation of his method. Kliman thus concludes by hermeneutic criterion/Stigler's principle of scientific exegesis, that the TSSI of Marx's concept of sequential and non-dualistic determination of value by labour time can best claim to represent Marx's own concept of value. Although articles on the TSSI centre on this crucial issue we make no apology for restricting it to a footnote. We believe the case for sequential and non-dualistic valuation is clear and that it is now time to see what we can do with it (thus expanding and indirectly contributing to the debate).

3. Freeman's (1996B) illustration of the process of price formation and circulation includes money stocks (their monetary expression and pre-price formation intrinsic value) in his calculation of MELT. For this reason in Potts (2004) we contrast 'Kliman's' MELT with 'Freeman's' MELT, including rentiers' money deposits. However, given Freeman (1996B) does not imagine our abstract financial system we feel it best to refer to 'our' calculation of MELT rather than 'Freeman's'.

4. We now also satisfy a modified 'with-money' form of Marx's second equality (note both equalities are applied in Marx's treatment of the transformation problem, Marx, 1981). At the level of the aggregate productive economy Marx's second equality states that the value embodied in the monetary expression of total profits equals the total surplus value extracted from labour during production. In our model the monetary

expression of the economy's total capital $M'^{£A}_t+Z^{£A}_t$, established at the end of production at t, can only grow in value terms from its level at the start of production at t ($M^{£A}_t+Z^{£A}_{t-1}$) by the total surplus value extracted from labour in production period t.

5. If we introduced international lending to facilitate trade imbalance at the end of t, while maintaining our assumption that markets clear to avoid crisis, then value would still not be transferred between countries at the end of t. Say at the end of t B ran a trade deficit with A, supported by a new loan from A rentiers to B productive capitalists. A productive capitalists would realise more/need to borrow less this precise amount, leaving total A rentier lending unchanged. In B productive capitalists would still need to rollover their loans to B rentiers in addition to taking out the new loan with A rentiers. The value represented by B's deficit would be matched by the value of A rentiers' new loan to B productive capitalists; their increased effective partial 'ownership' of B productive capital. So if a trade imbalance occurs at the end of t it does alter end t profit rates, unit values or the monetary expression or value of rentiers money stocks in either country. Clearly the different distribution of period t output in period t+1 trade imbalance produces will affect production and values in t+1, but this does not alter the fact that it can not affect values at the end of t.

6. Note to avoid circularity in our spreadsheet we can't use inflation in general for country A (accounting for the change in both commodities prices and weighting by proportion of expenditure), so have to use commodity 1 inflation. We use commodity 2 inflation for B, but using B's overall inflation would not cause circularity in our spreadsheet.

7. In Potts (2005A) we find that with 100% of rentiers money deposits lent technological change significantly affects the process of value transfer, while the rate of inflation also has an effect, but of a second order magnitude.

8. To reflect higher training in A we could scale up L_t in A as compared to B, but for simplicity we do not. Alternatively to ensure wages are lower in B we shall simply assume higher exploitation in B.

9. Such new rules ensure value transfer now affects productive capitalist consumption in value terms and thus the growth of total capital. Previously productive capitalists consumed βS^A_t and ΦS^B_t, no matter how value transfer in each country altered $Y^{A^*}_t$ from Y^A_t and $Y^{B^*}_t$ from Y^B_t. Consequently, as we assume only productive capitalists remove value from the system through their consumption, total capital $Y^{A^*}_t+Z^A_t$ and $Y^{B^*}_t+Z^B_t$ predictably grew by $S^A_t-\beta S^A_{t-1}$ and $S^B_t-\Phi S^B_{t-1}$ each period in each country, no matter the pattern of value transfer in each country. In our global system productive capitalist consumption in value terms will now depend on value transfer. If $Y^{A^*}_t+Y^{B^*}_t < Y^A_t+Y^B_t$, because $Z_t > Z_{t-1}$, productive capitalists will consume less, as their realised surplus value falls. Value transfer will thus slightly affect the growth of total capital, making it less 'well-behaved'.

10. As loans are in A money, exchange rate risk would seem irrelevant, but more concretely a sudden reduction in exchange rate increases country risk through undermining the financial stability of both the state and domestic companies.

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Biographical Note

Nick Potts is a Reader at Southampton Business School. He successfully completed his PhD on the question of integrating the productive economy and the monetary system together using a sequential and non-dualistic concept of value in 2005 (University of London, supervisor Lord Desai). This working paper builds on his PhD. He is interested in general in how to apply Marx's analysis of the inner workings of capitalism to the economic issues of today (including globalisation, the Euro and knowledge-based production). To find out more about Marx's economics we consult www.copejournal.org the website of *Critique of Political Economy* the journal of the International Working Group on Value Theory.