

The Fifth WAPE Forum

***The Crisis of Capitalism and its Solution:
Socialism of the 21st Century***

May 29-30, 2010 at Suzhou City, China

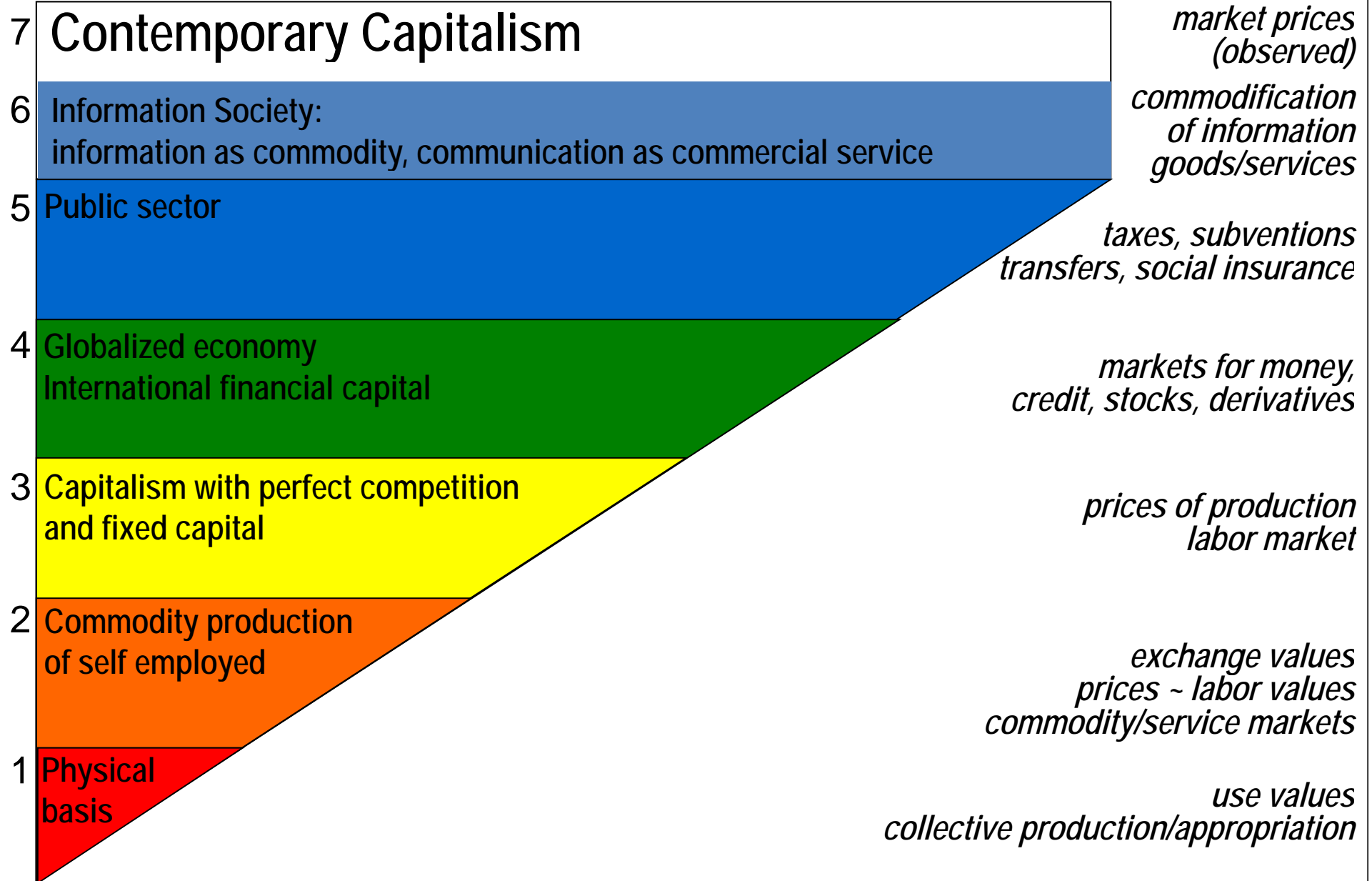
***From the appearance of the economy
to its essence and back***

Methodological preconditions on how to analyze crises

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Economic Reality – A Complex Construction



Layer 1: Use values, collectively produced and appropriated

- Mathematical description in terms of Leontief's input-output scheme to represent the economy in terms of use values.
- Each row and each column represent one branch of production or firm
- It reflects the degree of division of labor.
- The matrix of technical coefficients **A** represents the technology of the economy. The element a_{ij} gives the amount of goods of industry i needed to produce one unit of output of industry j .

x (output vector) contains all use values produced. It can be split by kind of use of goods into **Ax** (demand for intermediate goods) and **y** (final demand). The following famous formula is called the primal problem

$$\mathbf{Ax} + \mathbf{y} = \mathbf{x}$$

y (final demand) can be split it into **c** (consumption) and **s** (surplus product = capital investment)

$$\mathbf{y} = \mathbf{c} + \mathbf{s}.$$

or in matrix notation

$$\mathbf{Ax} + \mathbf{Cx} + \mathbf{Sx} = \mathbf{x},$$

where **C**, and **S** represent matrices of consumption coefficients and surplus coefficients respectively.

Layer 2: Labour values, small commodity production

The dual Leontief model deals with the unit prices

$$\mathbf{pA} + \mathbf{q} = \mathbf{p}$$

\mathbf{p} ...row vector of unit prices \mathbf{q} ... unit value added.

After substitution of \mathbf{q} by life unit labor input \mathbf{l} we get the basic formula how to compute Marx' labor values \mathbf{v}

$$\mathbf{vA} + \mathbf{l} = \mathbf{v}.$$

We can split \mathbf{l} into wages, \mathbf{w} , and profits π and get

$$\mathbf{l} = \mathbf{w} + \pi.$$

Marx used different symbols

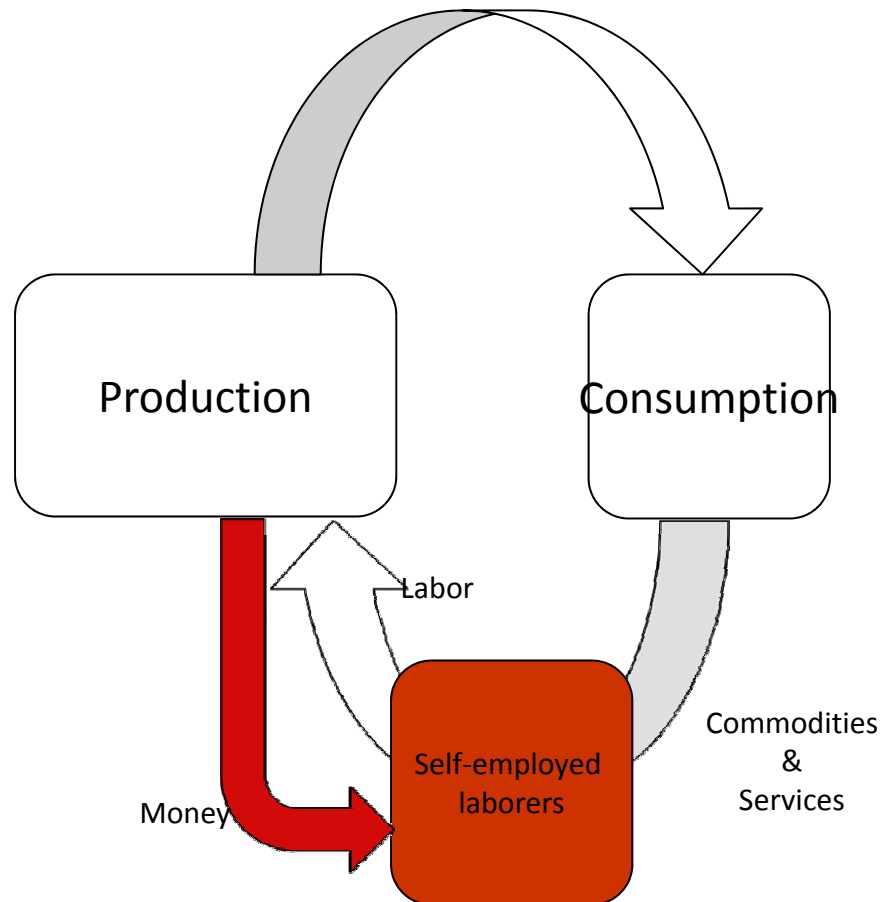
$$W = C + V + M,$$

where W is the labor value,

- C constant capital,
- V variable capital and
- M surplus value.

In our notation:

$$\mathbf{v} = \mathbf{vA} + \mathbf{w} + \pi.$$

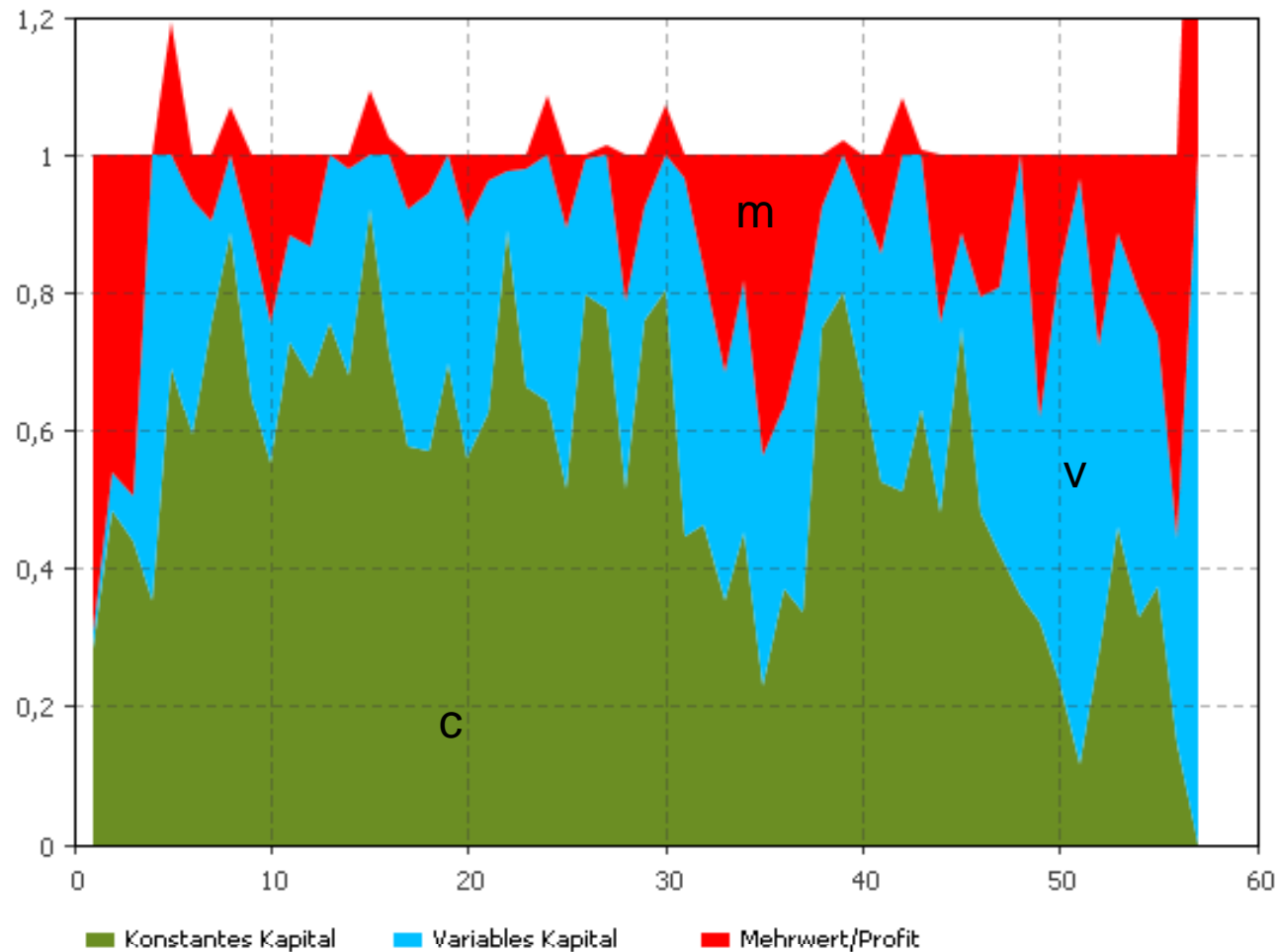


Structure of „classical“ labour values

all industries are value producers

c - constant capital, v - variable capital, m - surplus value

Austria 2003: 57 industries (percent), $r = 0.883$



Nr	Industry
1	Agriculture, hunting
2	Forestry, logging
3	Fishing, fish farms
4	Mining of coal and lignite
5	Extract. o. crude petrol. a. nat. gas, min. o. metal ores
6	Other mining and quarrying
7	Manufacture of food products and beverages
8	Manufacture of tobacco products
9	Manufacture of textiles
10	Manufacture of wearing apparel
11	Manufacture of leather, leather products, footwear
12	Manufacture of wood and of products of wood
13	Manufacture of paper and paper products
14	Publishing, printing and reproduction
15	Manufacture of coke, refined petroleum products
16	Manufacture of chemicals and chemical products
17	Manufacture of rubber and plastic products
18	Manufacture of other non-metallic mineral products
19	Manufacture of basic metals
20	Manufacture of fabricated metal products
21	Manufacture of machinery and equipment n.e.c.
22	Manufacture of office machinery and computers
23	Manufacture of electrical machinery and apparatus n.e.c.
24	Manufacture of radio, television equipment
25	Manuf. of medical, precision, optical instruments, clocks
26	Manufacture of motor vehicles and trailers
27	Manufacture of other transport equipment
28	Manufacture of furniture; manufacturing n.e.c.

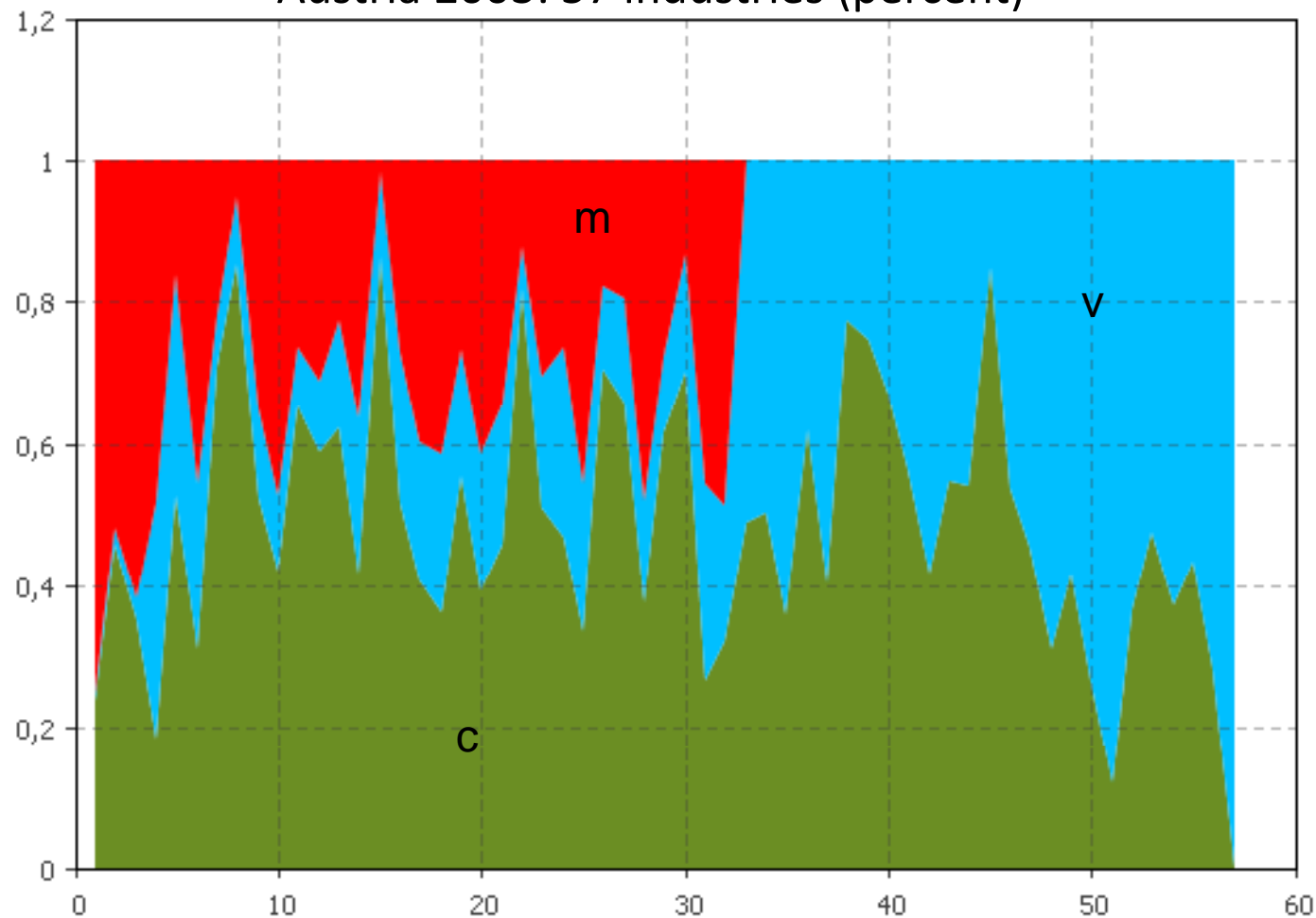
29	Recycling
30	Electricity, gas, steam and hot water supply
31	Collection, purification and distribution of water
32	Construction
33	Sale and repair of motor vehicles; automotive fuel
34	Wholesale and commission trade
35	Retail trade, repair of household goods
36	Hotels and restaurants
37	Land transport; transport via pipelines
38	Water transport
39	Air transport
40	Supporting a. auxiliary transport activities; travel agencies
41	Post and tele-communications
42	Financial intermediation, except insur.
43	Insurance and pension funding, except social security
44	Activities auxiliary to financial intermediation
45	Real estate activities
46	Renting of machinery and equipment without operator
47	Computer and related activities
48	Research and development
49	Other business activities
50	Public administration; compulsory social security
51	Education
52	Health and social work
53	Sewage and refuse disposal, sanitation and similar act.
54	Activities of membership organizations n.e.c.

Structure of labour values

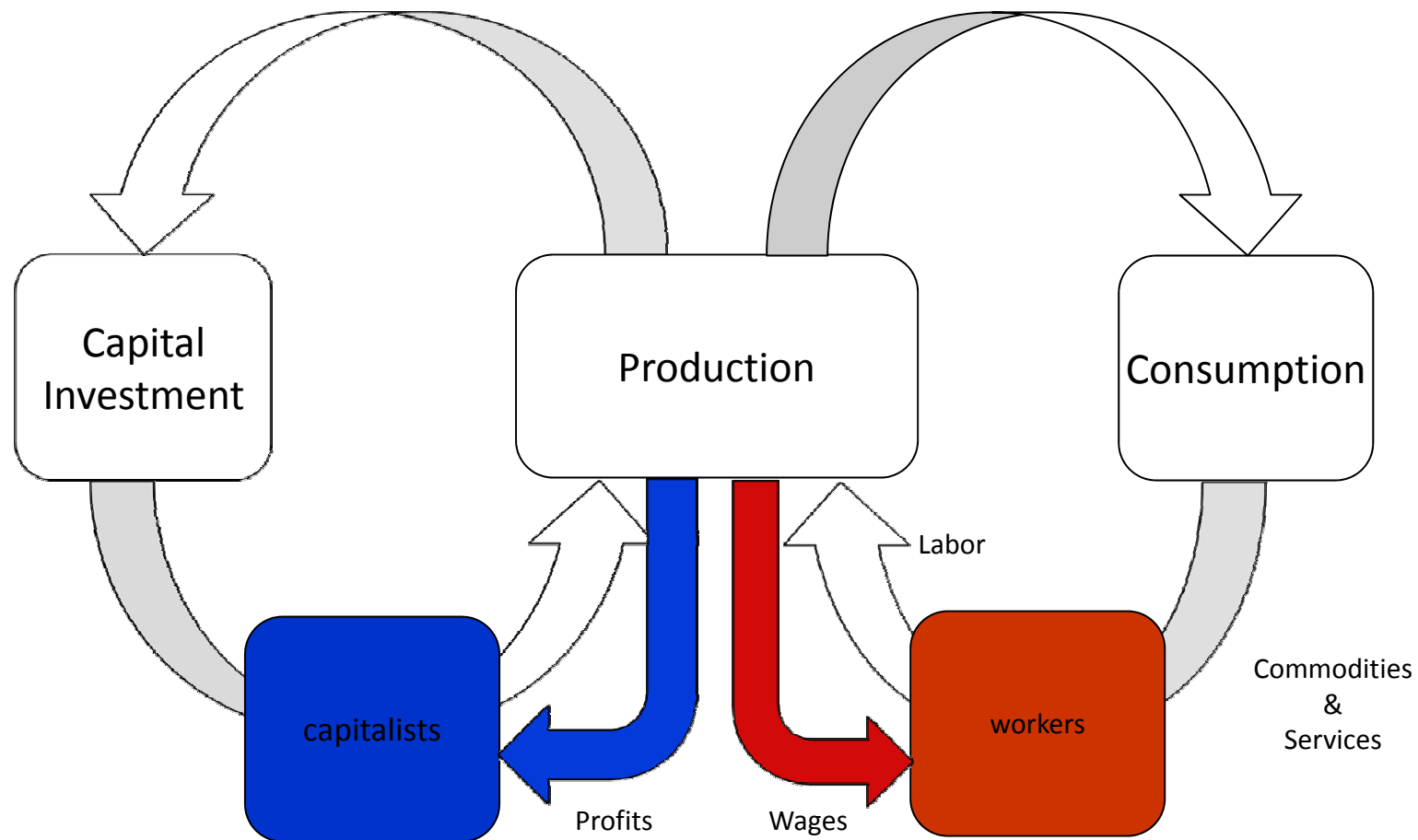
no surplus of services, variable exploitation rates

c - constant capital, v - variable capital, m - surplus value

Austria 2003: 57 industries (percent)



Layer 3: prices of production, capitalist economy at perfect competition



Layer 3: prices of production, capitalist economy at perfect competition

Marx provided us with the following solution for \mathbf{p} :

$\mathbf{p} = \mathbf{v} (\mathbf{K} + \mathbf{C}) (1 + r)$, where $r = \mathbf{v} (\mathbf{I} - \mathbf{A} - \mathbf{C}) \mathbf{x} / \mathbf{v} (\mathbf{K} + \mathbf{C}) \mathbf{x}$ and $\mathbf{v} = \mathbf{I} (\mathbf{I} - \mathbf{A})^{-1}$
 \mathbf{K} ...matrix of capital coefficients per unit of output, \mathbf{I} ...identity matrix with ones in its main diagonal, otherwise zeros, and r is the average rate of profit.

This method can be generalized to an iteration process which leads us to the solution proposed by von Bortkiewicz in the beginning of the 20th century (which is equal to the solution of an eigenvector/eigenvalue problem). The generalized iteration scheme inspired by Marx is:

$\mathbf{p}_i (\mathbf{K} + \mathbf{C}) (1 + r_i) = \mathbf{p}_{i+1}$ where $r_i = \mathbf{p}_i (\mathbf{I} - \mathbf{A} - \mathbf{C}) \mathbf{x} / \mathbf{p}_i (\mathbf{K} + \mathbf{C}) \mathbf{x}$,
 r_i ... average profit rate at iteration step i . (Different turnover times neglected, and assume they are all equal to one.

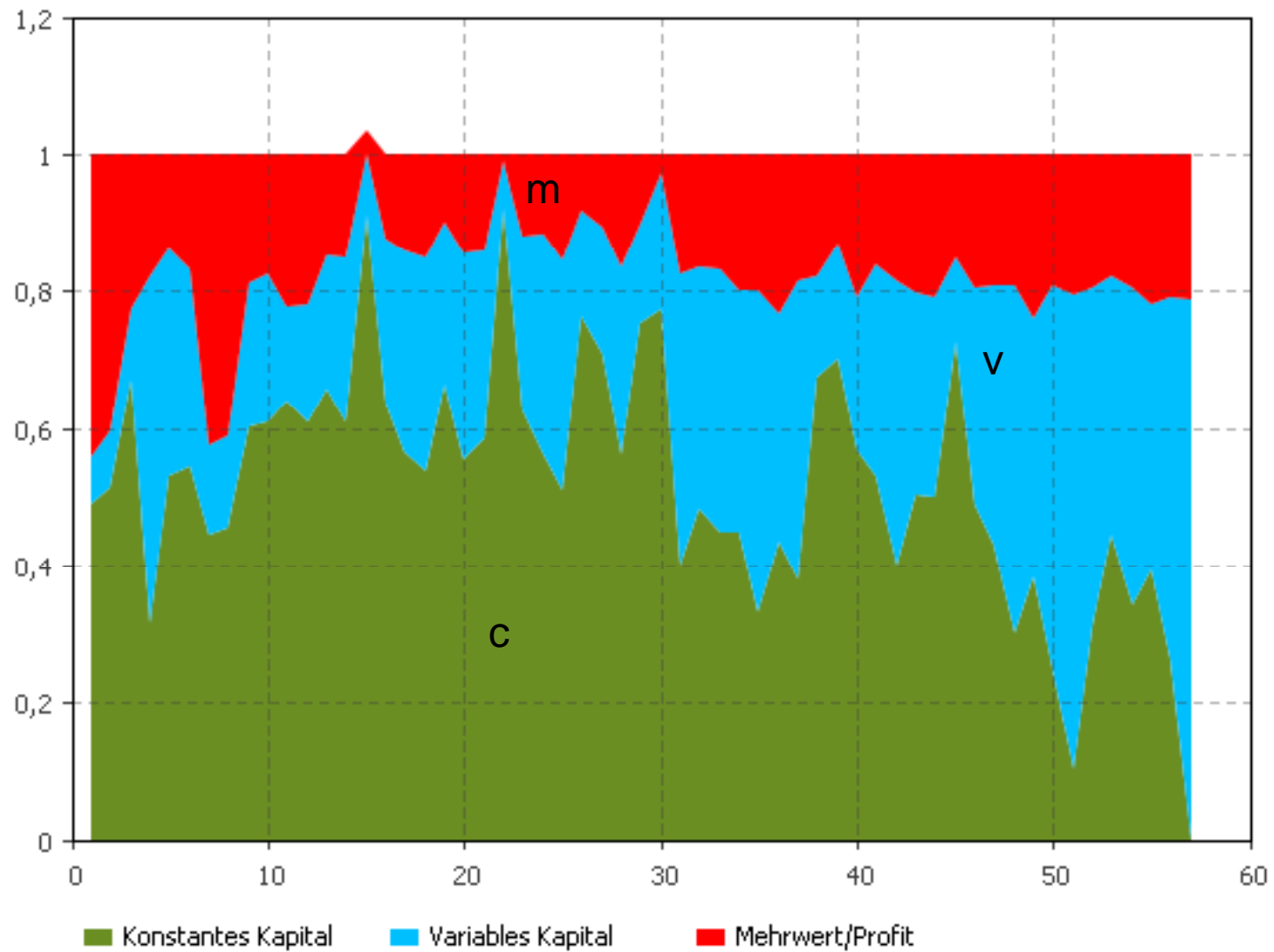
The link to labor time is kept up because the iteration scheme starts from the solution of equation (3) for \mathbf{v}

$$\mathbf{p}_0 = \mathbf{v} = \mathbf{I} (\mathbf{I} - \mathbf{A})^{-1}, \text{ where } r_0 = \mathbf{p}_0 (\mathbf{I} - \mathbf{A} - \mathbf{C}) \mathbf{x} / \mathbf{p}_0 (\mathbf{K} + \mathbf{C}) \mathbf{x}$$

Marx' solution: Prices of production

c - constant capital, v - variable capital, m - surplus value

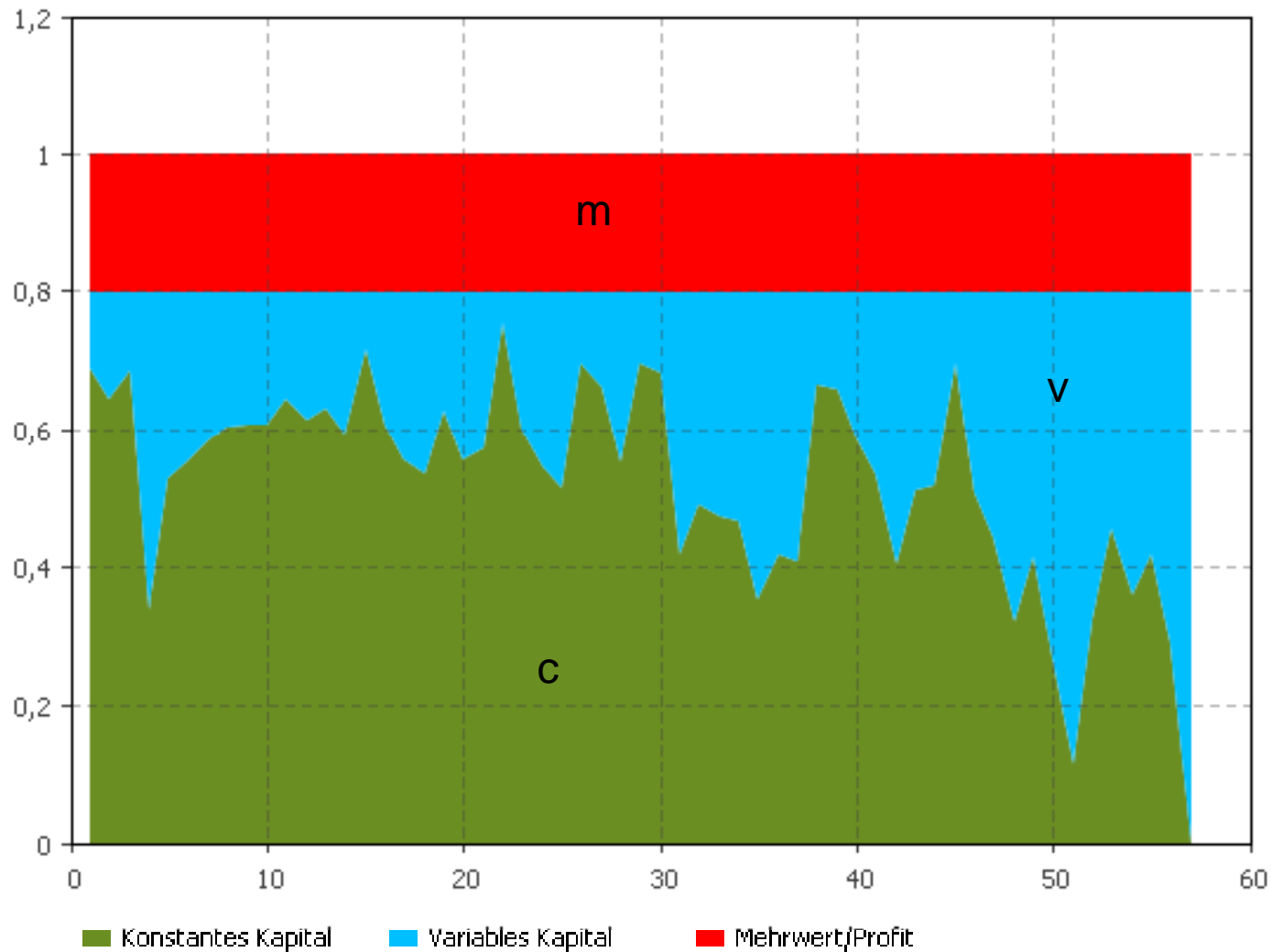
Austria 2003: 57 industries (percent), $r=0.901$



von Bortkiewicz: Prices of production

c - constant capital, v - variable capital, m - surplus value

Austria 2003: 57 industries (percent), $r=0.952$



Layer 3: prices of production, capitalist economy at perfect competition

Marx provided us with the following solution for \mathbf{p} :

$\mathbf{p} = \mathbf{v} (\mathbf{K} + \mathbf{C}) (1 + r)$, where $r = \mathbf{v} (\mathbf{I} - \mathbf{A} - \mathbf{C}) \mathbf{x} / \mathbf{v} (\mathbf{K} + \mathbf{C}) \mathbf{x}$ and $\mathbf{v} = \mathbf{I} (\mathbf{I} - \mathbf{A})^{-1} \mathbf{K}$...matrix of capital coefficients per unit of output, \mathbf{I} ...identity matrix with ones in its main diagonal, otherwise zeros, and r is the average rate of profit.

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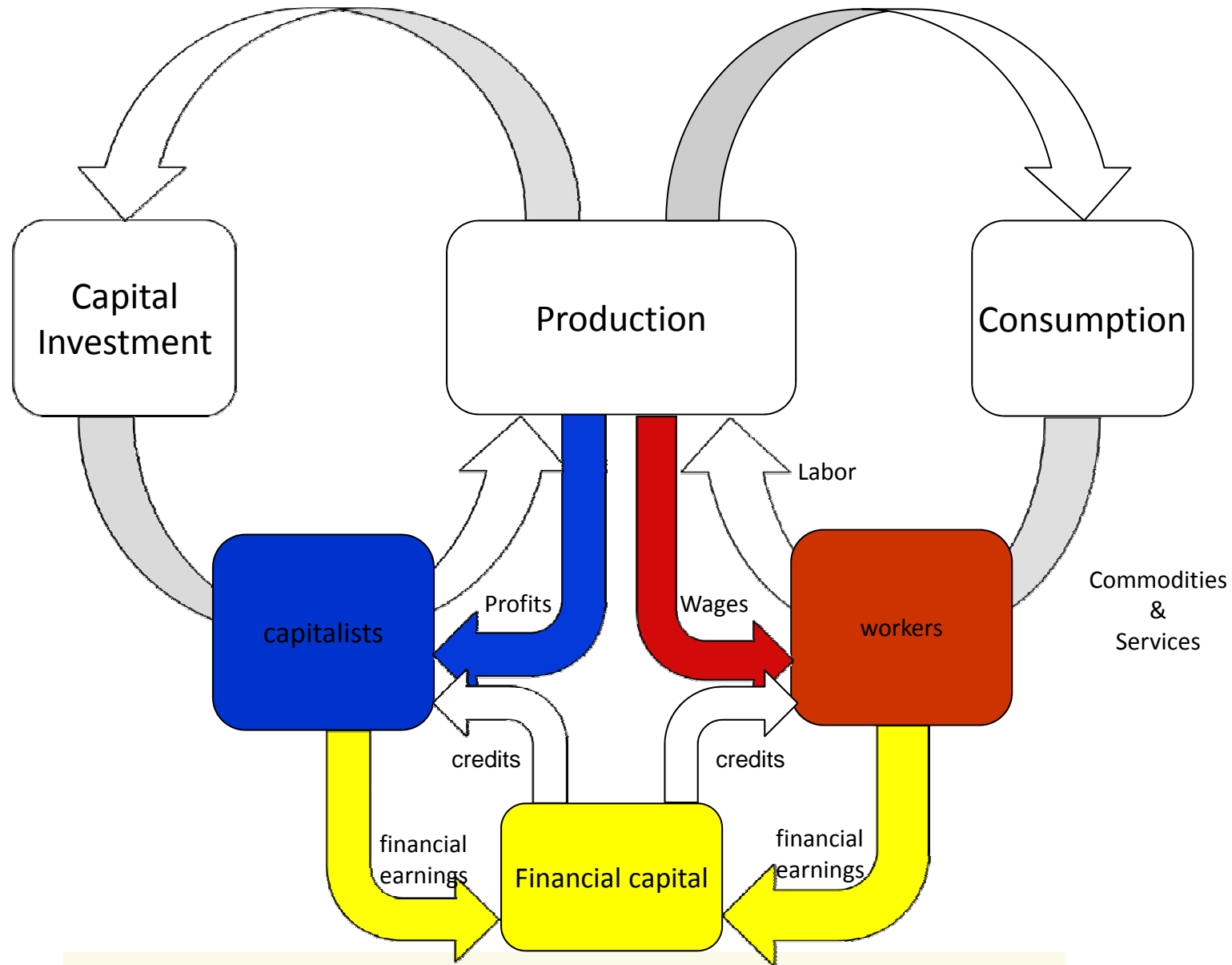
$$\mathbf{p}_i (\mathbf{K} + \mathbf{C}) (1 + r_i) = \mathbf{p}_{i+1} \text{ where } r_i = \mathbf{p}_i (\mathbf{I} - \mathbf{A} - \mathbf{C}) \mathbf{x} / \mathbf{p}_i (\mathbf{K} + \mathbf{C}) \mathbf{x},$$

r_i ... average profit rate at iteration step i . (Different turnover times neglected, and assume they are all equal to one).

The link to labor time is kept up because the iteration scheme starts from the solution of equation (3) for \mathbf{v}

$$\mathbf{p}_0 = \mathbf{v} = \mathbf{I} (\mathbf{I} - \mathbf{A})^{-1}, \text{ where } r_0 = \mathbf{p}_0 (\mathbf{I} - \mathbf{A} - \mathbf{C}) \mathbf{x} / \mathbf{p}_0 (\mathbf{K} + \mathbf{C}) \mathbf{x}$$

Layer 4: Real capital, financial capital



Layer 4: Real capital, financial capital

In Layer3 the following equilibrium conditions were assumed

Wages equal consumption: $\mathbf{w}\mathbf{x} = \mathbf{p}\mathbf{C}\mathbf{x} = \mathbf{p}\mathbf{c}$

Profits equal capital investment: $\boldsymbol{\pi}\mathbf{x} = \mathbf{p}\mathbf{S}\mathbf{x} = \mathbf{p}\mathbf{s}$.

If we want to reflect money explicitly in the economy, we need to get rid of such equilibria. Therefore we replace them by the following savings equations:

Money savings/increase of debt of households, \mathbf{s}_{hh} , are given by the following relations

$$\mathbf{s}_{hh,t} = \mathbf{w}_t - \mathbf{1}'\mathbf{C}_t + r_l, t \mathbf{m}_{hh,t} \quad \text{if } \mathbf{m}_{hh,t} > 0$$

$$\mathbf{s}_{hh,t} = \mathbf{w}_t - \mathbf{1}'\mathbf{C}_t + r_b, t \mathbf{m}_{hh,t} \quad \text{if } \mathbf{m}_{hh,t} < 0$$

\mathbf{m} ...money stocks, r_l ...interest rate for lending money to banks, r_b ... interest rate for borrowing, $r_l < r_b$

Similarly, we have money savings/increase of debt of firms, \mathbf{s}_f , as a result of profits, minus capital investment and borrowing/lending money (time indices suppressed)

$$\mathbf{s}_f = \boldsymbol{\pi} - \mathbf{1}'\mathbf{S} + r_l \mathbf{m}_f \quad \text{if } \mathbf{m}_f > 0$$

$$\mathbf{s}_f = \boldsymbol{\pi} - \mathbf{1}'\mathbf{S} + r_b \mathbf{m}_f \quad \text{if } \mathbf{m}_f < 0$$

Layer 4: Real capital, financial capital

The financial assets/debts of firms, households and state are held by the banks. Assets are rewarded by banks with an interest rate $r_{\text{borrowing}}$, credits have to be paid for with an interest rate r_{lending} ($r_{\text{lending}} > r_{\text{borrowing}}$). The payments of interest are deducted from / added to the surplus variables or wage income. Of course, the redistribution does not change the amount of total GDP.

In this simplified version the income of banks is given by the sum of all interest payments of all sectors including the household and government sectors minus all interest payments of the bank for deposits of firms, households of government (if any):

$$x_{\text{banks}} = \sum. \quad \begin{array}{ll} \{ -r_l m_{hh.} \text{ (if } m_{hh.} > 0) & -r_l m_{f.} \text{ (if } m_{f.} > 0) \} \\ + \\ \{ -r_b m_{hh.} \text{ (if } m_{hh.} < 0) & -r_b m_{f.} \text{ (if } m_{f.} > 0) \} \end{array}$$

Including a financial sector creates a secondary distribution of income.

Layer 4: Real capital, financial capital

Dynamic equations

The dynamics for physical capital is given by

$$\mathbf{K}_{a,t+1} = \mathbf{K}_{a,t} + \mathbf{S}_n = \mathbf{K}_{a,t} + (\mathbf{S} - \mathbf{S}_d),$$

where \mathbf{S}_n is the matrix of net capital investment per time unit, and \mathbf{S}_d the scrap matrix (or depreciation matrix) of capital. The relation between gross and net investment is given by

$$\mathbf{S}_n = \mathbf{S} - \mathbf{S}_d$$

The money capital stock of firms, banks and the government debt can be represented by a row vector $\mathbf{m}_{f,t}$, the one of households by $\mathbf{m}_{hh,t}$

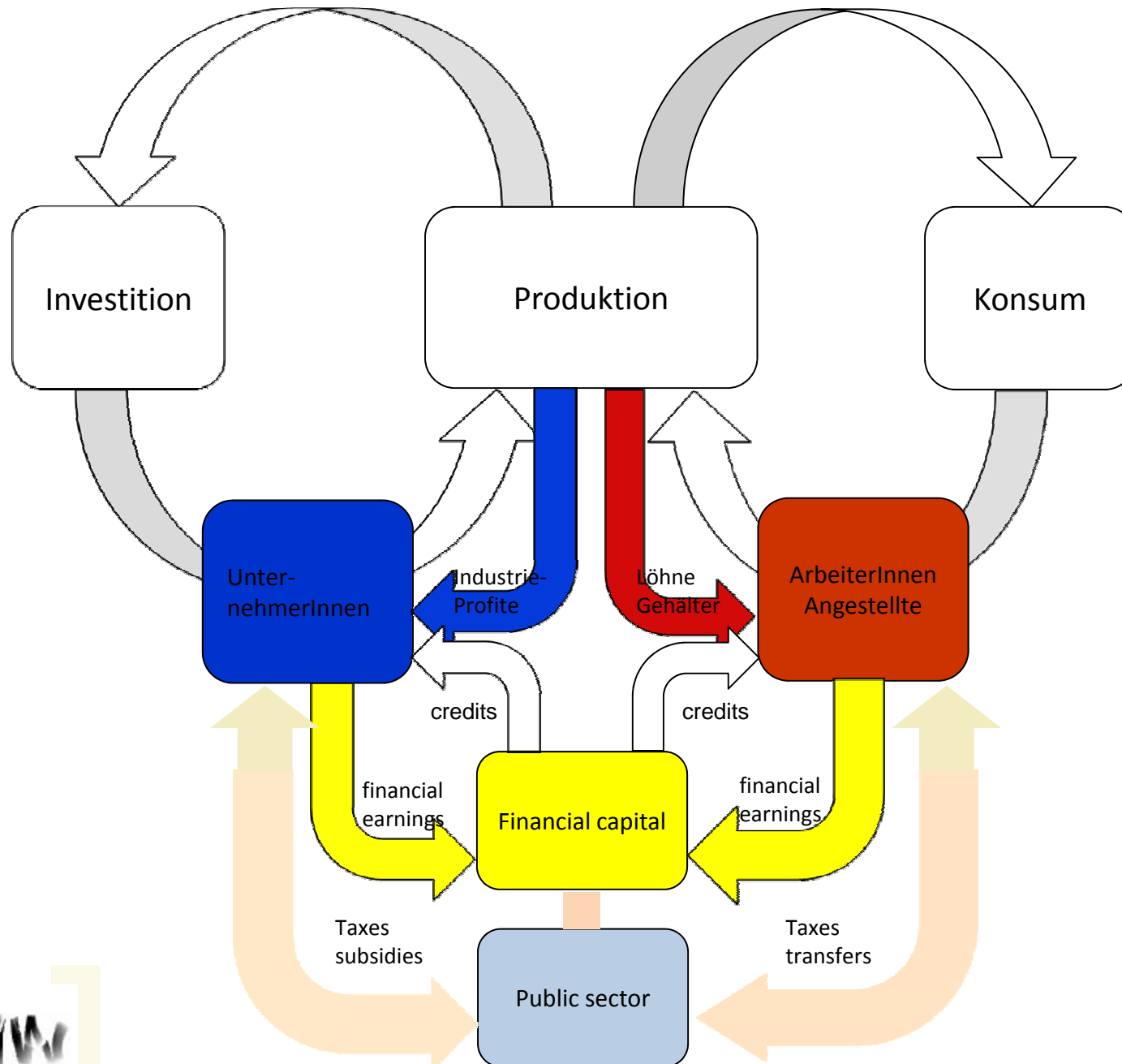
Money(+)/Debt(-) stocks of households, $\mathbf{m}_{hh,t}$, at time t , is given by:

$$\mathbf{m}_{hh,t+1} = \mathbf{m}_{hh,t} + \mathbf{s}_{hh,t}$$

Money(+)/Debt(-) stocks of firms, $\mathbf{m}_{f,t}$, at time t :

$$\mathbf{m}_{f,t+1} = \mathbf{m}_{f,t} + \mathbf{s}_{f,t}$$

Layer 5: Real capital, financial capital, public sector



Layer 5: Real capital, financial capital, public sector

For a simplified mathematical model one could include the following variables to represent activities of the state :

- t_{ind} tax rate of indirect taxes
- $t_{profits}$ tax rate of profits
- t_{wages} tax rate on wages
- indirect taxes
- direct taxes (wage tax, profit tax)
- public consumption
- public investment
- contributions to the social insurance system
- transfers to households
- subsidies to enterprises
-

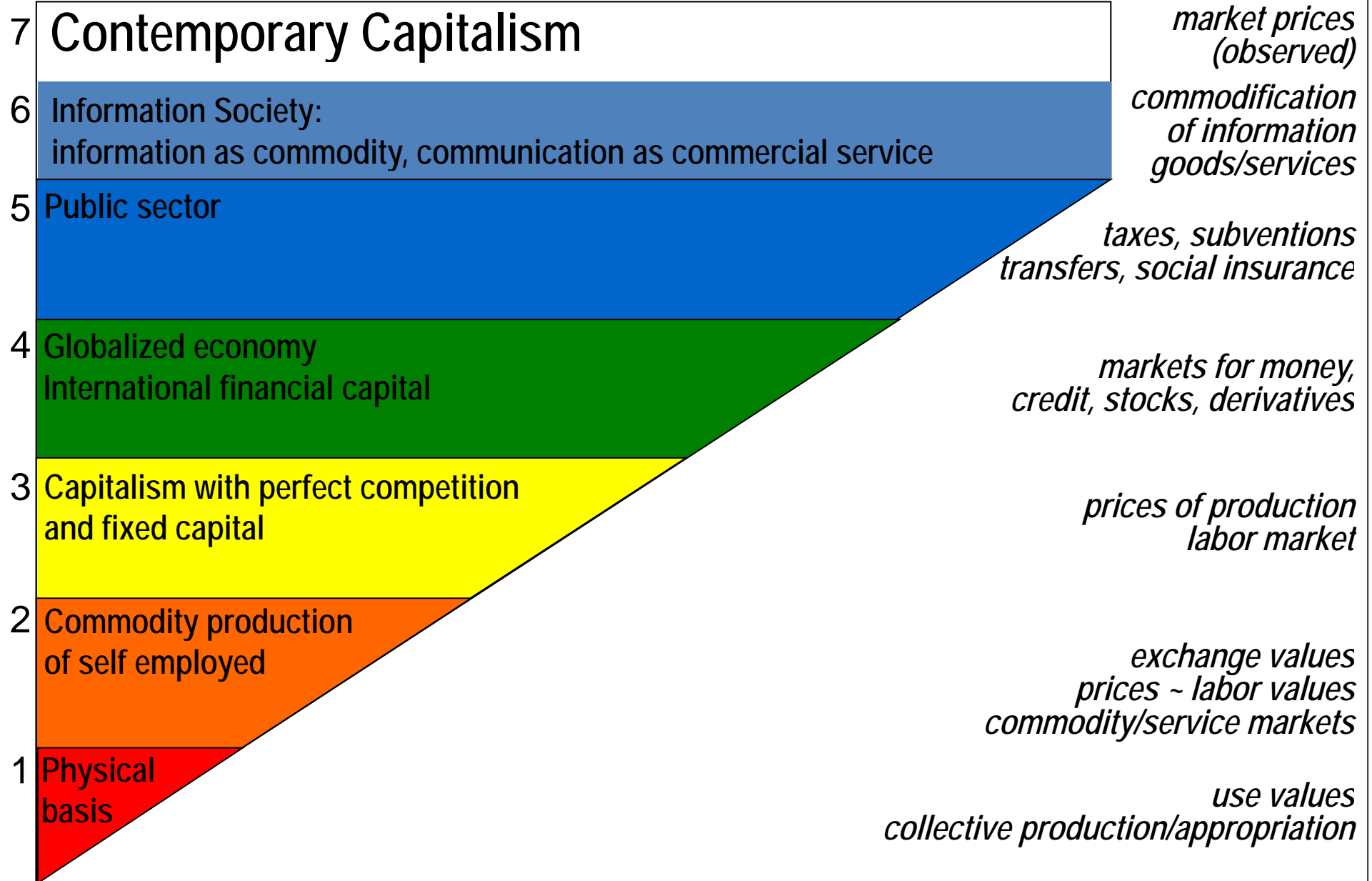
Including a public sector creates a tertiary distribution of income

Layer 6: Information society:

Commodification and Commercialization of cultural activities

- As already has happened in history with land and work, under the headline of „information society“ the market conquers the sector of cultural activities, writing, singing, dancing, chatting, performing any kind of arts, doing research etc.
- This is done by an efficient interaction of the economy, technology and law.
- Technology allows for freezing volatile information on a carrier of digital or analogue data and also reviving it. It transforms cultural activities into information goods, knowledge goods and cultural goods.
- By Law (e.g. Intellectual Property Rights) copying is forbidden. Therefore all properties of commodities are created and they can be exploited by private capital.
- Three kinds of markets have been established:
 - A market of data carriers with content (CDs, DVDs, tapes etc)
 - A market of communication services (mobile communication, Internet)
 - A market of devices (PCs, Laptops, TV-sets etc)

Economic Reality – A Complex Construction



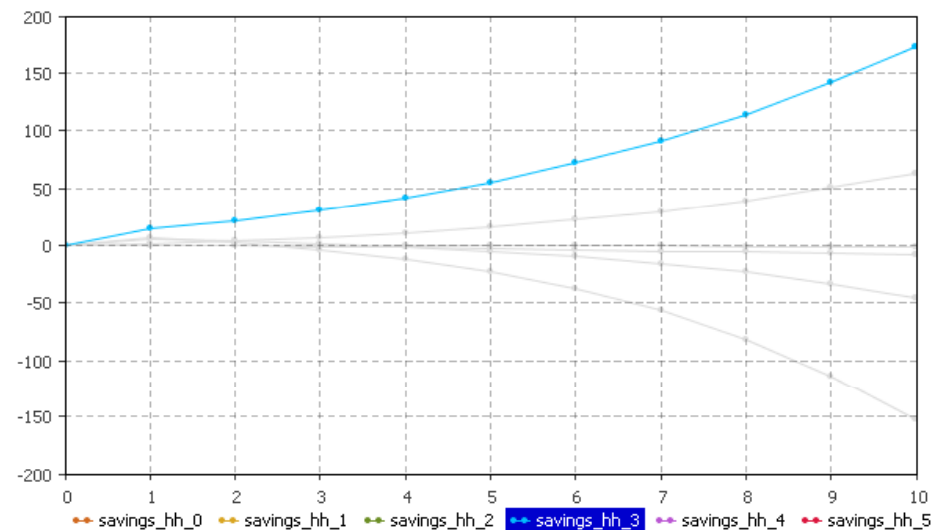
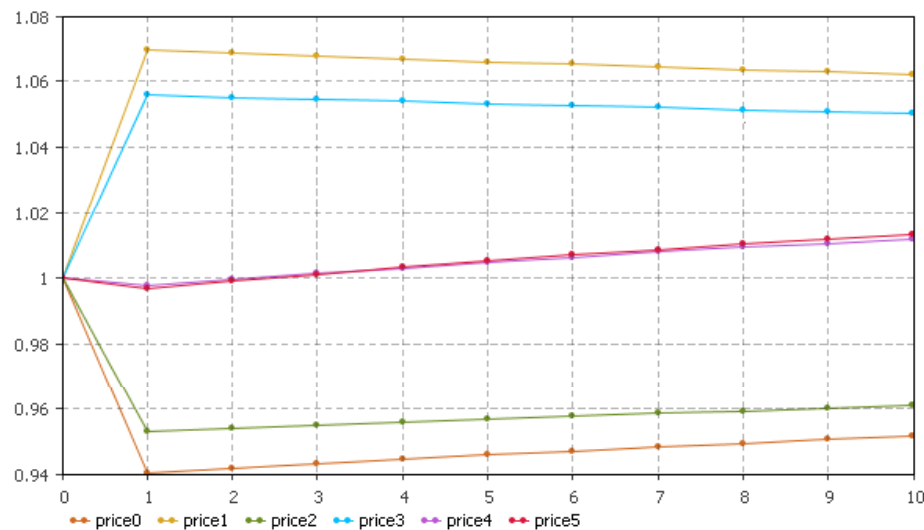
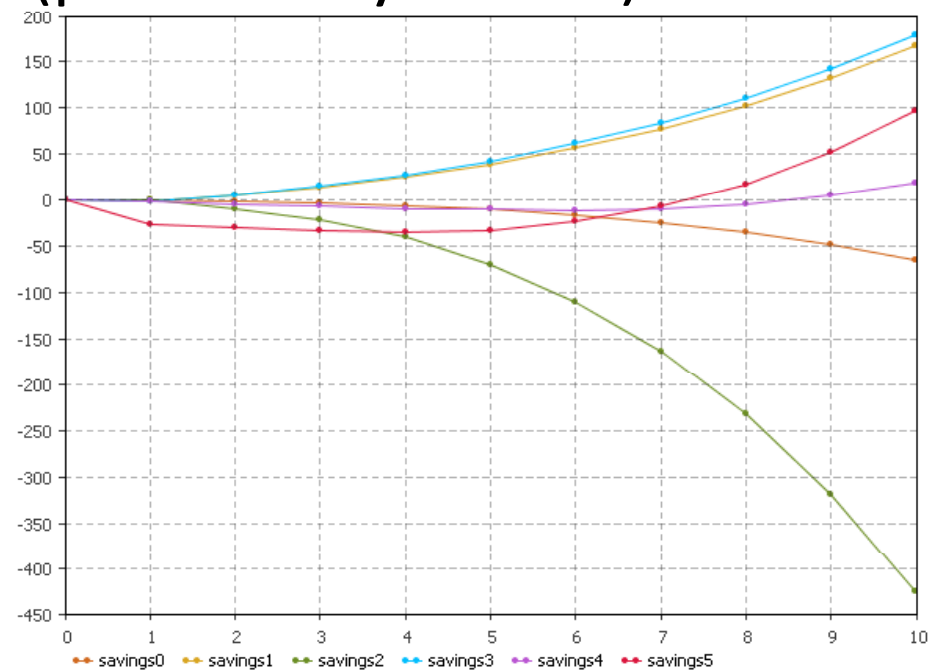
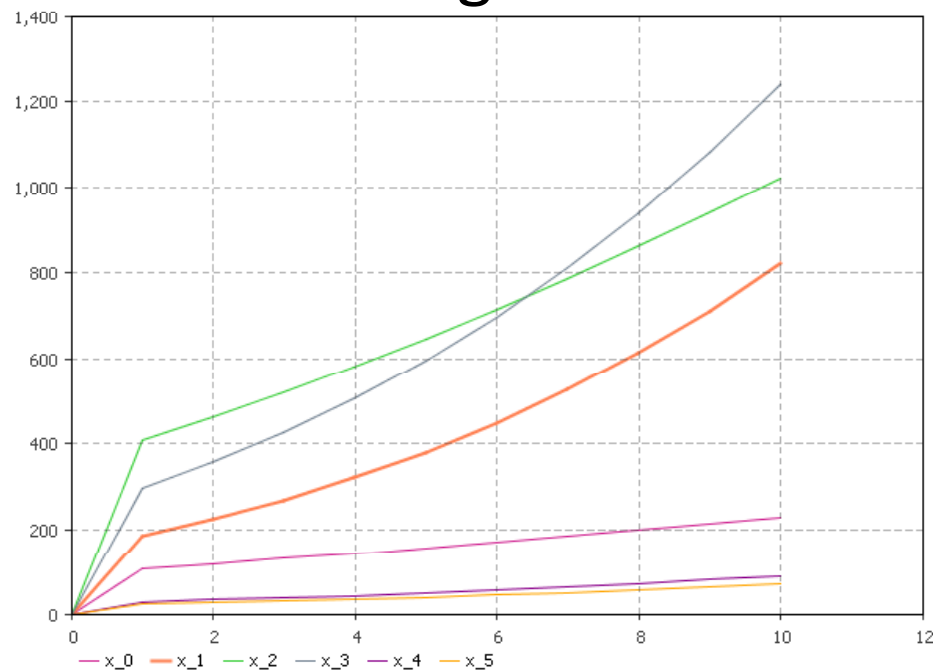
Layer 7: Contemporary capitalism

To approximate the system of contemporary capitalism, a dynamic input output model on stylized facts was constructed on two JAVA-based simulation platforms: ANYLOGIC (proprietary) and FABLES (free of charge). As a next step the model will be filled with actual data.

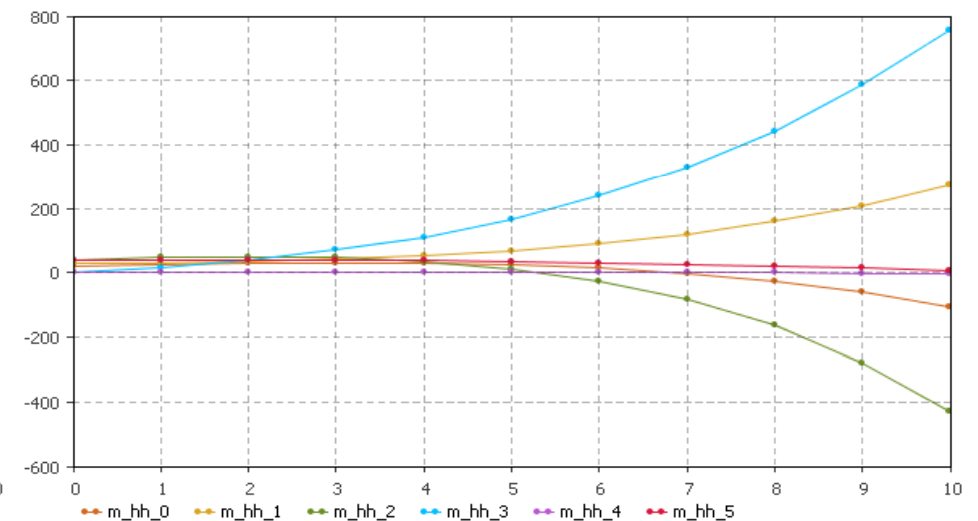
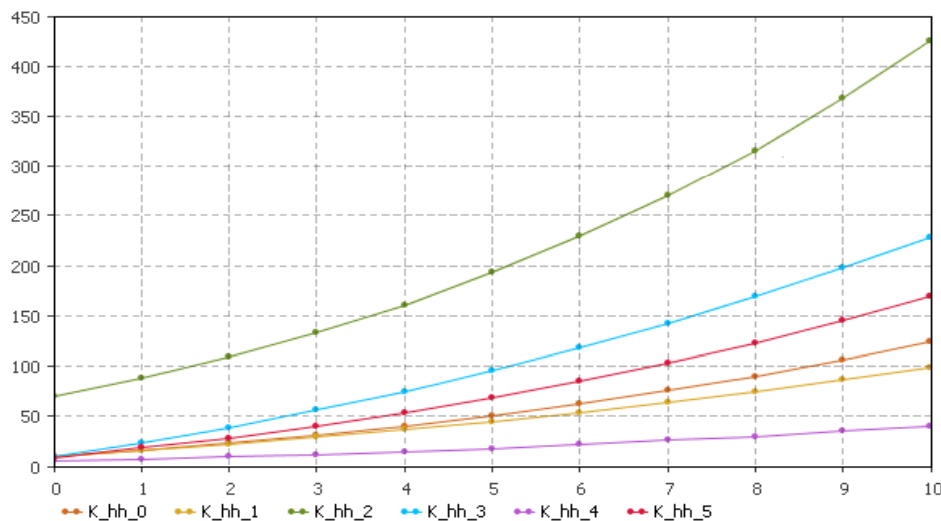
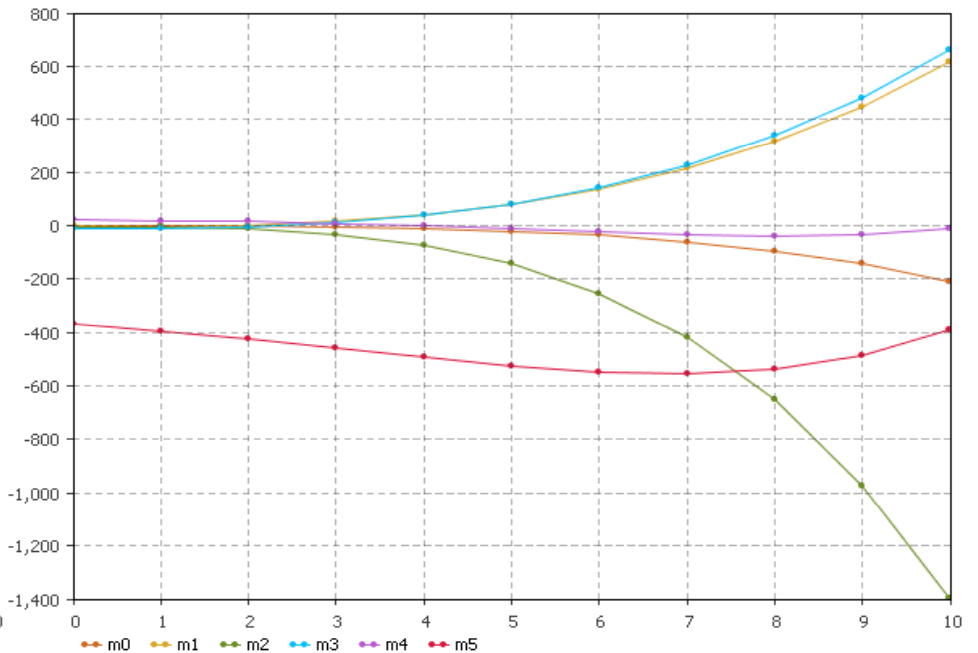
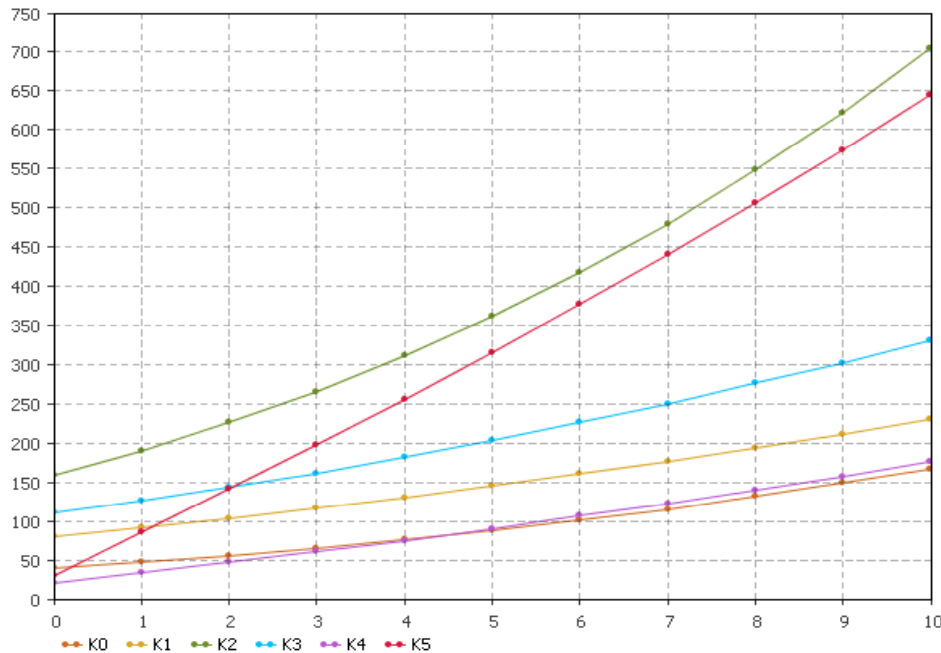
The following control variables allow for a change of the distribution of value added:

- r_b interest rate for credits
- r_l interest rate for assets at banks
- t_{ind} tax rate of indirect taxes
- $t_{profits}$ tax rate of profits
- t_{wages} tax rate on wages
- $deprec_rate$ depreciation rate (for the moment related to output, not to fixed capital).
- $leverage_factor$ limits the maximum amount of credits given by banks with respect to their financial assets.
- fraction of public investment on total investment

Output, savings, prices of six sectors of the economy and savings of households (preliminary results)



Capital stock and money/debt stock of each of the six sectors of the economy and of households (preliminary results)



Thanks for your attention

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