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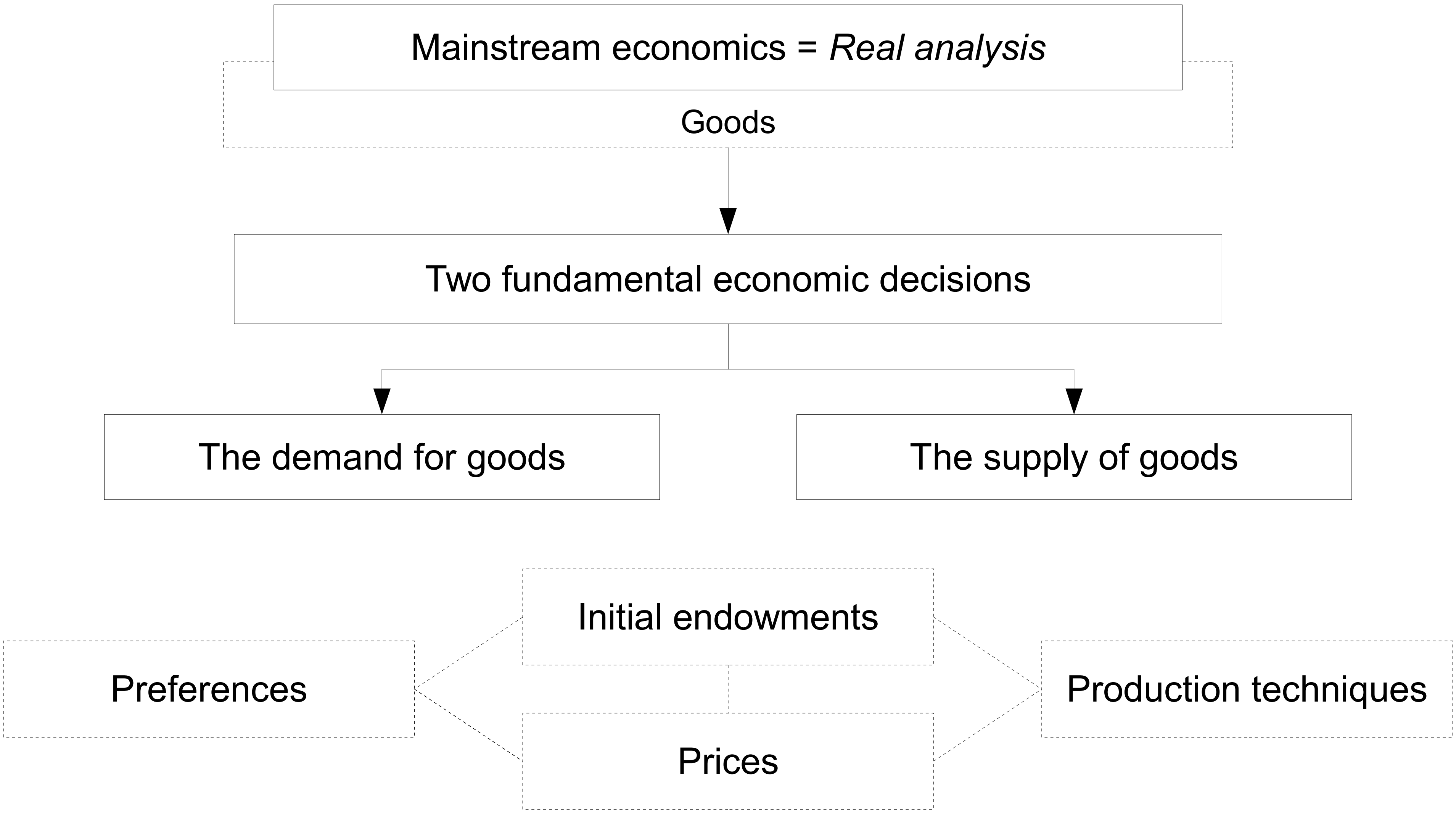
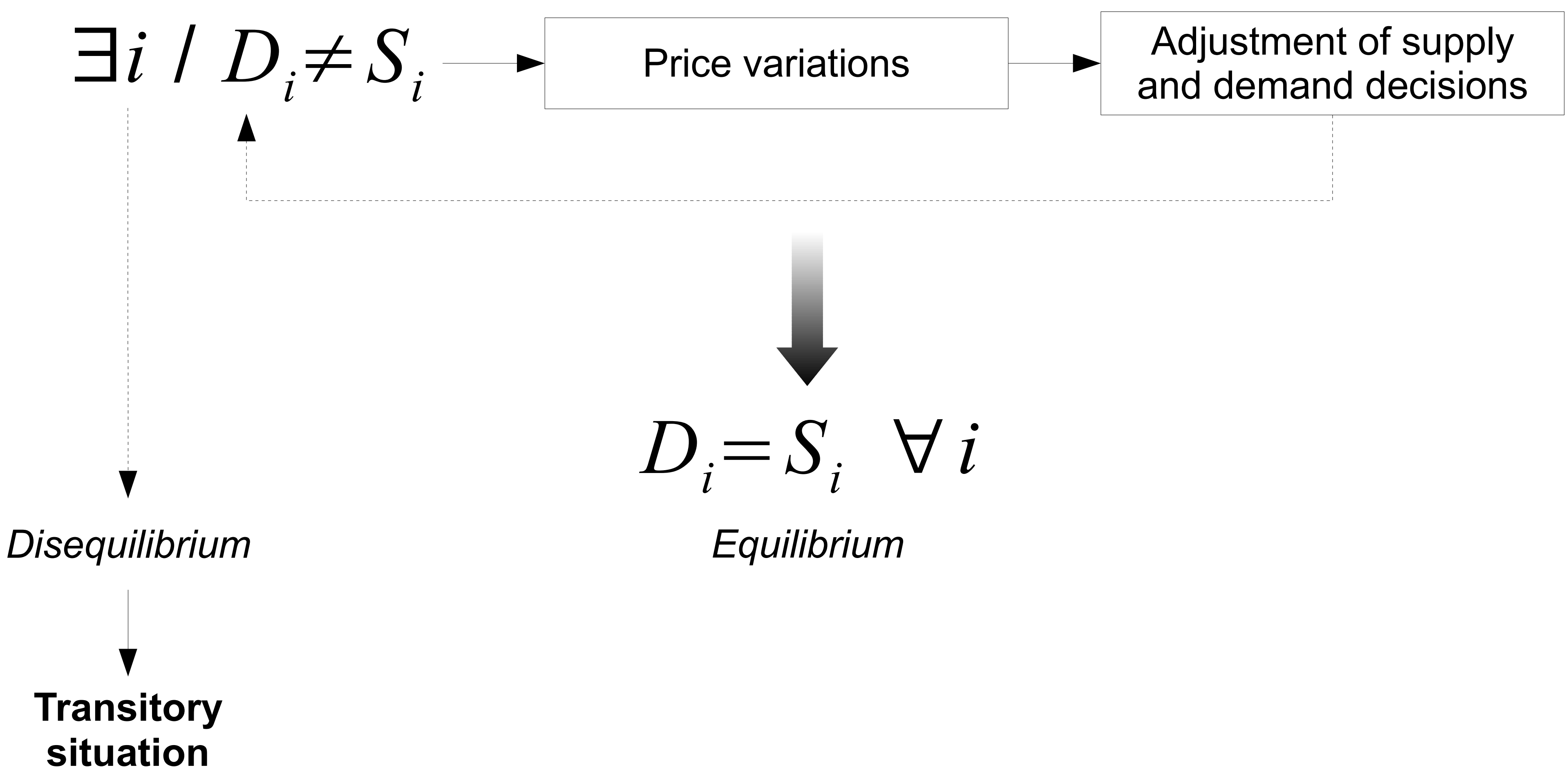
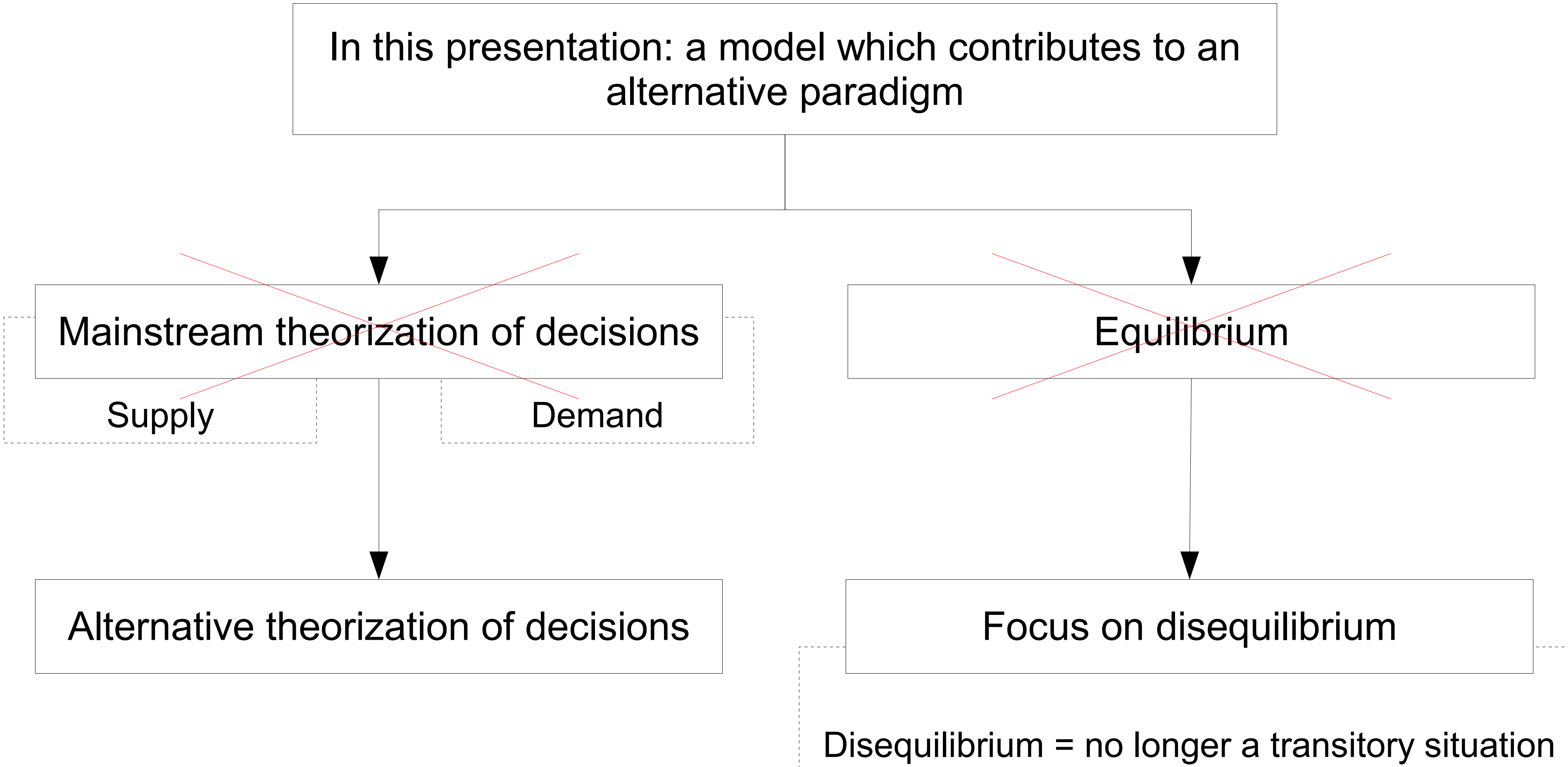
Economic decision-making, money and disequilibrium: A simplified 'benchmark' model

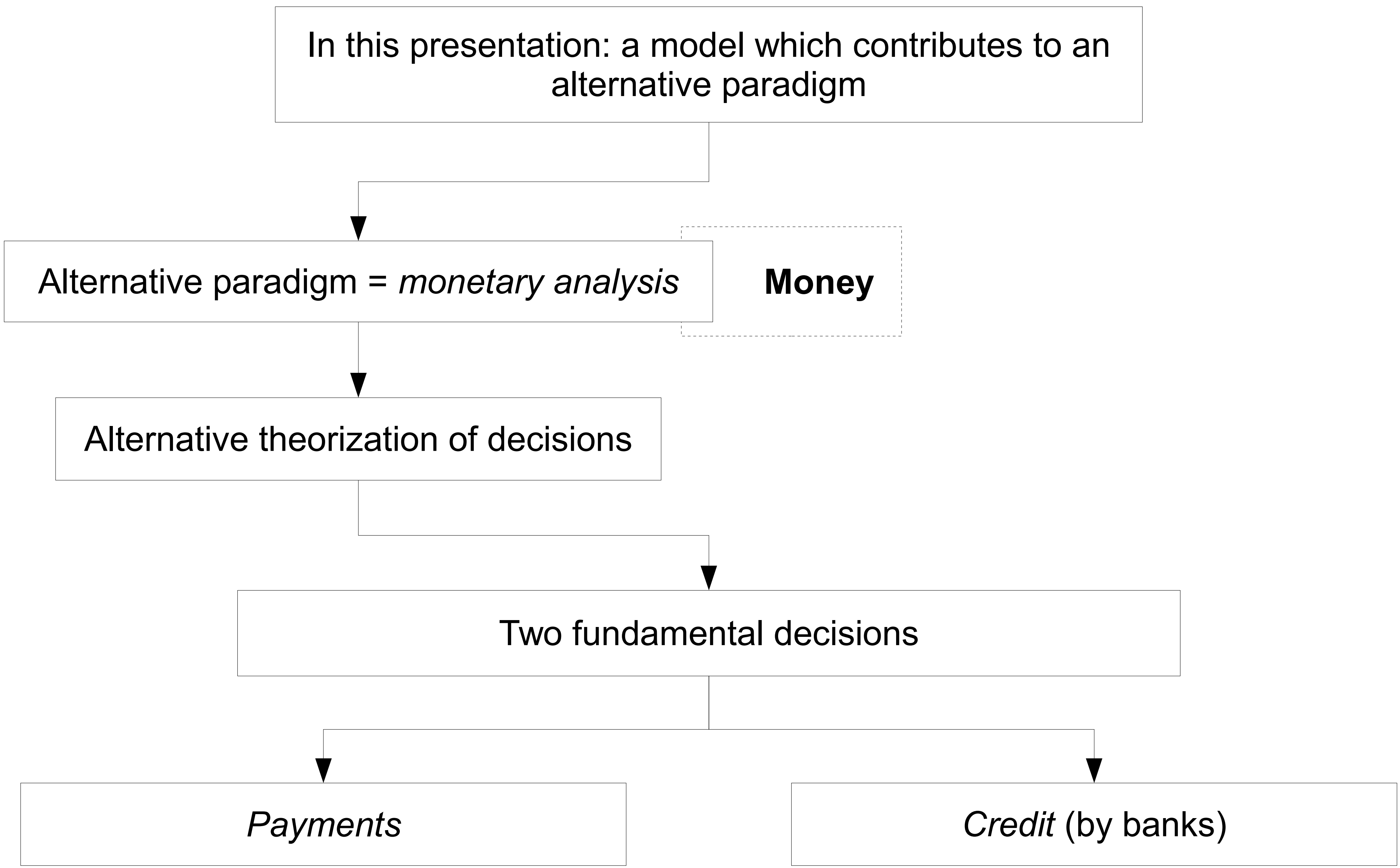
Rémi Stellian
remi.stellian@unidistance.ch

University of Fribourg and University of Grenoble
PhD student with the financial support of the Distance University of Switzerland
(Unidistance, FS-CH)

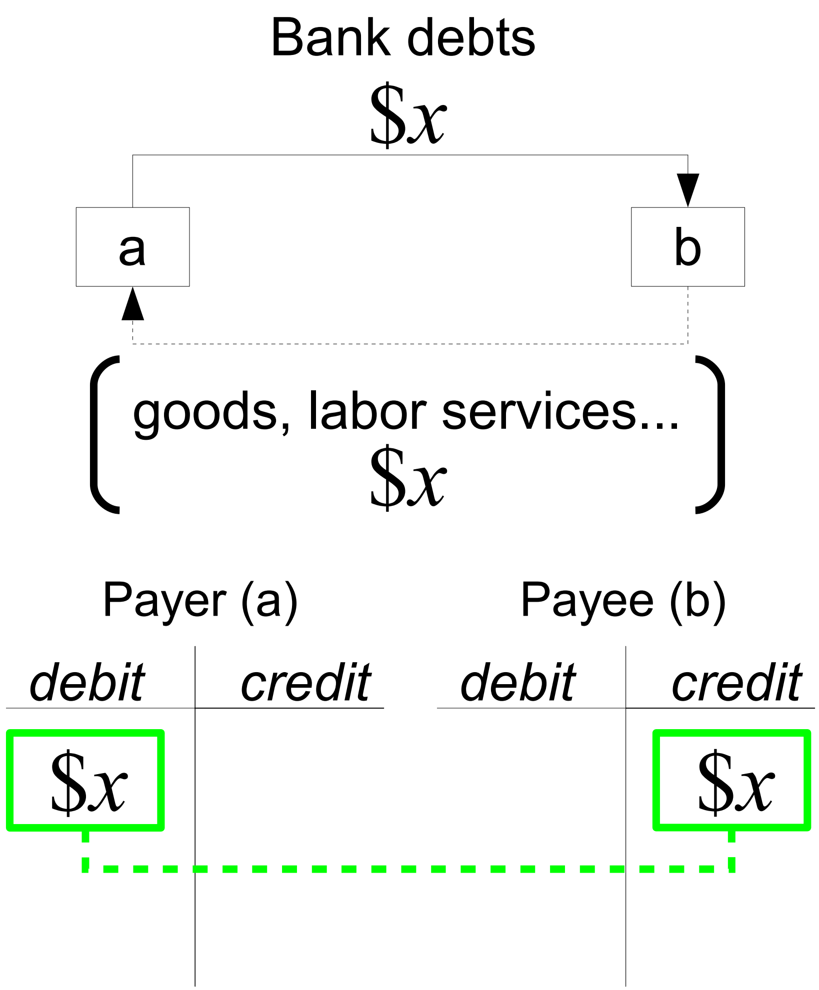

Mainstream economics = *Real analysis*
Goods
Two fundamental economic decisions
The demand for goods
The supply of goods
Initial endowments
Preferences
Production techniques
Prices


$\exists i \,/\, D_i \neq S_i$
Price variations
Adjustment of supply and demand decisions
$D_i = S_i \;\; \forall i$
Disequilibrium
Equilibrium
Transitory situation


In this presentation: a model which contributes to an alternative paradigm
Mainstream theorization of decisions
Supply
Demand
Equilibrium
Alternative theorization of decisions
Focus on disequilibrium
Disequilibrium = no longer a transitory situation

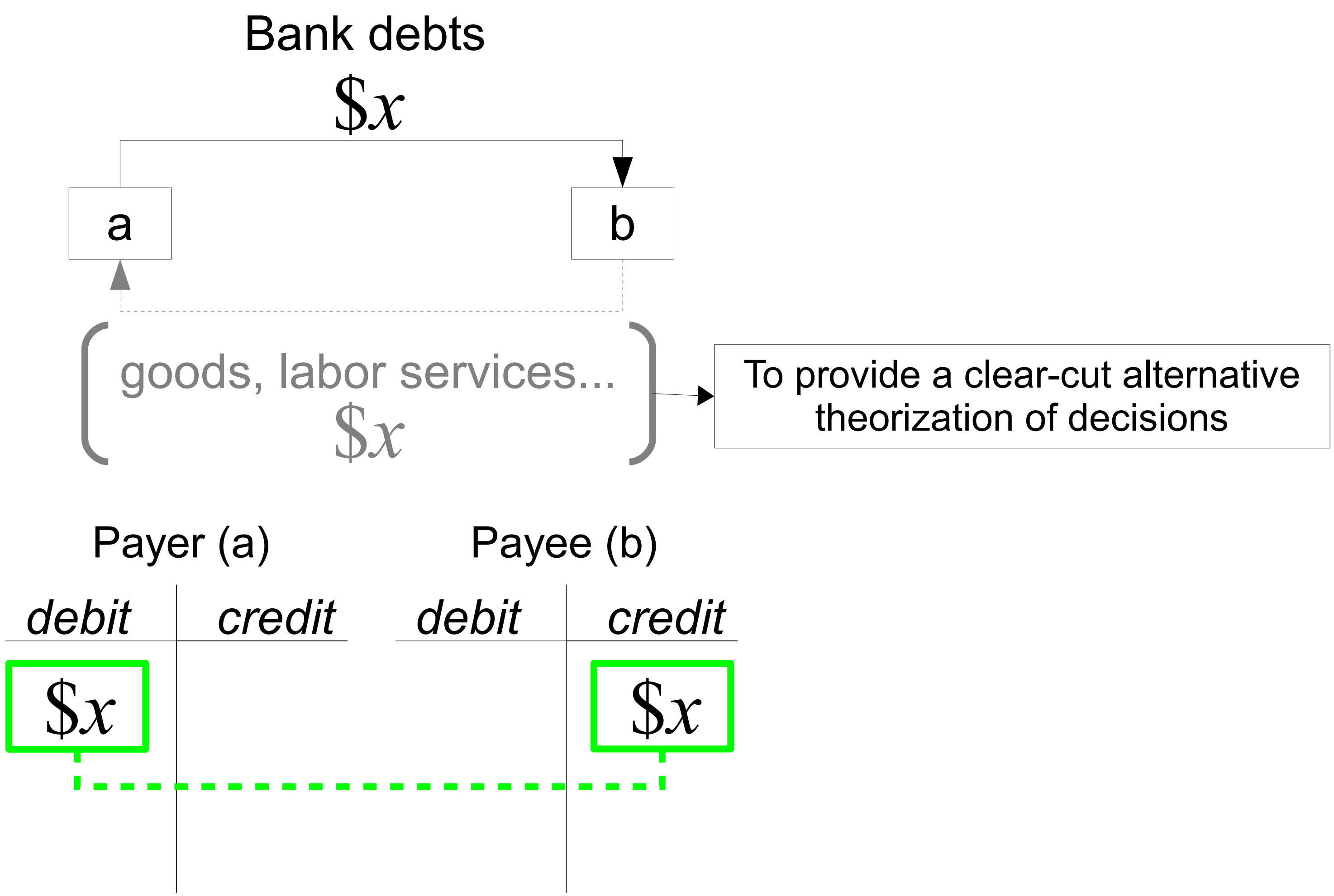

In this presentation: a model which contributes to an alternative paradigm
Alternative paradigm = *monetary analysis*
Money
Alternative theorization of decisions
Two fundamental decisions
Payments
Credit (by banks)

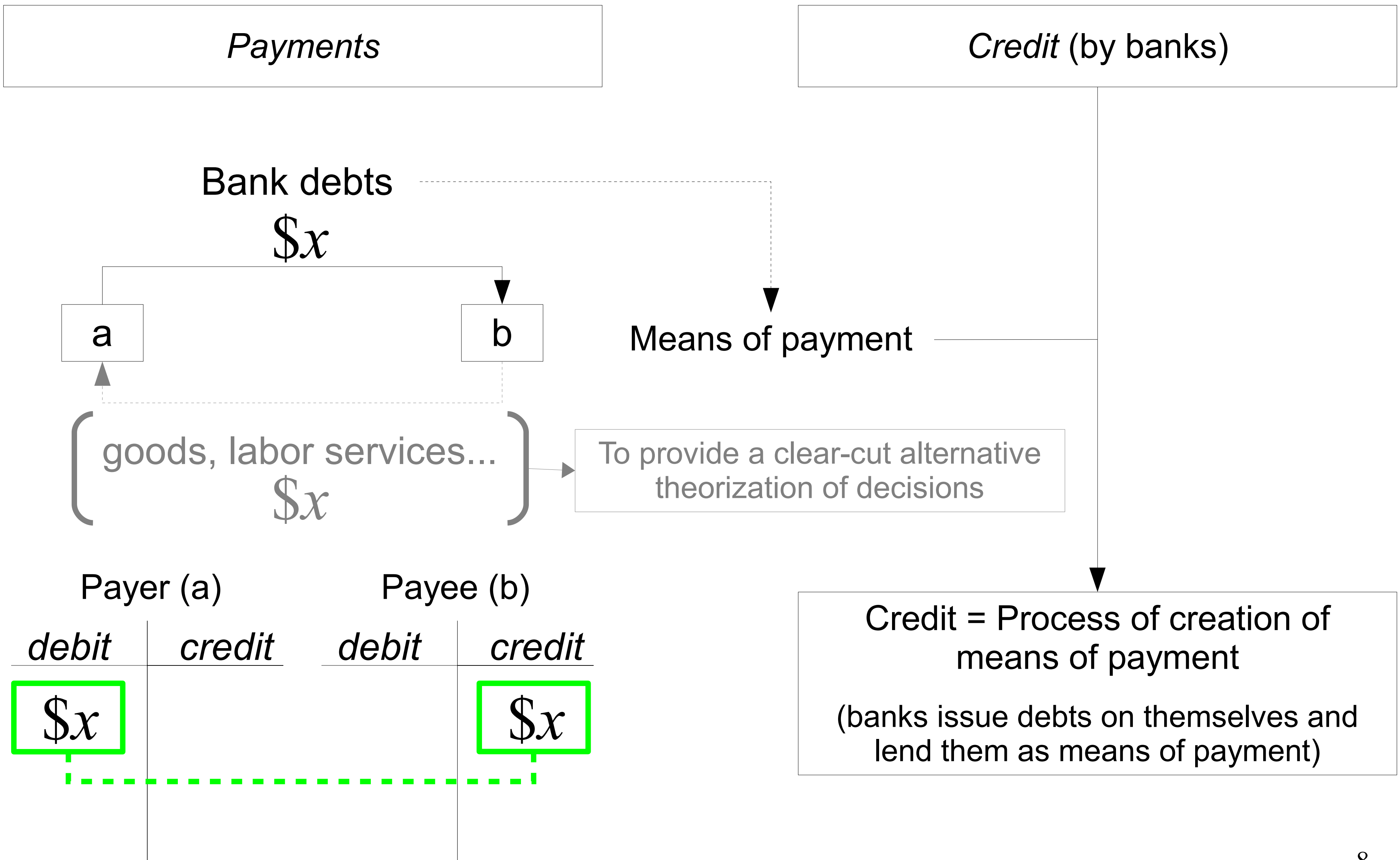
Payments	*Credit* (by banks)



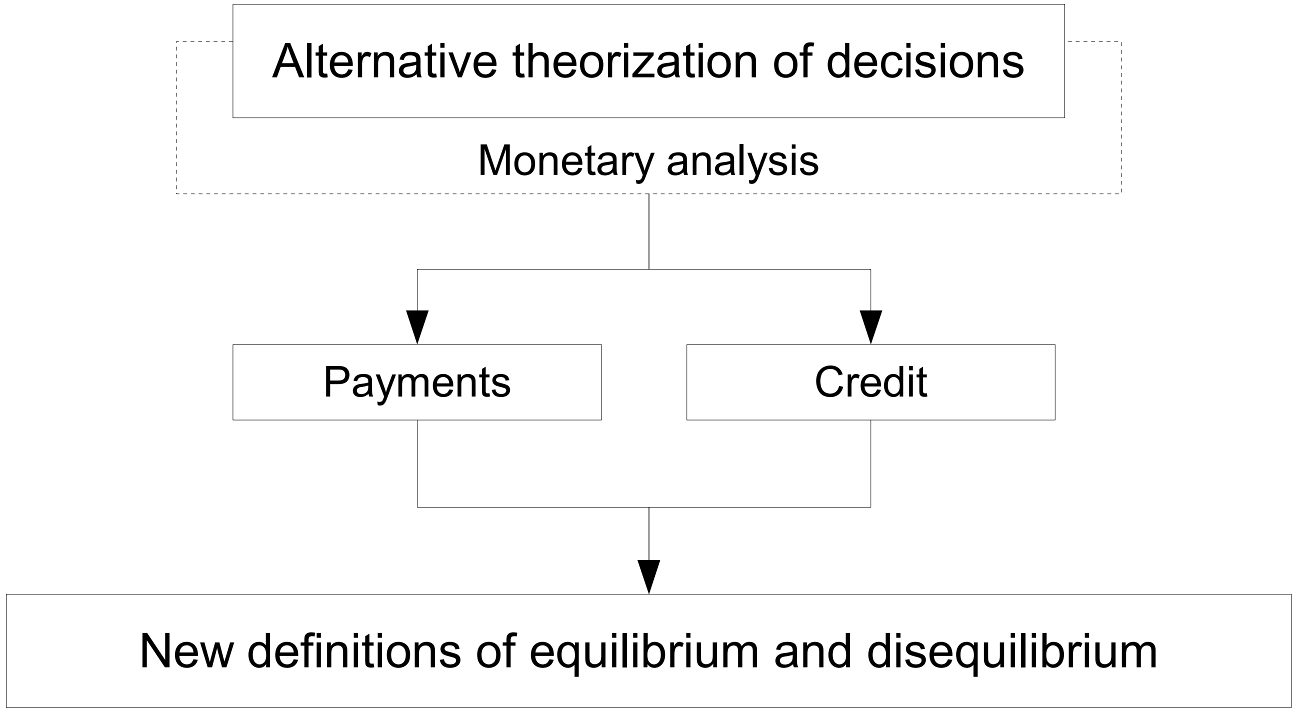
Payments

Credit (by banks)





Payments
Credit (by banks)
Bank debts
$x
a
b
Means of payment
goods, labor services...
$x
To provide a clear-cut alternative theorization of decisions
Payer (a)
Payee (b)
debit
credit
debit
credit
$x
$x
Credit = Process of creation of means of payment
(banks issue debts on themselves and lend them as means of payment)



$$D_i = S_i \quad \forall i$$

$$\exists i \; / \; D_i \neq S_i$$

→ Definitions *specific* to the theorization of decisions as in real analysis

Before the choice between real analysis and monetary analysis

(Dis-)Equilibrium

Economic decisions are (not) mutually compatible

(Milgate, 1988)

$$D_i = S_i \quad \forall i$$

Neither unsold stocks or unsatisfied needs

Mutual compatibility

Equilibrium

$$\exists i \ / \ D_i \neq S_i$$

Disequilibrium

Definition of equilibrium specific to monetary analysis

↓

The fulfillment of firms' expectations about the payments they benefit from

Definition of disequilibrium specific to monetary analysis

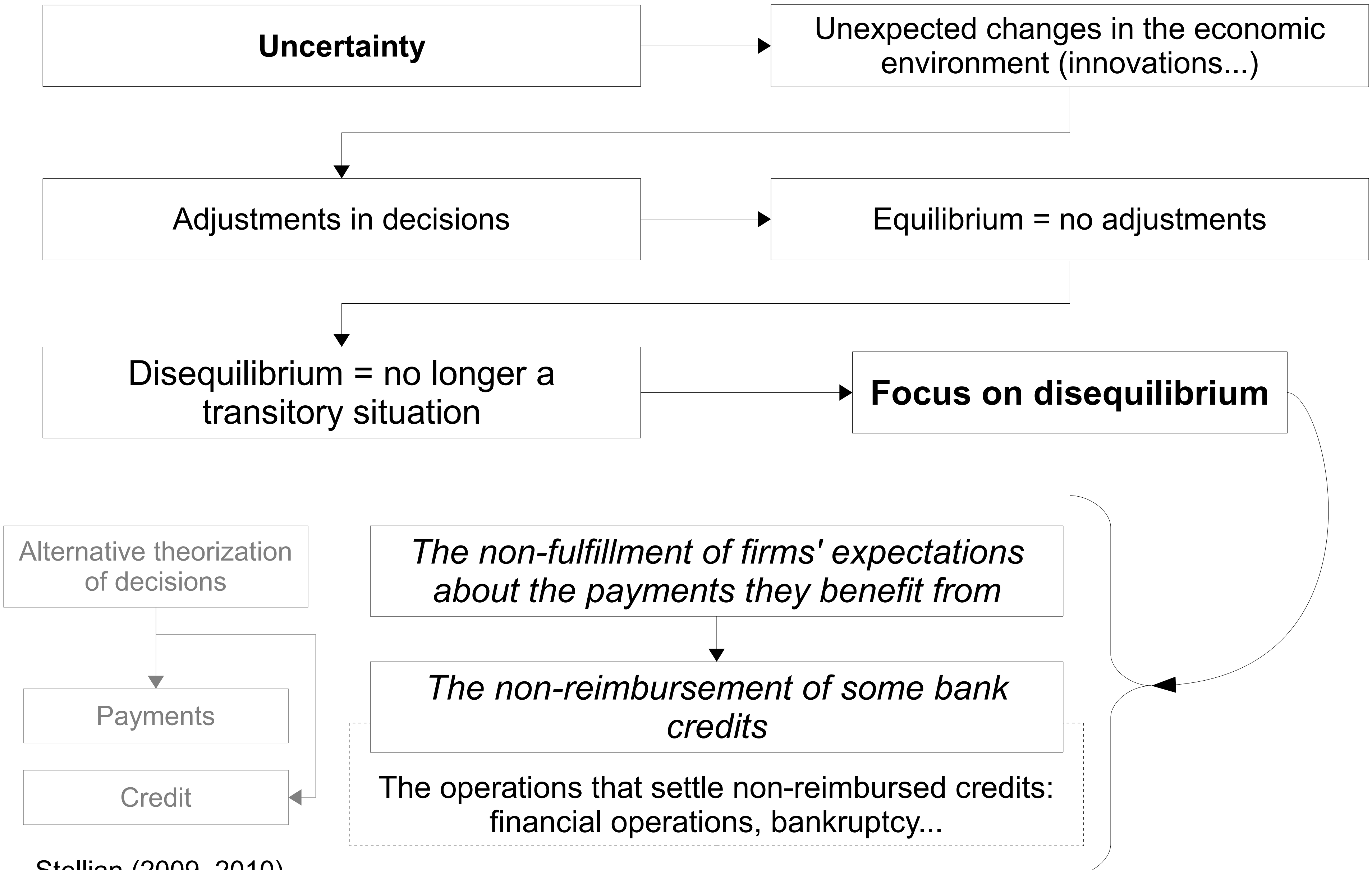
The non-fulfillment of firms' expectations about the payments they benefit from

↓

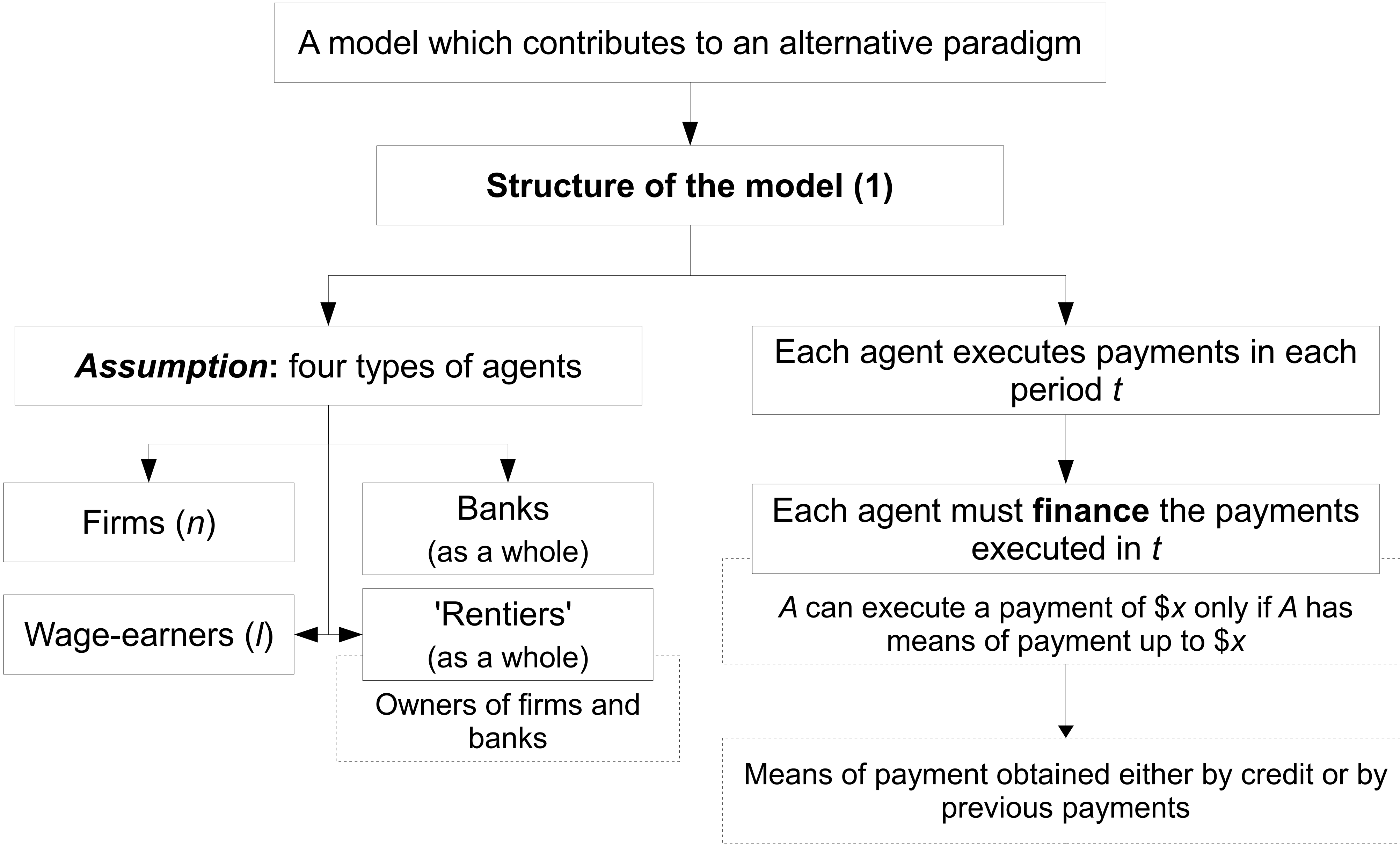
The non-reimbursement of some bank credits

The operations that settle non-reimbursed credits: financial operations, bankruptcy...

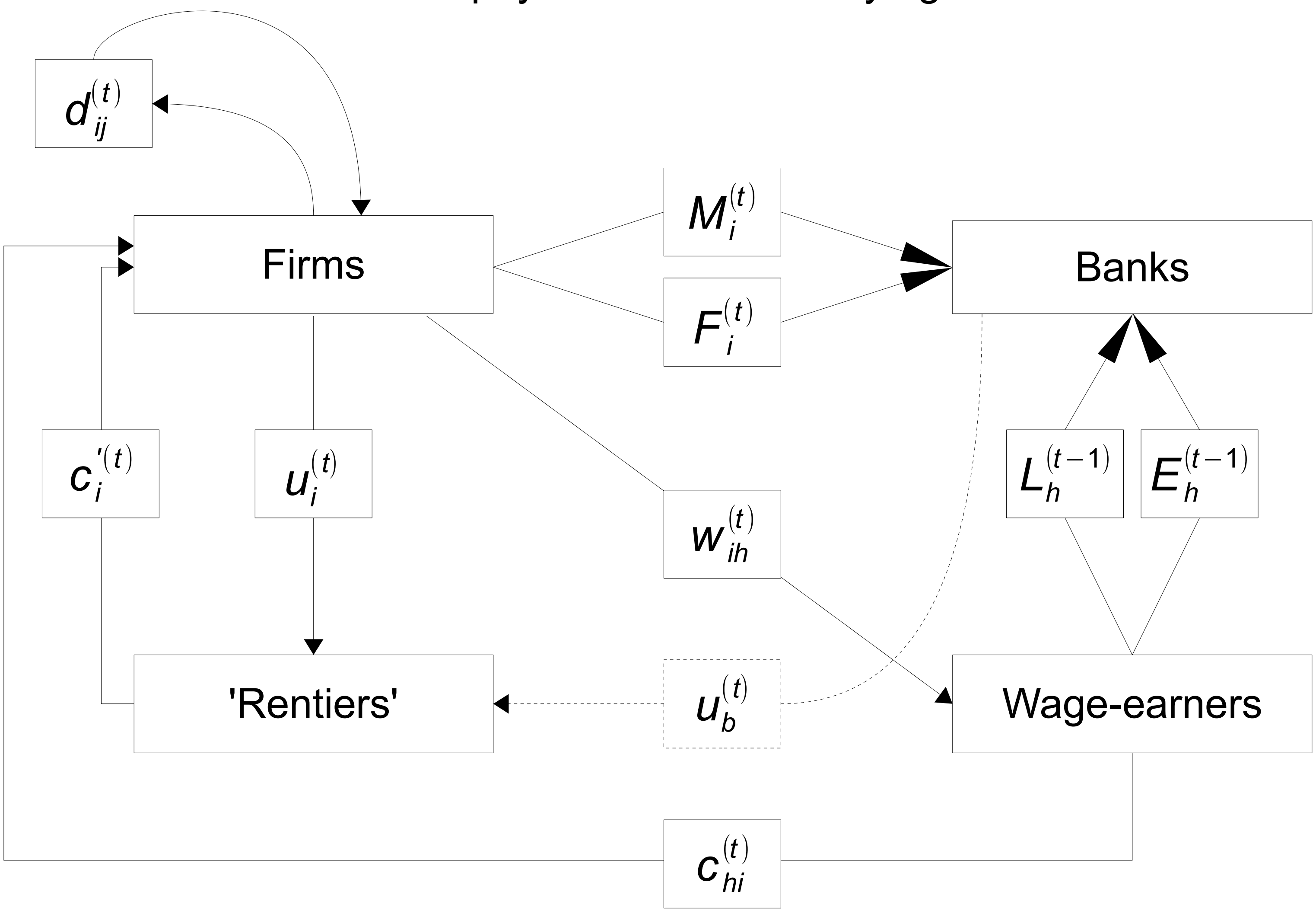
Stellian (2009, 2010)



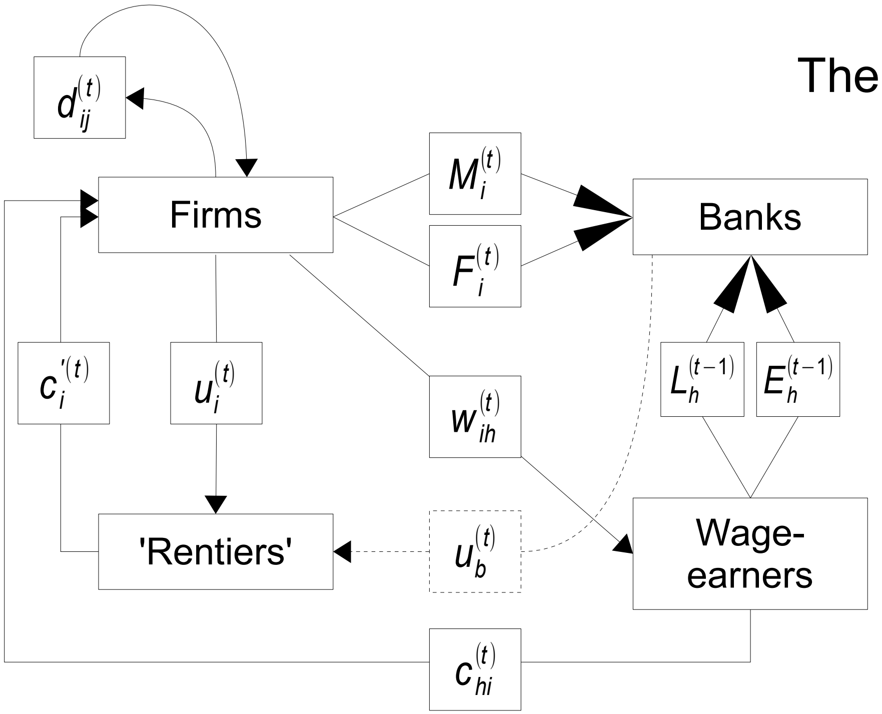
Stellian (2009, 2010)


A model which contributes to an alternative paradigm
Structure of the model (1)
Assumption: four types of agents
Firms (n)
Banks (as a whole)
Wage-earners (l)
'Rentiers' (as a whole)
Owners of firms and banks
Each agent executes payments in each period t
Each agent must finance the payments executed in t
A can execute a payment of $x only if A has means of payment up to $x
Means of payment obtained either by credit or by previous payments

The different payments executed by agents in t



Assumptions: No payments between rentiers and wage-earners
No payments between wage-earners themselves
No borrowing from rentiers, and thus no payments from rentiers to banks



The Financing of payments executed by a given firm i (in *t*)

$$M_i^{(t)} + \mu_i^{(t)} \Pi_i^{(t-1)} = \sum_{j=1}^{n} d_{ij}^{(t)} + \sum_{h=1}^{l} w_{ih}^{(t)}$$

Endogeneity of money (though not 'passive' banks)

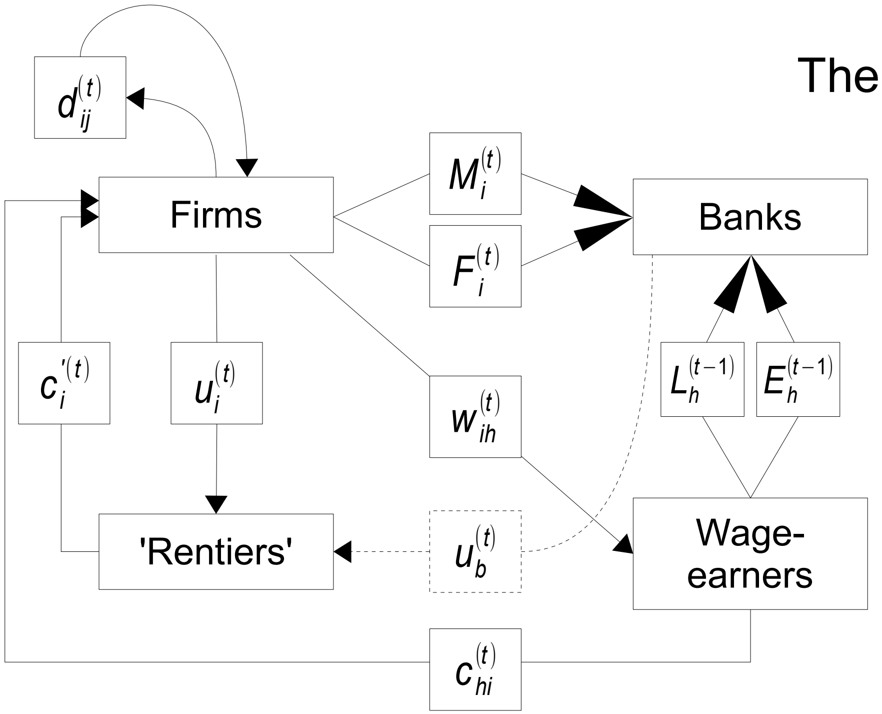
$$0 \leqslant \mu_i^{(t)} \leqslant 1$$

$$\Pi_i^{(t)} := R_i^{(t)} - \left(M_i^{(t)} + F_i^{(t)} \right)$$

$$R_i^{(t)} = \sum_{j=1}^{n} d_{ji}^{(t)} + \sum_{h=1}^{l} c_{hi}^{(t)} + c_i^{'(t)}$$

Assumption: every credit granted in *t* is completely reimbursed in *t* and interest charges are also paid in *t*, with the means of payment stemming from receipts in *t*

$$\forall i = 1; \cdots ; n$$



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Endogeneity of money
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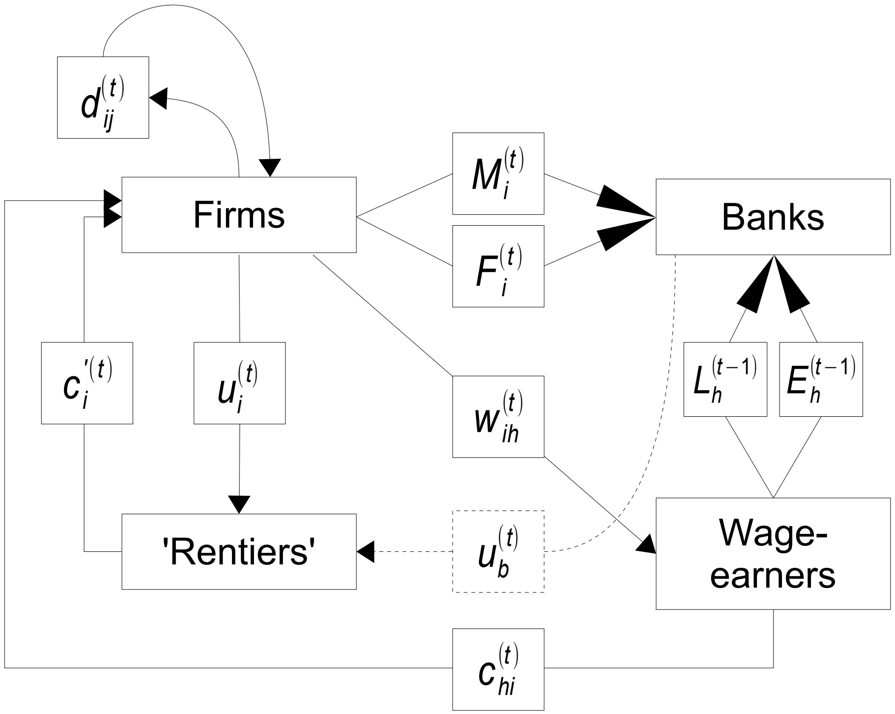
$$R_i^{(t)} = \sum_{j=1}^{n} d_{ji}^{(t)} + \sum_{h=1}^{l} c_{hi}^{(t)} + c_i^{'(t)}$$

$$u_i^{(t)} = \left(1 - \mu_i^{(t)} \right) \Pi_i^{(t-1)}$$

Assumption: the share of profit non-retained by *i* in *t*-1 is used for the payments of *i* to rentiers in *t*

Assumption: every credit granted in *t* is completely reimbursed in *t* and interest charges are also paid in *t*, with the means of payment stemming from receipts in *t*

$$\forall i = 1; \cdots; n$$



What if profit is negative?

$$M_i^{(t)}+\mu_i^{(t)}\Pi_i^{(t-1)}=\sum_{j=1}^{n}d_{ij}^{(t)}+\sum_{h=1}^{l}w_{ih}^{(t)}$$

$$\Leftrightarrow M_i^{(t)}=\sum_{j=1}^{n}d_{ij}^{(t)}+\sum_{h=1}^{l}w_{ih}^{(t)}-\mu_i^{(t)}\Pi_i^{(t-1)}$$

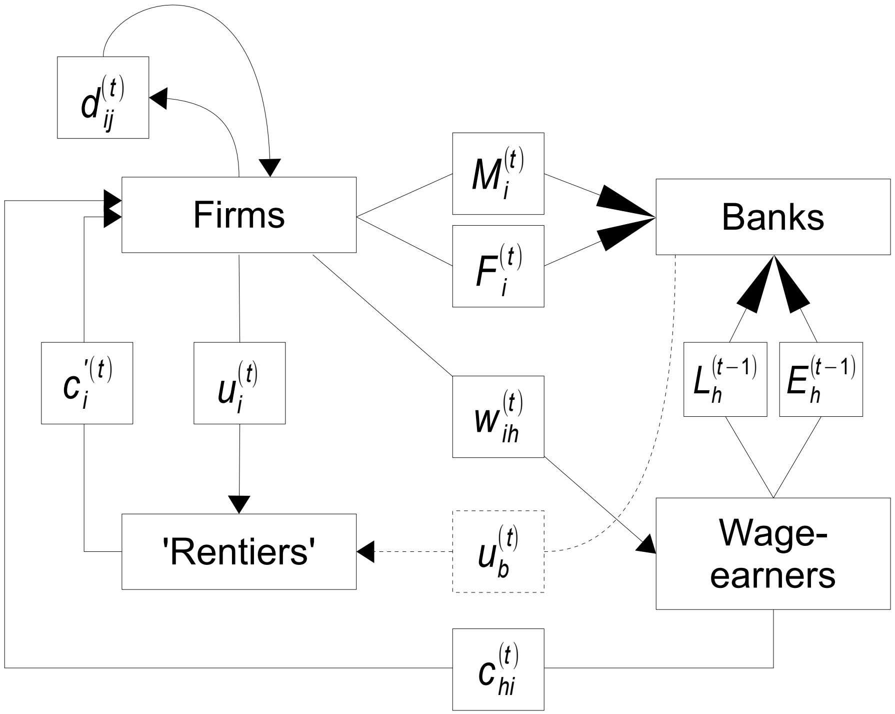
$$u_i^{(t)}=\left(1-\mu_i^{(t)}\right)\Pi_i^{(t-1)}\leqslant 0$$

Payment from rentiers to *i*

Assumption: the other part is settled by a payment form rentiers to *i* (emission of new shares)

Assumption: part of the negative balance in *t-1* is settled by credit in *t*

$$\forall i=1;\cdots;n$$



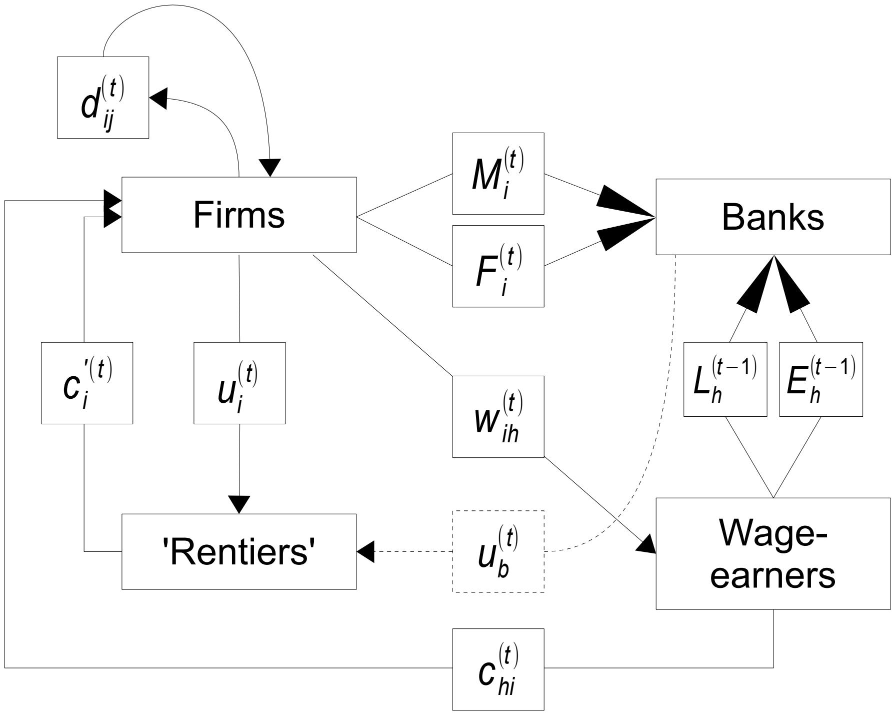
The financing of the payments executed by banks

$$u_b^{(t)} = \sum_{i=1}^{n} F_i^{(t-1)} + \sum_{h=1}^{l} E_h^{(t-1)}$$

The payments of banks to rentiers in *t* is executed with the means of payment received as interest charges in *t*-1

Assumption: all interest charges are distributed to rentiers

Assumption: credit granting/monitoring without cost



The financing of the payments executed by rentiers

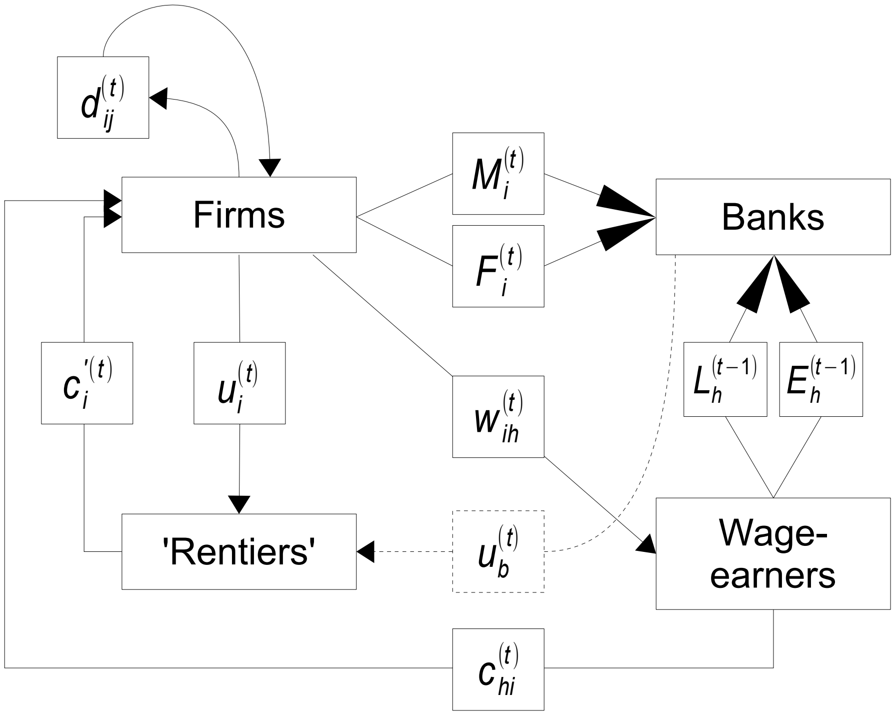
→ The amount of means of payments available in *t* for the payments to be executed by rentiers in *t*

$$Z'^{(t)} := \sum_{i=1}^{n} u_i^{(t)} + u_b^{(t)}$$

$$= \sum_{i=1}^{n} \left(1 - \mu_i^{(t)}\right) \Pi_i^{(t-1)} + \sum_{i=1}^{n} F_i^{(t-1)} + \sum_{h=1}^{l} E_h^{(t-1)}$$

Assumption: rentiers save part of their 'income'

$$\sum_{i=1}^{n} c_i^{'(t)} \leqslant Z'^{(t)}$$



The financing of the payments executed by a given wage-earner *h*

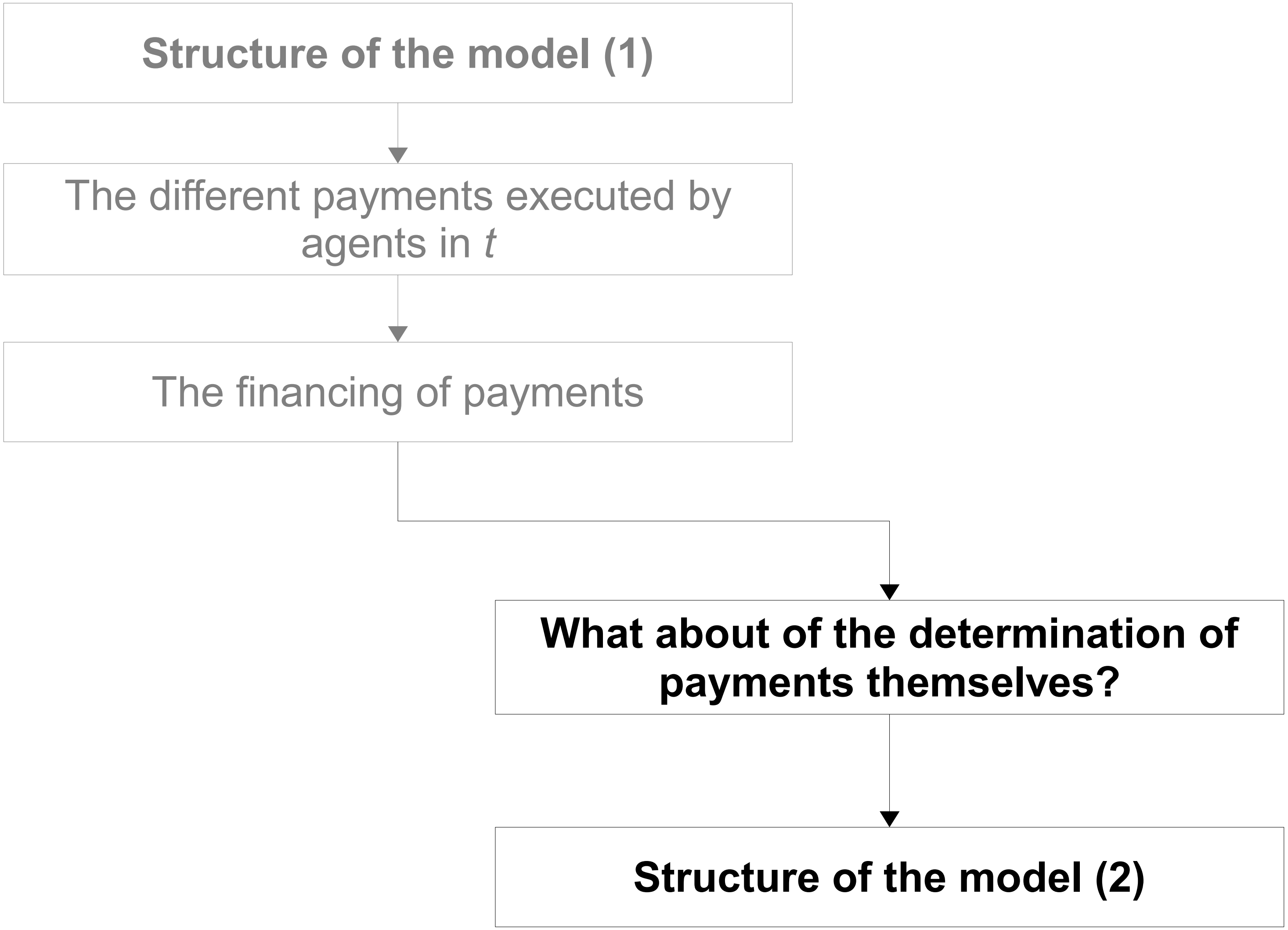
→ The amount of means of payments available in *t* for the payments to be executed by rentiers in *t*

Assumption: every credit granted to *h* in *t* is completely paid in *t*+1 and interest charges are also paid in *t*+1, with the means of payment stemming from wages

$$Z_h^{(t)} := \sum_{i=1}^{n} w_{ih}^{(t)} + L_h^{(t)} - \left(L_h^{(t-1)} + E_h^{(t-1)}\right)$$

Assumption: No savings from wage-earners

$$\sum_{i=1}^{n} c_{hi}^{(t)} = Z_h^{(t)} \quad \forall h = 1;\cdots;l$$


Structure of the model (1)
The different payments executed by agents in *t*
The financing of payments
What about of the determination of payments themselves?
Structure of the model (2)

What about of the determination of payments themselves?

↓

Structure of the model (2)

↓

Determination already introduced by the assumptions about finance

$$\left.\begin{matrix} M_i^{(t)} \\ F_i^{(t)} \end{matrix}\right\} \longrightarrow$$ Every credit granted in *t* is completely paid in *t* and interest charges are also paid in *t*, with the means of payment stemming from receipts in *t*

$$u_i^{(t)} = \left(1 - \mu_i^{(t)}\right) \Pi_i^{(t-1)}$$

$$u_b^{(t)} = \sum_{j=1}^{n} F_i^{(t-1)} + \sum_{h=1}^{l} E_h^{(t-1)}$$

$$\left.\begin{matrix} L_h^{(t)} \\ E_h^{(t)} \end{matrix}\right\} \longrightarrow$$ Every credit granted in *t* is completely paid in *t*+1 and interest charges are also paid in *t*+1, with the means of payment stemming from wages

What about of the determination of payments themselves?

Structure of the model (2)

What about the other payments?

$d_{ij}^{(t)}$

$w_{ih}^{(t)}$

$c_i^{'(t)}$

$c_{hi}^{(t)}$

What about of the determination of payments themselves?

Structure of the model (2)

What about the other payments? → Four additional assumptions

$d_{ij}^{(t)}$ → $d_{ij}^{(t)} = \underline{d}_{ij}\left(\widetilde{R}_i^{(t)}\right)$

$w_{ih}^{(t)}$ → $w_{ih}^{(t)} = \underline{w}_{ih}\left(\widetilde{R}_i^{(t)}\right)$

$\widetilde{R}_i^{(t)}$ → Receipts expected by *i* in *t*

$c_i^{'(t)}$ → $c_i^{'(t)} = \underline{c}_i^{'}\left(Z^{'(t)}\right)$

$c_{hi}^{(t)}$ → $c_{hi}^{(t)} = \underline{c}_{hi}\left(Z_h^{(t)}\right)$

Let us define: $\widetilde{R}^{(t)} := \begin{pmatrix} \widetilde{R}_1^{(t)} \\ \widetilde{R}_2^{(t)} \\ \vdots \\ \widetilde{R}_n^{(t)} \end{pmatrix}$; $F^{(t)} := \begin{pmatrix} F_1^{(t)} \\ F_2^{(t)} \\ \vdots \\ F_n^{(t)} \end{pmatrix}$; $L^{(t)} := \begin{pmatrix} L_1^{(t)} \\ L_2^{(t)} \\ \vdots \\ L_l^{(t)} \end{pmatrix}$; $E^{(t)} := \begin{pmatrix} L_1^{(t)} \\ E_2^{(t)} \\ \vdots \\ E_l^{(t)} \end{pmatrix}$

And: $\Theta^{(t)} := \left\{ \widetilde{R}^{(t)} ; F^{(t)} ; L^{(t)} ; F^{(t-1)} ; L^{(t-1)} ; E^{(t-1)} \right\}$ $\left(\Theta^{(0)} = \left\{ \widetilde{R}^{(0)} ; F^{(0)} ; L^{(0)} \right\} \right)$

We can show:

$$\Theta^{(t)} \dashrightarrow \begin{cases} d_{ij}^{(t)} \\ w_{ih}^{(t)} \\ u_b^{(t)} \\ c_{hi}^{(t)} \end{cases} \qquad \forall i, j = 1; \cdots ; n \quad \forall h = 1; \cdots ; l$$

$$\Theta^{(0)} ; \Theta^{(1)} ; \Theta^{(2)} ; \cdots ; \Theta^{(t)} \dashrightarrow \begin{cases} M_i^{(t)} \\ c_i'^{(t)} \end{cases} \qquad \forall i = 1; \cdots ; n$$

$$\Theta^{(0)} ; \Theta^{(1)} ; \Theta^{(2)} ; \cdots ; \Theta^{(t-1)} \dashrightarrow u_i^{(t)}$$

$$? \begin{cases} \widetilde{R}^{(t)} \\ F^{(t)} \\ L^{(t)} \\ E^{(t)} \end{cases} \longrightarrow \Theta^{(t)} := \left\{ \widetilde{R}^{(t)}; F^{(t)}; L^{(t)}; F^{(t-1)}; L^{(t-1)}; E^{(t-1)} \right\} \quad \forall t$$

Disequilibrium $\begin{cases} \widetilde{R}^{(t)} \\ F^{(t)} \\ L^{(t)} \\ E^{(t)} \end{cases}$ → $\Theta^{(t)} := \left\{ \widetilde{R}^{(t)} ; F^{(t)} ; L^{(t)} ; F^{(t-1)} ; L^{(t-1)} ; E^{(t-1)} \right\} \quad \forall t$

↓

Non-fulfillment of receipts + credits non-reimbursed → Each variable in *t* is the result of the adjustment of the same variable in *t*-1 with respect to disequilibrium

$$\widetilde{R}_i^{(t)} = \widetilde{R}_i^{(t-1)} + r_i \left(R_i^{(t-1)} - \widetilde{R}_i^{(t-1)} \right) \quad \forall i = 1 ; \cdots ; n$$

Disequilibrium whenever ≠ 0

Coefficient of adjustment of expected receipts with respect to disequilibrium in the previous period

$$r_i > 0$$

$$\Leftrightarrow \widetilde{R}_i^{(t)} = \left(1 - r_i \right) \widetilde{R}_i^{(t-1)} + r_i R_i^{(t-1)}$$

Disequilibrium $\begin{cases} \widetilde{R}^{(t)} \\ F^{(t)} \\ L^{(t)} \\ E^{(t)} \end{cases}$ → $\Theta^{(t)} := \left\{ \widetilde{R}^{(t)}; F^{(t)}; L^{(t)}; F^{(t-1)}; L^{(t-1)}; E^{(t-1)} \right\} \quad \forall t$

Non-fulfillment of receipts + credits non-reimbursed → Each variable in *t* is the result of the adjustment of the same variable in *t*-1 with respect to disequilibrium

$$F_i^{(t)} = F_i^{(t-1)} + f_i \left[R_i^{(t-1)} - \left(M_i^{(t-1)} + F_i^{(t-1)} \right) \right] \quad \forall i = 1; \cdots; n$$

$$f_i > 0$$

Disequilibrium whenever ≠ 0

Coefficient of adjustment of interest charges with respect to disequilibrium in the previous period

(banks are not 'passive lenders')

$$\Leftrightarrow F_i^{(t)} = \left(1 - f_i \right) F_i^{(t-1)} + f_i \left(R_i^{(t-1)} - M_i^{(t-1)} \right)$$

Disequilibrium $\begin{cases} \widetilde{R}^{(t)} \\ F^{(t)} \\ L^{(t)} \\ E^{(t)} \end{cases}$ → $\Theta^{(t)} := \left\{ \widetilde{R}^{(t)} ; F^{(t)} ; L^{(t)} ; F^{(t-1)} ; L^{(t-1)} ; E^{(t-1)} \right\} \quad \forall t$

Non-fulfillment of receipts + credits non-reimbursed → Each variable in *t* is the result of the adjustment of the same variable in *t*-1 with respect to disequilibrium

$$L_h^{(t)} = L_h^{(t-1)} + \delta_h \left[\sum_{i=1}^{n} w_{ih}^{(t-1)} - \left(L_h^{(t-1)} + E_h^{(t-1)} \right) \right] \quad \forall h = 1 ; \cdots ; l$$

Disequilibrium whenever ≠ 0

$$\delta_h > 0$$

Coefficient of adjustment of credit with respect to disequilibrium in the previous period

$$\Leftrightarrow L_h^{(t)} = \left(1 - \delta_h \right) L_h^{(t-1)} + \delta_h \left(\sum_{i=1}^{n} w_{ih}^{(t-1)} - E_h^{(t-1)} \right)$$

Disequilibrium $\begin{cases} \widetilde{R}^{(t)} \\ F^{(t)} \\ L^{(t)} \\ E^{(t)} \end{cases}$ → $\Theta^{(t)} := \left\{ \widetilde{R}^{(t)}; F^{(t)}; L^{(t)}; F^{(t-1)}; L^{(t-1)}; E^{(t-1)} \right\} \quad \forall t$

↓

Non-fulfillment of receipts + credits non-reimbursed → Each variable in *t* is the result of the adjustment of the same variable in *t*-1 with respect to disequilibrium

$$E_h^{(t)} = E_h^{(t-1)} + e_h \left[\sum_{i=1}^{n} w_{ih}^{(t-1)} - \left(L_h^{(t-1)} + E_h^{(t-1)} \right) \right] \quad \forall h = 1; \cdots; l$$

Disequilibrium whenever ≠ 0

$$\delta_h > 0$$

Coefficient of adjustment of interest charges with respect to disequilibrium in the previous period

$$\Leftrightarrow E_h^{(t)} = \left(1 - e_h\right) E_h^{(t-1)} + e_h \left(\sum_{i=1}^{n} w_{ih}^{(t-1)} - L_h^{(t-1)} \right)$$

$$\widetilde{R}_i^{(t)} = \left(1 - r_i\right) \widetilde{R}_i^{(t-1)} + r_i R_i^{(t-1)}$$

$$F_i^{(t)} = \left(1 - f_i\right) F_i^{(t-1)} + f_i \left(R_i^{(t-1)} - M_i^{(t-1)}\right)$$

$$L_h^{(t)} = \left(1 - \delta_h\right) L_h^{(t-1)} + \delta_h \left(\sum_{i=1}^{n} w_{ih}^{(t-1)} - E_h^{(t-1)}\right)$$

$$E_h^{(t)} = \left(1 - e_h\right) E_h^{(t-1)} + e_h \left(\sum_{i=1}^{n} w_{ih}^{(t-1)} - L_h^{(t-1)}\right)$$

***We can show*:**

$$\Theta^{(0)} \rightarrow \Theta^{(1)} \rightarrow \Theta^{(2)} \rightarrow \cdots \rightarrow \Theta^{(t)}$$

Disequilibrium

$$\widetilde{R}_i^{(t)} = \left(1 - r_i\right)\widetilde{R}_i^{(t-1)} + r_i R_i^{(t-1)}$$

$$F_i^{(t)} = \left(1 - f_i\right)F_i^{(t-1)} + f_i\left(R_i^{(t-1)} - M_i^{(t-1)}\right)$$

$$L_h^{(t)} = \left(1 - \delta_h\right)L_h^{(t-1)} + \delta_h\left(\sum_{i=1}^{n} w_{ih}^{(t-1)} - E_h^{(t-1)}\right)$$

$$E_h^{(t)} = \left(1 - e_h\right)E_h^{(t-1)} + e_h\left(\sum_{i=1}^{n} w_{ih}^{(t-1)} - L_h^{(t-1)}\right)$$

***We can show*:**

$$\Theta^{(0)} \rightarrow \Theta^{(1)} \rightarrow \Theta^{(2)} \rightarrow \cdots \rightarrow \Theta^{(t)}$$

Disequilibrium

$$\Theta^{(0)} \rightarrow \Theta^{(1)} \rightarrow \Theta^{(2)} \rightarrow \cdots \rightarrow \Theta^{(t)}$$

Disequilibrium

$$\Theta^{(t)} \dashrightarrow \begin{cases} d_{ij}^{(t)} \\ w_{ih}^{(t)} \\ u_b^{(t)} \\ c_{hi}^{(t)} \end{cases} \quad \forall i, j = 1;\cdots;n \quad \forall h = 1;\cdots;l$$

$$\Theta^{(0)};\Theta^{(1)};\Theta^{(2)};\cdots;\Theta^{(t)} \dashrightarrow \begin{cases} M_i^{(t)} \\ c_i^{'(t)} \end{cases} \quad \forall i = 1;\cdots;n$$

$$\Theta^{(0)};\Theta^{(1)};\Theta^{(2)};\cdots;\Theta^{(t-1)} \dashrightarrow u_i^{(t)}$$

$$\Theta^{(0)} = \left\{\widetilde{R}^{(0)};L^{(0)};E^{(0)}\right\} \rightarrow$$ The 'core' of the model

↓

Each payment in each period is determined by $\Theta^{(0)}$

To fix the initial conditions $\Theta^{(0)}$

To fix the number of firms and wage-earners (*n* and *l*)

↓

To fix the number of periods $t = T$

= To fix the number of times firms and banks adjust their decisions with respect to disequilibrium

↓

To determine the payments in *T* (numerical simulations)

To derive from payments a set of aggregate variables in $t = T$ which account for the economic activity

And thus to derive the aggregate variables from $\Theta^{(0)}$

Moreover, to determine the evolution of the aggregate variables from $t = 0$ to $t = T$

$$D_A^{(t)} := \sum_{i=1}^{n} \sum_{j=1}^{n} d_{ij}^{(t)}$$

$$C_A^{(t)} := \sum_{i=1}^{n} \sum_{h=1}^{l} c_{hi}^{(t)} + \sum_{i=1}^{n} c_i'^{(t)}$$

$$\rightarrow R_A^{(t)} := \sum_{i=1}^{n} R_i^{(t)} = D_A^{(t)} + C_A^{(t)}$$

$$M_A^{(t)} := \sum_{i=1}^{n} M_i^{(t)}$$

$$F_A^{(t)} := \sum_{i=1}^{n} F_i^{(t)}$$

$$\rightarrow \Pi_A^{(t)} := \sum_{i=1}^{n} \Pi_i^{(t)} = R_A^{(t)} - \left(M_A^{(t)} + F_A^{(t)}\right)$$

$$W_A^{(t)} := \sum_{h=1}^{l} \sum_{i=1}^{n} w_{ih}^{(t)}$$

$$L_A^{(t)} := \sum_{h=1}^{l} L_h^{(t)}$$

$$E_A^{(t)} := \sum_{h=1}^{l} E_h^{(t)}$$

Neither goods nor equilibrium in order to determine the aggregate variables which account for the economic activity...

↓

...but a series of definitions of assumptions about payments, how they are financed and how they are decided, in relation with disequilibrium

↓

To provide a clear-cut (benchmark) model of an alternative paradigm to mainstream economics

Economic decision-making, money and disequilibrium: A simplified 'benchmark' model

Thanks