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Count, trade, venture and desire: why money is at the core of decentralized economies.

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Count, trade, venture and desire: why money is at the core of decentralized economies.

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Abstract: This paper defends two related ideas: pure market and capitalist economies are different economic societies; neither can be adequately represented by theories of value but both can be accurately distinguished by a monetary approach. Within the framework of a simple modeling, we propose a conceptual clarification in four points. Firstly, market and capitalist economies are instituted by a principle of social quantification: money as the unit of account. Secondly, both economies are set in motion by a medium of circulation: money as the general equivalent. Thirdly, pure market society homogeneity is based on generalized access to money as the vehicle of autonomous expense (the carrier of unilateral action), while capitalist society heterogeneity is based on direct access to money reserved only to entrepreneurs and closed to monetarily dependent wage earners. Fourthly, if independent workers (integrated in a social division of labor) can be seen as motivated by the individual pursuit of utility, capitalists (engaged in an objective logic of capital accumulation) are driven by the subjective desire for money.

JEL classification: B00, D51, E42, P00.

Keywords: money, market, capitalism.

1- Introduction: Theories of value misrepresent both pure market and capitalist economies.

The pure market economy[2] and the capitalist economy are two monetary economies: this vision is anything but new and can especially be traced to Marx and Keynes. While these ideas are not totally forgotten today, they are somewhat frozen in time for both ideological and epistemological reasons[3]; and yet Keynes and Marx might not have been perfectly complete or absolutely consistent about these issues[4]. It thus makes sense to suggest some clarification of this vision in conceptual terms (which specific kinds of monetary economies are a pure market economy and a capitalist economy?) and to propose simple economic models or basic analytical representations of this vision, showing that these ideas can be expressed in the contemporary mainstream syntax. At the same time this paper accepts the prevailing syntax, it substitutes the dominant semantics with a monetary approach. Indeed, the view supported in this paper is deeply opposed to all theories of value, whose first gesture is to dismiss money as a superficial phenomenon and to impose real goods (and reified services) as the deep essence, the solid ground of the economic value.

[1] A previous French version of this paper ("*Les constituants monétaires du capitalisme*") was presented at the international conference dedicated to "Monetary Economic Analysis," Université Pierre Mendès-France, Grenoble, April 15th-16th 2010. A developed English version of this paper was presented at The New School "Macro Seminar", New York City, April 12th 2011.

[2] The market economy considered here is substantially *pure* as it is completely made of market elements, while a capitalist economy is partly or impurely a market economy (at least because of the wage relation). It is also formally *pure* as it is here an abstract representation or a speculative model (we don't wonder here if such a market economy ever existed in human history).

[3] The dominant free market vision denies the conception of the economic society as class organized and monetarily ruled. And contemporary mainstream economics does not focus a lot on old fashioned political economy debates about economic systems.

[4] The capitalist economy is undoubtedly monetary for Keynes, but he did not propose any distinction between a pure market economy and a capitalist one. Marx proposed such a distinction, but the specifications he gave of these economies are sometimes real (labor value and surplus value theories) and sometimes monetary, which raises some contradiction, so to speak.

Even if our perspective is in some way inspired by Marxian monetary analyses and by Keynesian circuit representations, this conceptual and analytical text is not, properly speaking, a history of economic thought paper: Marx and Keynes, among others, are not here reviewed but referred to as benchmarks. We will actually rely on four landmarks. We will refer to Walras for a real economy made of homogeneous agents [North-West] and to Ricardo for a real economy made of heterogeneous agents [South-West]. And we will refer to Smith (about the economy of primitive times) or to Marx I (about simple market production) for the monetary pure market economy [North-East] and to Keynes or to Marx II (about capitalist production) for the monetary capitalist economy [South-East]. Such a general map derives from the crossing of two independent major distinctions: one is about the type of economic society (made of symmetrical or asymmetrical agents) and the other is about the social objectivity (money or the list of goods) grounding economic evaluations.

The opposition between a pure market economy [North] and a capitalist economy [South] can be found in Smith and Marx. Walras only deals with a symmetrical economy, while Ricardo and Keynes are only concerned by asymmetrical economies. A pure market economy rests on the homogeneity of free and equal economic agents, who trade commodities through prices; and a capitalist economy is based on the heterogeneity of economic agents, capitalists exerting economic initiative and wage earners acting in a subordinate capacity. Prices are the only economic media in a pure market economy, while wage is not a price like any other in a capitalist economy.

The opposition between a real economy [West] and a monetary economy [East] runs in political economy, as pointed out by Schumpeter [1954][5]. Benetti and Cartelier [1980] developed this two-term alternative confronting theories of value and monetary approaches as two opposite basic ways to conceive the social objectivity grounding economic valuations. On one hand, theories of values are based on a "nomenclature of goods postulate" which socially defines the list of recognized commodities. Consequently, the major duty of this economics is to determine relative prices, whatever their expression in an indifferent *numéraire*. Money may secondarily be introduced as a convenient economic tool (to store value and to facilitate exchange), so the minor duty of this economics is to determine the real value of money and to establish its neutrality. On the other hand, monetary approaches are based on a "monetary postulate" which socially defines the unit of account and the rules of monetary creation, circulation and destruction. Consequently, all economic evaluations are primarily absolute and the basic economic variables to be explained are monetary flows or payments. As monetary counterparts, commodities may be recognized by their monetary exchangeability; and consistently their basic values have to be determined as monetary prices.

	WEST : Theory of value	*EAST :* Monetary theory
NORTH : Homogeneous economic statuses, or equal economic functions	**Walrasian economy** Real model of "market" exchange, but description of an individualistic planned economy (non-collectivist socialism)	**Pure market monetary economy** Monetary model of market exchange, and description of a social division of labor economy (without technical division of labor)
SOUTH : Heterogeneous economic statuses, or hierarchical economic functions	**Ricardian economy** Real model of "capitalist" production, but description of a real exploitation economy (a feudal economy)	**Keynesian economy** Monetary model of capitalist production, and description of a monetary exploitation economy (a capitalist economy)

[5] See "Value and Money" (Chapter 6, Part II of Schumpeter's "History of Economic Analysis").

Our starting point should be Walrasian [North-West], because this benchmark economy enables us to maintain a substantive contact with mainstream economics and because this neoclassical economy enables us to consider monetary economies from a distance (so the introduction of all monetary features will be explicit). The Walrasian camp has to be leaved because it might be considered as neither market nor capitalist. First, if the Walrasian pure exchange economy model describes an individualistic economy which is indeed homogeneous, it does not really display a market economy, as independant initiative is controlled by a central institution: individual intentions have to be socially ratified before being executed (no disequilibrium trading). The economy *à la Walras* is neither a command economy, as the economic decisions are made by the individuals and not by the Plan, nor a market economy, as the general consistency of all individual decisions has to be socially checked before economic action can take place: this mixed economy finally appears as some specific kind of individualistic planning[6]. Second, and more obviously, the Walrasian internal development from pure exchange to production and then to capitalization[7] misses what is here assumed to be a major and salient feature of capitalism: the relatively strong asymmetric relation between employers and employees.

A move toward the Ricardian world [South-West] may be possible, as this classical vision of the economic society is definitely asymmetric, so it could appear as a relevant representation of a capitalist economy[8]. But we won't carry on with this idea, as the real version of capitalist asymmetry is less appropriate than its monetary version. If the neoclassical vision upgrades the wage earner as if she/he were the equal of the capitalist entrepreneur (which denies the fact that the former obeys the latter inside the company), the classical vision downgrades the employee as a slave or an input for the employer (which denies the fact that the former is able to freely spend her/his revenue). In other words, the subtlety of the wage earner condition is missed by the too symmetrical neoclassical view and the too asymmetrical classical view. Conceiving the wage relation as a monetary dependence might appear as more balanced. Positively, as Ricardian political economy displays a very strong asymmetry between "masters and servants" and carries a non-monetary vision of exploitation (a physical part of the products of labor being taken by the lords and the priests), it could in some way represent a feudal economy.

Neglecting the move from Walras to Ricardo, we will first jump from a *real exchange economy* [North-West] to a *monetary pure market economy* [North-East]. The first model displays a Walrasian pure exchange economy, but specialized productions (and so independent workers) are implicitly present, as the initial endowments are assumed to be unimodal. It exemplifies a *real exchange economy without dedicated markets*, as bread and wine are directly traded (by two bakers and two wine-sellers and at a relative price). Individual disequilibria are excluded (as an expulsion of market sanction) and exchange only takes place when the equilibrium price is found. The second model introduces money as the unit of account, as the general equivalent and as the generalized vehicle of autonomous expense. It illustrates a *monetary economy of dedicated markets*, as each commodity is traded for money on its proper market at some absolute price. Effective individual disequilibria appear (as an expression of market sanction) as soon as market prices (*prices shaped by actions*) differ from calculus prices (*prices shaping decisions*), on the basis of a certain rule of price formation.

[6] This echoes the project of a synthesis between free market and socialism (*libéralisme et socialisme*) Walras wanted to achieve.
[7] On the Walrasian analytical development (from exchange to production and then capitalization and money), see for example Rebeyrol [1999] or Walker [2006].
[8] On the Ricardian vision of the capitalist economy (involving a class division), see for example Bidard et Klimovsky [2006] (page 16) or Foley [2006] (pages 76 and 77).

And we will then move from *the monetary economy of markets* [North-East] to *the monetary capitalist economy* [South-East][9]. In our third model, the economic society becomes a simple capitalist society as the ability to spend autonomously is restricted to capitalists only, wage-earners being defined by their monetary dependence: our four merchants become two entrepreneurs and two salaried employees. Capitalists determine the employment level and they "earn what they spend". Wage earners supply the quantity of labor demanded by the entrepreneurs and they "spend what they earn". Each salaried employee necessarily respects her/his budget constraint, but monetary disequilibrium is possible for any capitalist, who controls her/his initial expenses but radically ignores her/his final incomes. In our fourth model, the simple capitalist economy becomes a bit more complex, as one of the consumption goods is turned into an investment good, triggering the profit-investment dynamics. Capitalists still spend in consumption, but in investment too. So the pure logic of utility or the simple paradigm of needs (CMC') is substituted with the ruling logic of capital accumulation (MCM'), which is driven by the desire for money.

The central part of this paper consists in four variations on the theme of a same economic basis made of four agents (indexed a-b-c-d) and two commodities (indexed 1-2). To describe the effective economic relations involved in each model, we rely only on the quasi-matrix of bilateral physical flows for model I (equilibrium exchange) and mainly on the matrix of bilateral monetary flows for models II, III, IV (disequilibrium exchange). Physical flows are denoted in lower-case letters (consumption c ; investment i ; employee work t) and monetary flows in upper-case letters (consumption expenses C ; investment expenses I ; wages W). Reflexive flows (consumption and investment) are denoted with a prime. Appendices provide the exhaustive determination of models or the full explanation of the formation of economic variables. Expected variables are identified by italics.

We put forward the transfer matrices to emphasize the effective emergence of subjective positions through the operation of intersubjective relations, a methodological point that will be developed in the conclusion. And these matrices are a very convenient way to record effective exchanges and to report the formation of individual situations. For decentralized monetary economies, payment matrices display the general network of monetary relations: they clearly describe how i contributes to determine j's position (some of i's spendings making part of j's receipts if i buys something from j) and reversely how j contributes to determine i's position (some of i's receipts being made by part of j's spendings if i sells something to j). In the body of the text, we present the transfer matrices and develop the macroeconomic identities (Walras' law) and causalities (Kaldor-Kalecki principle) they involve. We complete the models in the appendices, making explicit the expectation schemes backing the decisions and the modes of market price formation taking place in the general structure of the economic circuit.

[9] This way to introduce first money and then wage relation is different from the approach chosen by Van de Velde [2005], who also starts with Walras [North-West] and ends with Keynes [South-East] too, but goes through Ricardo [South-West].

2- A real economy of exchange (Model I).

Let's consider a Walrasian pure exchange economy. If we adopt a unimodal profile for the initial endowments, a social division of labor is obtained (even if production remains implicit). This economic structure is animated by individuals who are specialized producers and "generalist consumers." Precisely, agents a and b hold good 1: they self-consume some of it and trade the other part of it for good 2. Likewise agents c and d own good 2: they eat some of it and exchange the remaining portion of it for good 1. Through a general barter, agent a jumps from the initial allocation (1 ; 0) to the equilibrium allocation (c'^{e}_{1a} ; c^{e}_{2a}), giving up some good 1 (to c and/or d) and getting some good 2 (from c and/or d).

↗	a.	b.	c.	d.	∑ (ini. alloc. $\underline{X}_h$)
a.	(c'^{e}_{1a} ; 0)	(0 ; 0)	(c^{e}_{1c}/2 ; 0)	(c^{e}_{1d}/2 ; 0)	(1 ; 0)
b.	(0 ; 0)	(c'^{e}_{1b} ; 0)	(c^{e}_{1c}/2; 0)	(c^{e}_{1d}/2; 0)	(1 ; 0)
c.	(0 ; c^{e}_{2a}/2)	(0 ; c^{e}_{2b}/2)	(0 ; c'^{e}_{2c})	(0 ; 0)	(0 ; 1)
d.	(0 ; c^{e}_{2a}/2)	(0 ; c^{e}_{2b}/2)	(0 ; 0)	(0 ; c'^{e}_{2d})	(0 ; 1)
∑ (equi. alloc. X^{e}_{h})	(c'^{e}_{1a} ; c^{e}_{2a})	(c'^{e}_{1b} ; c^{e}_{2b})	(c^{e}_{1c} ; c'^{e}_{2c})	(c^{e}_{1d} ; c'^{e}_{2d})	(2 ; 2)

Quasi-matrix of bilateral real flows of model I: (good 1 ; good 2).

The determination of equilibrium and then the implementation of equilibrium exchanges are developed in appendix 1. Let's quickly recall what could be called the Walrasian *tempo*. During the *tâtonnement*, there is *no disequilibrium trading*: whatever the exchange process[10], (equilibrium) prices to be applied and quantities to be exchanged are predetermined when exchange begins. At each step of the preliminary *tâtonnement*, knowledge of the current price system ensures individual equilibrium. Every emerging general disequilibrium remains virtual (as it is socially unvalidated) but if a general equilibrium appears, it is meant to become effective (as it is socially validated). As the recontracting *à la* Edgeworth, the *tâtonnement à la* Walras displays some general hypothetical negotiation which stops when a general agreement (general equilibrium situation or absence of coalition improvement) is reached. Then and only then, as the set of potential exchanges has been ratified, can it be applied. From the neoclassical view, *coordination operates through a pre-validation procedure of individual choices*.

Two social identities prevail in this real equilibrium world. First, the volume identity is simply expressed by the previous quasi-matrix: $\sum_h \underline{X}_h = \sum_h X^{e}_{h}$. It is a principle of material conservation of goods (the real economic matter) through exchange. This principle could be stated as the Lavoisier's law of economic mass: nothing is lost (consumption will occur after), nothing is gained (production occurred before), everything is transformed (the ownership on goods is reorganized by exchange). Second, the value identity is Walras' law, classically obtained from the necessary property of equilibrium for every budget constraint ($P Z_h = 0$ for any h), an individual property conserved through aggregation ($P Z = 0$).

Analytically, the "nomenclature of goods postulate" grounds the objectivity of market evaluations. This principle displays three dimensions. Firstly, it is a postulate of *real accounting*: values are expressed in real terms. Secondly, it is a postulate of *real exchange*: goods are traded for goods. Thirdly, it is a postulate of *real equilibrium*: in this simultaneous economy, the individuals' budget positions are always balanced and the principle of exchange equivalence is necessarily respected.

There is nothing monetary in this homogeneous economy. Prices are expressed in a *numéraire*, but the selection of a standard of value does not matter: the "absence of money illusion" prevails.

[10] See Ostroy and Starr [1974] about the different implementation procedures of competitive allocations.

3- A "monetary economy of markets" (Model II).

Keeping the same structure of social division of labor operated by homogeneous individuals, we substitute indirect monetary exchanges (on market for good 1 and on market for good 2) for direct barter (good 1 versus good 2).

↗	a.	b.	c.	d.	∑ (ini. alloc. $\underline{X}_h$)
a.	(c'_{1a} ; 0)	(0 ; 0)	(c_{1c} / 2 ; 0)	(c_{1d} / 2 ; 0)	(1 ; 0)
b.	(0 ; 0)	(c'_{1b} ; 0)	(c_{1c} / 2 ; 0)	(c_{1d} / 2 ; 0)	(1 ; 0)
c.	(0 ; c_{2a} / 2)	(0 ; c_{2b} / 2)	(0 ; c'_{2c})	(0 ; 0)	(0 ; 1)
d.	(0 ; c_{2a} / 2)	(0 ; c_{2b} / 2)	(0 ; 0)	(0 ; c'_{2d})	(0 ; 1)
∑ (final alloc. X_h)	(c'_{1a} ; c_{2a})	(c'_{1b} ; c_{2b})	(c_{1c} ; c'_{2c})	(c_{1d} ; c'_{2d})	(2 ; 2)

Quasi-matrix of bilateral real flows of model II: (good 1 ; good 2).

↗	a.	b.	c.	d.	∑ (outgoings)
a.	[C'_{1a}]	0	C_{2a} / 2	C_{2a} / 2	D_a
b.	0	[C'_{1b}]	C_{2b} / 2	C_{2b} / 2	D_b
c.	C_{1c} / 2	C_{1c} / 2	[C'_{2c}]	0	D_c
d.	C_{1d} / 2	C_{1d} / 2	0	[C'_{2d}]	D_d
∑ (incomings)	R_a	R_b	R_c	R_d	Ω

Matrix of bilateral monetary flows of model II: in dollars.

The transition from the real quasi matrix to the monetary matrix is given by: $C_{kh} = p_k * c_{kh}$. For this equation to be explicit, the formation of the monetary price of good k must be explained. A specification is proposed in the appendix 2, using what Benetti and Cartelier [2001] call the "Cantillon Smith rule," which states that the market price is formed as the ratio of two kinds of bid: the value demand on the volume supply[11]. In such an economy, the *tempo* is not neoclassical, as price formation is embedded in effective monetary transactions (on each market dedicated to one good). The market sequence may typically be broken down into three phases. First, the *market jump*: suppliers bid quantities of goods (to sell) and demanders bid quantities of money (to buy). Second, a market price emerges from these economic actions, and this effective price may be different from the expected price. Third, the *market sanction*: effective sales and receipts (for suppliers) and effective expenses and purchases (for demanders) are determined: the final allocations and the monetary balance give the synthetic market result for each individual. Under this monetary view of the market sequence, *coordination operates through a post-validation procedure of individual actions*.

Two social identities prevail in this monetary disequilibrium world. The volume identity (conservation of goods) still stands. The value identity (conservation of money) still comes from the aggregation of the effective budget constraints: the social monetary balance $S = \sum_h S_h = \sum_h (R_h - D_h) = (\sum_h R_h) - (\sum_h D_h) = \Omega - \Omega = 0$. This is the expression of Walras' law in a monetary economy[12]. Every expense (for one) being a receipt (for another) and vice versa, the sum of the monetary balances is nil: even if individual balances are positive or negative, they necessarily offset each other.

[11] This rule can be found in classical political economy, in Keynes and in strategic market games *à la* Shapley-Shubik [1977] (in this latter case without exploiting the disequilibrium potential of this rule).

[12] See Julien et Tricou [2007], pages 92 and 93.

Analytically, the "monetary postulate" henceforth grounds the objectivity of market evaluations. This principle is three-faceted. Firstly, it is a postulate of *monetary accounting*: values are expressed in monetary terms (in dollars for instance). Secondly, it is a postulate of *monetary exchange*: in this sequential economy, each good is traded for dollars[13]. Thirdly, it is a postulate of *monetary disequilibrium*: in this sequential economy, the individuals' effective budget positions are likely unbalanced, and this violation of the principle of exchange equivalence requires restoration through a "settling of scores" procedure. This post-market procedure of demonetization (money destruction) is indeed the closing moment where deficit are financed and surpluses are used, under the supervision of the Bank. It is the reverse side of the pre-market procedure of minting or monetization (money creation), which is the opening moment where a purchasing power is provided by the Bank to autonomous spenders. The downstream recording of a monetary disequilibrium and the obtaining of an undesired allocation are possible (and even likely) because of the upstream launching of an autonomous monetary expenditure.

This homogeneous economy is monetary, as money operates as a unit of account, a market general equivalent and a vehicle of autonomous expenditure (here for all individuals). And this pure market economy features independent workers or craftsmen who are "entrepreneurs" as they take a market risk but not "capitalists" as they are not employers and as they pursue utility and not money.

[13] This echoes the Clower aphorism: "money buys goods and goods buy money, but goods do not buy goods".

4- A monetary economy of capitalist production without accumulation (Model III).

The monetary economy is still made of two consumption goods, from now on explicitly produced. Individuals a et c remain specialized entrepreneurs, but individuals b and d become wage earners: b works for a and d works for c. So there are now capitalist employers and salaried employees, all remaining generalist consumers.

↗	a.	c.	b.	d.	∑
a.	$(c'_{1a} ; 0 ; 0)$	$(c_{1c} ; 0 ; 0)$	$(c_{1b} ; 0 ; 0)$	$(c_{1d} ; 0 ; 0)$	$(q_{1a} ; 0 ; 0)$
c.	$(0 ; c_{2a} ; 0)$	$(0 ; c'_{2c} ; 0)$	$(0 ; c_{2b} ; 0)$	$(0 ; c_{2d} ; 0)$	$(0 ; q_{2c} ; 0)$
b.	$(0 ; 0 ; t_{1b})$	$(0 ; 0 ; 0)$	$(0 ; 0 ; 0)$	$(0 ; 0 ; 0)$	$(0 ; 0 ; t_{1b})$
d.	$(0 ; 0 ; 0)$	$(0 ; 0 ; t_{2d})$	$(0 ; 0 ; 0)$	$(0 ; 0 ; 0)$	$(0 ; 0 ; t_{2d})$
∑	$(c'_{1a} ; c_{2a} ; t_{1b})$	$(c_{1c} ; c'_{2c} ; t_{2d})$	$(c_{1b} ; c_{2b} ; 0)$	$(c_{1d} ; c_{2d} ; 0)$	$(q_1 ; q_2 ; t)$

Quasi-matrix of bilateral real flows of model III: (good 1; good 2; labor).

↗	a.	c.	b.	d.	∑
a.	$[C'_{1a}]$	C_{2a}	W_{1b}	0	D_a
c.	C_{1c}	$[C'_{2c}]$	0	W_{2d}	D_c
b.	C_{1b}	C_{2b}	0	0	D_b
d.	C_{1d}	C_{2d}	0	0	D_d
∑	R_a	R_c	R_b	R_d	Ω

Matrix of bilateral monetary flows of model III: in dollars.

The transition from the real quasi matrix to the monetary matrix is given by: $W_{kh} = w_0\, t_{kh}$ (where w_0 is the exogenous nominal wage) and by $C_{kh} = p_k^* \, c_{kh}$. The market price of good k may once more rely on the "Cantillon Smith rule," as developed in appendix 3.

In this world of monetary disequilibrium, the social identity of material conservation still stands, as Walras' law ($\sum_h S_h = 0$). But every wage earner does respect her/his budget constraint, because (s)he can only spend what (s)he earned: $S_b = S_d = 0$. Therefore, $S_a + S_c = 0$: all capitalist balances offset each other, even if each capitalist does not necessarily respect her/his budget constraint, for (s)he spends before recording her/his deeply uncertain receipts.

This "restricted Walras' law"[14] is consistent with the Kalecki-Kaldor principle. On one hand, "wage earners spend what they earn." Every salaried employee i (= b,d) determines her/his consumption expenditures ($C_{1i} + C_{2i}$) depending on her/his wage (W_{ki}). For b: $W_{1b} = C_{1d} + C_{2b}$. For d: $W_{2d} = C_{1d} + C_{2d}$. At the macro level, we have: $W_{1b} + W_{2d} = C_{1b} + C_{1d} + C_{2b} + C_{2d}$ or $W = C^w$, with a trivial causality[15] from the revenue W to the consumption spending C^w. On the other hand, "capitalists earn what they spend." Every capitalist j (= a,c) pays the employed labor and spends her/his expected revenue without knowing what the receipt (and what the profit) will be. For a: $\pi_a = R_a - W_{1b} = C'_{1a} + C_{1c} + C_{1b} + C_{1d} - W_{1b}$. For c: $\pi_c = R_c - W_{2d} = C_{2a} + C'_{2c} + C_{2b} + C_{2d} - W_{2d}$. At the macro level, we have: $\pi_a + \pi_c = C'_{1a} + C_{2a} + C_{1c} + C'_{2c} + C^w - W = C'_{1a} + C_{2a} + C_{1c} + C'_{2c} = C_a + C_c$ or $\pi = C^k$ [or also $(\pi_a - C'_{1a}) + (\pi_c - C'_{2c}) = C_{2a} + C_{1c}$], with a paradoxical causality from the consumption spending C^k to the revenue π.

[14] See Cartelier [1995], pages 47 to 53.

[15] The causality is robust, but the equality ($W = C^w$) simply stems from the absence of savings in this atemporal model.

Analytically, in this model as in the former one, the "monetary postulate" grounds the objectivity of economic evaluations, the two dimensions of *monetary accounting* and *monetary exchange* being unchanged. On the other hand, the third dimension of *monetary disequilibrium* is modified, as the initiative ability operated by autonomous spendings is from now on reserved only to capitalists. As a result, monetary circulation is complexified, with a differenciation between primary or initiatory flows (W_{1b} and W_{2d}; C_{1c} and C_{2a}) and secondary or derived flows (C_{1b}; C_{1d}; C_{2b}; C_{2d}), in addition to reflexive flows (C'_{1a} and C'_{2c}).

Through the structural relation of *monetary dependence*, the economic society turns heterogeneous and the economy turns capitalist: entrepreneurs become owners-managers and workers become wage earners or dependent workers.

5- A monetary economy of capitalist production with accumulation (Model IV).

This monetary economy is still made of two produced goods. Individuals a and c remain specialized entrepreneurs, respectively employing individuals b and d. But the two commodities are now structurally differenciated as an investment good (1 produced by a and b) and a consumption good (2 produced by c and d)[16], which enables the introduction of a logic of accumulation.

↗	a.	c.	b.	d.	∑
a.	$(i'_{1a} ; 0 ; 0)$	$(i_{1c} ; 0 ; 0)$	$(0 ; 0 ; 0)$	$(0 ; 0 ; 0)$	$(q_{1a} ; 0 ; 0)$
c.	$(0 ; c_{2a} ; 0)$	$(0 ; c'_{2c} ; 0)$	$(0 ; c_{2b} ; 0)$	$(0 ; c_{2d} ; 0)$	$(0 ; q_{2c} ; 0)$
b.	$(0 ; 0 ; t_{1b})$	$(0 ; 0 ; 0)$	$(0 ; 0 ; 0)$	$(0 ; 0 ; 0)$	$(0 ; 0 ; t_{1b})$
d.	$(0 ; 0 ; 0)$	$(0 ; 0 ; t_{2d})$	$(0 ; 0 ; 0)$	$(0 ; 0 ; 0)$	$(0 ; 0 ; t_{2d})$
∑	$(i'_{1a} ; c_{2a} ; t_{1b})$	$(i_{1c} ; c'_{2c} ; t_{2d})$	$(0 ; c_{2b} ; 0)$	$(0 ; c_{2d} ; 0)$	$(q_1 ; q_2 ; t)$

Quasi-matrix of bilateral real flows of model IV: (investment good 1; consumption good 2; labor).

↗	a.	c.	b.	d.	∑
a.	$[I'_{1a}]$	C_{2a}	W_{1b}	0	D_a
c.	I_{1c}	$[C'_{2c}]$	0	W_{2d}	D_c
b.	0	C_{2b}	0	0	D_b
d.	0	C_{2d}	0	0	D_d
∑	R_a	R_c	R_b	R_d	Ω

Matrix of bilateral monetary flows of model IV: in dollars.

The transition from the real volumes to monetary values is given by: $W_{kh} = w_0\, t_{kh}$, $I_{1h} = p_1^* \, i_{2h}$ and $C_{2h} = p_2^* \, c_{2h}$. The two market prices may obey different rules of formation, as illustrated in appendix 4. The social identity of material conservation, Walras' law ($\sum_h S_h = 0$), the respect of the budget constraint by each wage earner ($S_b = S_d = 0$) and the offsetting of all capitalists balances ($S_a + S_c = 0$) still stand.

The Kalecki-Kaldor principle still prevails, with a simplified aspect for wage earners (just one consumption good remains) and a complexified aspect for capitalists (one investment good appears). On one hand, the employees'wages determine their consumption spendings. If wage earners don't save, then $W_{1b} = C_{2b}$ for b and $W_{2d} = C_{2d}$ for d. At the macroeconomic level: $W_{1b} + W_{2d} = C_{2b} + C_{2d}$, or $W = C^w$. On the other hand, the employers' investment and consumption spendings determine their profits. For a: $\pi_a = R_a - W_{1b} = I'_{1a} + I_{1c} - W_{1b}$. For c: $\pi_c = R_c - W_{2d} = C_{2a} + C'_{2c} + C^w - W_{2d}$. At the macroeconomic level: $\pi = \pi_a + \pi_c = I'_{1a} + I_{1c} + C_{2a} + C'_{2c} + C^w - W = I'_{1a} + I_{1c} + C_{2a} + C'_{2c} = I + C^k$, or also: $(\pi_a - I'_{1a}) + (\pi_c - C'_{2c}) = I_{1c} + C_{2a}$.

Analytically, the "monetary postulate" still grounds the objectivity of economic evaluations, with *monetary accounting* and *monetary exchange* (as in II and III) and with *monetary disequilibrium* stemming from the capitalists' autonomous expenses (as in III). Monetary circulation is even more complexified by a dissymmetry of initiatory flows (W_{1b} and W_{2d}; I_{1c} and C_{2a}), of derived flows (C_{2b} and C_{2d}) and of reflexive flows (I'_{1a} and C'_{2c}). Capital accumulation renders the capitalist economy dynamic and supports the perpetual search for a bigger wealth by capitalist entrepreneurs.

[16] As good 1 is bought by capitalists only and good 2 is bought by all agents, the symmetry between the two sectors is lost.

6- Conclusion.

Money, market and capitalism. Following the prevailing *doxa* or according to the free market view, a capitalist economy and a market economy are basically the same thing. Objections to this confusion go against strong prejudices, but also hit conceptual difficulties: a capitalist economy can't be reduced to a market economy but contains market elements; a capitalist economy is based on a strong asymmetry but wage-earners are dependent without being totally heteronomous; a capitalist economy accomplishes a massive accumulation of commodities but its ultimate motive is not the satisfaction of needs, and so on… Yet, a monetary approach might enable one to properly distinguish a pure market economy and a capitalist economy.

First, both pure market and capitalist economies rest on the nominal basis of monetary quantification through the unit of account (a): individuals are socialized as dollar account holders. Second, both economies rest on the principle of monetary mediation by the general equivalent (b): commodities are recognized as objects traded for dollars. Beyond sharing these two working general principles, the pure market economy and the capitalist economy differ in the structural distribution of monetary access (c) and in terms of individual motives (d).

The representation of a *pure market economy* requires an autonomous spending capability granted to all agents (c_1), this universal monetary access expressing the homogeneity of the market society. Moreover, it is not necessary to introduce the desire for money to capture the specific features of the market society, since these features can simply be represented by the mathematizable principle of utility (operable by maximization) or by the anthropological principle of need (understood as the minimal search for subsistence or as the progressive will to better one's condition).

The monetary representation of a *capitalist economy* substantially modifies the distribution of monetary autonomy, restricted to capitalists (c_2). This divide between independent spenders and dependent ones expresses the heterogeneity of the capitalist society. The introduction of unlimited desire for money is moreover necessary, as the subjective driving force of the process of accumulation (beyond the structural logic of capital and the competitive constraint pushing every capitalist to invest): the frantic and indefinite search for profit and for its increase by re-investment surpasses material interest and ultimately obeys the chrematistic passion[17] defining the capitalist spirit. Here instrumental money ("*la monnaie*") is also sweet cash ("*l'argent*"), an object that stirs passion and emotion (d_2).

So the monetary approach enables to assert that capitalism can't be reduced to market, because of the *wage relation* (which determines workers as dependent agents) and because of the *desire for money* (which indefinitely fuels the pursuit of accumulation by capitalists). The open question is then the relation between these two elements, which belong to different orders (structural economic organization and psychological economic profile) and which may seem independent. Indeed, the wage relation may be abstractly conceived without the desire for money, assuming that capitalists are not moved by the desire of accumulation but by the search for utility (or by the satisfaction of needs), as exemplified by our model III which displays a capitalist economy driven by utility and not by profit. Reversely, the desire for money may be conceived without the wage relation, under the specific form of pure speculation (commercial or financial). But this relative independence could be turned into a fruitful complementarity, following the vision of a "complete capitalism" combining an objective *capitalist structure* and a subjective *capitalist mentality*.

[17] See Berthoud [1992], especially pages 170 and 171.

Such a perspective can be backed by some conceptual and methodological clarifications, about a general framework that assumes a prior objective social structure, emphazises the operation of intersubjective relations and recognizes the role of subjective impulses.

Objective structure, intersubjective relations and subjective impulses. When the jump is made from a real economy with money to a monetary economy with goods and services, money as the common unit of account is no longer a neglected monetary function[18], but constitutes the crucial economic feature. As a unit of account, money is the basic economic objectivity: it institutes a common economic language that is meant to be written as a nominal accounting. So economic values are quantitative because of their monetary expression and they are socially recognized thanks to the unit of their measurement. As a consequence, economic quantitativism is neither disembodied (as in mathematics) nor natural (as in physics): it is socially grounded in the qualitative framework of a constitution whose first article verbally creates a unit of account, a "nominal anchorage."

This fundamental convention is the keystone of an objective social institution, the payment system, which settles the rules of money creation, circulation and destruction. Through circulation, money determines all object exchanged for it as a commodity, whose value is given by the payment operation: prices are basically absolute in a monetary economy (as they are fundamentally relative in a real economy). Economic agents are recognized in the social structure of accounting by the engaged expenses and by the received receipts (as they are recognized by detained allocations and preferences defined in the social structure of the commodity space in a real economy)[19].

An individual *decides* her/his spendings but merely *records* her/his receipts. So agents granted with the monetary power of spending before earning benefit from the extended liberty of independent agents. And agents subjected to the monetary necessity of earning before spending have to content themselves with the limited liberty of dependent agents. For every individual, the effective spendings become part of others' receipts. But she/he does not control others' spendings, which partly become her/his receipts; she/he can't even perfectly foresee these others' spendings, as they are decided by other (more or less) free individuals.

A decentralized economy involves a plurality of free action takers: this of course means the absence of an economic dictator or a central planner. But this also entails the presence of a deep social opacity: a general endogenous uncertainty. As a consequence, the private evaluation of an individual or the evaluation she/he thinks she/he will be given by the others (expected receipts) and her/his effective social evaluation by the others (effective receipts) are likely to differ and mark an individual disequilibrium in decentralized economies such as pure market and capitalist economies.

Let's bring together all these elements, calling "*objective*" what is the same for all and imposed on each; "*subjective*" what is proper to each and decided by each; and "*intersubjective*" what occurs between several individuals (from two to all). First we have the objective framework, the rules of the game: the institution of money and the monetary institution of a pure market economy (introducing the

[18] In their book "Animal spirits," Akerlof and Shiller [2009] notice, in a chapter dedicated to "Money illusion," that the functions of money as a medium of exchange and as a store of value "have been analyzed to death by economists […]. But economists have paid scant attention to the role of money as a unit of account. Its use as a unit of account means that people think in terms of money. It means that contracts are denominated in money terms. Likewise, accounting is denominated in nominal terms".

[19] Choosing R^n as the commodity space is not purely mathematical or economically obvious: it institutes goods as the basic economic objectivity, which constitutes the first postulate of theories of value.

market relation as a coordination feature) or of a capitalist economy (adding the wage relation as a subordination feature). Second we have subjective actions, essentially spending bids: situated in the objective framework, they are indeed intersubjective relations initiated by an individual decision (I decide to spend money you don't choose to receive). Third we have the objective outcome, the result of the game: through a process of emergence or self-transcendence, a social statement comes from all intersubjective relations and comes back as an objective judgment for each individual (her/his monetary balance).

This epistemological development reveals an approach which could be called "soft structuralism" or "relational individualism": individuals make decisions and take actions in a socially determined context, which means from a defined economic position (entrepreneur or wage-earner) and in the network of economic relations (payments). Engaging and engaged by social relations, interdependent individuals are, at the same time and at different degrees, independent and dependent. Two versions of this approach may eventually be distinguished, considering what should or could be said about individual psychology.

From a more formal and explanatory point of view, we should strictly focus our attention on the "hard" object of structuring and structured social relations[20], whose objectivity provides social science a solid ground, under the specific form of social and quantitative variables for economics. As conscious motivations or unconscious forces are too uncertain or too "soft" to be seriously considered, psychological considerations should be ignored or minimized[21].

From a more substantive and comprehensive point of view, we should first focus our attention on social relations but then turn towards individual driving forces. Individual action is always socially defined and even partly socially determined, but a social system can't function and reproduce itself without some individual *impetus*. So it is legitimate to wonder if agents who are running a pure market economy are moved by the satisfaction of needs, the search for utility or the "propensity to truck, barter and exchange one thing for another." And it is also relevant to wonder why, beyond systemic constraints, capitalists engage themselves in the dynamics of accumulation. Which "animal spirit" is at stake when a market jump is made, especially when a deeply uncertain and definitely strategic investment decision is made: a Schumpeterian desire to keep busy and to undertake new projects, or a Freudian desire of money, which is the desire of always more money? In any case, if money should be first considered as an institution, it might or should then be envisioned as the reified and even fetishied object of strong economic passions, under the conservative form of miser preservation (for the rentier) or under the destructive-creative form of indefinite accumulation (for the capitalist). The rationality of the "demand for money" and of "profit maximization" may ultimately be the rationalization of individual motivations driven by some "monetary illusion."

[20] For an explicitly structuralist macroeconomic construction, see Taylor [2004].
[21] Such a point of view is defended by Benetti and Cartelier [1980].

Appendix 1: Development of model I.

1- Individual optimal choices.

Given the price system $P = (p_1 ; p_2)$, prices expressed in a conventional *numéraire*,
each agent h (= a, b, c, d) maximizes her/his utility U_h under the budget constraint $P \cdot Z_h = 0$,
where Z_h is the vector of excess demands for h: $z_{kh}(P) = x_{hk}(P) - \underline{x}_{hk}$ (k = 1,2).
If $U_h = x_{1h}\, x_{2h}$, $Z_a = Z_b = (-0,5 ; 0,5(p_1/p_2))$ and $Z_c = Z_d = (0,5(p_2/p_1) ; -0,5)$.
If $U_h = x_{1h}^{1/2} + x_{2h}^{1/2}$, $Z_a = Z_b = [-p_1 / (p_1+p_2) ; p_1^2 / p_2(p_1+p_2)]$ and $Z_c = Z_d = [p_2^2 / p_1(p_1+p_2)] ; -p_2 / (p_1+p_2)]$.

2- Equilibrium prices and allocations.

The general equilibrium of this economy is determined when (for instance) $\sum_h z_{1h}(P^e) = 0$.
The economy being symmetrical, the general equilibrium is obtained when $p_1 = p_2$.
If $U_h = x_{1h}\, x_{2h}$ or if $U_h = x_{1h}^{1/2} + x_{2h}^{1/2}$, $Z_a^e = Z_b^e = (-0,5 ; 0,5)$ and $Z_c^e = Z_d^e = (0,5 ; -0,5)$.
The equilibrium allocations are:
$(c'^e_{1a} ; c^e_{2a}) = (\underline{x}_{1a} + z^{e-}_{1a} ; z^{e+}_{2a})$ and same thing for b; $(c^e_{1c} ; c'^e_{2c}) = (z^{e+}_{1c} ; \underline{x}_{2c} + z^{e-}_{2c})$ and same thing for d.
The economy being symmetrical, the equilibrium allocations are identical: $(c^e_{1h} ; c^e_{2h}) = (0,5 ; 0,5)$.

3- Implementation of equilibrium exchanges.

If equilibrium trade is centralized, everybody brings all the equilibrium supplies to the clearing house (or *chambre de compensation*) and then comes back to collect all the equilibrium demands.

If equilibrium trade is decentralized, then we have to explain how a and b deliver good 1 to c and d and how c and d deliver good 2 to a and b. In the following quasi-matrix, bilateral trade coefficients λ, μ, ψ and φ (which are ≥ 0 and ≤ 1) have been introduced to describe who gets what from whom.

↗	a.	b.	c.	d.	∑ (ini. alloc. $\underline{x}_h$)
a.	$(c'^e_{1a} ; 0)$	$(0 ; 0)$	$((1-\psi)c^e_{1c} ; 0)$	$((1-\varphi)c^e_{1d} ; 0)$	$(1 ; 0)$
b.	$(0 ; 0)$	$(c'^e_{1b} ; 0)$	$(\psi c^e_{1c} ; 0)$	$(\varphi c^e_{1d} ; 0)$	$(1 ; 0)$
c.	$(0 ; (1-\lambda)c^e_{2a})$	$(0 ; (1-\mu)c^e_{2b})$	$(0 ; c'^e_{2c})$	$(0 ; 0)$	$(0 ; 1)$
d.	$(0 ; \lambda c^e_{2a})$	$(0 ; \mu c^e_{2b})$	$(0 ; 0)$	$(0 ; c'^e_{2d})$	$(0 ; 1)$
∑ (equi. alloc. X_h^e)	$(c'^e_{1a} ; c^e_{2a})$	$(c'^e_{1b} ; c^e_{2b})$	$(c^e_{1c} ; c'^e_{2c})$	$(c^e_{1d} ; c'^e_{2d})$	$(2 ; 2)$

Quasi-matrix of bilateral real flows of model I: (good 1 ; good 2).

Does everybody get what (s)he is supposed to get? These "getting conditions" are obviously respected, for any possible value of the bilateral trade coefficients.
Does everybody give what (s)he is supposed to give? These "giving conditions" are respected if:
$1 - c'^e_{1a} = (1-\psi)c^e_{1c} + (1-\varphi)c^e_{1d}$ for a and $1 - c'^e_{1b} = \psi c^e_{1c} + \varphi c^e_{1d}$ for b,
$1 - c'^e_{2c} = (1-\lambda)c^e_{2a} + (1-\mu)c^e_{2b}$ for c and $1 - c'^e_{2d} = \lambda c^e_{2a} + \mu c^e_{2b}$ for d.
If a and b are indeed identical ($c'^e_{1a} = c'^e_{1b}$ and $c^e_{2a} = c^e_{2b}$) and likewise for c and d,
then we must have $\psi + \varphi = 1$ and $\lambda + \mu = 1$ for the "giving conditions" to be respected.
So the general equilibrium barter could for instance be achieved by two separate bilateral matches, between a and c ($\lambda = 0$ and $\psi = 0$) and between b and d ($\mu = 1$ and $\varphi = 1$). But as the general equilibrium approach features the notion of general interdependence, exchange is perhaps better accomplished by a global barter (easily obtained when $\lambda = \mu = \psi = \varphi = 1/2$), so we select this scenario in the quasi-matrix initially given in the text.

Appendix 2: Development of model II.

1- Market projection and exchange engagement.

Under expected monetary prices $P = (p_1 ; p_2)$, each agent h maximizes her/his utility U_h under the expected budget constraint $P \,.\, Z_h = 0$.
When $z_{kh} < 0$, agent h supplies good k and bring to market k a supply (in volume) $o_{kh} = |z_{kh}^-|$ (real bid).
When $z_{kh} > 0$, agent h demands good k and expresses on market k a demand (in value) $M_{kh} = p_k z_{kh}^+ = p_k d_{kh}$ (monetary bid), for which she/he requests a minting operation.
If $U_h = x_{1h} x_{2h}$, $Z_a = Z_b = (-0,5 ; 0,5(p_1/p_2))$ and $Z_c = Z_d = (0,5(p_2/p_1) ; -0,5)$,
so $o_{1a} = o_{1b} = 0,5$ and $M_{2a} = M_{2b} = 0,5p_1$; $o_{2c} = o_{2d} = 0,5$ and $M_{1c} = M_{1d} = 0,5p_2$.
If $U_h = x_{1h}^{1/2} + x_{2h}^{1/2}$, $Z_a = Z_b = [-p_1 / (p_1+p_2) ; p_1^2 / p_2(p_1+p_2)]$ and $Z_c = Z_d = [p_2^2 / p_1(p_1+p_2)] ; -p_2 / (p_1+p_2)]$,
so $o_{1a} = o_{1b} = p_1 / (p_1+p_2)$ and $M_{2a} = M_{2b} = p_1^2 / (p_1+p_2)$; $o_{2c} = o_{2d} = p_2 / (p_1+p_2)$ and $M_{1c} = M_{1d} = p_2^2 / (p_1+p_2)$.

2- Formation of market prices and market circulation.

Under the "Cantillon-Smith rule" (Benetti and Cartelier [2001]), the price of a good is given by the ratio between the money brought to the market to be spent and the goods brought to the market to be sold, so we have $p_1^* = (M_{1c}+M_{1d}) / (o_{1a}+o_{1b}) = p_2$ and $p_2^* = (M_{2a}+M_{2b}) / (o_{2c}+o_{2d}) = p_1$.
If $U_h = x_{1h} x_{2h}$, then $p_1^* = p_2$ and $p_2^* = p_1$.
If $U_h = x_{1h}^{1/2} + x_{2h}^{1/2}$, then $p_1^* = p_2^2 / p_1$ and $p_2^* = p_1^2 / p_2$.

With this specific rule of price formation, market sanction involves receipts and purchases but does not affect expenses and sales:
- The volume of supply or expected sale (o_{kh}) equals the effective sale (v_{kh}).
- The value of demand or expected expenses (M_{kh}) equals the effective expenses (A_{kh}).
- Expected receipts ($p_k o_{kh}$) differ from effective receipts ($V_{kh} = p_k^* v_{kh} = p_k^* o_{kh}$) if $p_k \neq p_k^*$.
- Expected purchase (d_{kh}) differs from effective purchase ($a_{kh} = A_{kh} / p_k^* = (p_k/p_k^*) d_{kh}$) if $p_k \neq p_k^*$.

3- Market results: effective allocations and monetary balances.

With the Cobb Douglas utility function, the real and the monetary positions are:
$(1-v_{1a} ; a_{2a}) = (0,5 ; 0,5)$ and $S_a = V_{1a} - A_{2a} = 0,5 (p_2 - p_1)$ for a and idem for b.
$(a_{1c} ; 1-v_{2c}) = (0,5 ; 0,5)$ and $S_c = V_{2c} - A_{1c} = 0,5 (p_1 - p_2)$ for c and idem for d.

With the additive utility function, the real and the monetary positions are:
$(1-v_{1a} ; a_{2a}) = (p_2 / (p_1+p_2) ; p_2 / (p_1+p_2))$ and $S_a = V_{1a} - A_{2a} = p_2 - p_1$ for a and idem for b.
$(a_{1c} ; 1-v_{2c}) = (p_1 / (p_1+p_2) ; p_1 / (p_1+p_2))$ and $S_c = V_{2c} - A_{1c} = p_1 - p_2$ for c and idem for d.

An equilibrium for this monetary economy corresponds to correct price expectations ($p_k = p_k^*$ for all k). Such self-fulfilling prices coincide with Walrasian prices ($p_1 = p_2$) and generate the Walrasian allocation with a nil monetary balance for every individual.

A disequilibrium corresponds to incorrect price expectations ($p_k \neq p_k^*$ for at least one k), which entail positive and negative monetary balances (which need to be settled).

In any case, the emerging general allocation is feasible and the social monetary balance is nil.

Appendix 3: Development of model III.

1- The entrepreneurs-consumers' planning.
The owners-managers notice the level of the exogenous monetary wage and take the expected prices of the commodities as given: (w_0; p_1; p_2) = (wage; expected price of good 1 ; expected price of good 2).
Optimizing program of a: Max $U_a(c'_{1a}; c_{2a})$ subject to the expected budget constraint, $R_a = D_a$
(or $\pi_a = p_1 q_{1a} - w_0 \int_{1a} = p_1 c'_{1a} + p_2 c_{2a}$), and to the technological constraint, $q_{1a} = f_{1a}(\int_{1a})$.
First order optimality conditions are: $MUc'_{1a}/MUc_{2a} = (p_1/p_2)$ and $MP\int_{1a} = (w_0/p_1)$.
This way, c'_{1a}, c_{2a}, q_{1a}, $\int_{1a}$ and π_a, R_a, D_a are determined as functions of (w_0; p_1; p_2).
For c, one can the same way determine c'_{2c}, c_{1c}, q_{2c}, $\int_{2c}$ and π_c, R_c, D_c as functions of (w_0; p_1; p_2).
This kind of utility maximization requires a maximization of the expected revenue:
π_j has to be maximized for U_j to be maximized.

2- Purchase of labor and production.
Labor demands are supposed to be satisfied, by b for a and by d for c:
$\int_{1a}$ (labor demanded by a) = $\int_{1a}$ (labor bought by a) = t_{1b} (labor sold by b).
Likewise for employer c and her/his employee d: $\int_{2c} = \int_{2c} = t_{2d}$.
Production and wage payment follow:
$q_{1a} = q_{1a}$ and $W_{1b} = w_0 t_{1b}$ for enterprise 1; $q_{2c} = q_{2c}$ and $W_{2d} = w_0 t_{2d}$ for enterprise 2.
According to this view, there is not a genuine "labor market," as the aggregate labor demand determines the level of employment, labor suppliers passively adjusting to the entrepreneurs' wishes.

3- Engagement of money to be spent and of goods to be sold on the markets.
Every entrepreneur is a supplier on her/his market and a demander on the other market.
Entrepreneur a offers $o_{1a} = q_{1a} - c'_{1a}$ on market 1 and bids $M_{2a} = p_2 c_{2a}$ on market 2.
Entrepreneur c offers $o_{2c} = q_{2c} - c'_{2c}$ on market 2 and bids $M_{1c} = p_1 c_{1c}$ on market 1.
For the wage earners, let's denote by β and δ the fractions of their wages b and d respectively devoted to the purchase of good 1. These preference parameters appear as exogenous budget coefficients, but they could be endogenized through the maximization of a Cobb-Douglas utility function.
Wage earner b engages $M_{1b} = \beta W_{1b}$ on market 1 and $M_{2b} = (1-\beta) W_{1b}$ on market 2.
Wage earner d engages $M_{1d} = \delta W_{2d}$ on market 1 and $M_{2d} = (1-\delta) W_{2d}$ on market 2.

4- Formation of market prices following the Cantillon-Smith rule.
$p_1 = [M_{1b} + M_{1c} + M_{1d}] / [o_{1a}] = M_1 / o_1$ on the market of good 1.
$p_2 = [M_{2a} + M_{2b} + M_{2d}] / [o_{2c}] = M_2 / o_2$ on the market of good 2.

5- Market results: emergence of effective outgoings-incomings and purchases-sales.
We denote purchases by a, sales by v, expenses by A and receipts by V.
For a: the sale $v_{1a} = o_{1a}$ and the receipt $V_{1a} = p_1 v_{1a}$; the spending $A_{2a} = M_{2a}$ and the purchase $a_{2a} = A_{2a}/p_2$.
For c: the sale $v_{2c} = o_{2c}$ and the receipt $V_{2c} = p_2 v_{2c}$; the spending $A_{1c} = M_{1c}$ and the purchase $a_{1c} = A_{1c}/p_1$.
For b: the expenses are $A_{1b} = M_{1b}$ et $A_{2b} = M_{2b}$ and the purchases are $a_{1b} = A_{1b}/p_1$ et $a_{2b} = A_{2b}/p_2$.
For d: the expenses are $A_{1d} = M_{1d}$ et $A_{2d} = M_{2d}$ and the purchases are $a_{1d} = A_{1d}/p_1$ et $a_{2d} = A_{2d}/p_2$.

6- Final allocations.
Final bundle for a: $(c'_{1a}; c_{2a}) = (q_{1a} - v_{1a}; a_{2a}) = (q_{1a} - o_{1a}; M_{2a}/p_2) = (c'_{1a}; (p_2/p_2)\, c_{2a})$.
Final bundle for c: $(c_{1c}; c'_{2c}) = (a_{1c}; q_{2c} - v_{2c}) = (M_{1c}/p_1; q_{2c} - o_{2c}) = ((p_1/p_1)\, c_{1c}; c'_{2c})$.
Final bundle for b: $(c_{1b}; c_{2b}) = (a_{1b}; a_{2b}) = (M_{1b}/p_1; M_{2b}/p_2) = (\beta W_{1b}/p_1; (1-\beta) W_{1b}/p_2)$.
Final bundle for d: $(c_{1d}; c_{2d}) = (a_{1d}; a_{2d}) = (M_{1d}/p_1; M_{2d}/p_2) = (\delta W_{2d}/p_1; (1-\delta) W_{2d}/p_2)$.

At the macro level, it can be verified that $c'_{1a} + (p_1/p_1)\, c_{1c} + \beta W_{1b}/p_1 + \delta W_{2d}/p_1 = c'_{1a} + o_{1a} = q_{1a}$ and that $(p_2/p_2)\, c_{2a} + c'_{2c} + (1-\beta)W_{1b}/p_2 + (1-\delta)W_{2d}/p_2 = c'_{2c} + o_{2c} = q_{2c}$: the final allocation is indeed feasible.

7- Monetary balances.
Monetary balance for a: $S_a = V_{1a} - A_{2a} - W_{1b} = (\dots) = [A_{1c} + A_{1d}] - [A_{2a} + A_{2b}]$.
Monetary balance for c: $S_c = V_{2c} - A_{1c} - W_{2d} = (\dots) = [A_{2a} + A_{2b}] - [A_{1c} + A_{1d}]$.
One entrepreneur's monetary balance appears as the difference between the inflows and the outflows of her/his monetary zone: $[A_{1c} + A_{1d}]$ is the monetary leak from c's sphere to a's one (purchase of 1 by c and d) and $[A_{2a} + A_{2b}]$ is the monetary leak from a's sphere to c's one (purchase of 2 by a and b).
Under the Cantillon-Smith rule, one entrepreneur's balance only depends on the uncertainty of her/his receipts (effective / expected), because the effective expenses are equal to the expected ones.
Monetary balance for b: $S_b = W_{1b} - A_{1b} - A_{2b} = W_{1b} - \beta\, W_{1b} - (1-\beta)\, W_{1b} = 0$.
Monetary balance for d: $S_d = W_{2d} - A_{1d} - A_{2d} = W_{2d} - \delta\, W_{2d} - (1-\delta)\, W_{2d} = 0$.
At the macro level, we verify that $S = S_a + S_c + S_b + S_d = 0$ (the total balance is nil):
$S = V_{1a} - A_{2a} - W_{1b} + V_{2c} - A_{1c} - W_{2d} + W_{1b} - A_{1b} - A_{2b} + W_{2d} - A_{1d} - A_{2d} =$
$[V_{1a} - A_{1c} - A_{1b} - A_{1d}] + [V_{2c} - A_{2a} - A_{2b} - A_{2d}] = 0 + 0 = 0$.
As $S_b = S_d = 0$ (every wage earner's balance is nil),
we also verify that $S_a + S_c = 0$ (the entrepreneurs total balance is nil).

As $S_a = V_{1a} - A_{2a} - W_{1b} = p_1\, o_{1a} - (p_2\, c_{2a} + W_{1b}) = p_1\, o_{1a} - p_1\, o_{1a} = [p_1 - p_1]\, o_{1a}$ (because $R_a = D_a$)
and $S_c = V_{2c} - A_{1c} - W_{2d} = p_2\, o_{2c} - (p_1\, c_{1c} + W_{2d}) = p_2\, o_{2c} - p_2\, o_{2c} = [p_2 - p_2]\, o_{2c}$ (because $R_c = D_c$),
we have: $S = [p_1 - p_1]\, o_{1a} + [p_2 - p_2]\, o_{2c} = 0$ (Walras law).
It follows that there are three possible situations for the markets:
if $p_1 = p_1$ and $p_2 = p_2$ ($S_a = 0$ and $S_c = 0$), then equilibrium in 1 and equilibrium in 2.
if $p_1 < p_1$ and $p_2 > p_2$ ($S_a < 0$ and $S_c > 0$), then overproduction in 1 and underproduction in 2.
if $p_1 > p_1$ and $p_2 < p_2$ ($S_a > 0$ and $S_c < 0$), then underproduction in 1 and overproduction in 2.

As a convention, the receipts (R) and the expenses (D) include the value of self-consumption,
while the value of the sales (V) and the value of the purchases (A) don't include it,
which of course doesn't change anything to the calculus of the balances:
For a, $S_a = R_a - D_a = [V_{1a} + p_1 c'_{1a}] - [A_{2a} + W_{1b} + p_1 c'_{1a}] = V_{1a} - A_{2a} - W_{1b}$.
For c, $S_c = R_c - D_c = [V_{2c} + p_2 c'_{2c}] - [A_{1c} + W_{2d} + p_2 c'_{2c}] = V_{2c} - A_{1c} - W_{2d}$.

8- Entrepreneurs' profits.
As $\pi_a = p_1 q_{1a} - W_{1b}$ and $\pi_a = p_1 q_{1a} - W_{1b}$, a's windfall result is: $WR_a = \pi_a - \pi_a = [p_1 - p_1]\, q_{1a}$.
Likewise for c: $WR_c = \pi_c - \pi_c = [p_2 - p_2]\, q_{2c}$.
In profits net of self-consumptions, the windfall results correspond to the monetary balances.

9- State of equilibrium.
If the price expectations are correct ($p_1 = p_1$ and $p_2 = p_2$), then $S_a = S_c = 0$ and $WR_a = WR_c = 0$ on the monetary side and $(c'_{1a}; c_{2a}) = (c'_{1a}; c_{2a})$ and $(c_{1c}; c'_{2c}) = (c_{1c}; c'_{2c})$ on the real side:
so the targeted allocation is attained, with a balanced effective budget constraint, for any capitalist.

NB: Identification of the notations used in the text and the ones used in this appendix:
Volumes of consumption (c) correspond to the amounts of good purchases (a) and to the volumes of self-consumption (c'). Values of consumption (C) correspond to the levels of consumption expenses (A) and to the values of self-consumption (C').

Appendix 4: Development of model IV.

Let's develop this model from the basis of the former one, highlighting the changes introduced. To emphasize the dissymmetry between consumption and investment, we keep the same rule of price formation for good 2 but turn to a different rule for good 1. Unlike the flexible Cantillon-Smith rule kept for the consumption good, we choose a fixed price rule for this investment good.

1- The capitalists' investment decisions.
Considering the expected price p_1 of the production good, the interest rate to come and more generally their expectations about the following periods, capitalists determine their level of investment: i'_{1a} for a and i_{1c} for c. Notice that if the current period carries a certain degree of uncertainty and entails some market jump and sanction, the uncertainty intrinsic to investment decisions is even greater, as it involves deeply uncertain variables: the evolution of profits and of the interest rate in the future periods.

2- The capitalists' production decisions.
Given the exogenous wage w_0 and the expected price p_1 of the investment good, a is assumed to maximize $\pi_a = p_1 q_{1a} - w_0 \int_{1a}$ under the technological constraint $q_{1a} = f_{1a}(\int_{1a})$. The optimality condition equalizing $MP\int_{1a}$ and (w_0/p_1) enables the determination of q_{1a}, $\int_{1a}$ and π_a as functions of w_0 and p_1. Capitalist a indeed produces $q_{1a} = q_{1a}$ using labor brought by b ($\int_{1a} = \int_{1a} = t_{1b}$) in exchange of a wage payment ($W_{1b} = w_0 t_{1b}$).
Likewise, c maximizes $\pi_c = p_2 q_{2c} - w_0 \int_{2c}$ under $q_{2c} = f_{2c}(\int_{2c})$, which gives q_{2c}, $\int_{2c}$ and π_c as functions of w_0 and p_2. Capitalist c produces $q_{2c} = q_{2c}$ using labor brought by b ($\int_{2c} = \int_{2c} = t_{2d}$) in exchange of a wage payment ($W_{2d} = w_0 t_{2d}$).

3- The consumption spending decisions.
For capitalists, profits are supposed to cover investment and consumption spendings, under the simplifying assumption of self-financing. As the accumulation process prevails, the financing of investment spendings comes first and consumption spendings are residual.
For a, $\pi_a = p_1 i'_{1a} + p_2 c_{2a} = I'_{1a} + C_{2a}$, which determines C_{2a} as a residue: $C_{2a} = \pi_a - I'_{1a}$ (assumed to be > 0).
For c, $\pi_c = p_1 i_{1c} + p_2 c'_{2c} = I_{1c} + C'_{2c}$, which determines C'_{2c} as a residue: $C'_{2c} = \pi_c - I_{1c}$ (assumed to be > 0).
For wage earners, all the revenue is used to buy the consumption good:
worker b engages $M_{2b} = W_{1b}$ and worker d engages $M_{2d} = W_{2d}$ on market 2.

4- Market actions, market prices and market results.
Capitalist a decides to self-invests i'_{1a} and offers $o_{1a} = q_{1a} - i'_{1a}$ on market 1.
On the other side of market 1, c demands i_{1c}.
The market price is $p_1 = p_1$ for the investment good.
First case: if $o_{1a} = i_{1c}$ (equilibrium), then $i_{1c} = i_{1c}$ and $i'_{1a} = i'_{1a}$; and we also have $I_{1c} = I_{1c}$ and $I'_{1a} = I'_{1a}$.
Second case: if $o_{1a} > i_{1c}$ (overproduction), then $i_{1c} = i_{1c}$ and $i'_{1a} > i'_{1a}$ (unsold good): $i'_{1a} = q_{1a} - i_{1c}$.
Third case: if $o_{1a} < i_{1c}$ (underproduction), then $i'_{1a} = i'_{1a}$ and $i_{1c} < i_{1c}$ (unbought good): $i_{1c} = q_{1a} - i'_{1a}$.
In any case, we have i_{1c} or $a_{1c} = \text{Min}[i_{1c}; o_{1a}] = v_{1a}$ (the exchange being voluntary and efficient); and we can denote the exchanged quantity of good 1 in a neutral way (purchase and sale) by e_1: $e_1 = \text{Min}[o_{1a}; i_{1c}]$.

Capitalist c self-consumes $c'_{2c} = c'_{2c} = C'_{2c} / p_2$ and offers $o_{2c} = q_{2c} - c'_{2c}$ on market 2.
On the other side of market 2, a bids $M_{2a} = C_{2a}$ or $p_2 c_{2a}$, b engages $M_{2b} = W_{1b}$ and d engages $M_{2d} = W_{2d}$.
The market price is $p_2 = [M_{2a} + M_{2b} + M_{2d}] / [o_{2c}] = M_2 / o_2$ for the consumption good.
For c: $v_{2c} = o_{2c}$ and $V_{2c} = p_2 v_{2c} = p_2 o_{2c}$.
For a: $A_{2a} = M_{2a}$ and $a_{2a} = M_{2a}/p_2$. For b: $A_{2b} = M_{2b}$ and $a_{2b} = M_{2b}/p_2$. For d: $A_{2d} = M_{2d}$ and $a_{2d} = M_{2d}/p_2$.

5- Final allocations.
Final bundle for a: $(i'_{1a}; c_{2a}) = (q_{1a} - v_{1a}; a_{2a}) = (q_{1a} - e_1; A_{2a}/p_2) = (q_{1a} - e_1; M_{2a}/p_2) = (q_{1a} - e_1; (p_2/p_2)\, c_{2a})$.
Final bundle for c: $(i_{1c}; c'_{2c}) = (a_{1c}; q_{2c} - v_{2c}) = (e_1; q_{2c} - o_{2c}) = (e_1; c'_{2c})$.
Final bundle for b: $(i_{1b}; c_{2b}) = (0; a_{2b}) = (0; A_{2b}/p_2) = (0; M_{2b}/p_2) = (0; W_{1b}/p_2)$.
Final bundle for d: $(i_{1d}; c_{2d}) = (0; a_{2d}) = (0; A_{2d}/p_2) = (0; M_{2d}/p_2) = (0; W_{2d}/p_2)$.
At the macro level, it can be verified that $q_{1a} - e_1 + e_1 = q_{1a}$ and that
$(p_2/p_2)\, c_{2a} + c'_{2c} + W_{1b}/p_2 + W_{2d}/p_2 = c'_{2c} + v_{2c} = q_{2c}$: the final allocation is indeed feasible.

6- Monetary balances and windfall results.
Monetary balance for a: $S_a = V_{1a} - A_{2a} - W_{1b} = [A_{1c}] - [A_{2a} + A_{2b}]$.
Monetary balance for c: $S_c = V_{2c} - A_{1c} - W_{2d} = [A_{2a} + A_{2b}] - [A_{1c}]$.
Monetary balance for b: $S_b = W_{1b} - A_{2b} = 0$.
Monetary balance for d: $S_d = W_{2d} - A_{2d} = 0$.
One verifies that $S = S_a + S_c + S_b + S_d = 0$ (because of the monetary general structure)
and that $S_a + S_c = 0$ (because of the monetary capitalist structure).

As $S_a = R_a - D_a - R_a + D_a = p_1 v_{1a} - p_2 c_{2a} - W_{1b} - p_1 o_{1a} + p_2 c_{2a} + W_{1b} = p_1 (v_{1a} - o_{1a}) - p_2 c_{2a} + p_2 c_{2a} = p_1 (e_1 - o_{1a})$
and $S_c = R_c - D_c - R_c + D_c = p_2 c_{2a} + p_2 c_{2b} - p_1 i_{1c} - p_2 o_{2c} + p_1 i_{1c} + W_{2d} = p_1 (i_{1c} - e_1) + o_{2c} (p_2 - p_2)$,
we have: $S = p_1 (i_{1c} - o_{1a}) + o_{2c} (p_2 - p_2) = 0$ (Walras' law).
It follows that there are three possible situations for the markets:
if $i_{1c} = o_{1a}$ and $p_2 = p_2$ ($S_a = 0$ and $S_c = 0$), then equilibrium in 1 and equilibrium in 2.
if $i_{1c} < o_{1a}$ and $p_2 > p_2$ ($S_a < 0$ and $S_c > 0$), then overproduction in 1 and underproduction in 2.
if $i_{1c} > o_{1a}$ and $p_2 < p_2$ ($S_a = 0$ and $S_c = 0$), then underproduction in 1 and overproduction in 2.

$WR_a = \pi_a - \pi_a = p_1 (i_{1a} + e_1) - W_{1b} - p_1 (i_{1a} + o_{1a}) + W_{1b} = p_1 (e_1 - o_{1a})$.
if $o_{1a} = i_{1c}$ (equilibrium in 1), then $e_1 = o_{1a}$ and $WR_a = 0$.
if $o_{1a} > i_{1c}$ (overproduction in 1), then $o_{1a} > e_1$ and $WR_a < 0$.
if $o_{1a} < i_{1c}$ (underproduction in 1), then $e_1 = o_{1a}$ and $WR_a = 0$.

$WR_c = \pi_c - \pi_c = p_2 q_{2c} - W_{2d} - p_2 q_{2c} + W_{2d} = (p_2 - p_2) q_{2c}$.
if $p_2 = p_2$ (equilibrium in 2), then $WR_c = 0$.
if $p_2 > p_2$ (underproduction in 2), then $WR_c > 0$.
if $p_2 < p_2$ (overproduction in 2 [so underproduction in 1]), then $WR_c < 0$.

The "underproduction in 1 and overproduction in 2" case deserves clarification. For a, the underproduction in 1 is indeed ineffective ($S_a = 0$ and $WR_a = 0$) as (s)he sells the expected quantity at the expected price. For c, the overproduction in 2 makes the actual receipts smaller than the expected ones (so $WR_c < 0$). On market 1, c wanted to spend $p_1 i_{1c}$ but actually spent only $p_1 e_1$, and this unused amount of money compensates the missing receipts [$p_1 (i_{1c} - e_1) = o_{2c} (p_2 - p_2)$], so in the end $S_c = 0$.

7- State of equilibrium.
If $o_{1a} = i_{1c}$ and $p_2 = p_2$, then $S_a = S_c = 0$ and $WR_a = WR_c = 0$ on the monetary side
and $(i'_{1a}; c_{2a}) = (i'_{1a}; c_{2a})$ and $(i_{1c}; c'_{2c}) = (i_{1c}; c'_{2c})$ on the real side:
so the targeted allocation is attained, with a balanced effective budget constraint, for any capitalist.

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