The distortionary effect of monetary policy: credit expansion vs. lump-sum transfers in the lab

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Monetary Policy Challenges from a Small Country Perspective

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Introduction

Motivation

- Does the process of monetary injection matter for the allocative effect of monetary policy?
- In mainstream macroeconomics, the process of monetary injection is irrelevant because money is, in itself, neutral. Real effects of monetary policy are accounted for by means of exogenous frictions
  - in information gathering: Phelps (1970), Lucas (1972), Mankiw-Reis (2002)
  - in price setting: Rotemberg (1982), Calvo (1983)
- Following Cantillon (1755), the process of monetary injection matters because money is never neutral as it enters the economy at a certain point and affects relative prices rather than all prices to the same extent.

Introduction

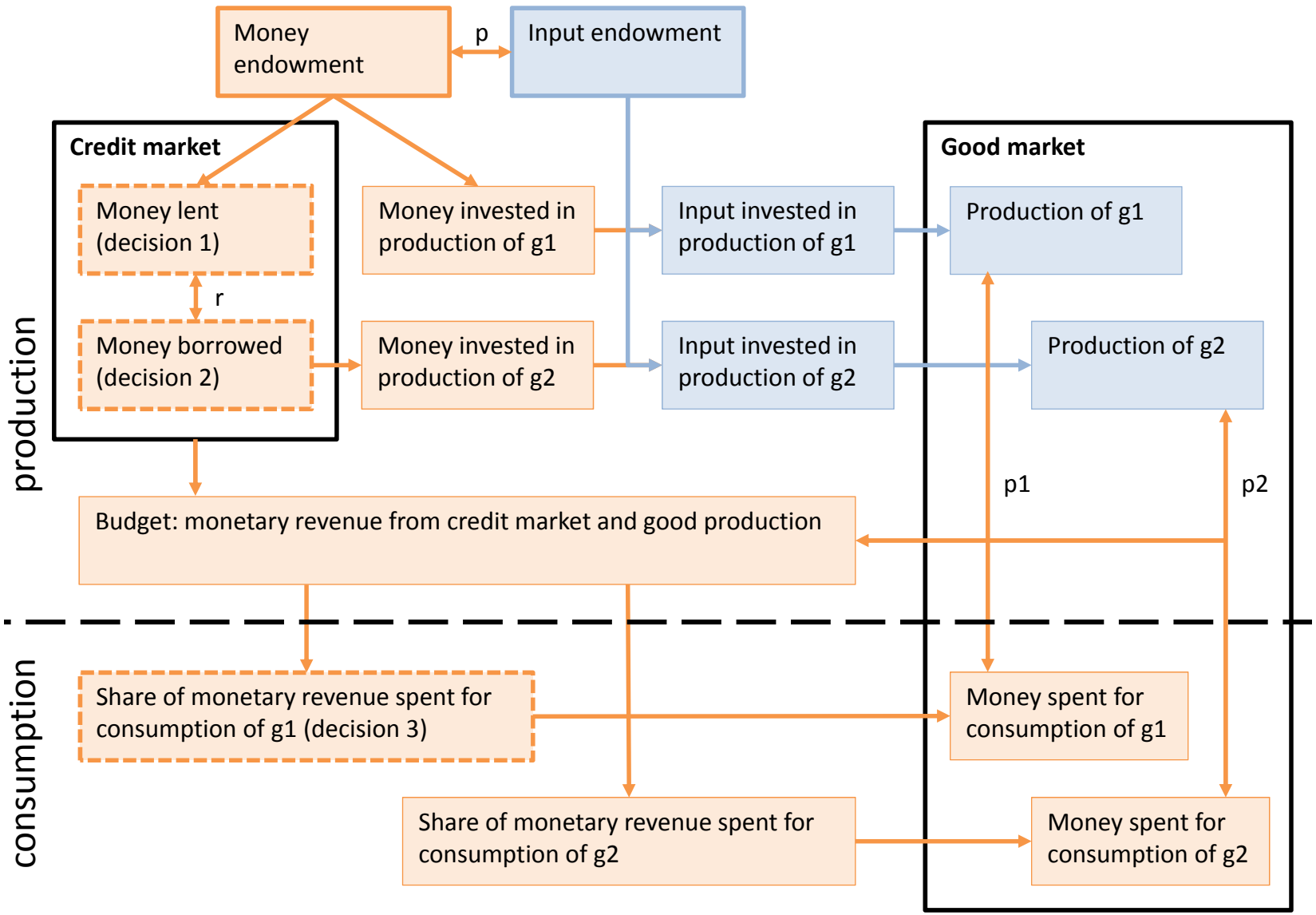
Two processes of monetary injection

- Credit expansion: money is injected into the credit market.
  In the credit-money economy, money is issued through the granting of credit.
  Money is *lent* into existence.

- Lump-sum transfers: money is evenly distributed across agents.
  The central bank issues and gives money without compensation.
  The increase in money is not conditional on the granting of credit.
  Money is *spent* into existence.

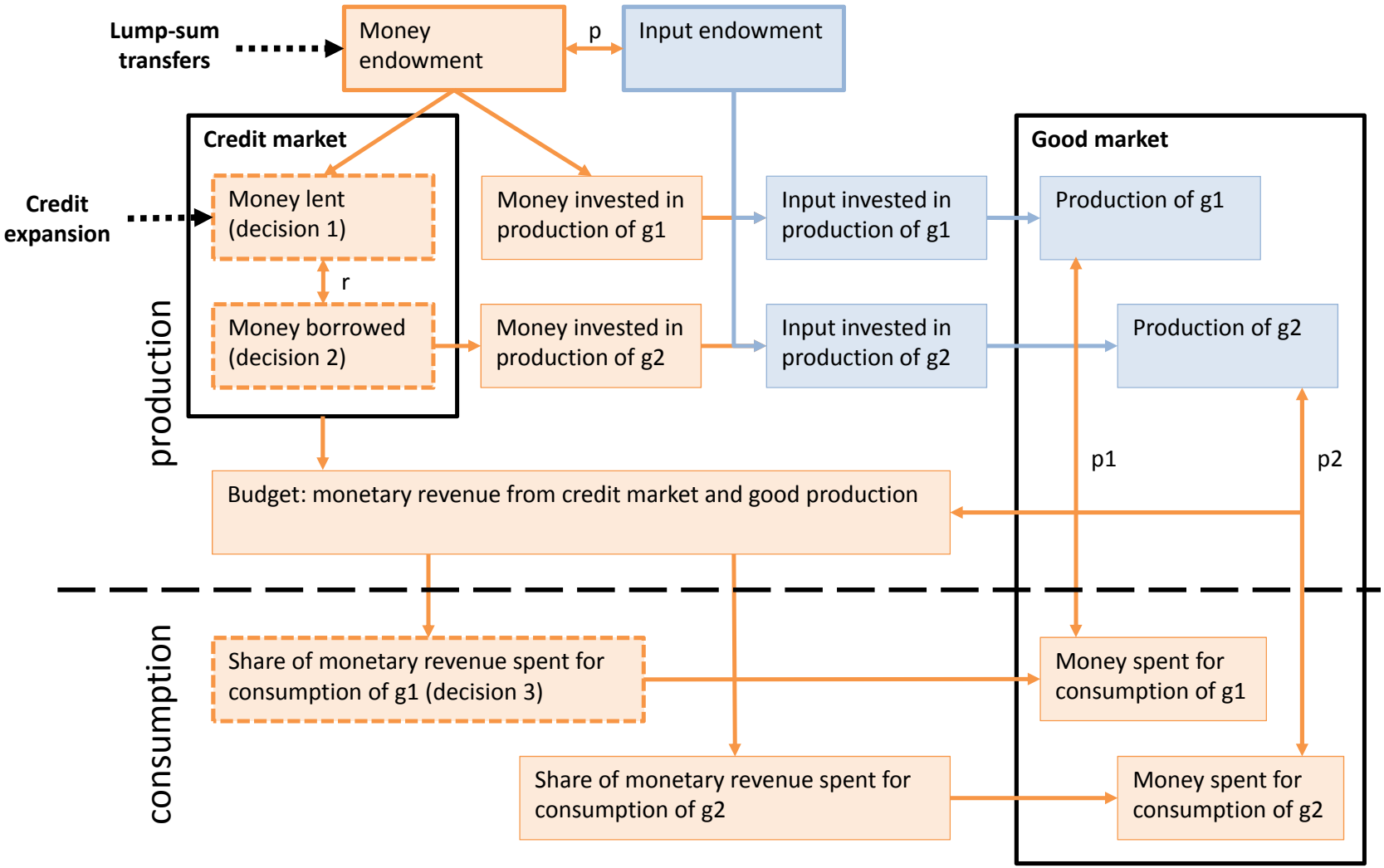
Introduction

Schema of the general equilibrium economy



Introduction

Schema of the general equilibrium economy



Introduction

Main results

- In our theoretical model, the optimal allocation of resources is independent of the process of monetary injection.
- However, equilibrium behavior of agents depends on the monetary process:
  - agents should increase both lending and borrowing in the wake of lump-sum transfers
  - agents should reduce lending but increase borrowing in the wake of credit expansion.
- In the experiment, credit expansion entails substantially larger distortions in the production allocation than lump-sum transfers.
- Credit expansion also exerts a redistributive effect across subjects in favor of those who have a high consumption preference for good 2.

Introduction

Related experimental literature on money and credit

- Money illusion: Fehr and Tyran (2001 AER, 2008 ECMA)
- Emergence of money in search-models: Duffy and Ochs (1999 AER), Duffy and Puzzello (2014 AER)
- Impersonal exchanges in decentralized economy: Camera and Casari (2014 AEJ:MI)
- Monetary general equilibrium: Lian and Plott (1998 ET)
- Credit market in a barter economy as pure financial intermediation: Bosch-Domenech and Silvester (1997 EJ)

- This paper: credit expansion as monetary injection into the credit market

Agenda

- Introduction
- The economy
- The experiment
- Results
- Conclusion

The economy

Production technology and utility function

Endowment

- L_i: real input (labor)
- M_i: money

Production technology

- $g_{i,1} = L_{i,1}$: production of good 1
- $g_{i,2} = L_{i,2}^{\beta}$, with $0 < \beta < 1$: production of good 2

Utility function

- $U_i = c_{i,1}^{\alpha_i} \cdot c_{i,2}^{1-\alpha_i}$

The economy

Decisions

1. Lending decision - production of good 1
   M_i^l, with $0 < M_i^l < M_i$: money lent on the credit market
   $M_i - M_i^l$: money invested into the production of good 1

2. Borrowing decision - production of good 2
   M_i^b: money borrowed on the credit market and invested into the production of good 2

3. Consumption decision
   s_i, with $0 < s_i < 1$: share of revenue spent on the consumption of good 1
   $1 - s_i$: share of revenue spent on the consumption of good 2

The economy

Monetary policy

- Credit expansion captures the functioning of the current credit-money economy, where money is created through the granting of credit.
  K: money injected into the credit market

- Lump-sum transfers increase the quantity of money endowment without directly affecting the credit market.
  M: money endowment

The economy

Some assumptions

- Agents must borrow on the credit market the money they invest in the production of good 2. This captures the fact that some sectors are more dependent on credit than others.
- Agents cannot make use of their own input, money lent and produced goods, but must sell and buy at the market price. This gives a role to market exchanges when agents are homogenous.
- Market prices are simultaneously determined on all markets such that markets clear.
- Agents cannot hoard money.

The economy

Market clearing

- Input price

$$p = \frac{M + K}{L} \quad \rightarrow \quad w_i = p(L_i - L_{i,1} - L_{i,2})$$

- Interest rate

$$r = \frac{M^b}{M^l + K} \quad \rightarrow \quad f_i = (r-1)(M_i^l - \tfrac{M_i^b}{r}) + r\tfrac{K}{n}$$

- Price of goods 1 and 2

$$\begin{aligned} p_1 &= \frac{\sum_i s_i g_{i,2} B - \sum_i (1-s_i)(w_i + f_i) g_2}{\sum_i (1-s_i) g_{i,1} g_2 + \sum_i s_i g_{i,2} g_1} \\ p_2 &= \frac{\sum_i (1-s_i) g_{i,1} B - \sum_i s_i (w_i + f_i) g_1}{\sum_i (1-s_i) g_{i,1} g_2 + \sum_i s_i g_{i,2} g_1} \\ B_i &= p_1 g_{i,1} + p_2 g_{i,2} + w_i + f_i \end{aligned}$$

The economy

First-order conditions

- Optimal lending and borrowing decisions

$$
\begin{aligned}
B_i &= \frac{M_i - M_i^l}{p} p_1 + \left(\frac{M_i^b}{rp}\right)^{\beta} p_2 + rM_i^l - M_i^b + r\frac{K}{n} \\
\frac{\partial B_i}{\partial M_i^l} &= 0 \quad \Leftrightarrow \quad p_1 = rp \\
\frac{\partial B_i}{\partial M_i^b} &= 0 \quad \Leftrightarrow \quad \beta p_2 \left(\frac{M_i^b}{rp}\right)^{\beta-1} = rp
\end{aligned}
$$

- Optimal consumption decision

$$
\begin{aligned}
\mathcal{L} &= c_{i,1}^{\alpha_i} \cdot c_{i,2}^{1-\alpha_i} + \lambda \left[B_i - c_{i,1}p_1 - c_{i,2}p_2\right] \\
\frac{\partial \mathcal{L}}{\partial c_{i,1}} &= 0, \frac{\partial \mathcal{L}}{\partial c_{i,2}} = 0 \quad \Leftrightarrow \quad c_{i,1}p_1 = \alpha_i B_i
\end{aligned}
$$

The economy

Equilibrium

$$
\begin{aligned}
p_1 &= (\bar{\alpha} + \beta(1-\bar{\alpha}))\,\frac{M+K}{L} \\
p_2 &= (1-\bar{\alpha})\left(\frac{\beta(1-\bar{\alpha})}{\bar{\alpha}+\beta(1-\bar{\alpha})}\bar{L}_i\right)^{-\beta}(\bar{M}_i+\bar{K}_i) \\
r &= \bar{\alpha}+\beta(1-\bar{\alpha}) \\
g_{i,1} &= \frac{\bar{\alpha}}{\bar{\alpha}+\beta(1-\bar{\alpha})}L_i \\
g_{i,2} &= \left(\frac{\beta(1-\bar{\alpha})}{\bar{\alpha}+\beta(1-\bar{\alpha})}L_i\right)^{\beta} \\
\bar{M}_i^l &= \frac{\beta(1-\bar{\alpha})}{\bar{\alpha}+\beta(1-\bar{\alpha})}\bar{M}_i - \frac{\bar{\alpha}}{\bar{\alpha}+\beta(1-\bar{\alpha})}\bar{K}_i \\
M_i^b &= \beta(1-\bar{\alpha})(\bar{M}_i+\bar{K}_i) \\
s_i &= \alpha_i
\end{aligned}
$$

The economy

Theoretical reaction to monetary policy

- Credit expansion

$$\frac{\partial \bar{M}_i^l}{\partial \bar{K}_i} = -\frac{\bar{\alpha}}{\bar{\alpha} + \beta(1-\bar{\alpha})} < 0$$
$$\frac{\partial M_i^b}{\partial \bar{K}_i} = \beta(1-\bar{\alpha}) > 0$$

- Lump-sum transfers

$$\frac{\partial \bar{M}_i^l}{\partial \bar{M}_i} = \frac{\beta(1-\bar{\alpha})}{\bar{\alpha} + \beta(1-\bar{\alpha})} > 0$$
$$\frac{\partial M_i^b}{\partial \bar{M}_i} = \beta(1-\bar{\alpha}) > 0$$

The experiment

Procedure

- Sessions were run at the GATE-LAB of the University of Lyon in February 2015.
- 4 sessions of each 18 participants, 3 independent groups of 6 participants per session, 12 independent groups in total.
- 3 stages per session corresponding to different treatments (baseline, credit expansion, lump-sum transfers), 15 periods per stage, 45 periods per session.
- 350 ECU=1 euro, payoffs ranged from 15 to 28 euros, average payoff about 22 euros.

The experiment

Parameters and theoretical values

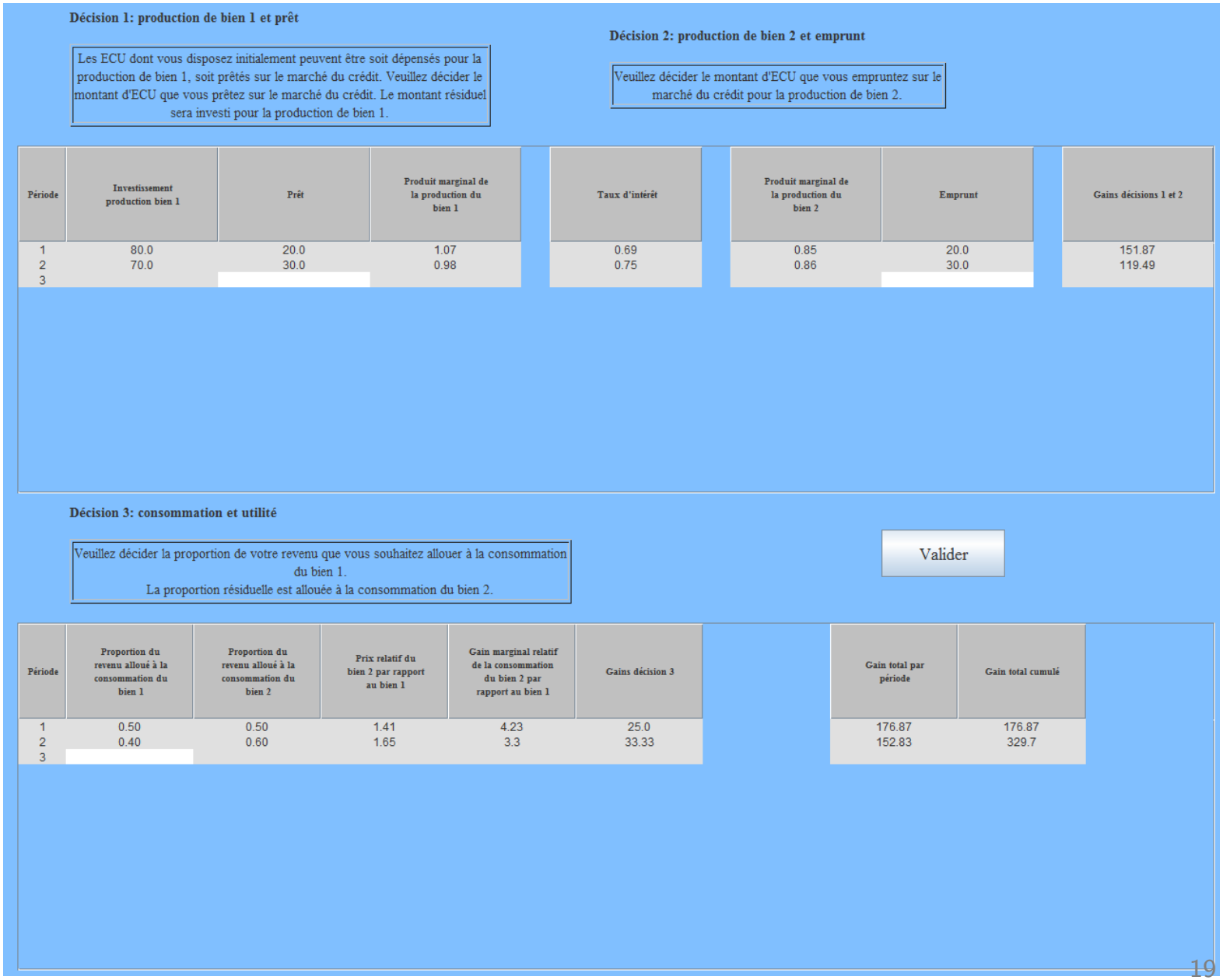
Group	Period	Treatment	M_i	$\bar{K}_i$	L_i	β	$\bar{\alpha}$
1-6	1-15	Baseline	100	0	20	0.8	0.5
	16-30	Credit expansion	100	40	20	0.8	0.5
	31-45	Lump-sum transfers	140	0	20	0.8	0.5
7-12	1-15	Baseline	100	0	20	0.8	0.5
	16-30	Lump-sum transfers	140	0	20	0.8	0.5
	31-45	Credit expansion	100	40	20	0.8	0.5

with $\alpha_i \in [0.25, 0.35, 0.45, 0.55, 0.65, 0.75]$

Treat.	r	p	p_1	p_2	M_i^l	M_i^b	$g_{i,1}$	$g_{i,2}$
B	0.9	5	4.50	8.71	44.44	40.00	11.11	5.74
C	0.9	7	6.30	12.19	22.22	56.00	11.11	5.74
L	0.9	7	6.30	12.19	62.22	56.00	11.11	5.74

The experiment

Screen



Décision 1: production de bien 1 et prêt

Les ECU dont vous disposez initialement peuvent être soit dépensés pour la production de bien 1, soit prêtés sur le marché du crédit. Veuillez décider le montant d'ECU que vous prêtez sur le marché du crédit. Le montant résiduel sera investi pour la production de bien 1.

Décision 2: production de bien 2 et emprunt

Veuillez décider le montant d'ECU que vous empruntez sur le marché du crédit pour la production de bien 2.

Période	Investissement production bien 1	Prêt	Produit marginal de la production du bien 1	Taux d'intérêt	Produit marginal de la production du bien 2	Emprunt	Gains décisions 1 et 2
1	80.0	20.0	1.07	0.69	0.85	20.0	151.87
2	70.0	30.0	0.98	0.75	0.86	30.0	119.49
3							

Décision 3: consommation et utilité

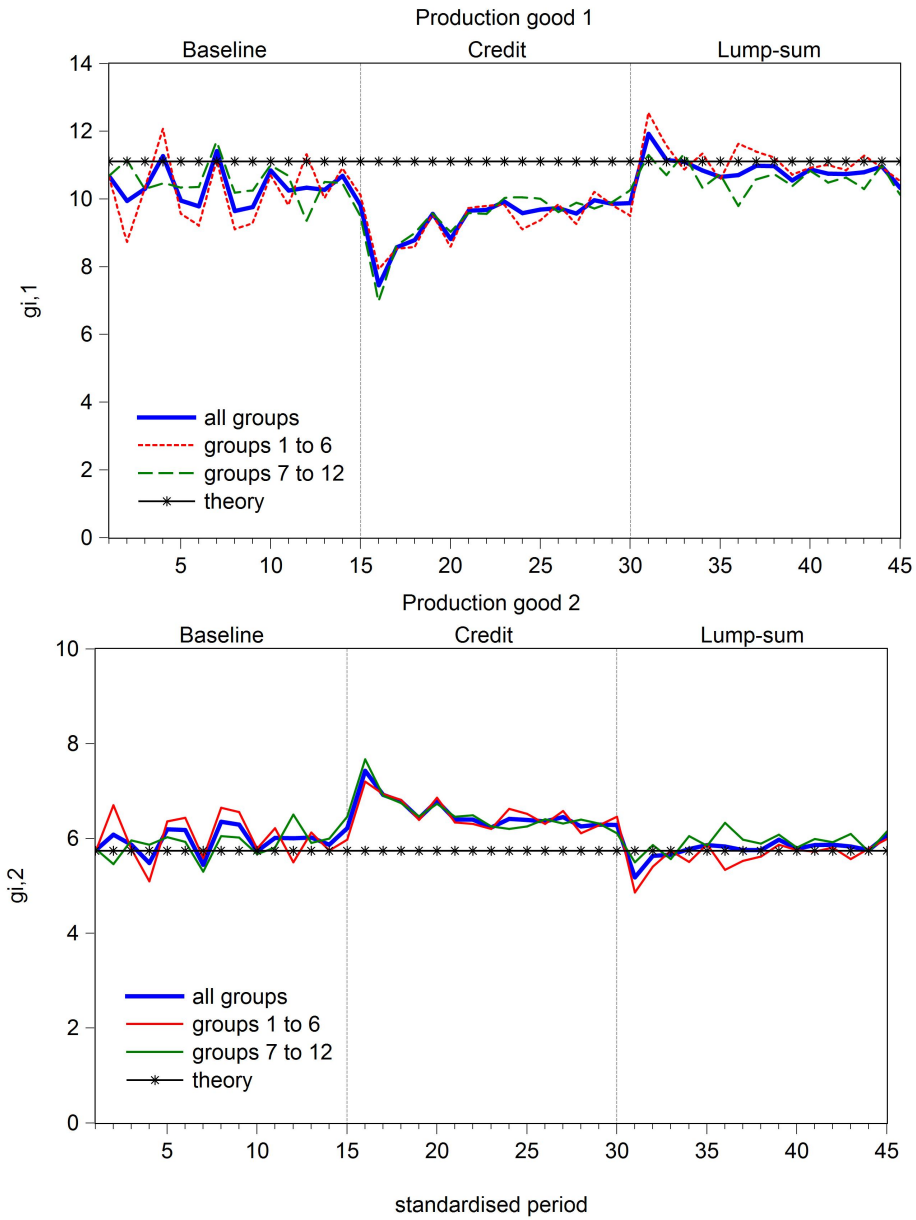
Veuillez décider la proportion de votre revenu que vous souhaitez allouer à la consommation du bien 1.
La proportion résiduelle est allouée à la consommation du bien 2.

Valider

Période	Proportion du revenu alloué à la consommation du bien 1	Proportion du revenu alloué à la consommation du bien 2	Prix relatif du bien 2 par rapport au bien 1	Gain marginal relatif de la consommation du bien 2 par rapport au bien 1	Gains décision 3	Gain total par période	Gain total cumulé
1	0.50	0.50	1.41	4.23	25.0	176.87	176.87
2	0.40	0.60	1.65	3.3	33.33	152.83	329.7
3							

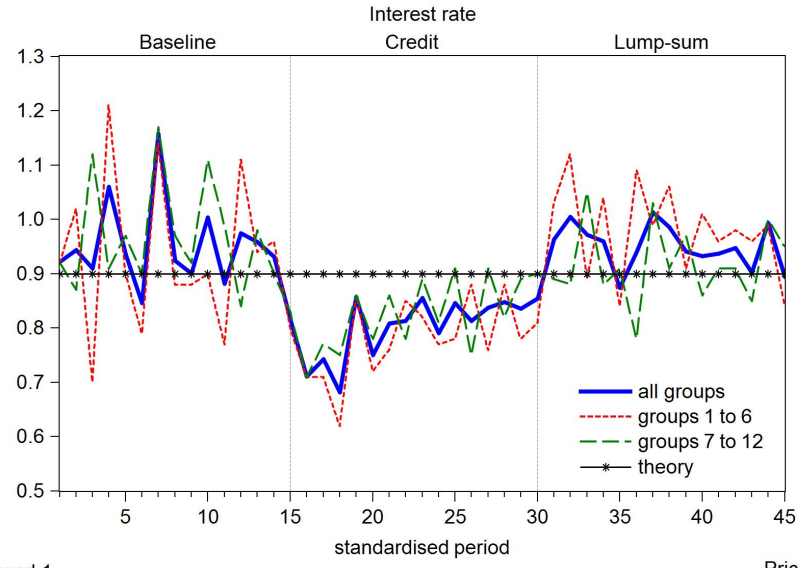
Results

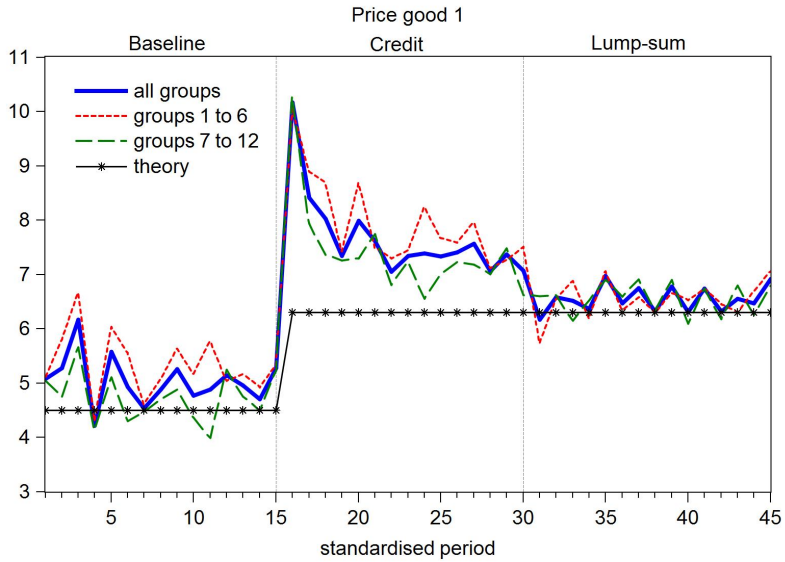
Production of good 1 and good 2

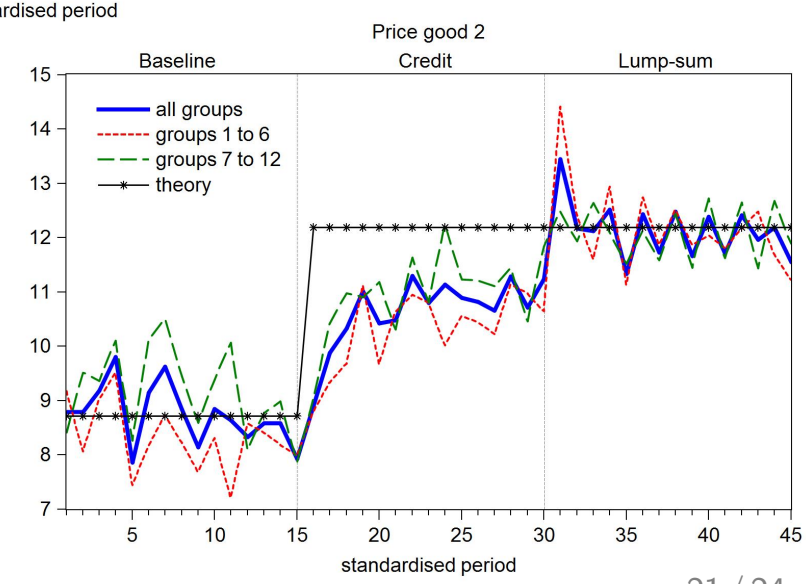


Results

Interest rate and prices

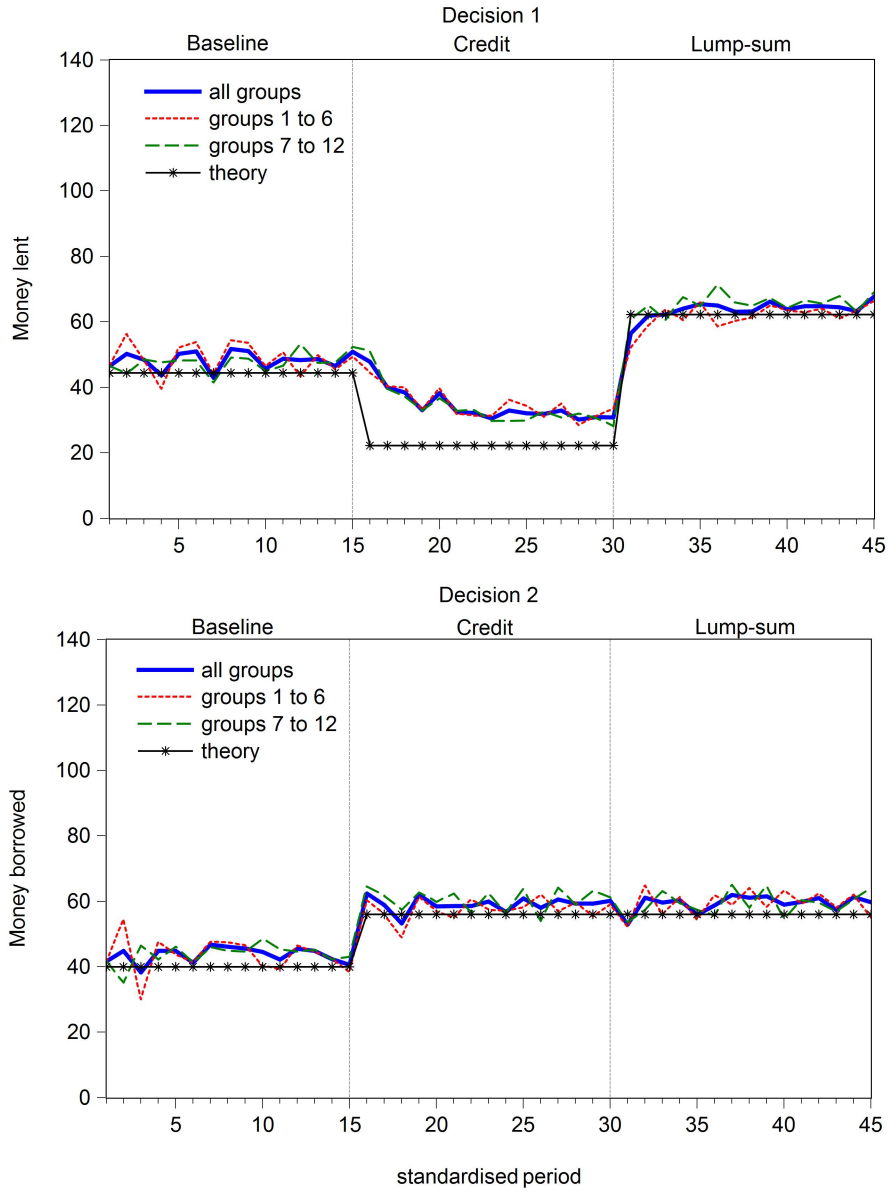






Results

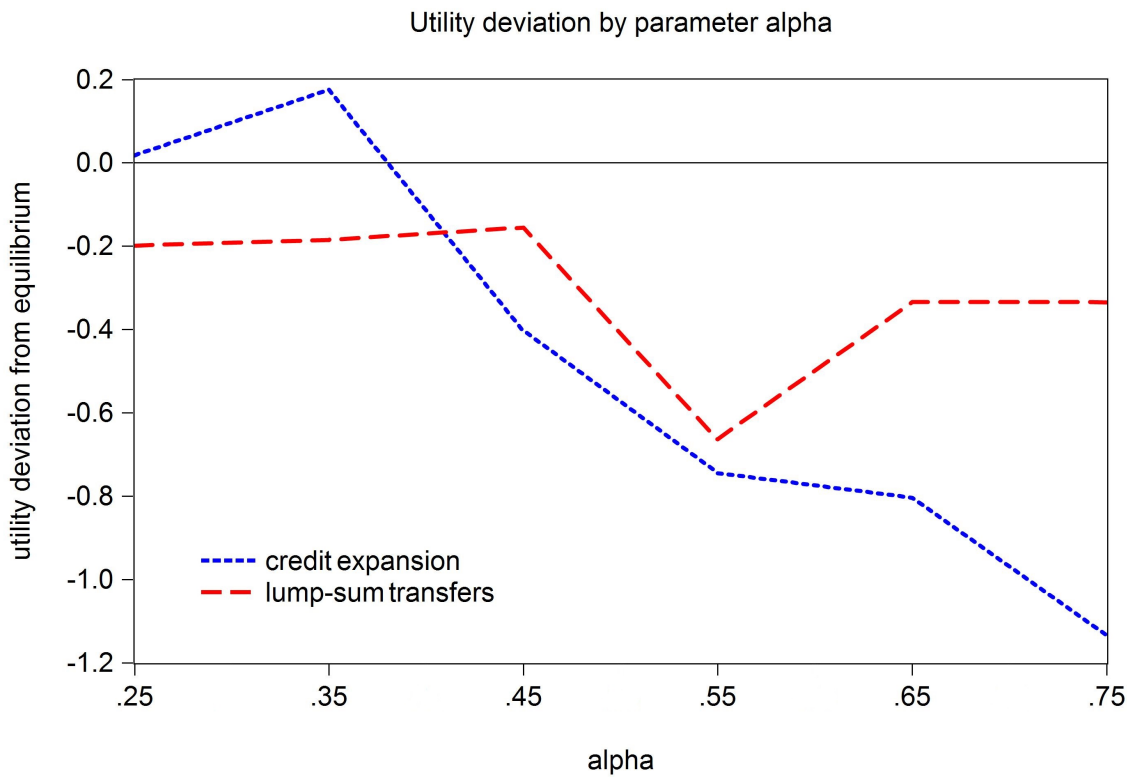
Lending and borrowing decisions



Results

Redistributive effect

- As credit expansion stimulates the production of good 2 above equilibrium, it improves utility of subjects with a high marginal utility of consuming good 2 and deteriorates utility of subjects with a low marginal utility of consuming good 2.



Conclusion

- Although theory predicts that the process of monetary injection is irrelevant and neutral for resource allocation, the experiment shows that credit expansion exerts a significant distortionary effect because it does not affect all markets evenly.
- Credit expansion also has a redistributive effect across subjects in favor of those who have a high consumption preference for the good that is stimulated by credit.
- This suggests that the process of monetary injection and its economic consequences should be addressed in implementing specific monetary policy measures or in designing the monetary system as a whole.