
Liquidity Preference, Uncertainty and Debt-Deflation Process in a Stock-Flow Consistent Model

Yannis Dafermos, University of Athens

The Hyman P. Minsky Summer Conference

The Levy Economics Institute of Bard College

June 27-29, 2010

The purpose of the paper

- Liquidity preference and uncertainty constitute fundamental concepts in Post Keynesian analysis of monetary production economies (Davidson, 2002).
- In stock-flow consistent (SFC) models liquidity preference has been formalized as a factor that affects the asset choice of households and commercial banks (see e.g. Godley and Lavoie, 2007; Zezza and Dos Santos, 2006; Le Heron and Mouakil, 2008).
- With regard to uncertainty, Le Heron and Mouakil (2008) have concentrated attention on the way that the perceived risks of banks affect their credit rationing. Le Heron (2009) has linked the behaviour of the private sector with its state of confidence.

The purpose of the paper

- The aim of this paper is to extend the above considerations by developing a SFC model that pays explicit emphasis to the impact that liquidity preference and perceived uncertainty may exert on economic behavior and macroeconomic performance.
- The novel features of the model are the following:
 - We incorporate liquidity preference simultaneously in the decision-making process of households, firms and commercial banks.
 - We make an explicit connection between liquidity preference and precautionary motive.
 - We follow Minsky (1975, ch. 4) and associate the asset choice of households and firms with their financial obligations.
 - We link the desired borrowing of households and firms with their perceived degree of uncertainty.

The purpose of the paper

- An additional aim of the paper is to indicate how a rise in the perceived degree of uncertainty of the private sector is likely to generate a debt-deflation process, similar to the one that has been described by Fisher (1933), Minsky (1982) and Wolfson (1996).
- In light of this objective, the constructed model is solved numerically with the aid of simulations and the developments that are triggered by a shock of perceived uncertainty are explored.

The outline of the presentation

1. The structure of the model
2. Liquidity preference and perceived uncertainty in the decision-making process of *households*
3. Liquidity preference and perceived uncertainty in the decision-making process of *firms*
4. Liquidity preference and perceived uncertainty in the decision-making process of *banks*
5. Uncertainty shock and debt-deflation process (simulations)
6. Conclusion

The outline of the presentation

1. **The structure of the model**
2. Liquidity preference and perceived uncertainty in the decision-making process of *households*
3. Liquidity preference and perceived uncertainty in the decision-making process of *firms*
4. Liquidity preference and perceived uncertainty in the decision-making process of *banks*
5. Uncertainty shock and debt-deflation process (simulations)
6. Conclusion

1. The structure of the model

- Our postulated economy consists of households, firms, commercial banks, the government and the central bank.
- Households hold their wealth in the form of high-powered money (HPM_H), deposit money (M), treasury bills (B_H) and equities (e). They also take on loans from banks (LH) in order to finance consumption expenditures and speculate in the stock market.
- Firms' assets comprise capital stock (K) and high-powered money (HPM_F). Their investment expenditures are financed by retained earnings, equity emission and loans from banks (LF).
- Commercial banks earn profits by lending households and firms and by purchasing treasury bills (B_B). They also hold reserves (HPM_F) -both required and voluntary.

1. The structure of the model

- Central bank provides advances (A) to commercial banks and acts as a residual purchaser of the treasury bills issued by the government.
- Government receives revenues by imposing taxes on the income of households. It issues treasury bills in order to finance its deficit.
- For the purposes of our analysis, we define an indicator of Perceived Degree of Uncertainty of private sector (PDU). This indicator takes values from 0 (minimum uncertainty) to 1 (maximum uncertainty).

The balance sheet matrix

	Government	Households	Firms	Commercial Banks	Central Bank	Total
Deposits		+M		-M		0
Equities		+ e_p	- e_p			0
Loans to households		-LH		+LH		0
Loans to firms			-LF	+LF		0
Capital			+K			+K
CB Advances				-A	+A	0
Treasury bills	-B	+ B_H		+ B_B	+ B_{cb}	0
High-Powered Money		+ HPM_H	+ HPM_F	+ HPM_B	-HPM	0
Net Wealth	-B	+ V_H	+ V_F	0	0	+K

1. The structure of the model

The transactions matrix

	Government	Households	Firms		Commercial Banks		Central Bank		Total
			Current	Capital	Current	Capital	Current	Capital	
Consumption		-C	+C						0
Government expenditures	-G		+G						0
Net investment			+I	-I					0
Wages		+W	-W						0
Profits		+DP	-TP	+UP					0
Interest on households' loans		$-r_{LH-1}LH_{-1}$			$+r_{LH-1}LH_{-1}$				0
Interest on firms' loans			$-r_{LF-1}LF_{-1}$		$+r_{LF-1}LF_{-1}$				0
Interest on deposits		$+r_{M-1}M_{-1}$			$-r_{M-1}M_{-1}$				0
Income taxes	+T	-T							0
Interest on CB advances					$-r_{CB-1}A_{-1}$		$+r_{CB-1}A_{-1}$		0
Commercial banks' profits		+BP			-BP				0
Central Bank's profits	+CBP						-CBP		0
Interest on treasury bills	$-r_{B-1}B_{-1}$	$+r_{B-1}B_{H-1}$			$+r_{B-1}B_{B-1}$		$+r_{B-1}B_{CB-1}$		0
Δ loans to households		$+\Delta LH$				$-\Delta LH$			0
Δ loans to firms				$+\Delta LF$		$-\Delta LF$			0
Δ deposits		$-\Delta M$				$+\Delta M$			0
Δ equities		$-\Delta ep_e$		$+\Delta ep_e$					0
Δ CB advances						$+\Delta A$		$-\Delta A$	0
Δ treasury bills	$+\Delta B$	$-\Delta B_H$				$-\Delta B_B$		$-\Delta B_{CB}$	0
Δ HPM (High-Powered Money)		$-\Delta HPM_H$		$-\Delta HPM_F$		$-\Delta HPM_B$		$+\Delta HPM$	0
Total	0	0	0	0	0	0	0	0	0

The outline of the presentation

1. The structure of the model
- 2. Liquidity preference and perceived uncertainty in the decision-making process of *households***
3. Liquidity preference and perceived uncertainty in the decision-making process of *firms*
4. Liquidity preference and perceived uncertainty in the decision-making process of *banks*
5. Uncertainty shock and debt-deflation process (simulations)
6. Conclusion

2. Liquidity preference and perceived uncertainty in the decision-making process of *households*

- The asset choice of households relies on the Tobinsque principles:

$$HPM_H = \left[\lambda_{10} + \lambda_{11} \cdot (-g_p^e / (1 + g_p^e)) + \lambda_{12} r^e r_M + \lambda_{13} r^e r_B + \lambda_{14} r^e r r_e + \lambda_{15} (YT_H^e / V_{HA}^e) \right] V_{HA}^e$$

$$M = \left[\lambda_{20} + \lambda_{21} \cdot (-g_p^e / (1 + g_p^e)) + \lambda_{22} r^e r_M + \lambda_{23} r^e r_B + \lambda_{24} r^e r r_e + \lambda_{25} (YT_H^e / V_{HA}^e) \right] V_{HA}^e$$

$$B_H = \left[\lambda_{30} + \lambda_{31} \cdot (-g_p^e / (1 + g_p^e)) + \lambda_{32} r^e r_M + \lambda_{33} r^e r_B + \lambda_{34} r^e r r_e + \lambda_{35} (YT_H^e / V_{HA}^e) \right] V_{HA}^e$$

$$E = \left[\lambda_{40} + \lambda_{41} \cdot (-g_p^e / (1 + g_p^e)) + \lambda_{42} r^e r_M + \lambda_{43} r^e r_B + \lambda_{44} r^e r r_e + \lambda_{45} (YT_H^e / V_{HA}^e) \right] V_{HA}^e$$

- The allocation of wealth relies on: 1) the expected rate of return of each asset, 2) the transaction demand for money and 3) λ_{10} which captures the component of *liquidity premium* that is associated with the *precautionary motive* of households.

2. Liquidity preference and perceived uncertainty in the decision-making process of *households*

- The precautionary motive depends on:
 - 1) *Perceived degree of uncertainty*. We have assumed that the higher is the perceived degree of uncertainty (PDU) the higher is the proportion of wealth that households wish to hold in the form of money relative to other assets.
 - 2) *Households' financial obligations*. We draw on Minsky's (1975, ch. 4) extension to Keynes's liquidity preference schedule, according to which economic units' precautionary motive induces them to hold more money as their financial obligations increase.
- In our formalization, the demand for money is allowed to increase as the burden of debt of households (bur_H) becomes higher relative to their target one (bur_H^T).

2. Liquidity preference and perceived uncertainty in the decision-making process of *households*

- The burden of households' debt is given by:

$$bur_H = [(r_{LH} + rep_{LH}) \cdot LH_{-1}] / YT_H$$

- Overall, we have that:

$$\lambda_{10} = h_{10} + h_{11} \cdot PDU + h_{12} \cdot (bur_{H-1} - bur_H^T)$$

$$\lambda_{20} = h_{20} + h_{21} \cdot PDU + h_{22} \cdot (bur_{H-1} - bur_H^T)$$

$$\lambda_{30} = h_{30} + h_{31} \cdot PDU + h_{32} \cdot (bur_{H-1} - bur_H^T)$$

$$\lambda_{40} = h_{40} + h_{41} \cdot PDU + h_{42} \cdot (bur_{H-1} - bur_H^T)$$

$$h_{1j} > 0 \quad h_{2j}, h_{3j}, h_{4j} < 0 \quad j = 1, 2$$

2. Liquidity preference and perceived uncertainty in the decision-making process of *households*

- The new amount of loans that households demand for consumption purposes is a function of their lagged income (see Godley and Lavoie, 2007, ch. 11):

$$NLH_{CD} = \xi \cdot YT_{H-1}$$

- ξ is given by:

$$\xi = \xi_0 + \xi_1(bur_H^T - bur_{H-1}) - \xi_2 \cdot r_{LH} - \xi_3 \cdot PDU$$

- The new amount of loans that households demand for speculation in the stock market depends on their lagged wealth:

$$NLH_{ED} = \rho \cdot V_{H-1}$$

- ρ is given by: $\rho = \rho_0 + \rho_1(bur_H^T - bur_{H-1}) + \rho_2 \cdot (rr_e^e - r_{LH}) - \rho_3 \cdot PDU$

The outline of the presentation

1. The structure of the model
2. Liquidity preference and perceived uncertainty in the decision-making process of *households*
- 3. Liquidity preference and perceived uncertainty in the decision-making process of *firms***
4. Liquidity preference and perceived uncertainty in the decision-making process of *banks*
5. Uncertainty shock and debt-deflation process (simulations)
6. Conclusion

3. Liquidity preference and perceived uncertainty in the decision-making process of *firms*

- The desired real investment of firms is given by:

$$RI_D = \left(b_0 + b_1 cu_{-1} + b_2 \frac{UP}{K_{-1}} + b_3 (bur_F^T - bur_{F-1}) - b_4 \cdot r_{LF} \right) RK_{-1}$$

- The animal spirits of firms and their target burden of debt depend on the perceived degree of uncertainty.
- In our model we also assume that firms hold a proportion (hp) of their undistributed profits (UP) in the form of high-powered money in order to be able to meet their contractual cash outflows.
- This proportion is given by: $hp = hp_0 + hp_1 \cdot PDU + hp_2 \cdot (bur_{F-1} - bur_F^T)$

The outline of the presentation

1. The structure of the model
2. Liquidity preference and perceived uncertainty in the decision-making process of *households*
3. Liquidity preference and perceived uncertainty in the decision-making process of *firms*
4. **Liquidity preference and perceived uncertainty in the decision-making process of *banks***
5. Uncertainty shock and debt-deflation process (simulations)
6. Conclusion

4. Liquidity preference and perceived uncertainty in the decision-making process of *banks*

- Our analysis relies on the recent literature on the liquidity preference of banks (see e.g. Cardim de Carvalho, 1999; Dow, 2006; Le Heron and Mouakil, 2008; Bibow, 2009)
- According to this literature, the higher is the liquidity preference of banks the more they reallocate their funds from loans to treasury bills and voluntary reserves. In our model, this implies that banks increase their creditworthiness criteria.
- We use an index for credit rationing (CR) that takes values from 0 (no rationing) to 1 (full rationing):

$$CR_{LH} = \omega_1 \cdot PDU + \omega_2 \cdot bur_{H-1} + \omega_3 \cdot (LH_{-1} / V_{H-1}) + \omega_4 \cdot (liq_{-1} - liq^T) + \omega_5 \cdot r_{CB}$$

$$CR_{LF} = \sigma_1 \cdot PDU + \sigma_2 \cdot bur_{F-1} + \sigma_3 \cdot (LF_{-1} / K_{-1}) + \sigma_4 \cdot (liq_{-1} - liq^T) + \sigma_5 \cdot r_{CB}$$

4. Liquidity preference and perceived uncertainty in the decision-making process of *banks*

- The proportion v of deposit money that is held in the form of voluntary reserves is a function of the perceived degree of uncertainty and of central bank's interest rate:

$$v = v_0 + v_1 \cdot PDU - v_2 \cdot r_{CB}$$

- The lending interest rates depend on the discount interest rate, the oligopoly structure and the perceived risk of default (see also Le Heron and Mouakil, 2008):

$$r_{LH} = r_{CB} + m_{0LH} + m_{1LH} \cdot bur_{H-1} + m_{2LH} \cdot (LH_{-1} / V_{H-1}) + m_{3LH} \cdot PDU$$

$$r_{LF} = r_{CB} + m_{0LF} + m_{1LF} \cdot bur_{F-1} + m_{2LF} \cdot (LF_{-1} / K_{-1}) + m_{3LF} \cdot PDU$$

- We allow the perceived degree of uncertainty to affect the risk premium.

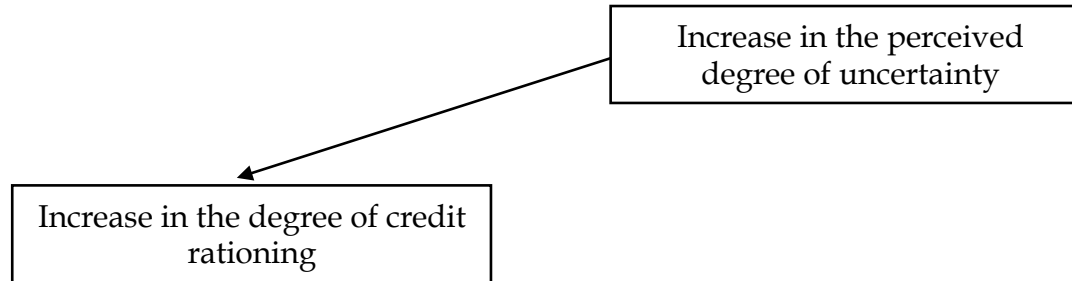
The outline of the presentation

1. The structure of the model
2. Liquidity preference and perceived uncertainty in the decision-making process of *households*
3. Liquidity preference and perceived uncertainty in the decision-making process of *firms*
4. Liquidity preference and perceived uncertainty in the decision-making process of *banks*
- 5. Uncertainty shock and debt-deflation process (simulations)**
6. Conclusion

5. Uncertainty shock and debt-deflation process

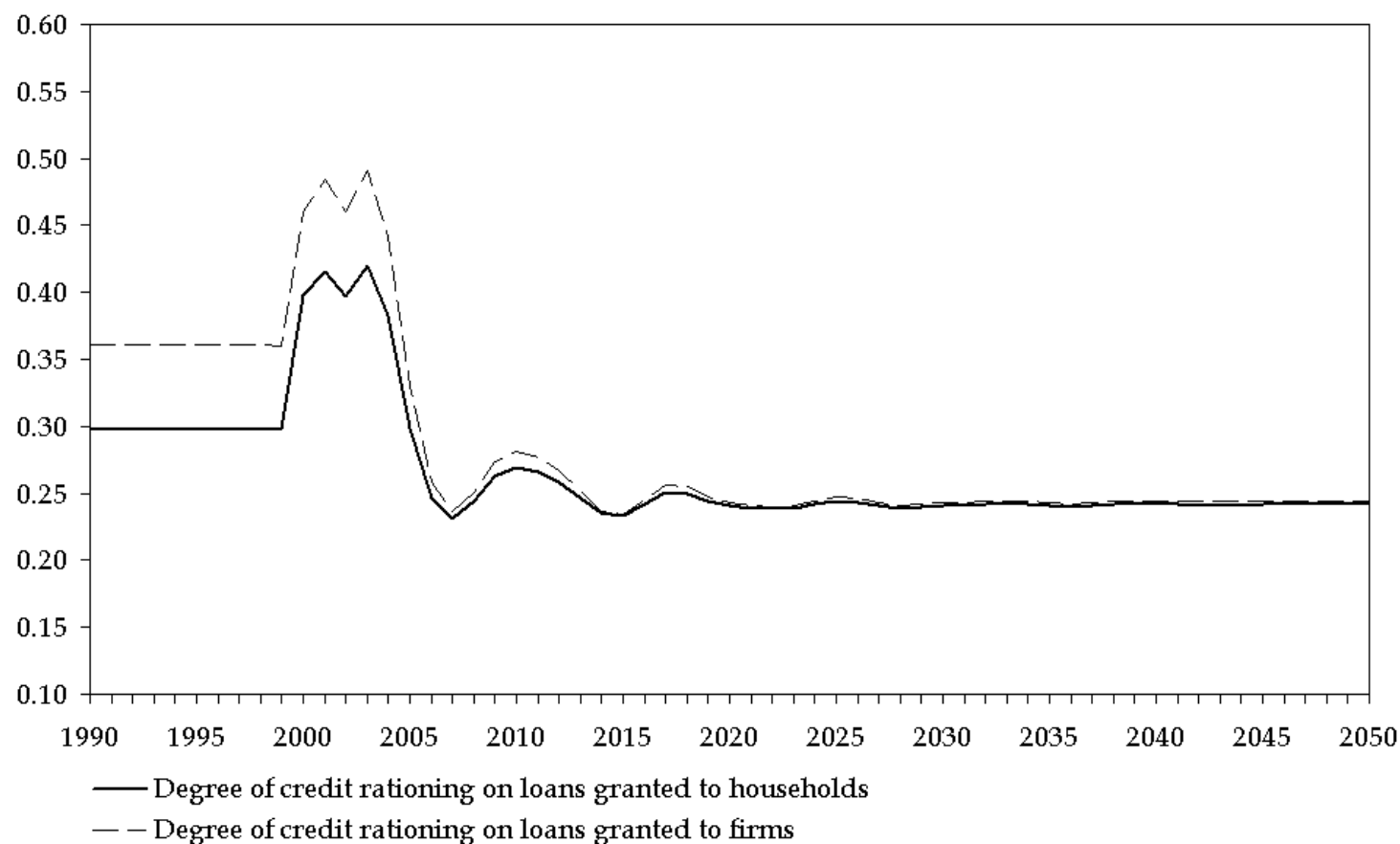
- Our model was solved numerically and a steady-state was found after successive approximations.
- We assume that at year '2000' the perceived degree of uncertainty in the private sector is pushed up as a result of an exogenous shock (institutional change, political instability, information for a crisis).
- In particular, our indicator (PDU) is presumed to increase from 0.2 to 0.4.
- The simulations indicate that a rise in the perceived degree of uncertainty is likely to set off a debt-deflation process, which encompasses debt contraction, equity deflation, decreasing employment/output and falling price inflation.

5. Uncertainty shock and debt-deflation process

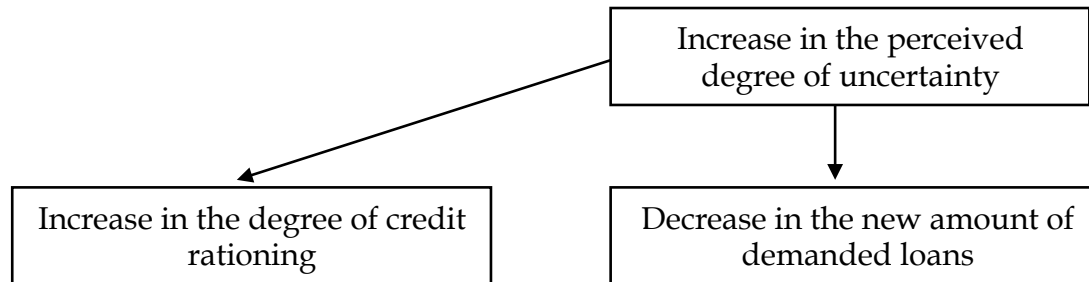


5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on the evolution of the degree of credit rationing

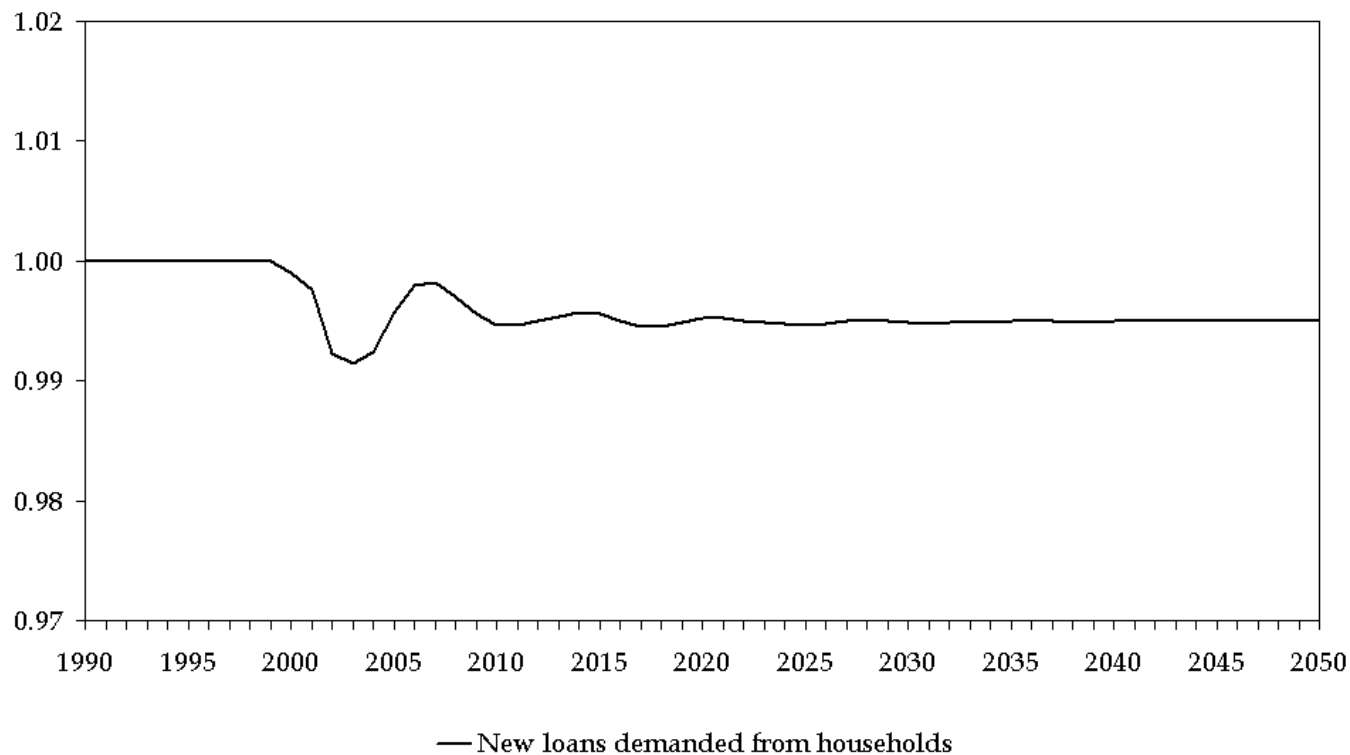


5. Uncertainty shock and debt-deflation process



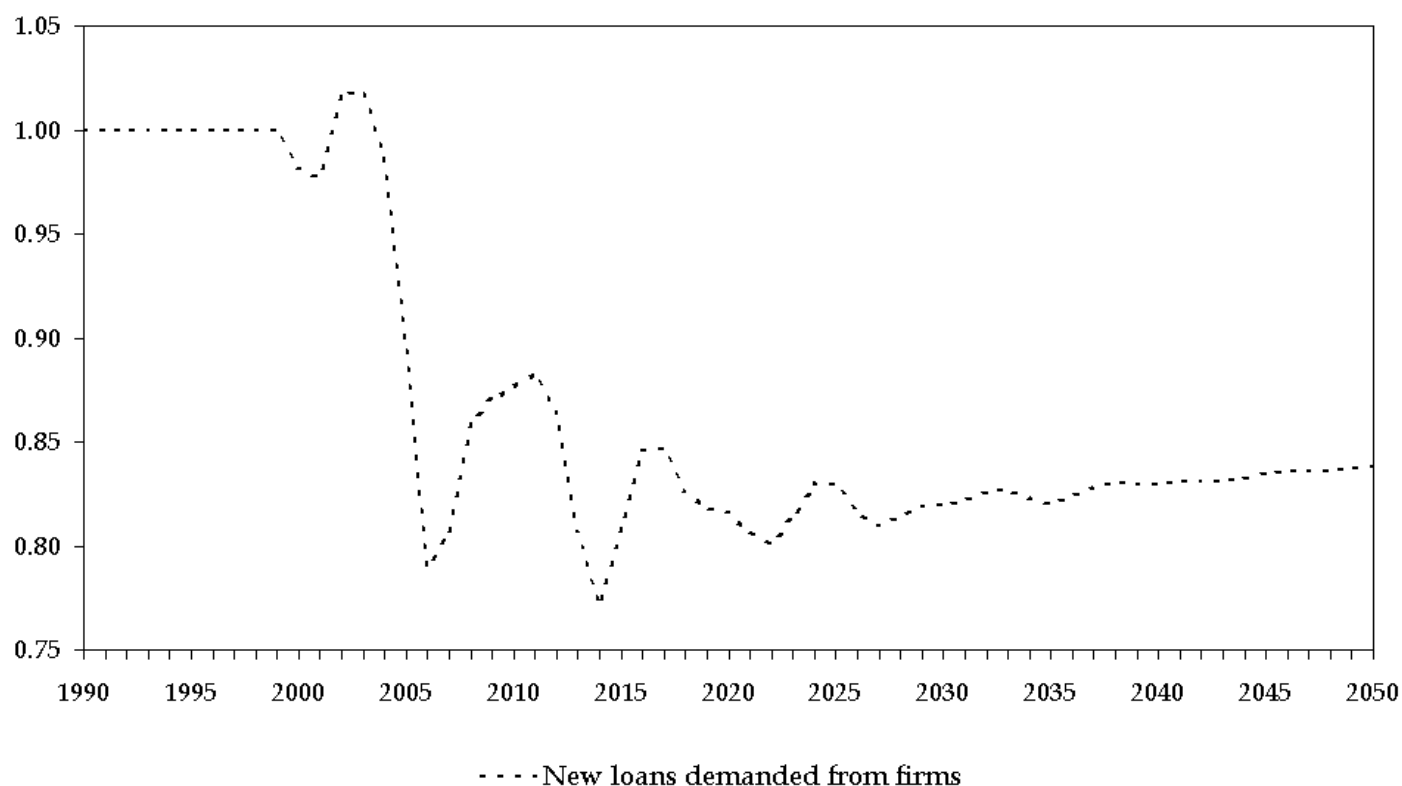
5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on the evolution of the new amount of demanded loans from households

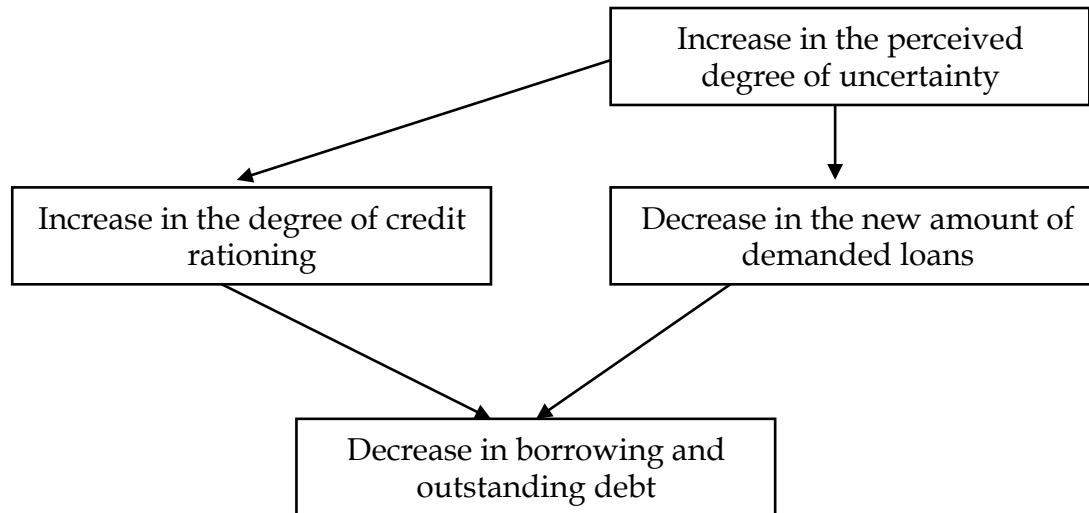


5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on the evolution of the new amount of demanded loans from firms

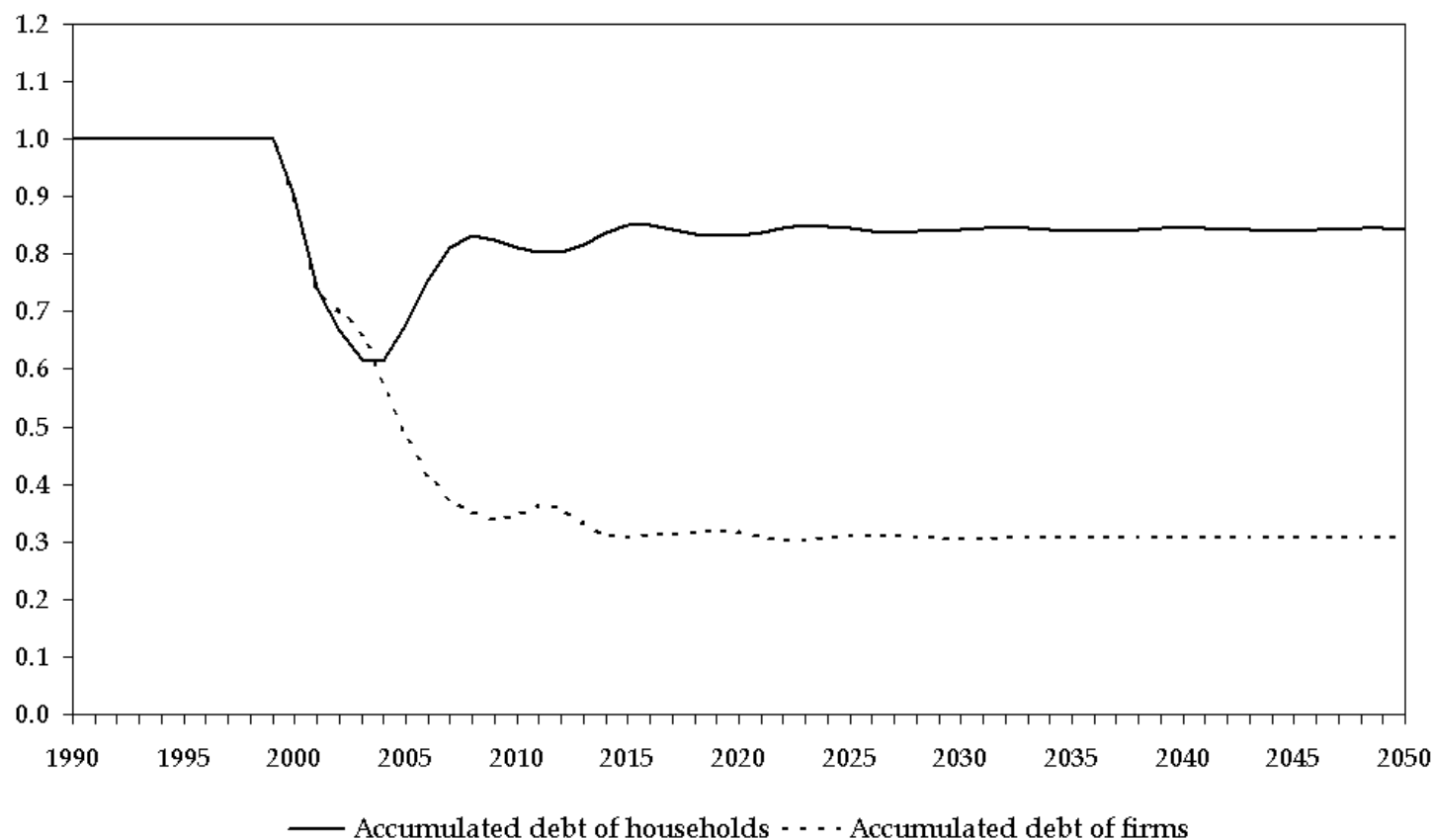


5. Uncertainty shock and debt-deflation process

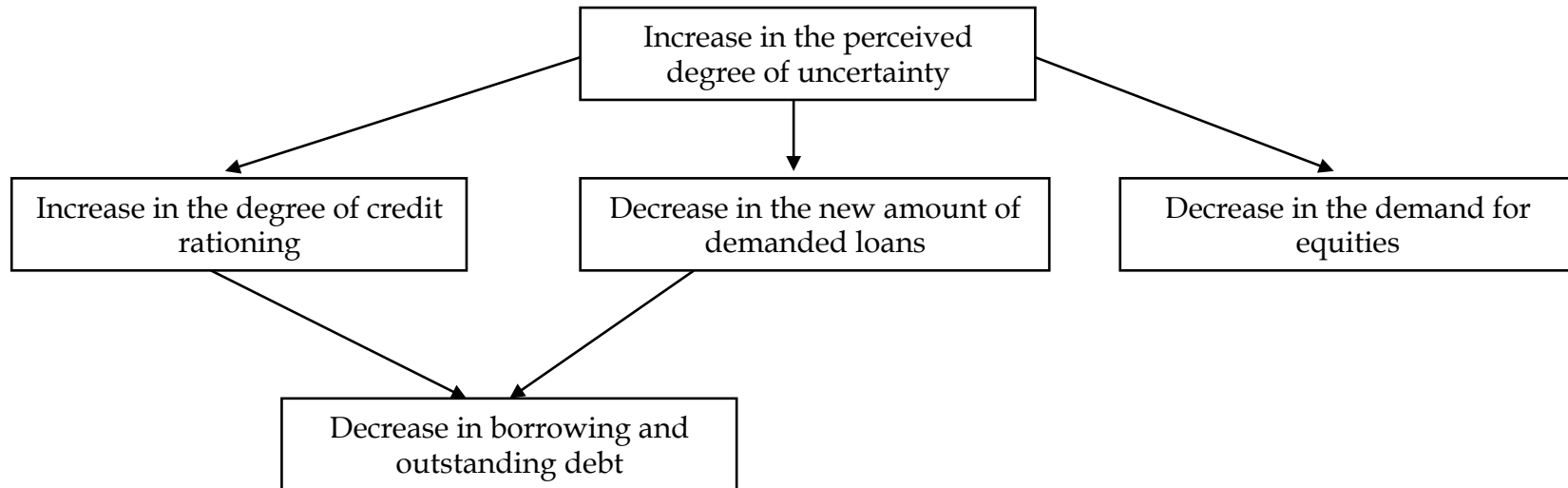


5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on the evolution of the outstanding debt

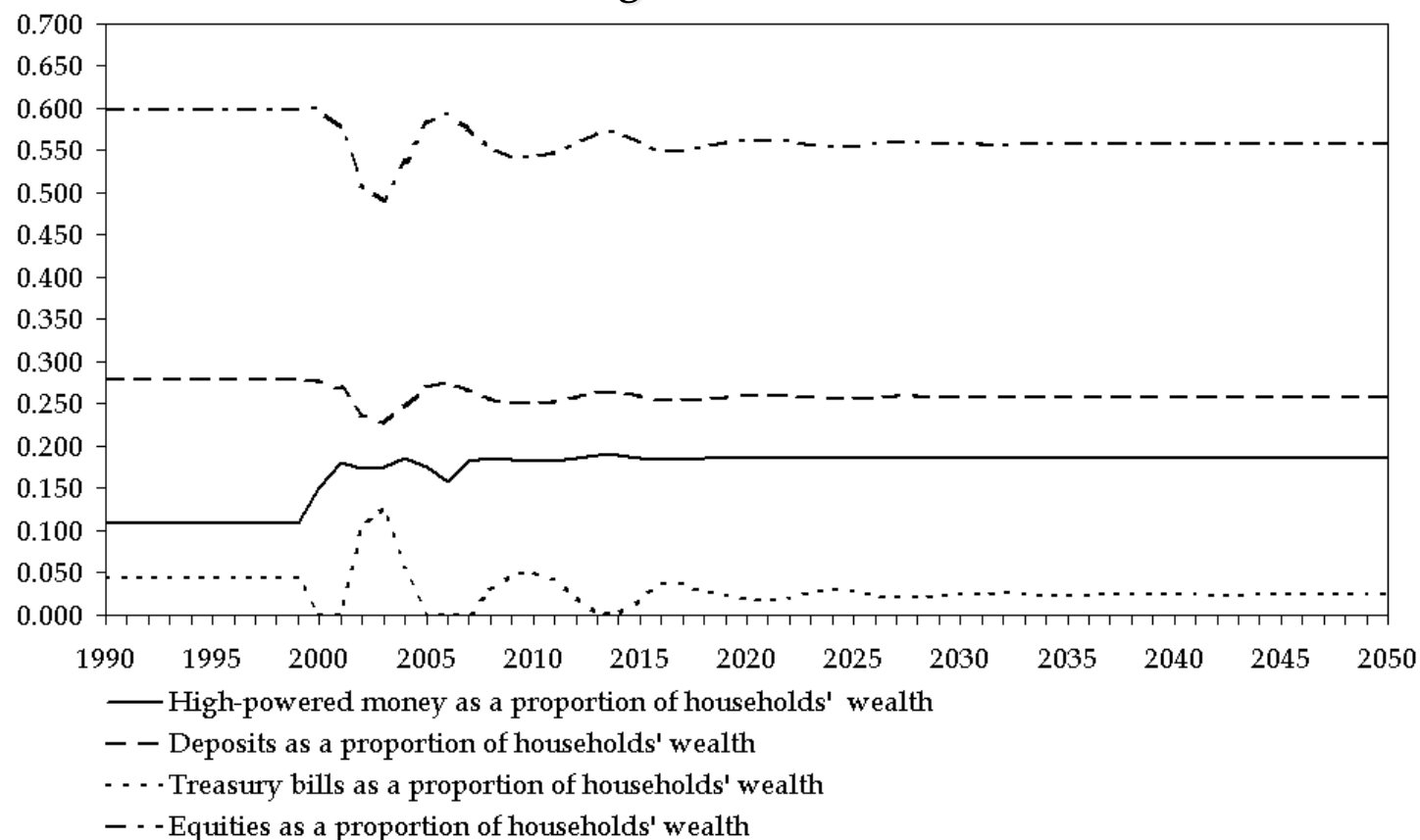


5. Uncertainty shock and debt-deflation process

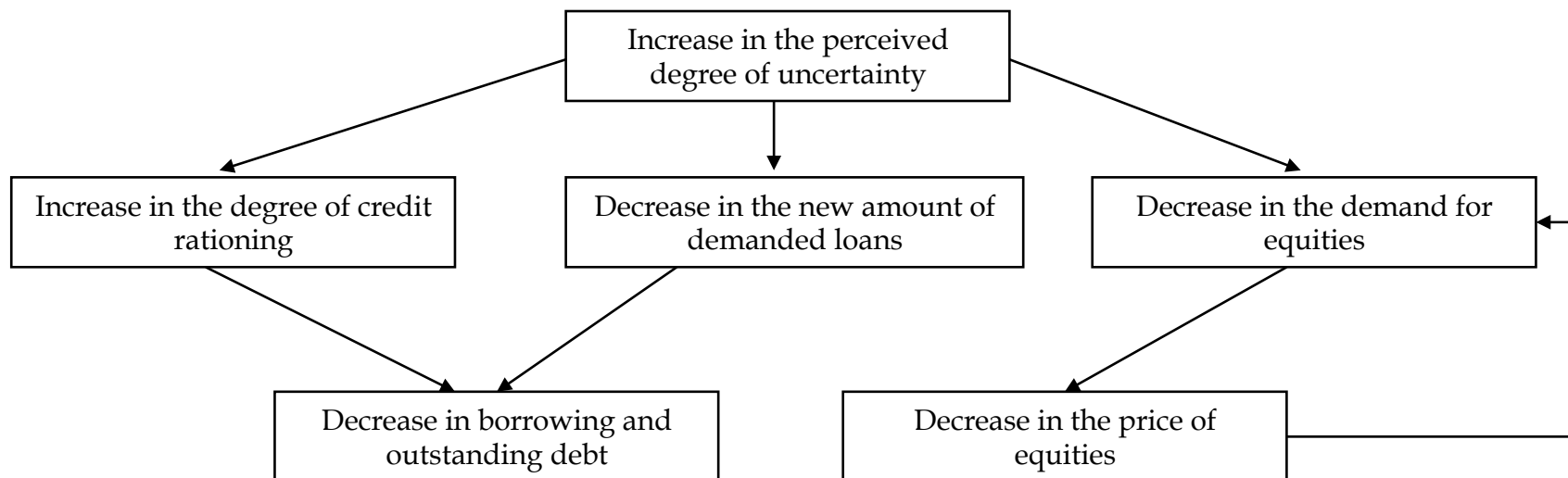


5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on the evolution of the proportion of households' wealth being held in the form of various assets

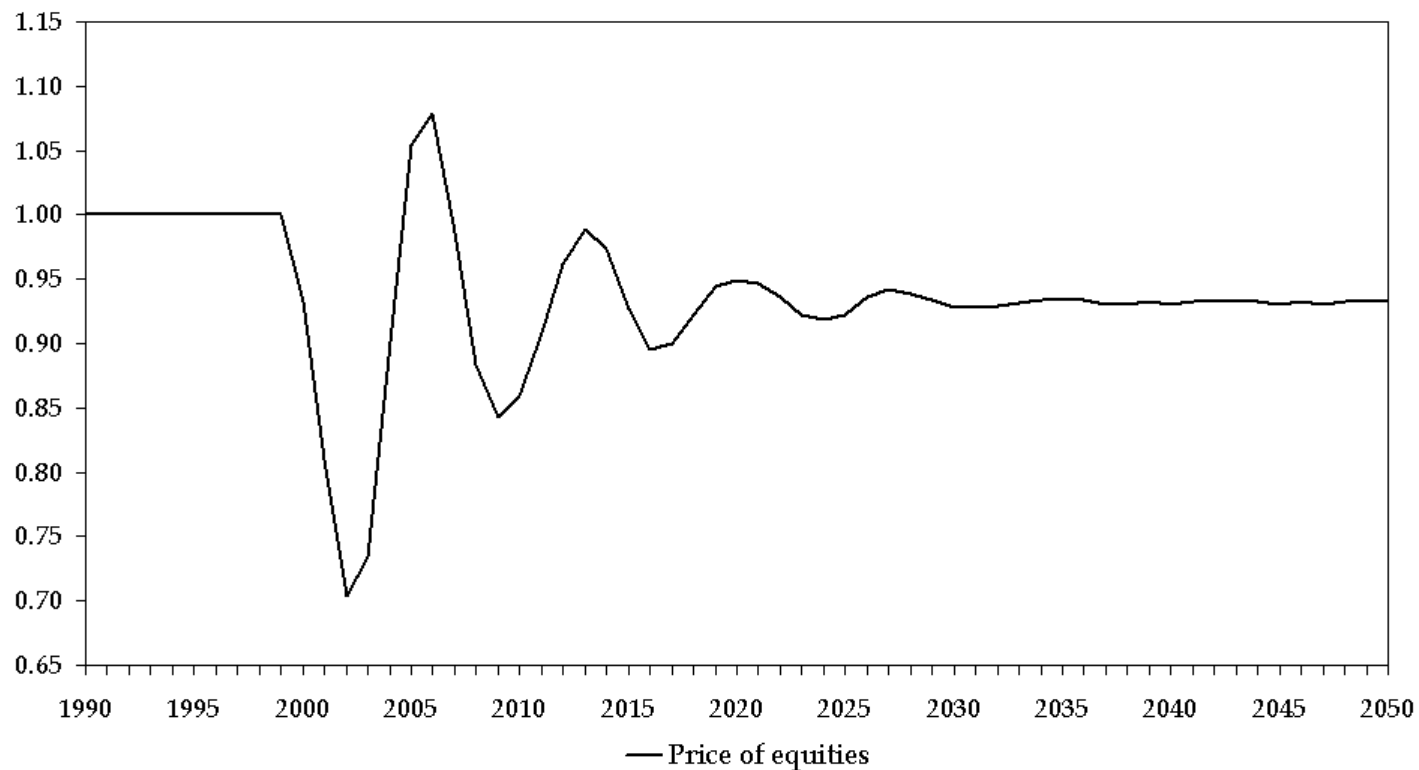


5. Uncertainty shock and debt-deflation process

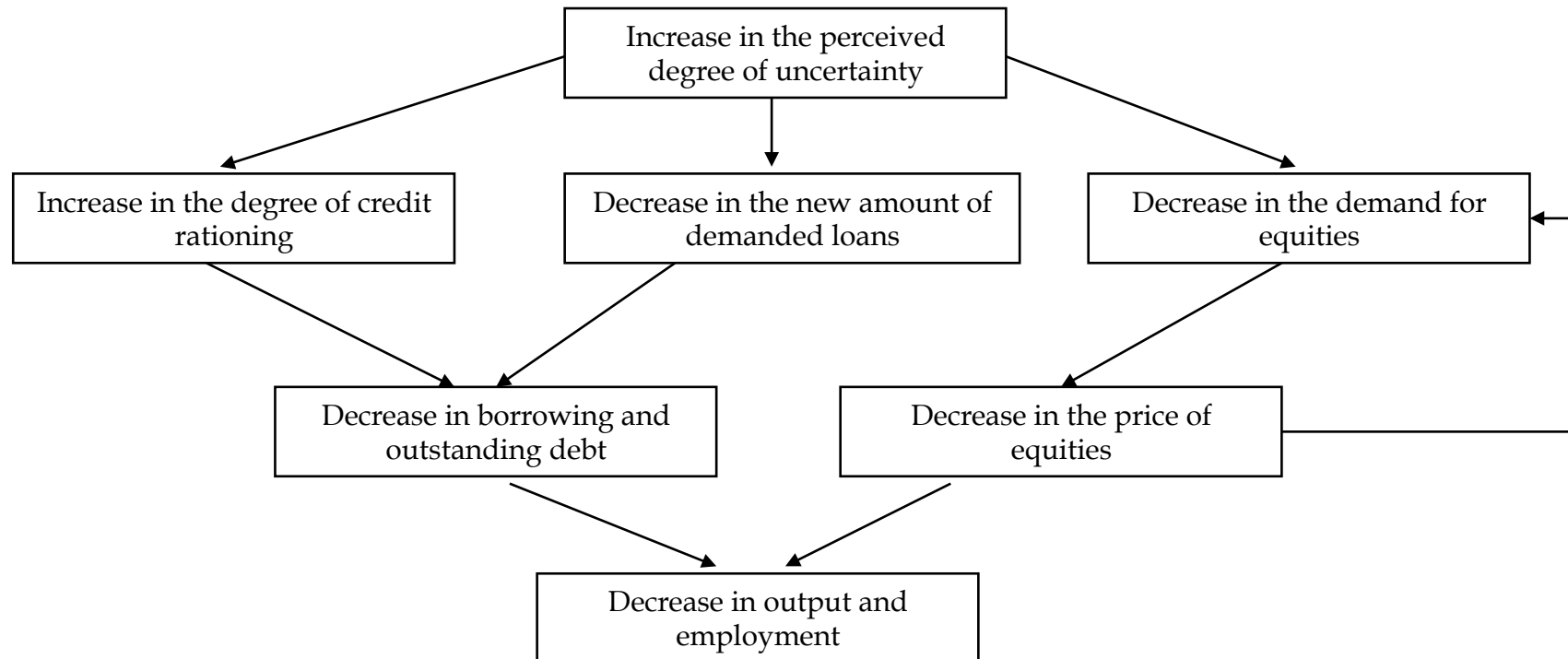


5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on the evolution of the price of equities

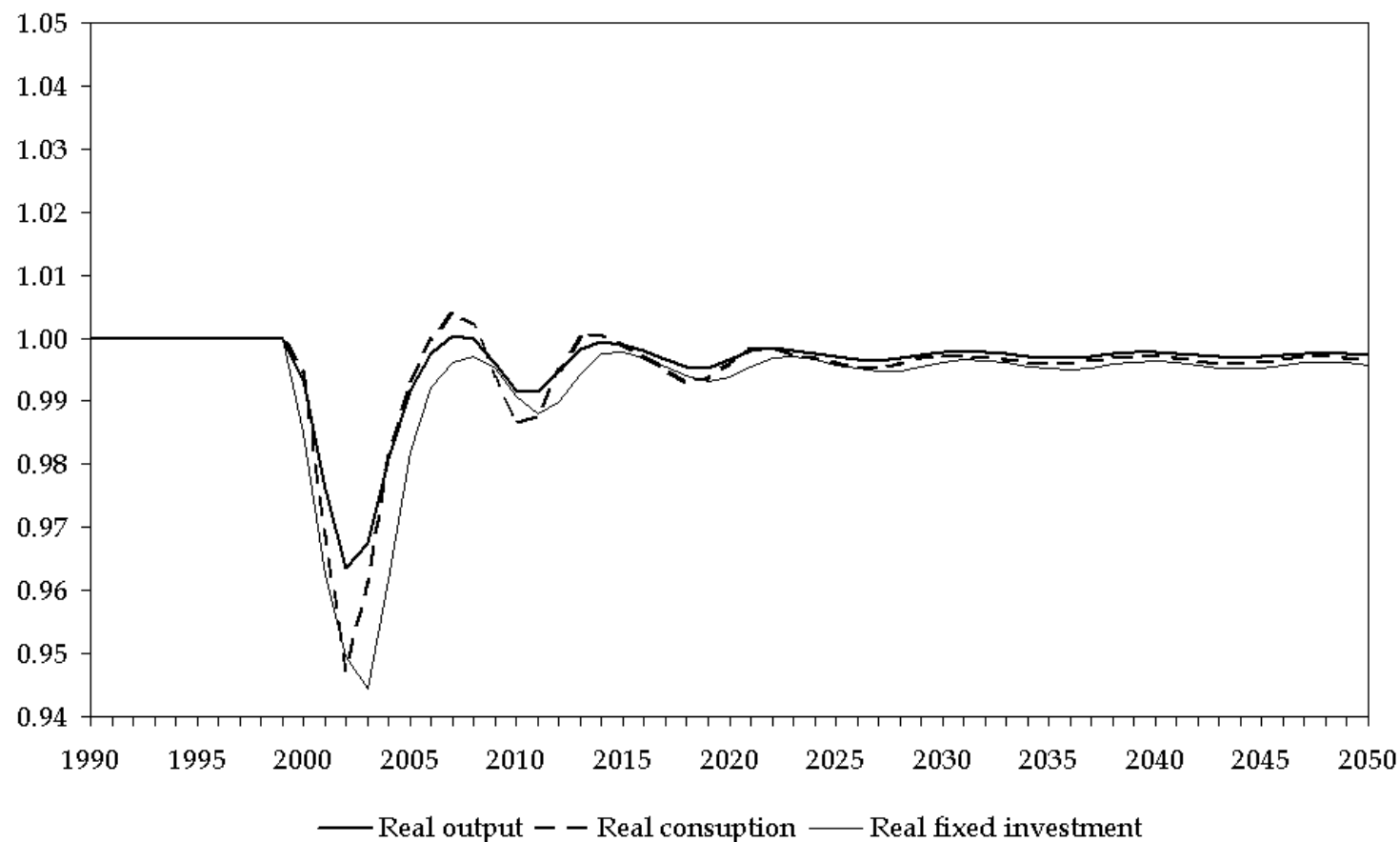


5. Uncertainty shock and debt-deflation process



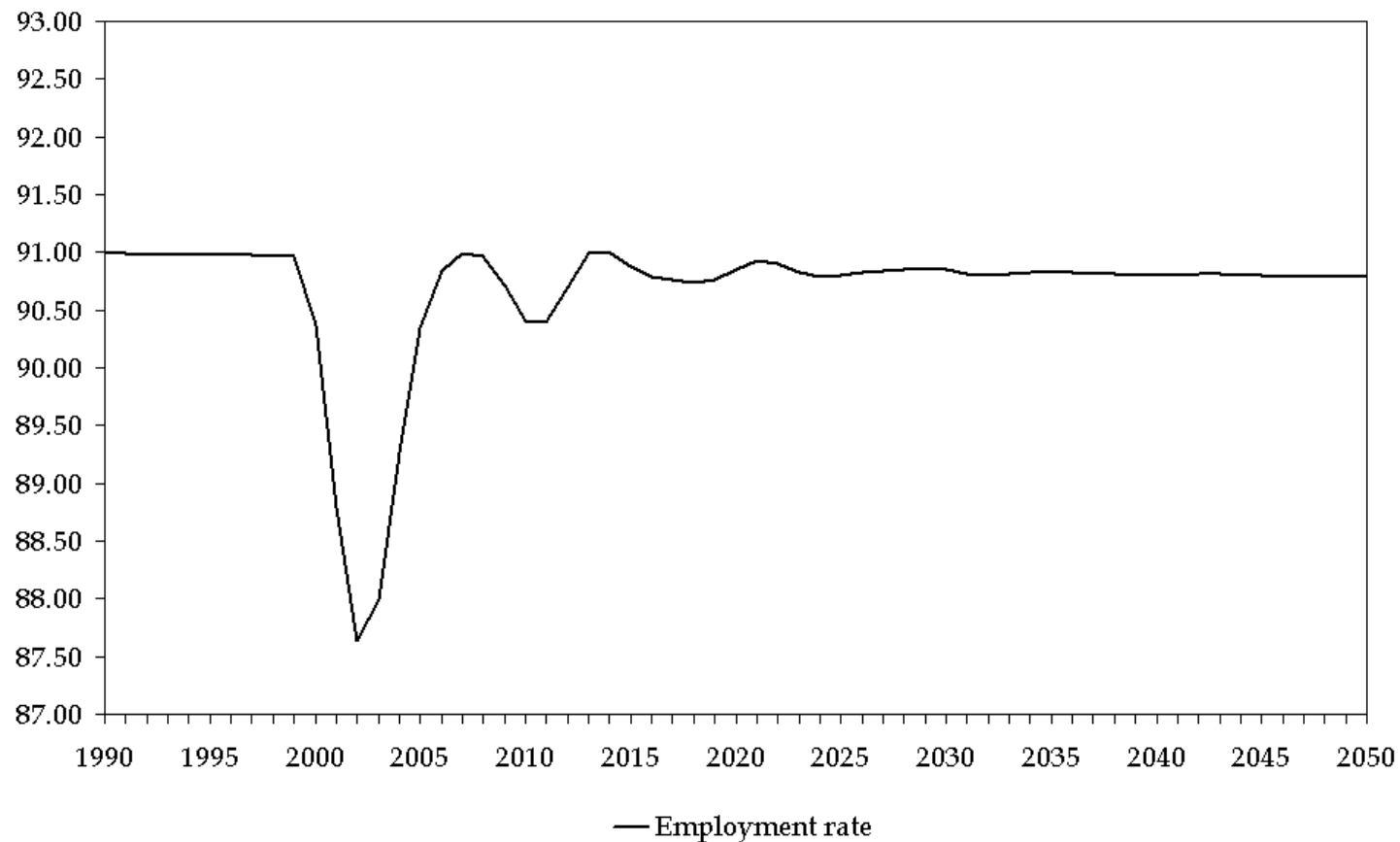
5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on real output, consumption and fixed investment

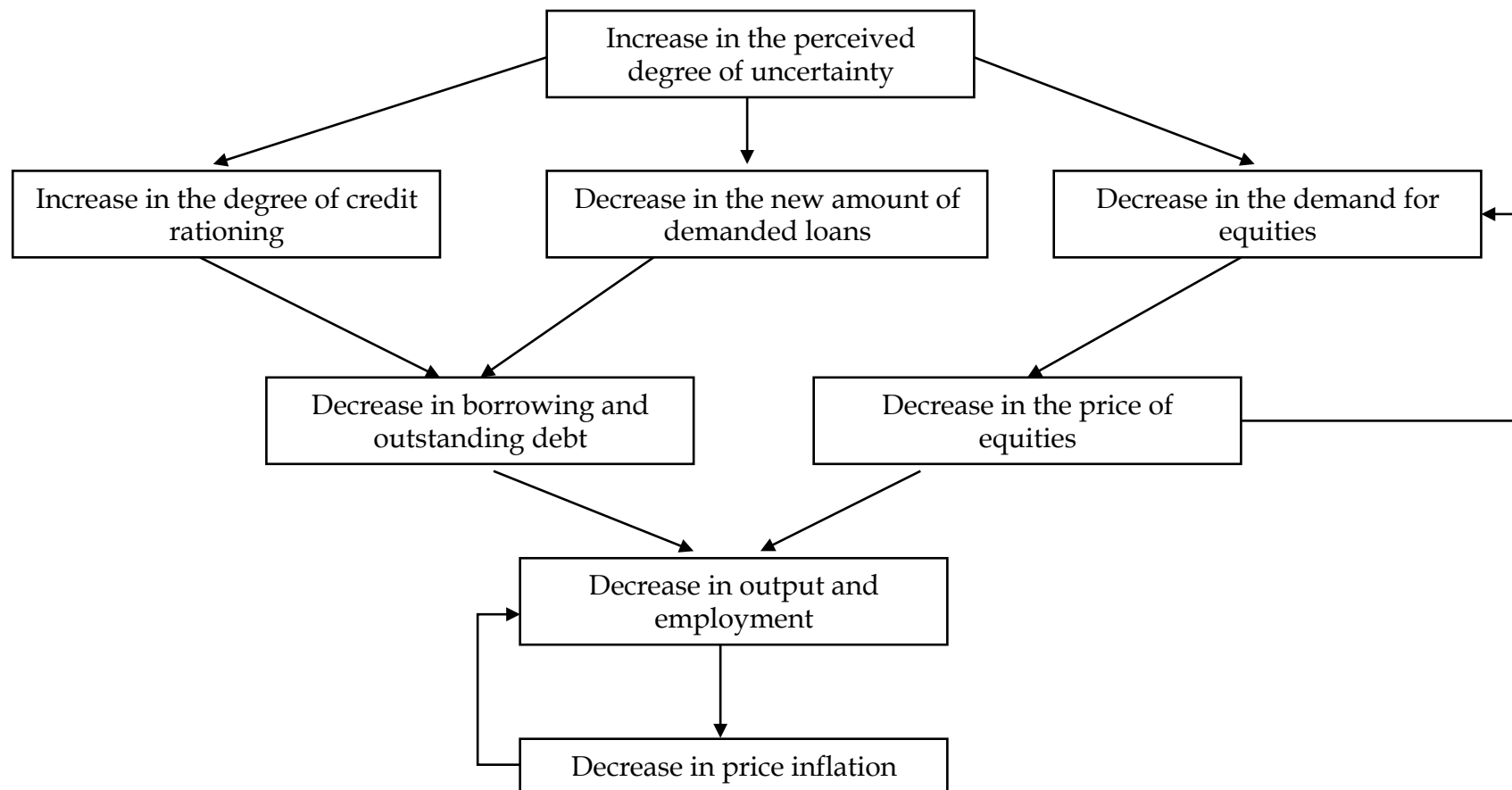


5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on the evolution of the rate of employment

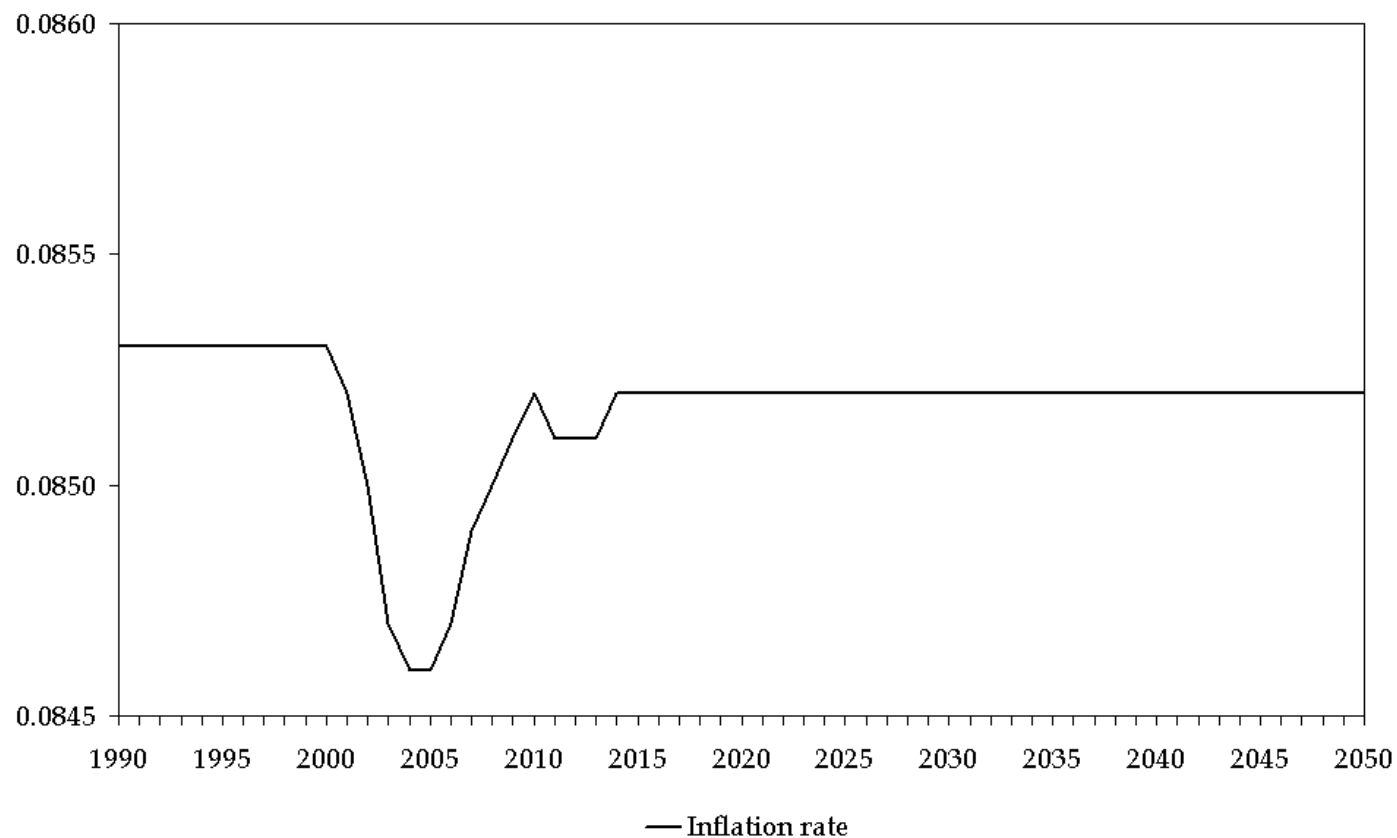


5. Uncertainty shock and debt-deflation process

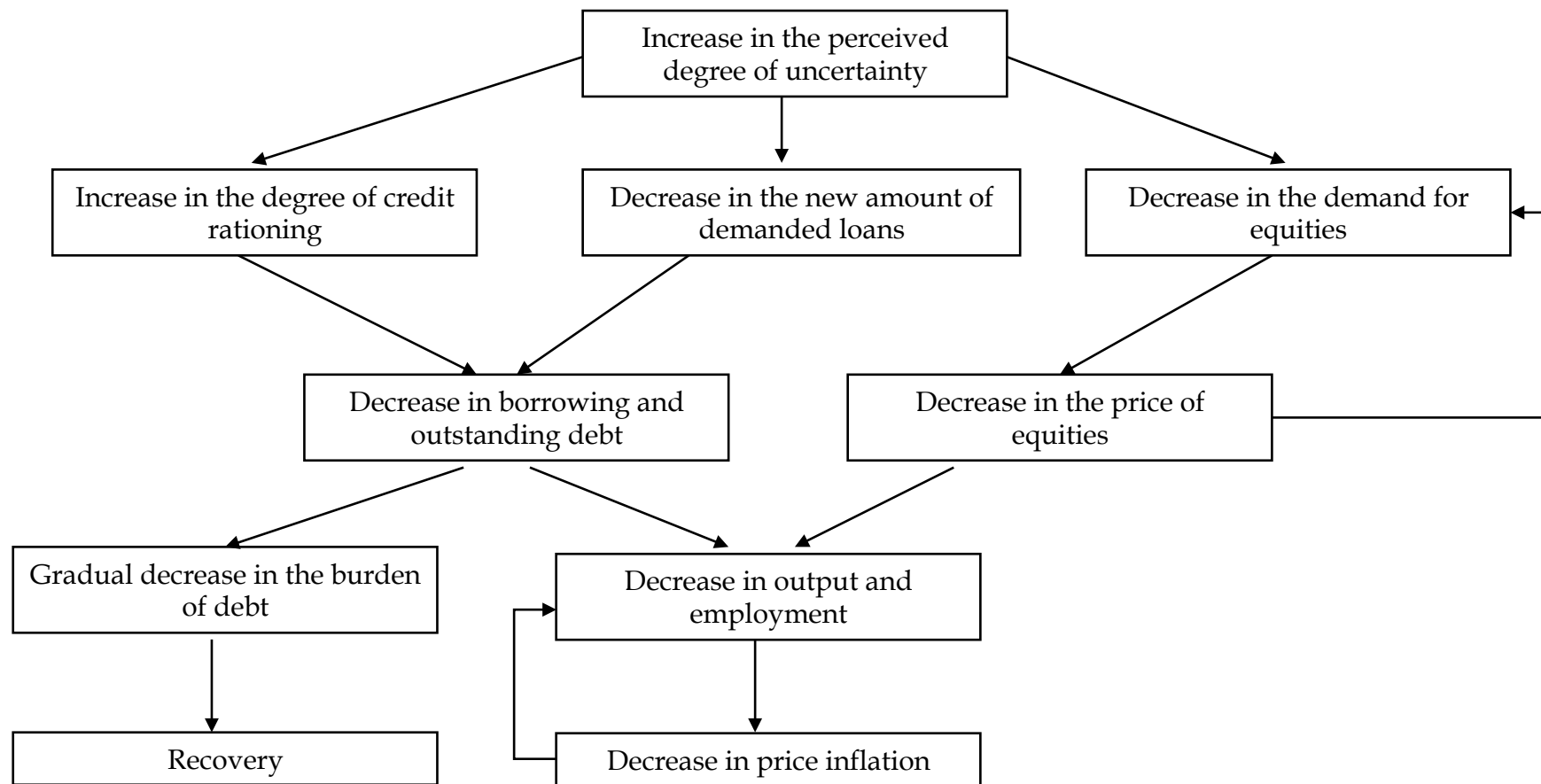


5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on the evolution of the rate of inflation

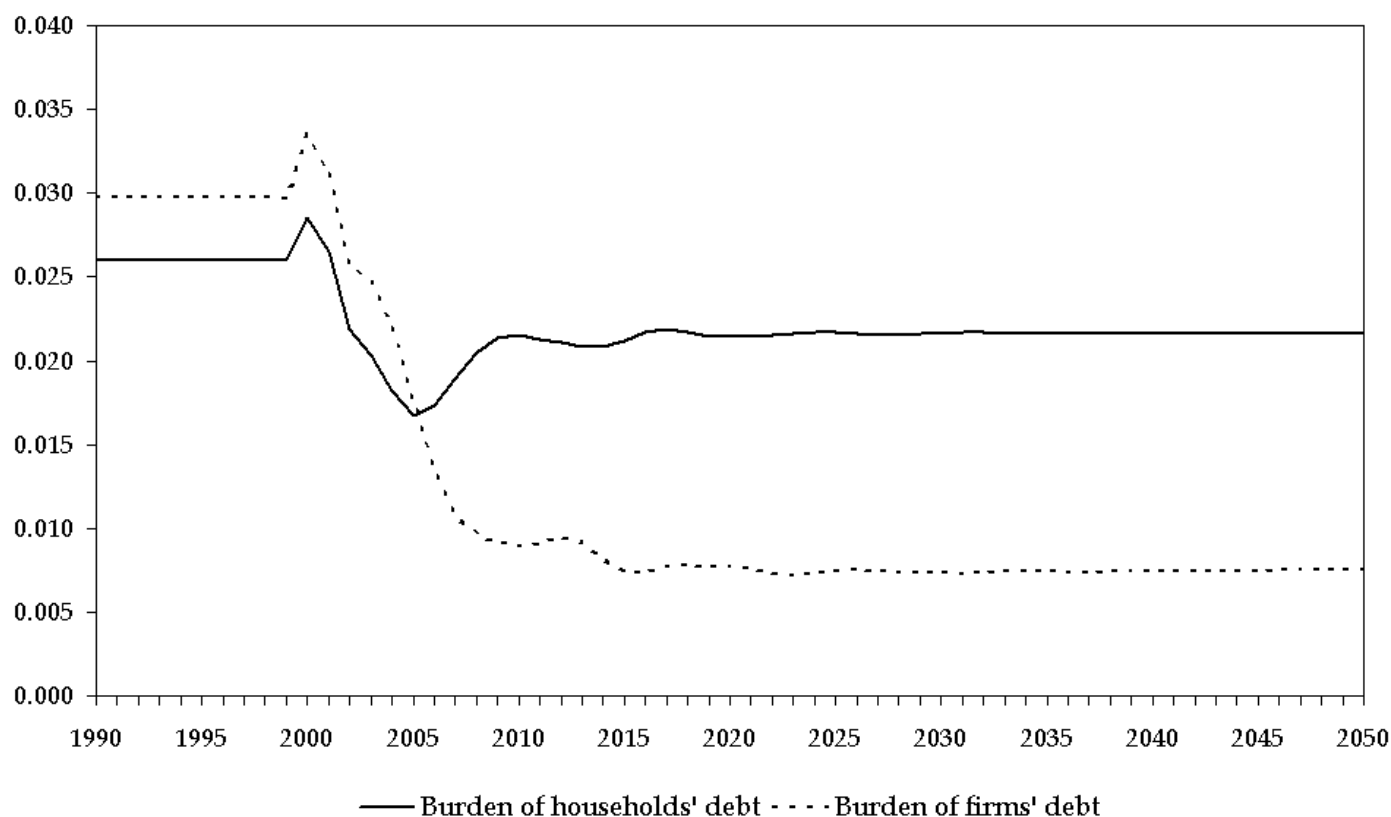


5. Uncertainty shock and debt-deflation process



5. Uncertainty shock and debt-deflation process

The effect of higher perceived uncertainty on the evolution of private sector's private debt



The outline of the presentation

1. The structure of the model
2. Liquidity preference and perceived uncertainty in the decision-making process of *households*
3. Liquidity preference and perceived uncertainty in the decision-making process of *firms*
4. Liquidity preference and perceived uncertainty in the decision-making process of *banks*
5. Uncertainty shock and debt-deflation process (simulations)
- 6. Conclusion**

6. Conclusion

- In this paper we developed a SFC model that explicitly integrates the role of liquidity preference and perceived uncertainty into the decision-making process of households, firms and commercial banks.
- We placed emphasis on the link between the precautionary motive and asset choice, on the impact of financial obligations on the desired liquidity posture of households and firms as well as on the effect of perceived uncertainty on desired borrowing.
- The model was deployed in order illustrate the channels through which a rise in the perceived degree of uncertainty of the private sector can set off a debt-deflation process.