

Macro-foundations of Micro and Micro-foundations of Macro Income distribution, Increasing risks and Household behaviours

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« *Session II - Finance* »

Introduction: an attempt to synthesize SFC - ABM

TOP DOWN + BOTTOM UP modelling

(1) As Boland (1982) explains: Keynes was more concerned with the lacking macro-foundations of microeconomics than the micro-foundation of macroeconomics.

(2) The orthodox critics of Keynesian theory have a formal micro-foundation, but they get this by modelling a multitude of similar agents, *i.e.* by using a representative agent. In the real world, agents are heterogeneous in their rationality. (ABM)

(3) In a complex system, the action of the whole is more than the simple sum of the actions of its parts. Notably the accounting system is a medium through which economic interaction takes place, and through which the feedback from macro to micro works. (SFC modelling)

Introduction: an attempt to synthesize SFC - ABM

TOP DOWN + BOTTOM UP modeling

- (1) But with a SFC model, you stabilize the economy on a steady state, and it is difficult to understand endogenous crisis without an exogenous shock.
- (2) And somehow, the macroeconomic behaviour of each sector in a SFC likes that of a representative agent. Interaction between heterogeneous agents can provide interesting solutions.
- (3) With ABM, the problem is the high degree of “liberty”. It is never easy to be sure if and how macroeconomic constraints work.

Summary of the presentation

- *(1) Macro-foundations for micro*
- *(2) Micro-foundations for the macro model*
- *(3) Presentation of some solutions in a SFC -
AB Model*
- *(4) Four experiments*

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Macro foundations for the behaviour of economic agents

Stock flow consistent model

(1) **To build a macroeconomic model** with two consistent matrices (stock and flows) constrained behaviours of different economic agents. The shape of the model involves macrofoundations for the micro-agents. « The fact that money stocks and flows must satisfy accounting identities in individual budgets and in an economy as a whole provides a fundamental law of macroeconomics analogous to the principle of conservation of energy in physics » (Godley and Cripps, 1983)

Top down modeling

Macro foundations for the behaviour of economic agents

(2) Convention

Keynes, 1938, p 294 " *To avoid being in the position of Buridan's ass, we fall back, therefore, and necessarily do so, on motives of another kind, which are not 'rational' in the sense of being concerned with the evaluation of consequences, but are decided by habit, instinct, preferences, desire, will, etc.*"

For instance, we introduce some conventional leverage ratio in the lender's risk of banks. Lender's risk increases above this conventional leverage ratio. And this Lev_{conv} can be linked to the growth rate. We can also introduce some limit value for a variable.

- **(3) State of confidence**, macroeconomic uncertainty, self-fulfilling prophecy: animal spirits *versus* conventions.

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Micro foundations for macroeconomic trends

Agent based modelling

(1) The importance of the fundamental **heterogeneity** of agents. To understand endogenous crisis, you need **heterogeneity** of agents. We introduce 4 types of households

(2) You need **endogenous money**.

" What distinguishes agent-based Keynesian economics from agent-based computational economics in general, which tends to focus on exchange processes, is the role played by money, comprising the role played by monetary prices as stabilizing devices rather than relative prices as market clearing devices and the role played by monetary values in economic decision making. (...). Using agent-based computational techniques, Keynesian macro-theory may be microfounded without loosing its sting." Charlotte Bruun, 1999, p.2

(3) C. Bruun, 1999, p.8 **Decision rules rather than optimization**

" Agents live in an uncertain and complex world, and they need tools for coping with uncertainty and the complexity. One such tool is money and contracts in money-terms, another tool is to base decision making on simple rules rather trying to optimize".

For instance, I introduce a Taylor rule for the central bank function of reaction (Le Heron, 2008-2011)

(4) Charlotte Bruun, 1999: **the method**

- First study the macro-properties of the system without implicating behaviour in more than broad terms.
- Secondly study a single microunit, bearing the macro-properties in mind.
- As a third step, study the interaction between macro-properties and micro-properties by allowing a whole population of microunits to interact." An interaction (learning process or micro feed back) between the agents is needed.

(5) You need to tell a story, i.e. to explain and to justify why and how the agents are different rationality and therefore different behaviours. We introduce heterogeneity only in the households.

5-1 The first explanation is the unequal distribution of income. Following Kalecki, we distinguish two classes: workers and capitalists.

5-2 The second explanation is the mood of the workers: we distinguish three types of workers. The optimistic workers always want to increase their consumption at the same rate, even if their income (lower wage, lower growth, change in distribution) decreases. They go into debt if necessary when the production declines. W_o 25%
The normal workers keep always the same marginal propensity to consume. W_n 50%

Finally, the pessimistic workers change their marginal propensity to consume, adapting it to their income. Notably they increase their savings as a precaution when the rate of growth decreases. W_p 25%

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The PK-SFC-ABM model

■ PRIVATE SECTOR

- ◆ INVESTMENT OF FIRMS
- ◆ CONSUMPTION OF HOUSEHOLDS (WORKERS AND CAPITALISTS)
- ◆ FINANCING FROM BANKS

■ POLICY MIX

- ◆ FISCAL POLICY OF STATE
- ◆ MONETARY POLICY OF CENTRAL BANK

■ INFLATION

Firms

- $I \equiv \varphi + IF$ Net investment
- $IF = P^u - amL_F$ Self financing
- ▼ $\varphi = \Delta L_F$ External financing

- $gr_{kD} = \gamma_0 + \gamma_1 \cdot r_{cf-1} + \gamma_2 \cdot u_{-1} - \gamma_3 \cdot FCI_{-1}$
Desired growth in the stock of capital
- ▼ γ_0 State of confidence
- $r_{cf} = P_F^u / K$ Ratio of cash flow
- $u = Y/Y_{fc}$ Capacity utilization rate
- $FCI = \mu_1 \cdot i_l \cdot L_F / K$ Borrower's risk

Commercial banks

A qualitative theory of money. 2 channels for the endogenous money : net investment of firms, higher consumption of optimistic workers

$$L = L_F + L_W$$

INVESTMENT of FIRMS

v (B1) $\Delta L_F = \Delta L_F^d \cdot (1 - LR_F)$ Financing of firms by banks

$$LR_F = \gamma_4 + a_1 \cdot (\text{lev}_{F-1} - a_2 \text{lev}_{Fc}) - b_1 \cdot i_{cb} \quad \text{Lender's risk}$$

$$\text{lev}_F = L_F / K$$

CONSUMPTION of WORKERS

v (B2) $\Delta L_{Wo} = (C_{Wod} - C_{Wos}) \cdot (1 - LR_{Wo})$

$$LR_{Wo} = a_{Wo} \cdot (\text{Lev}_{Wo-1} - \gamma_6 \cdot \text{Lev}_{Woc-1})$$

$$\text{lev}_{Wo} = L_{Wo} / Y_{Wo}$$

Households « 3 Workers and 1 Capitalist-rentiers »

- (H1) $C = C_W + C_K$
- (H2) $C_W = C_{Wo} + C_{Wn} + C_{Wp}$
- (H3) $C_{Wo} = C_{Wo-1} + \Delta L_{Wo}$
- (H4) $C_{Wod} = C_{Wo-1} \cdot (1 + grC_{Wostat})$ With grC_{Wostat} : constant
- (H5) $C_{Wos} = (\alpha_{o1} \cdot Y_W^a) + (\alpha_{o3} \cdot D_{W-1})$ With α_i : constant
-
- (H6) $C_{Wn} = (\alpha_{n1} \cdot Y_W^a) + (\alpha_{n3} \cdot D_{W-1})$ With α_i : constant
- (H7) $C_{Wp} = (\alpha_{p1} \cdot Y_W^a) + (\alpha_{p3} \cdot D_{W-1})$
- (H8) $\alpha_{p1} = \alpha_{p1-1} \cdot (1 + a_4 \cdot (gr_{y-1} - gr_{ya-1}))$ With a_4 : constant
- (H9) $\alpha_{p3} = \alpha_{p3-1} \cdot (1 + a_4 \cdot (gr_{y-1} - gr_{ya-1}))$ With a_4 : constant
- (H10) $C_K = (\alpha_2 \cdot Y_K^a) + (\alpha_4 \cdot D_{K-1})$ with $\alpha_2 < \alpha_1$ $\alpha_4 > \alpha_3$

Households « 3 Workers and 1 Capitalist-rentiers »

- (H11) $Y_{Wo}^a = Y_{Wo-1} + \theta_h \cdot (Y_{Wo-1} - Y_{Wo-1}^a)$
- (H12) $Y_{Wn}^a = Y_{Wn-1} + \theta_h \cdot (Y_{Wn-1} - Y_{Wn-1}^a)$
- (H13) $Y_{Wp}^a = Y_{Wp-1} + \theta_h \cdot (Y_{Wp-1} - Y_{Wp-1}^a)$
- (H14) $Y_K^a = Y_{K-1} + \theta_h \cdot (Y_{K-1} - Y_{K-1}^a)$
-
- (H15) $Y_H = Y_{Wo} + Y_{Wn} + Y_{Wp} + Y_K$
- (H16) $Y_{Wo} = Wo + i_{d-1} \cdot D_{Wo-1} - T_{Wo} - i_{l-1} \cdot L_{Wo-1} - amL_{Wo}$
- (H17) $Y_{Wn} = Wn + i_{d-1} \cdot D_{Wn-1} - T_{Wn}$
- (H18) $Y_{Wp} = Wp + i_{d-1} \cdot D_{Wp-1} - T_{Wp}$
- (H19) $Y_K = P_F^d + P_B + i_{d-1} \cdot D_{K-1} - T_K$

Households « 3 Workers and 1 Capitalist »

- (H20) $\Delta D_{W_0} \equiv Y_{W_0} - C_{W_0} + \Delta L_{W_0}$
- (H21) $\Delta D_{W_n} \equiv Y_{W_n} - C_{W_n}$
- (H22) $\Delta D_{W_p} \equiv Y_{W_p} - C_{W_p}$
- (H23) $\Delta D_K \equiv Y_K - C_K$
- (H24) $D = D_{W_0} + D_{W_n} + D_{W_p} + D_K$
-
- (H25) $amL_{W_0} = al_{W_0} \cdot L_{W_0-1}$

INTERACTION BETWEEN WORKERS

- (H26) $rop = rop_i + a_5 (gr_{y-1} - gr_{ya-1})$ With rop_i, a_5 : constant
- (H27) $rpe = rpe_i - a_6 (gr_{y-1} - gr_{ya-1})$ With rpe_i, a_6 : constant
- (H28) $rno = 1 - rop - rpe$

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- ◆ INFLATION

Fiscal policy of Government

- $T \equiv T_H + T_F + T_B$ Taxes
- $T_H = T_W + T_K$ Taxes on households
- $T_W = \tau_1 \cdot Y_{W-1}$ Taxes on workers
- $T_K = \tau_2 \cdot Y_{K-1}$ Taxes on capitalists
- $T_F = \tau_3 \cdot P_{F-1}$ Taxes on firms
- $T_B = \tau_4 \cdot P_{B-1}$ Taxes on commercial banks
- ▼ $\Delta B = DG$ Treasury bonds
- $G = G_{-1} \cdot (1 + gr_{y-1})$ Government expenditure
- $DG \equiv G + i_{b-1} \cdot B_{-1} - T - P_{cb} - amB$ Government deficit
- $amB = a_b \cdot B_{-1}$ Amortization of Gvt debt

Monetary policy of CB

- $i_{cb} = i^* + \Pi - \alpha_4 \cdot OG_R + \alpha_6 (\Pi - \Pi^*)$ Taylor rule
- ▼ $\Pi = \Pi^* + d_1 \cdot (OG_{Rmini} - OG_R) + d_2 \cdot (OG_{Rmaxi} - OG_R)$ NKPC₂₁

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AB Model*
- (4) *Four experiments*

Four Experiments

- **EXP1** An permanent shock in monetary policy
- **Higher interest rate: i_{cb} from 3 to 4% IN BLACK**
- **EXP2** A change in income distribution
- **Lower wages in GDP: W/Y - IN BLUE**
- **EXP3** A change in income distribution
- **Lower wages in the full model: TR and NKPC IN RED**
- **EXP4** A change in income distribution
- **Lower wages with « radical banks »: lender's risk (1 or 0)**
- **IN GREEN**

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Figure 1-A Effects on the Growth rate of the GDP (EXP 1, 2 and 3)

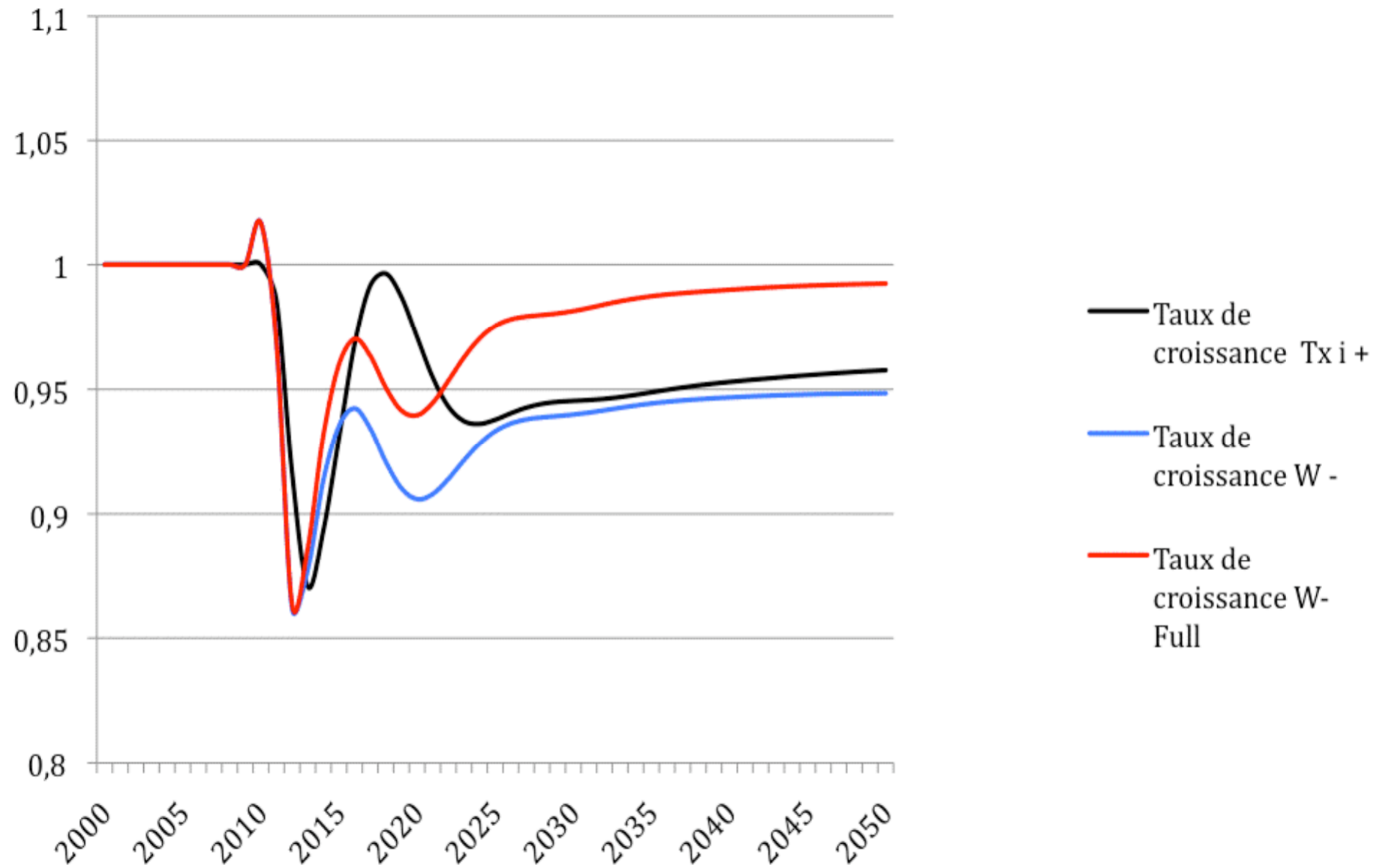


Figure 2-A Effects on the desired rate of accumulation of firms (EXP 1, 2 and 3)

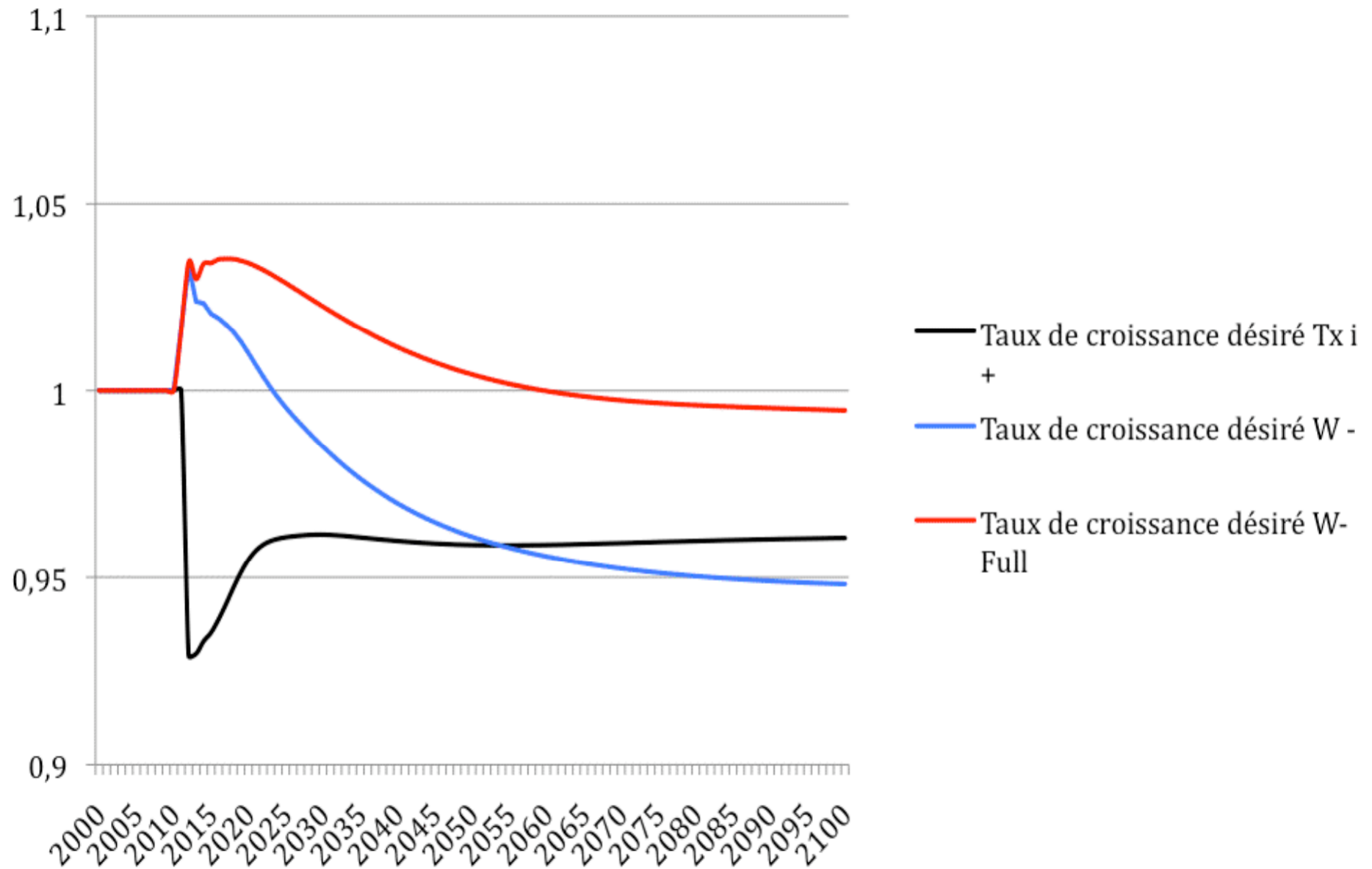


Figure 3-A Effects on lender's risk on firms (EXP 1, 2 and 3)

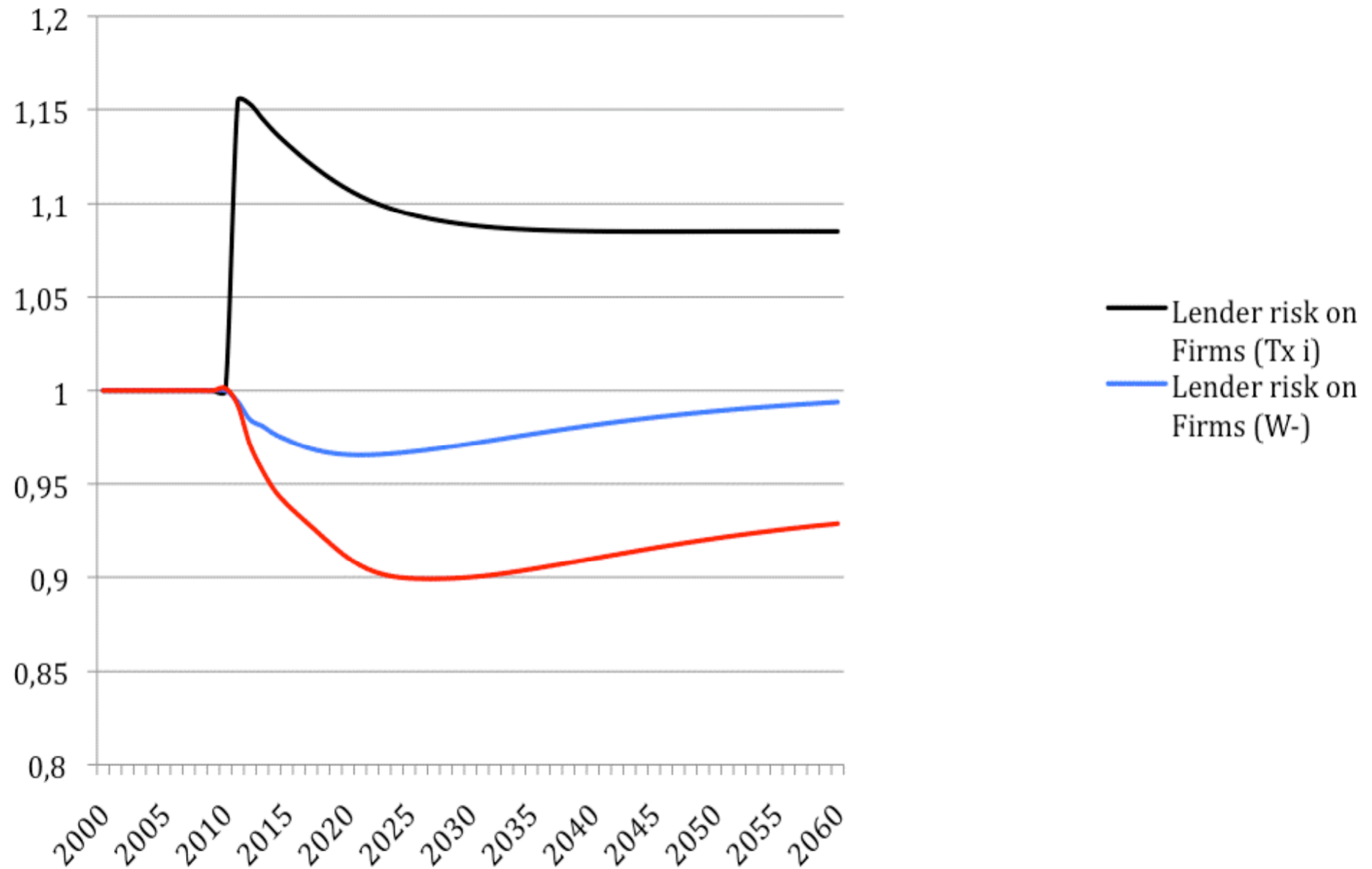


Figure 4-A Effects on lender's risk on optimistic workers (EXP 1, 2 and 3)

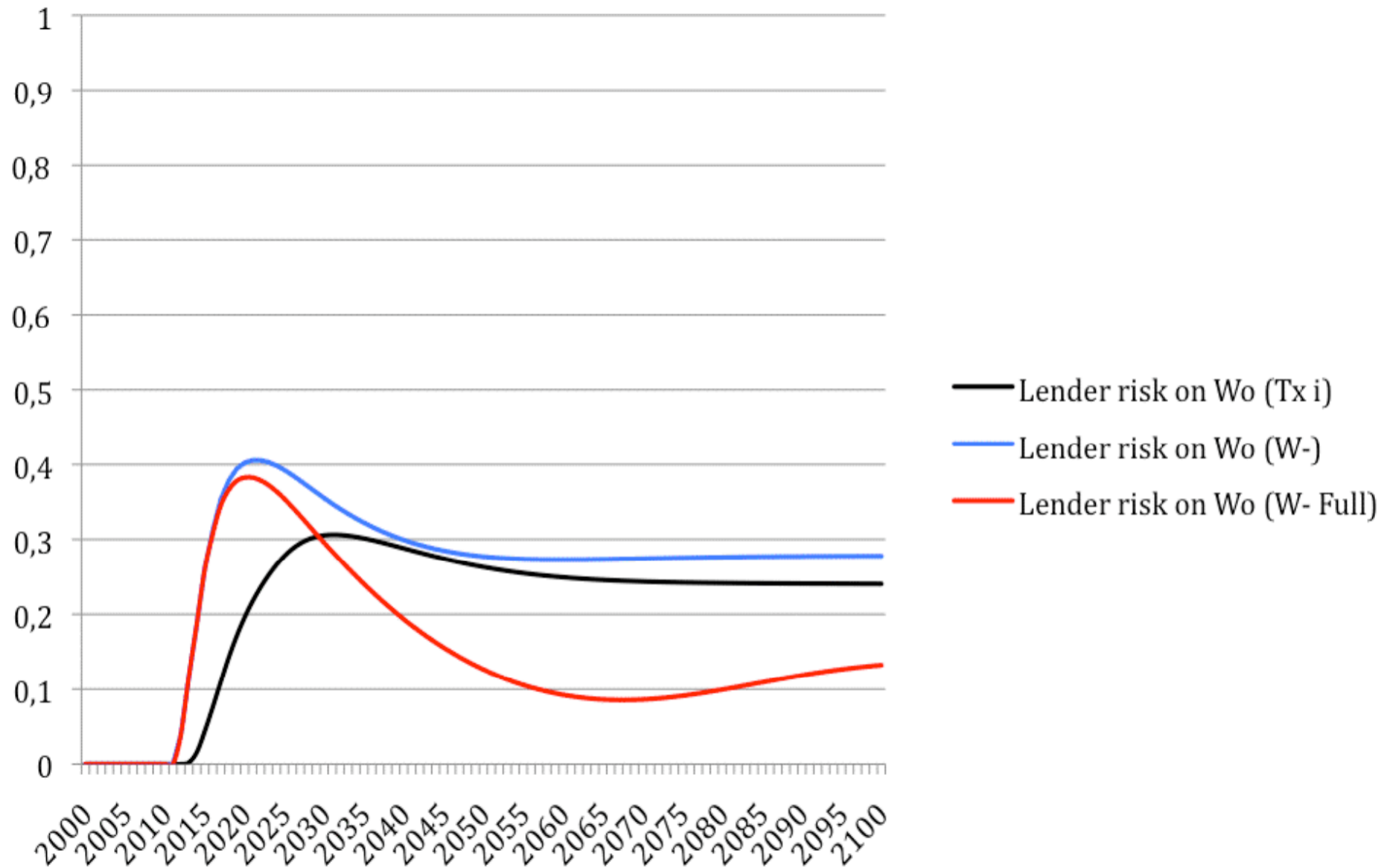


Figure 5-A Effects on leverage of firms (EXP 1, 2 and 3)

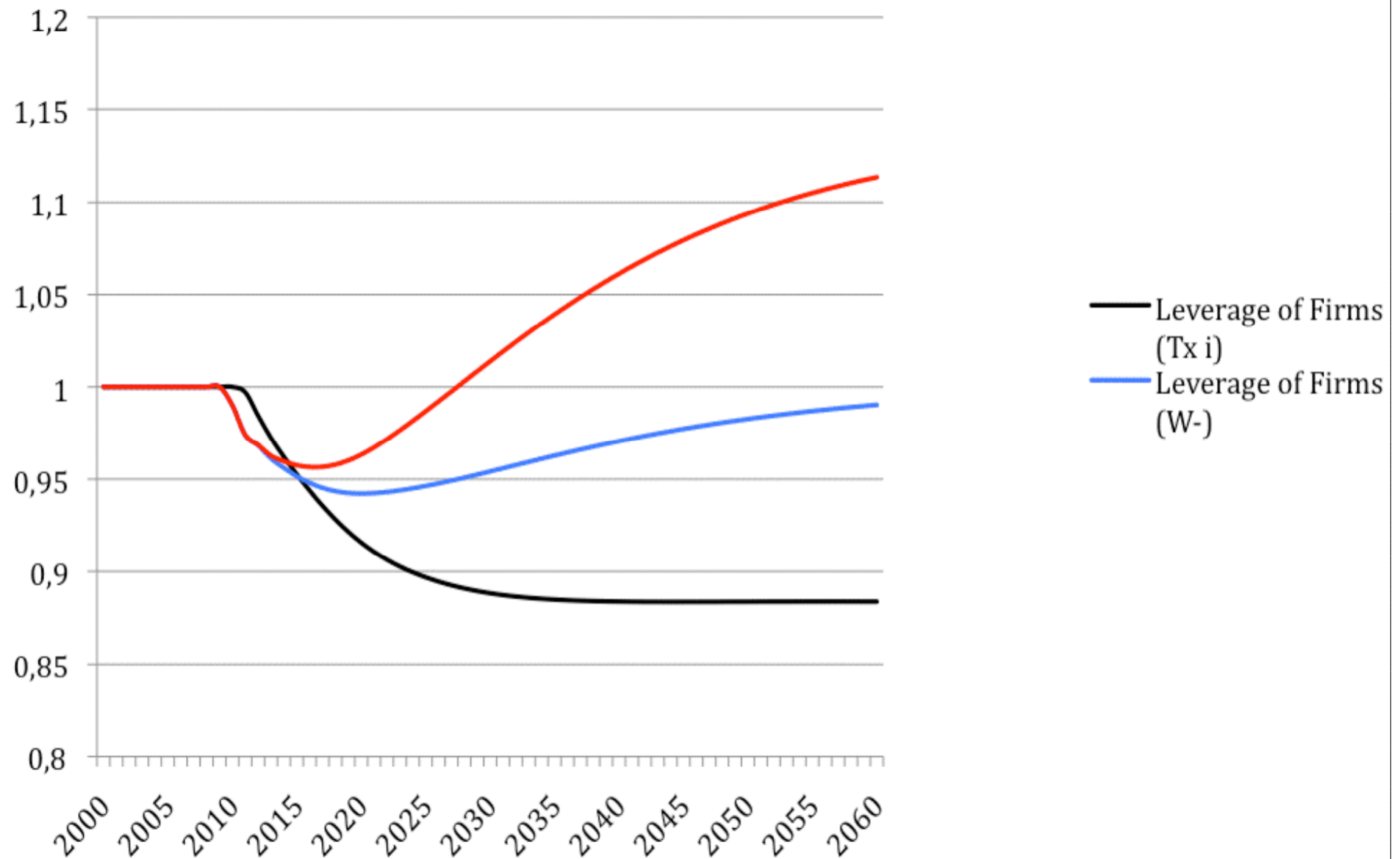


Figure 6-A Effects on leverage of optimistic workers (EXP 1, 2 and 3)

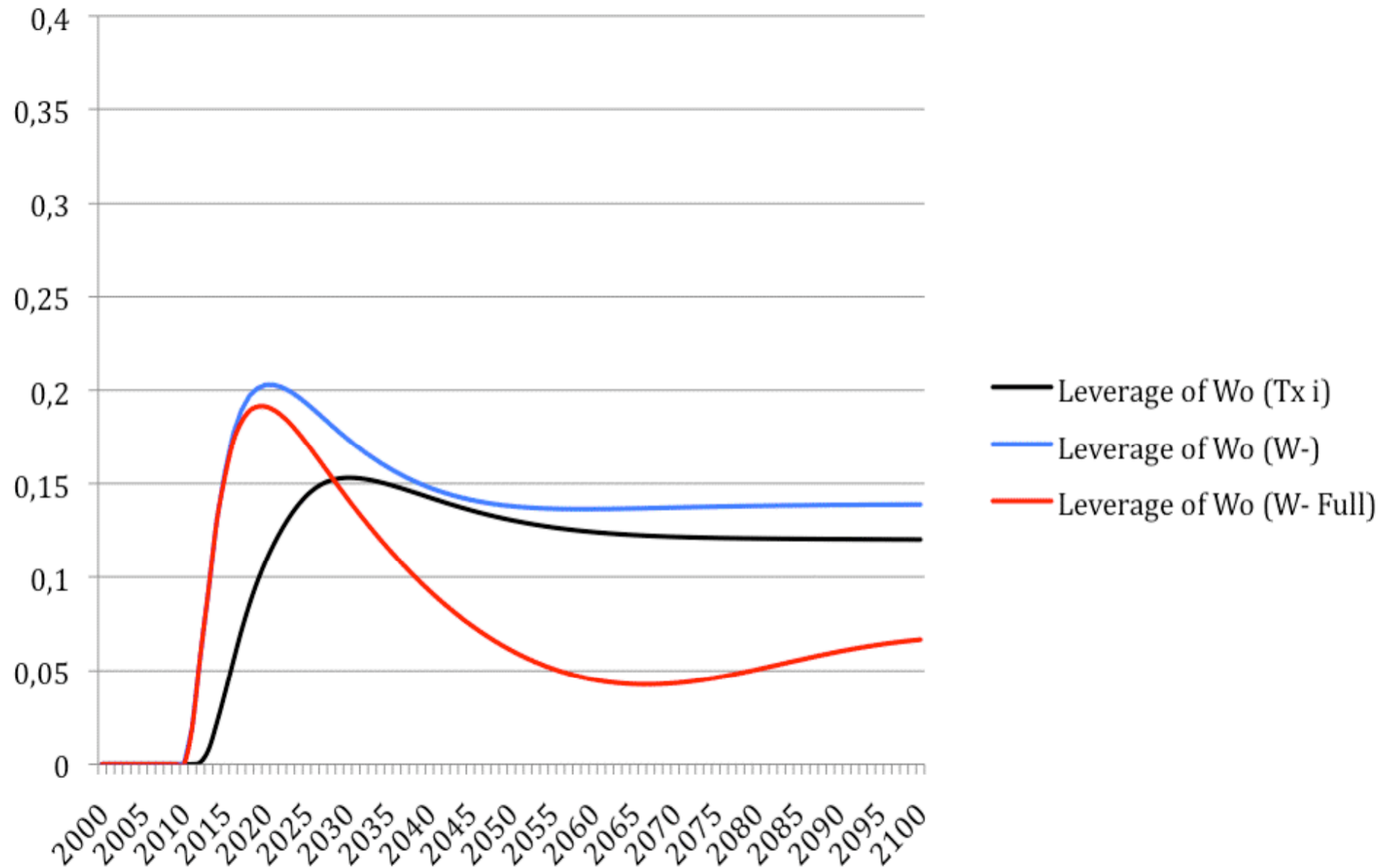
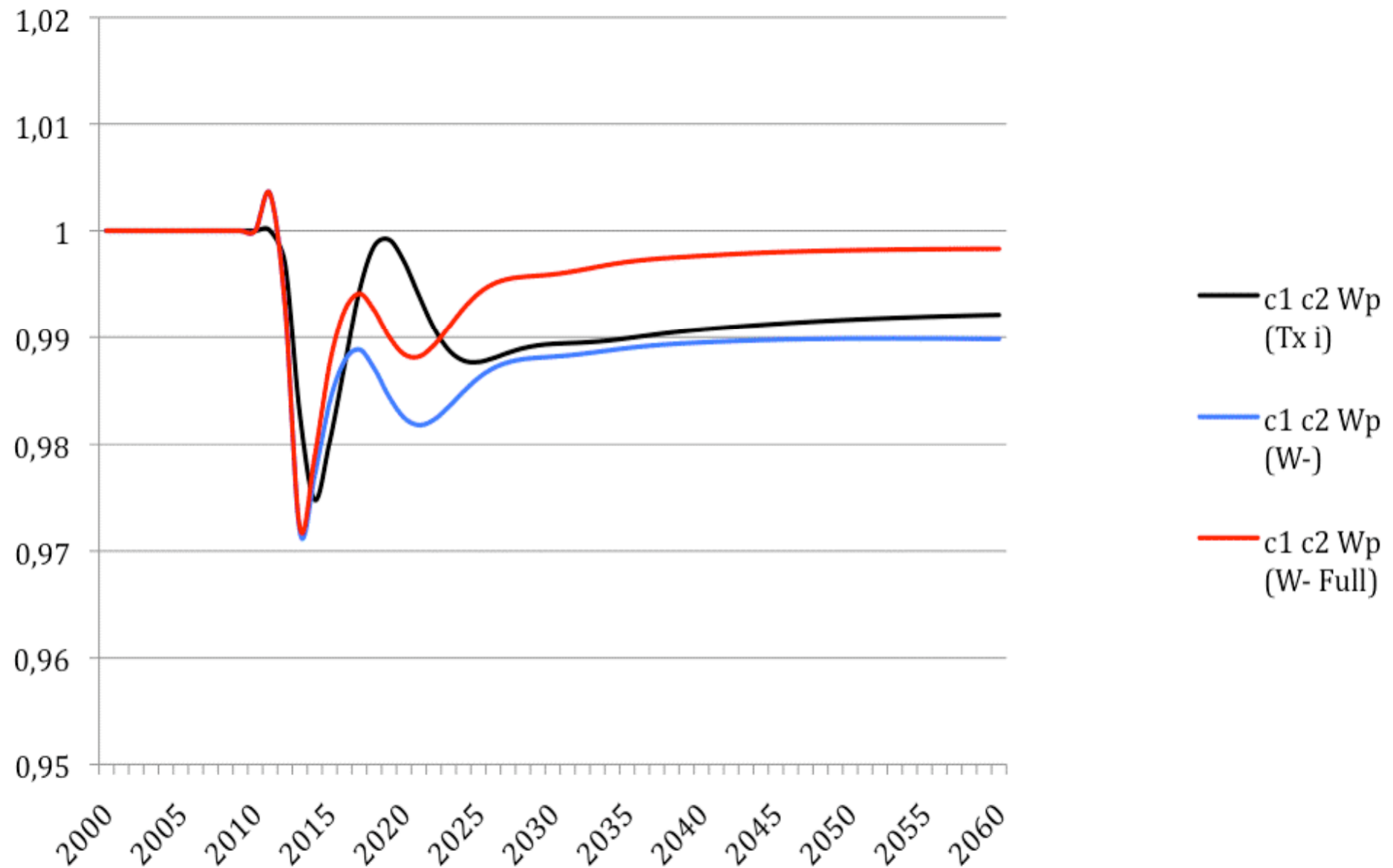


Figure 7-A Effects on marginal propensity of consume of pessimistic workers (EXP 1, 2 and 3)



Four Experiments

- **EXP1 An permanent shock in monetary policy**
- **Higher interest rate: i_{cb} from 3 to 4%**
- **EXP2 A change in income distribution**
- **Lower wages in GDP: W/Y -**
- **EXP3 A change in income distribution**
- **Lower wages in the full model (TR and NKPC)**
- **EXP4 A change in income distribution**
- **Lower wages with « radical banks »: lender's risk (1 or 0)**

Figure 8-A Effects on the structure of consumption (EXP 1)

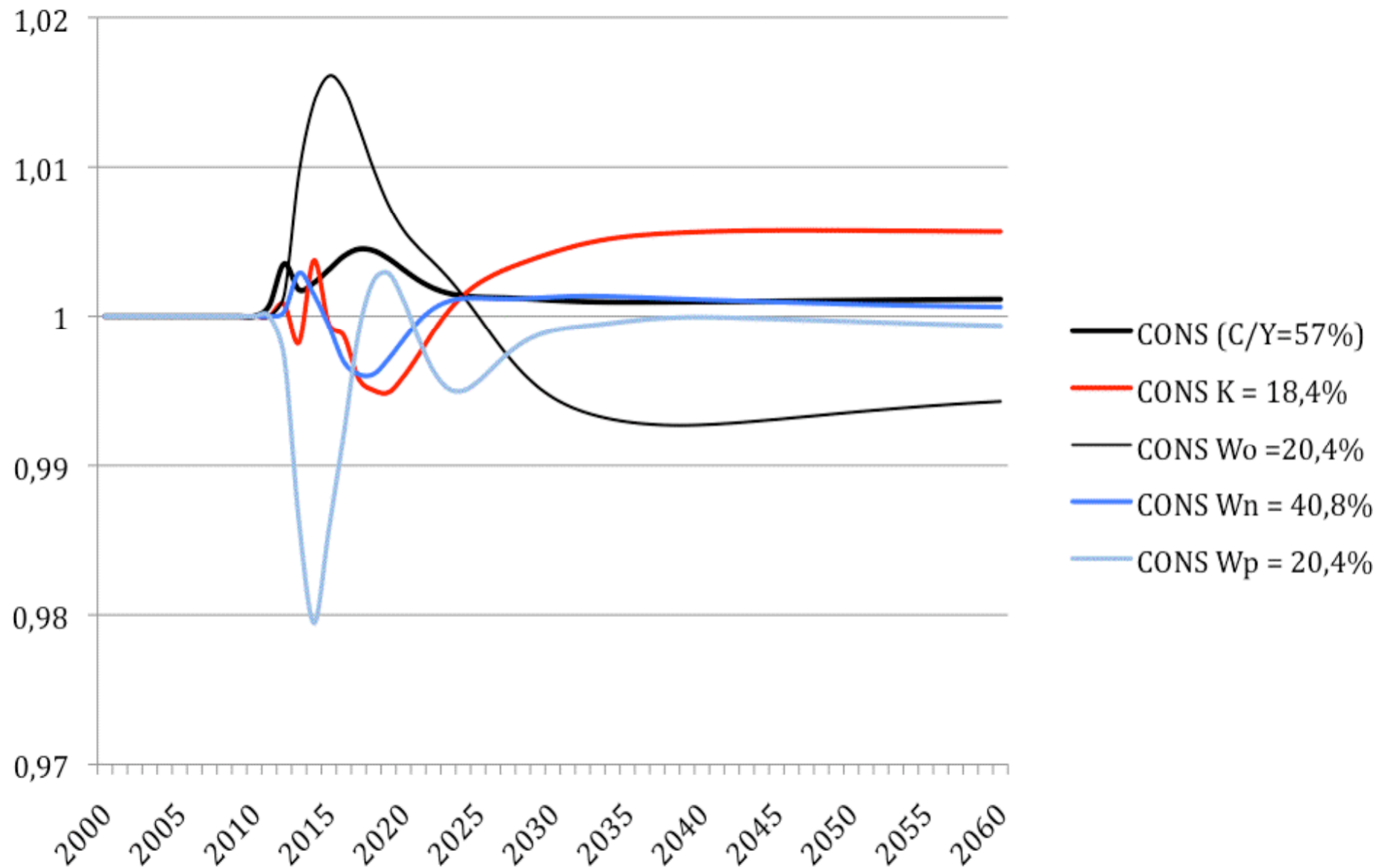


Figure 9-A Effects on the structure of household deposit (EXP 1)

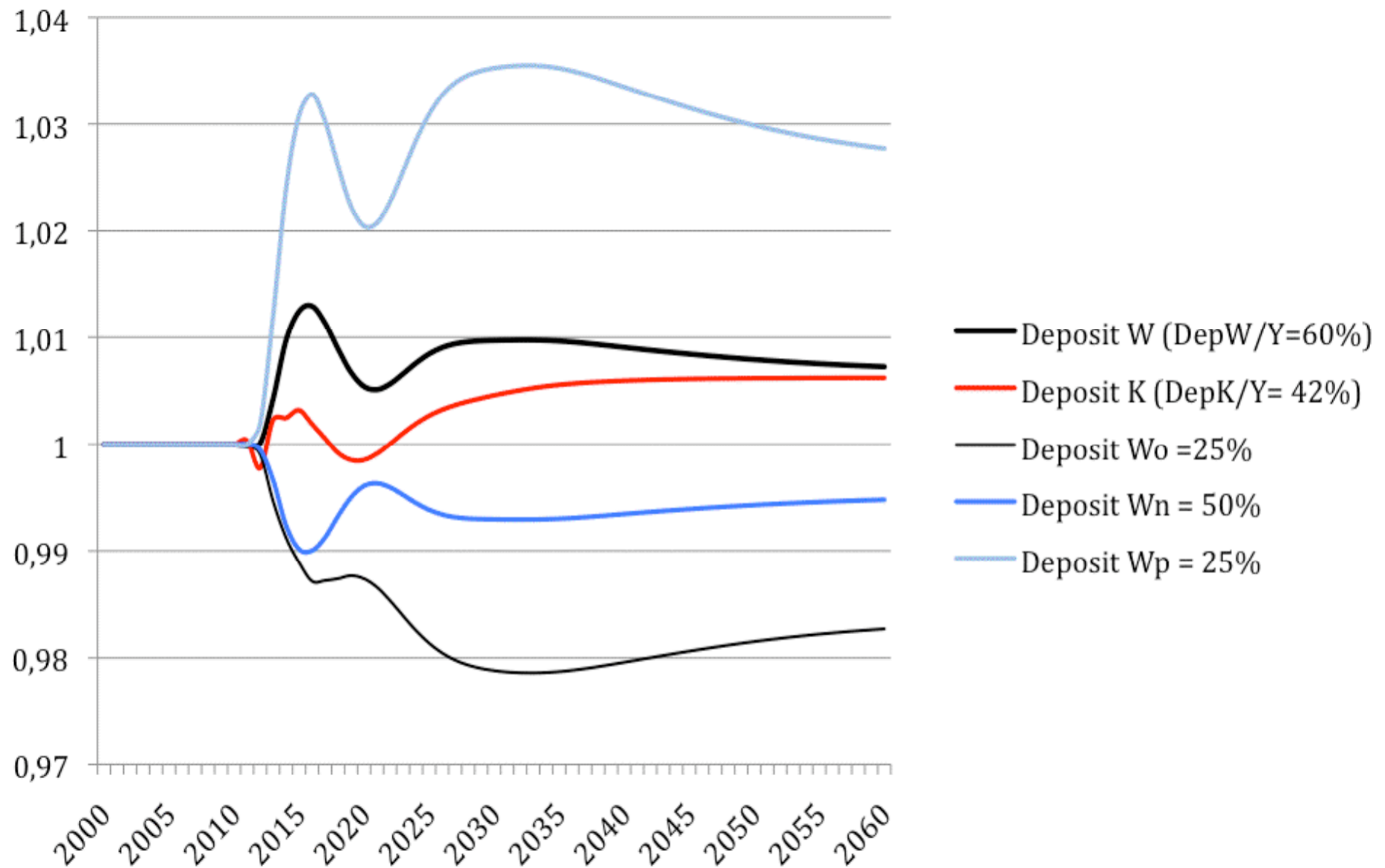
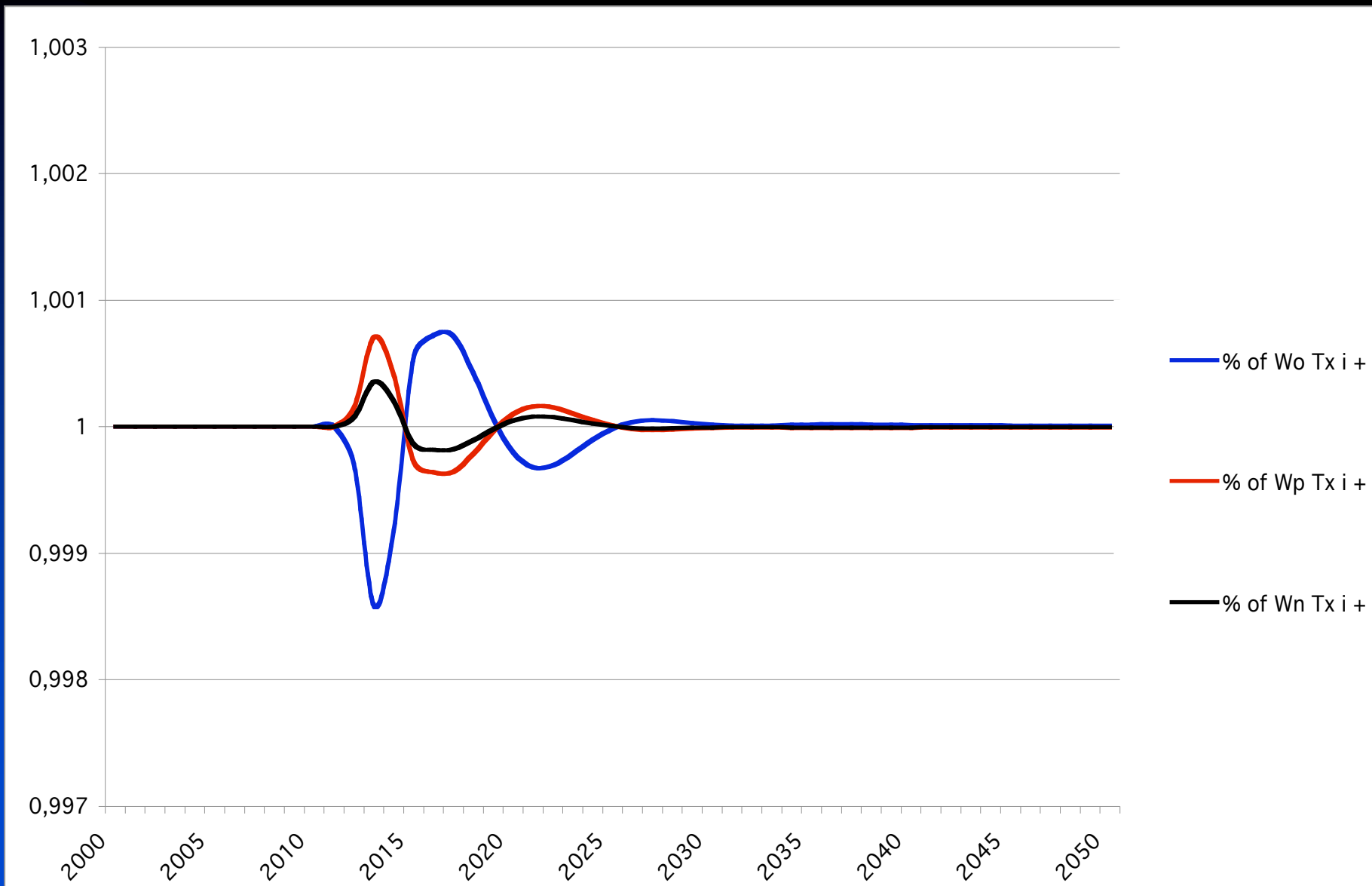


Figure 11-A Effects on the structure of household (EXP 1)



Four Experiments

- **EXP1** An permanent shock in monetary policy
- **Higher interest rate: i_{cb} from 3 to 4%**
- **EXP2** A change in income distribution
- **Lower wages in GDP: W/Y -**
- **EXP3** A change in income distribution
- **Lower wages in the full model (TR and NKPC)**
- **EXP4** A change in income distribution
- **Lower wages with « radical banks »: lender's risk (1 or 0)**

Figure 8-C - Effects on the structure of consumption (EXP 3)

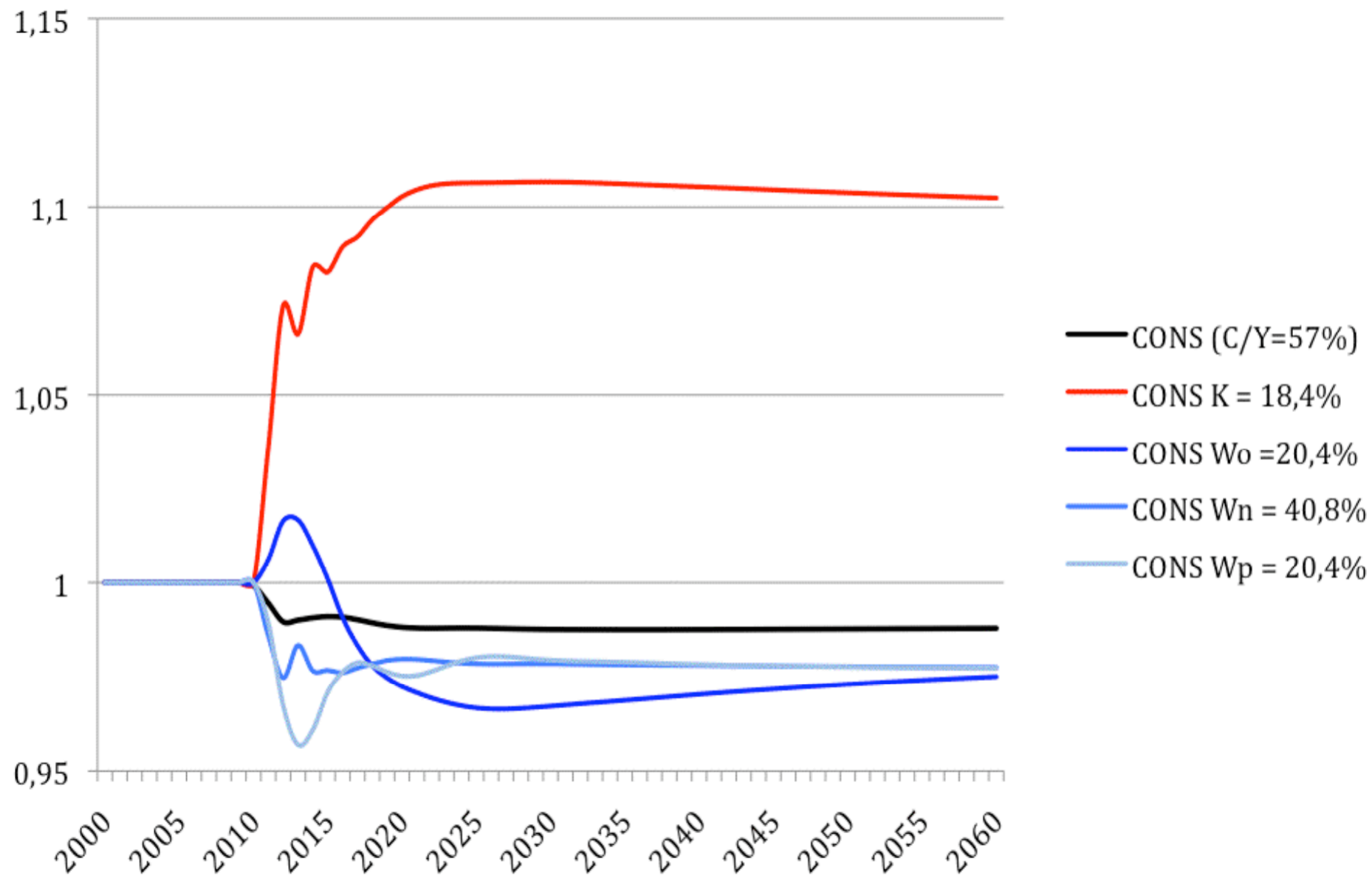


Figure 9-C - Effects on the structure of household deposit (EXP 3)

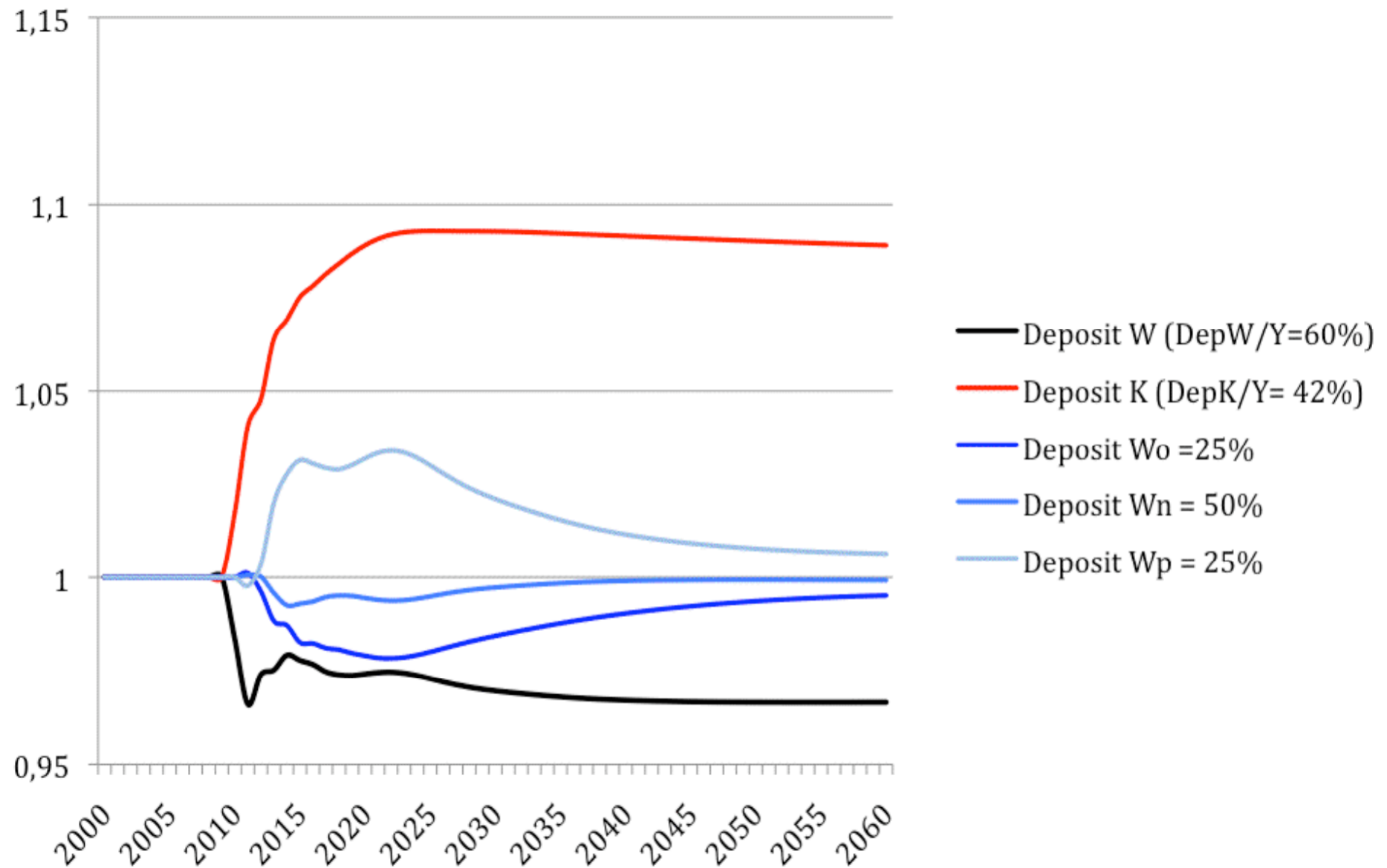


Figure 10 - Effects on interest rate and inflation (EXP 3)

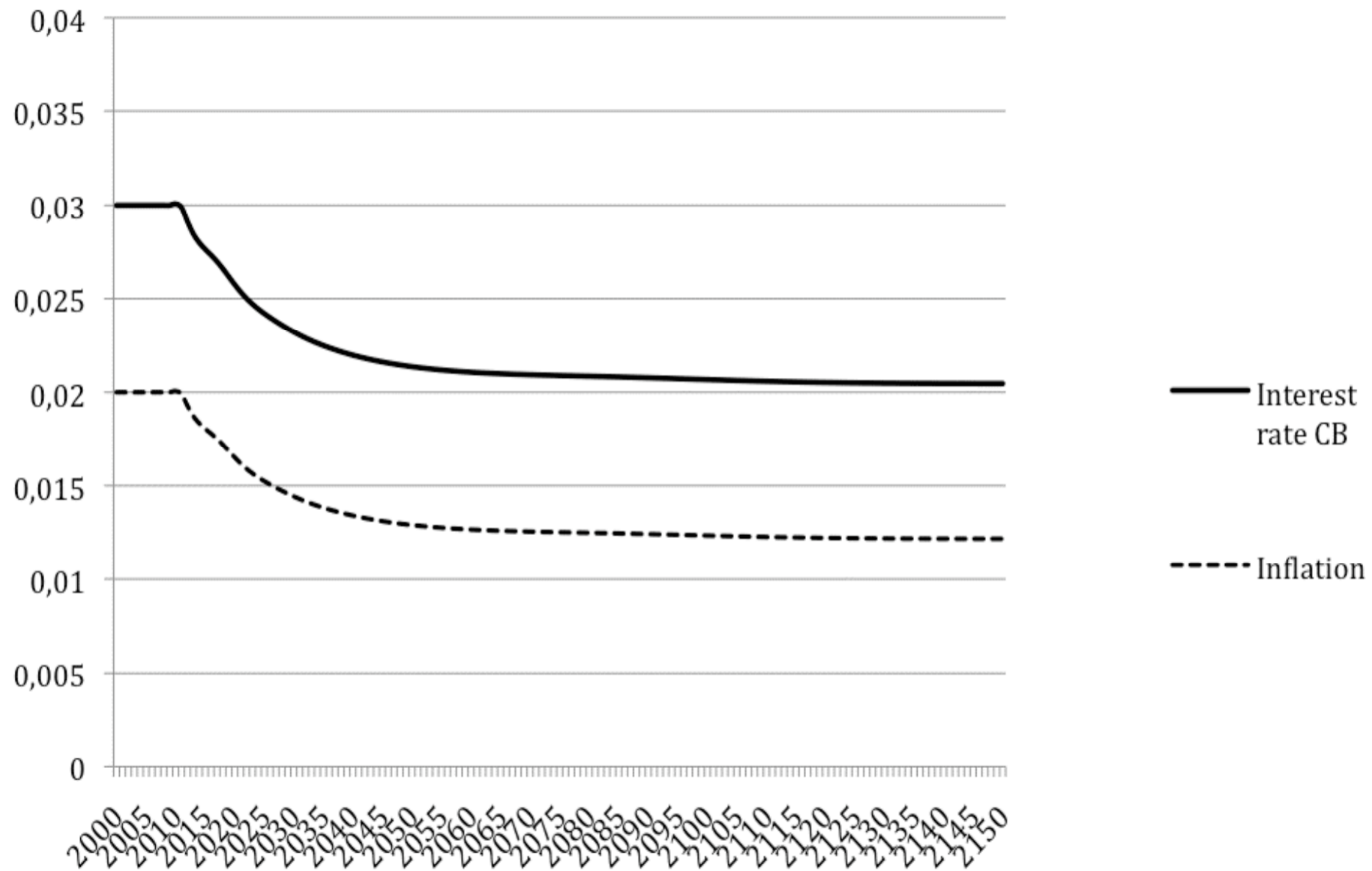
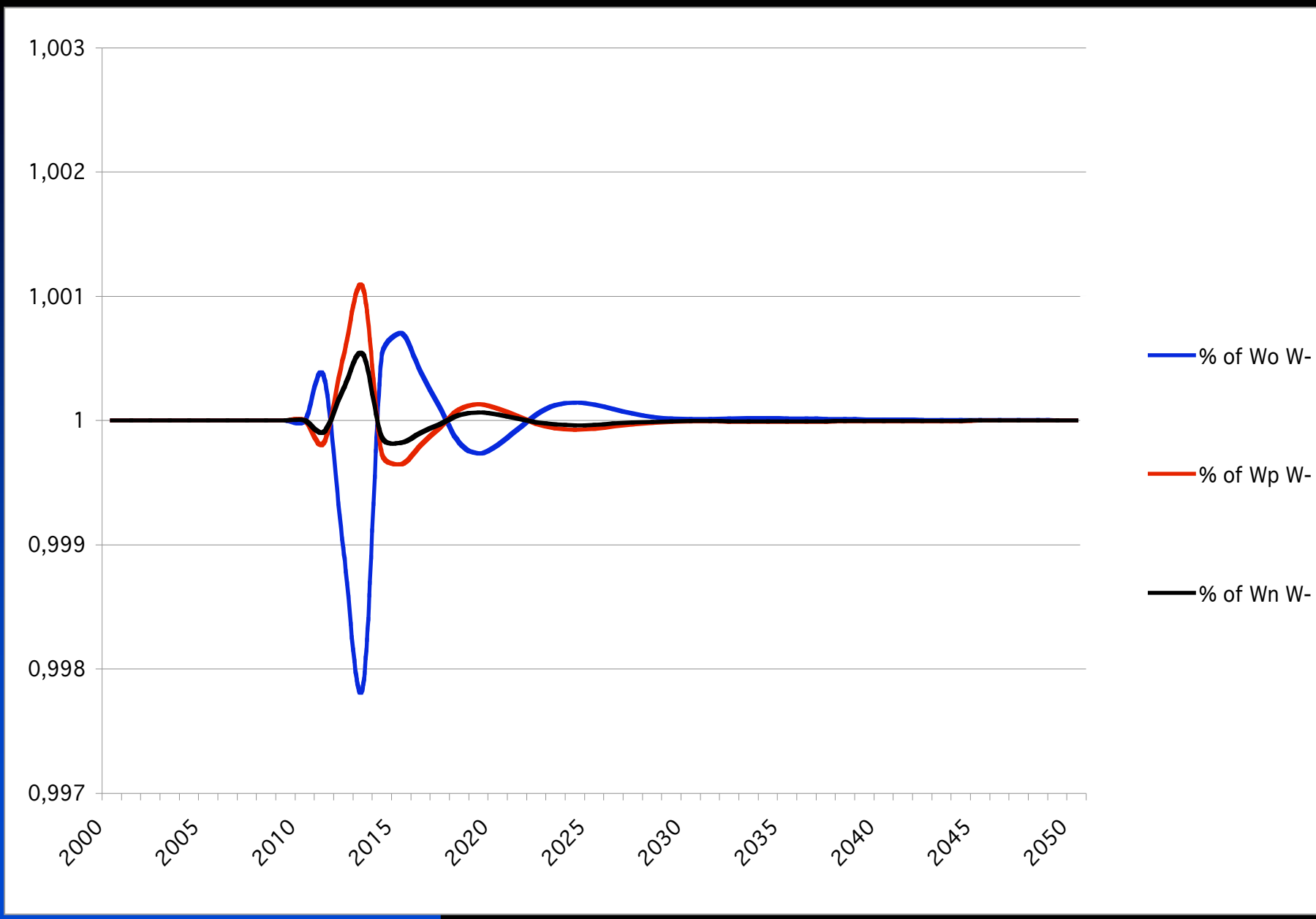


Figure 11-C - Effects on structure of household (EXP 3)



Four Experiments

- **EXP1** An permanent shock in monetary policy
- **Higher interest rate: i_{cb} from 3 to 4%**
- **EXP2** A change in income distribution
- **Lower wages in GDP: W/Y -**
- **EXP3** A change in income distribution
- **Lower wages in the full model (TR and NKPC)**
- **EXP4** A change in income distribution
- **Lower wages with « radical banks »: lender's risk (1 or 0)**

Figure 1-B Effects on the rate of growth (EXP 4)

Taux de croissance W- Cycle

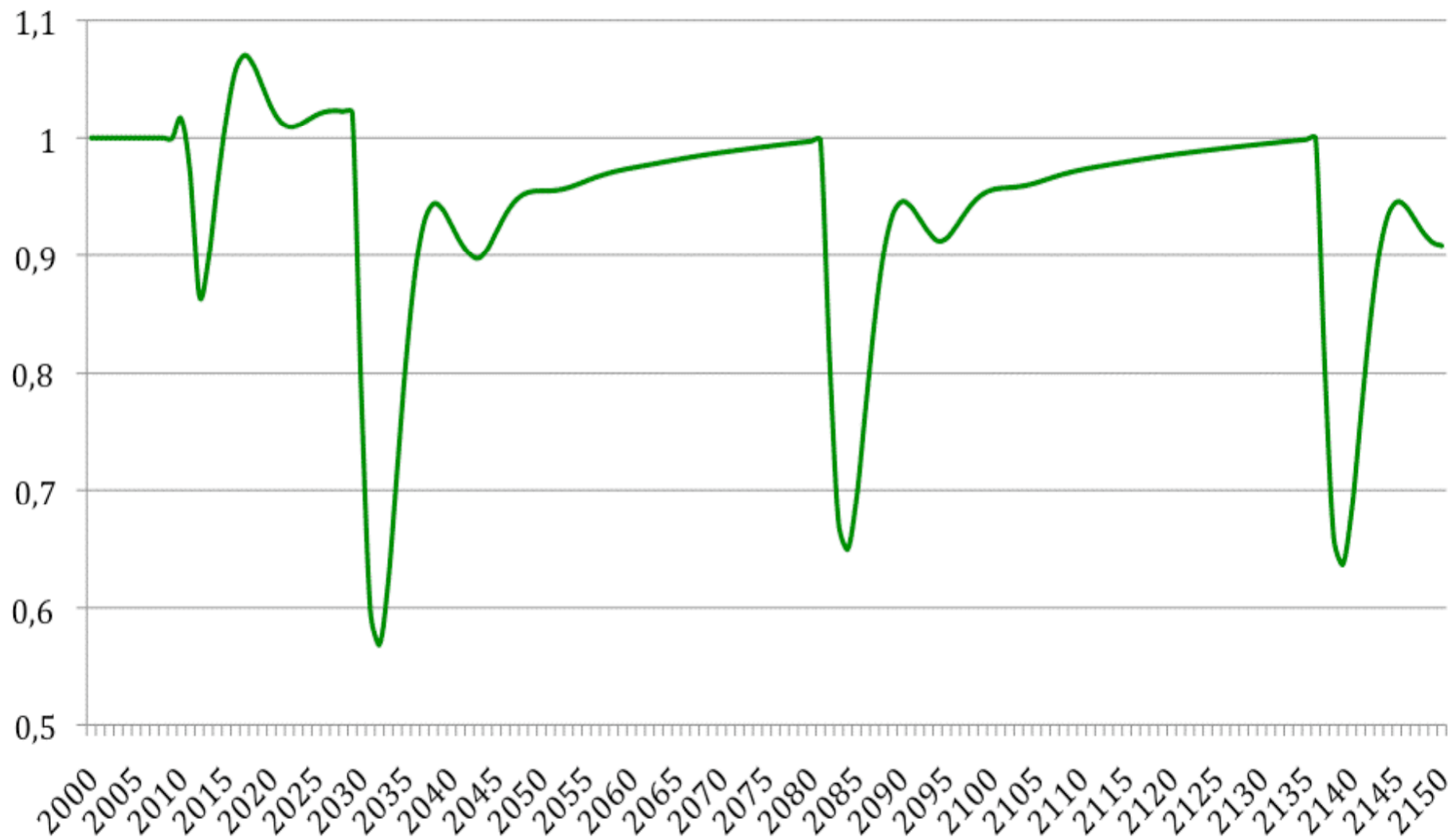


Figure 2-B Effects on the desired rate of accumulation of firms (EXP 4)

Taux de croissance désiré W- Cycle

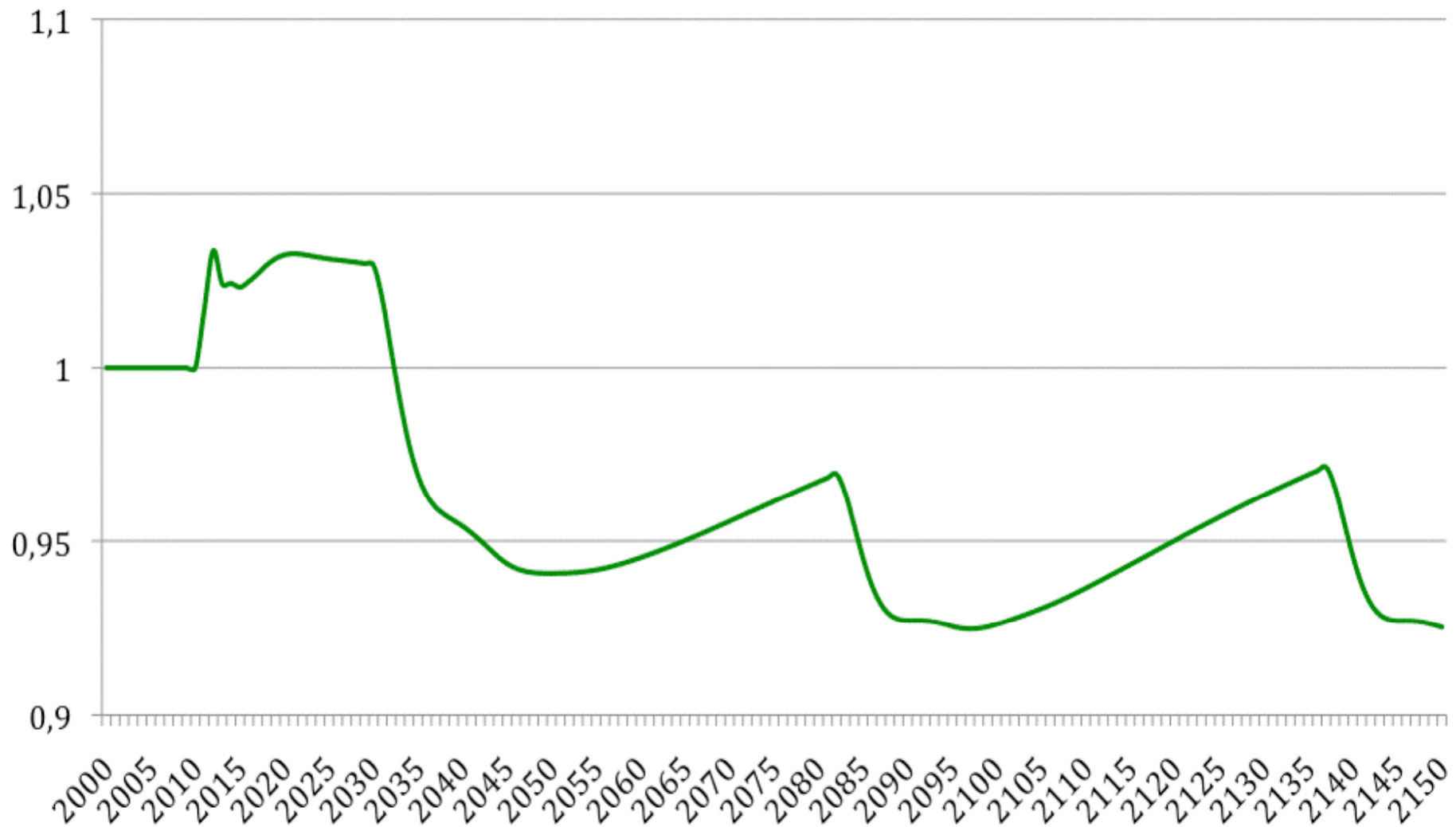


Figure 8-D Effects on the structure of consumption (EXP 4)

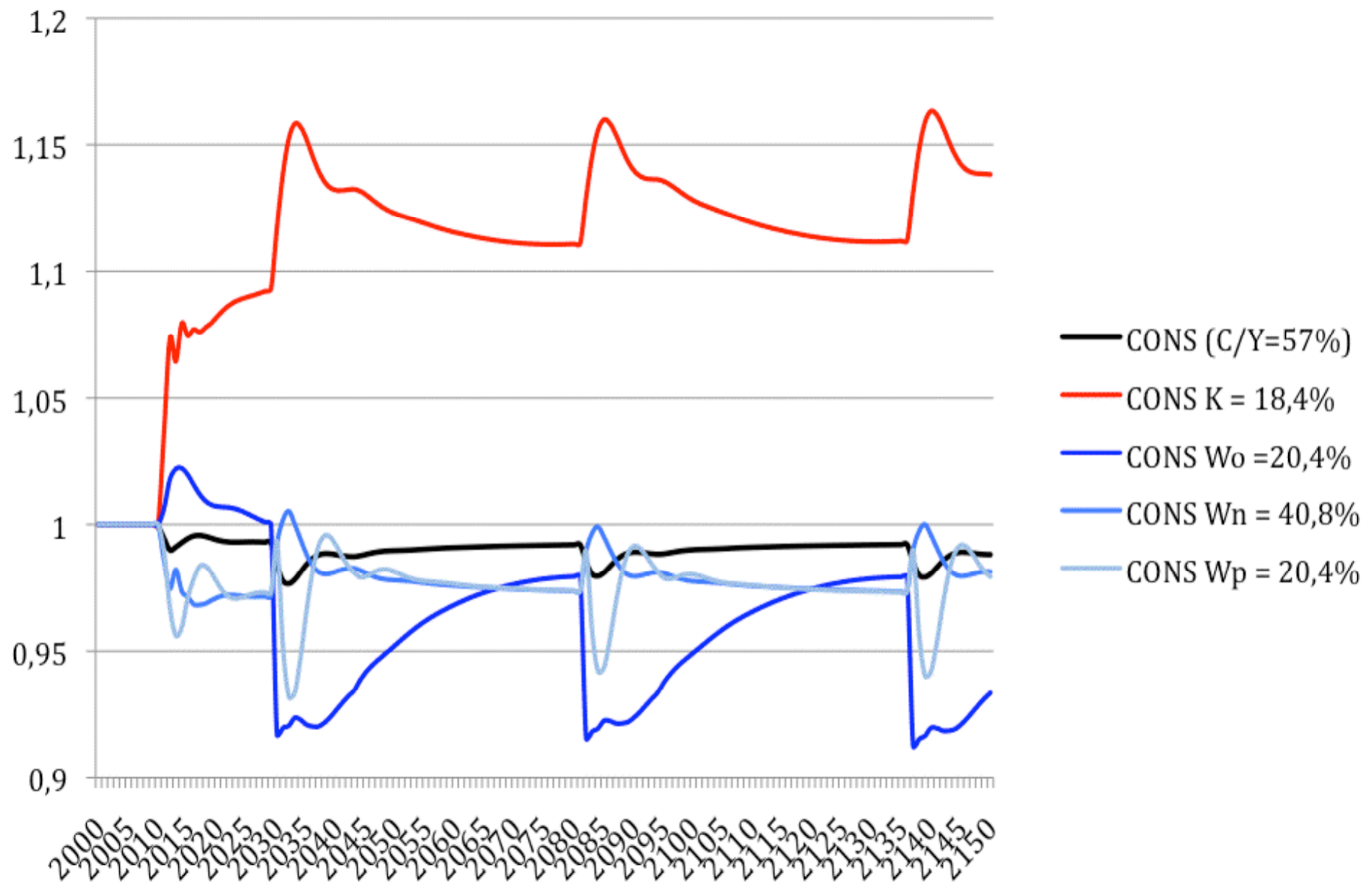


Figure 9-D Effects on the structure of deposit (EXP 4)

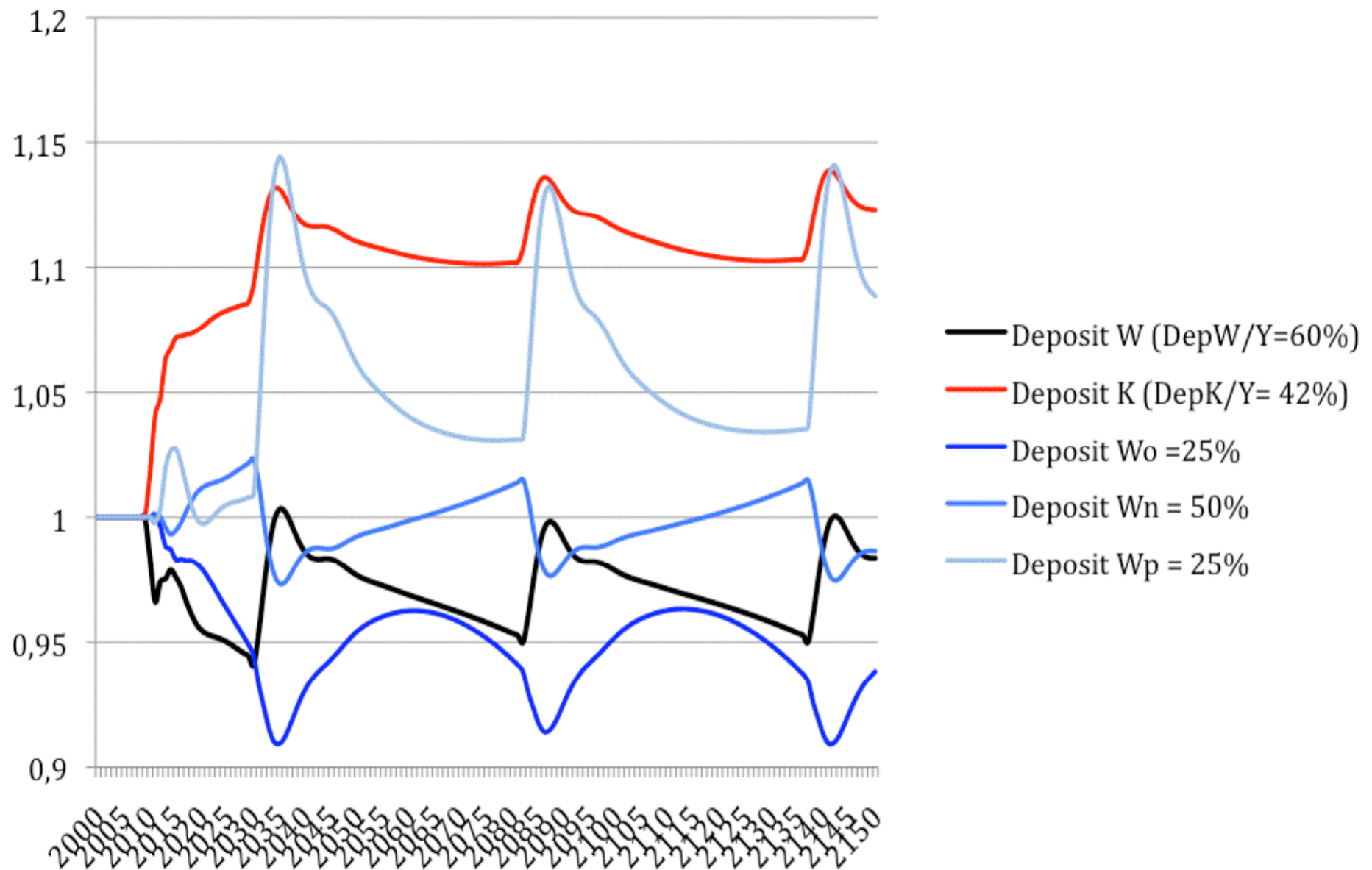


Figure 3-B Effects on the lender's risk on firms (EXP 4)

Lender risk on Firms (W- Cycle)

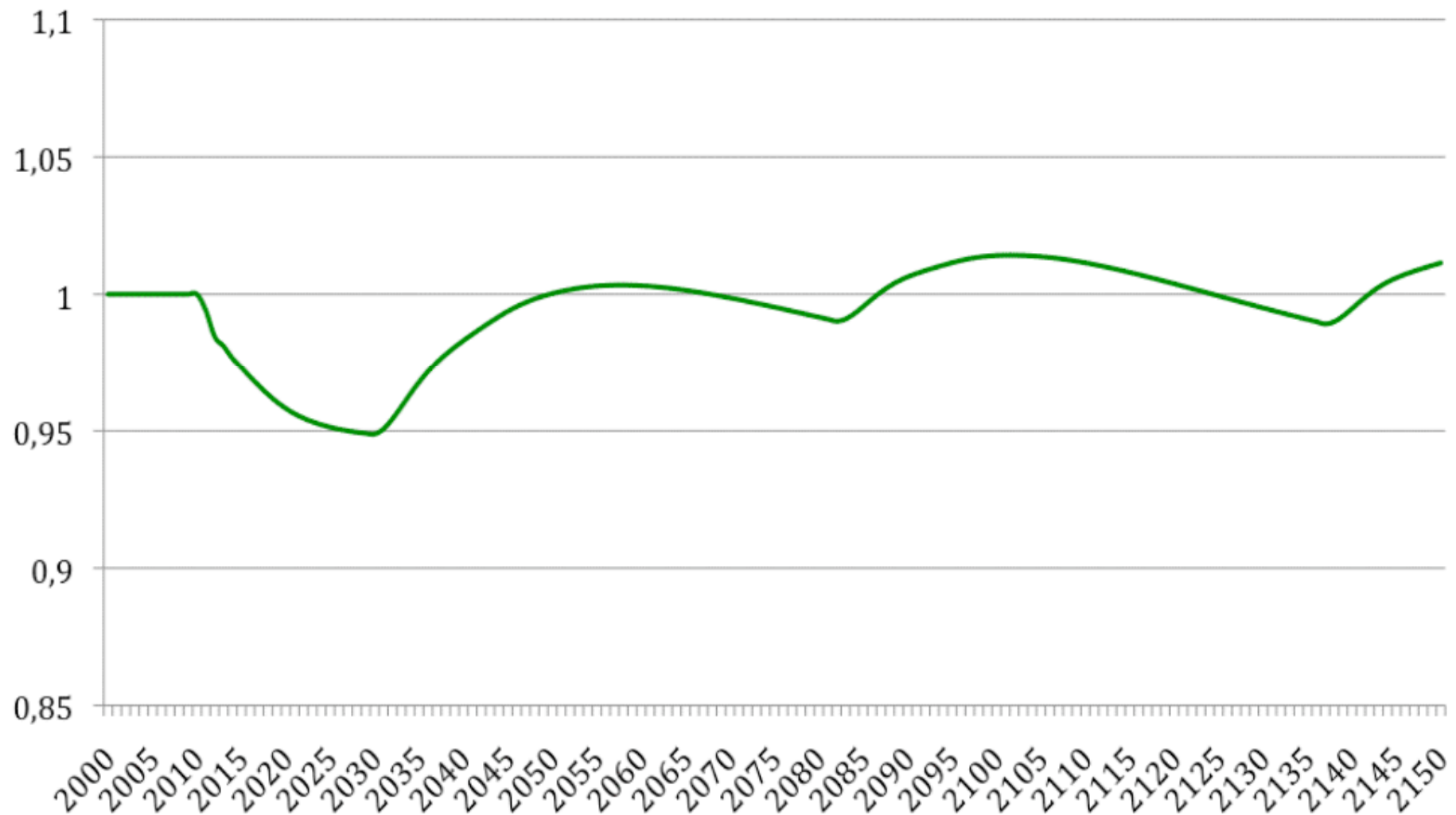


Figure 6-B Effects on leverage of W_0 and lender's risk (EXP 4)

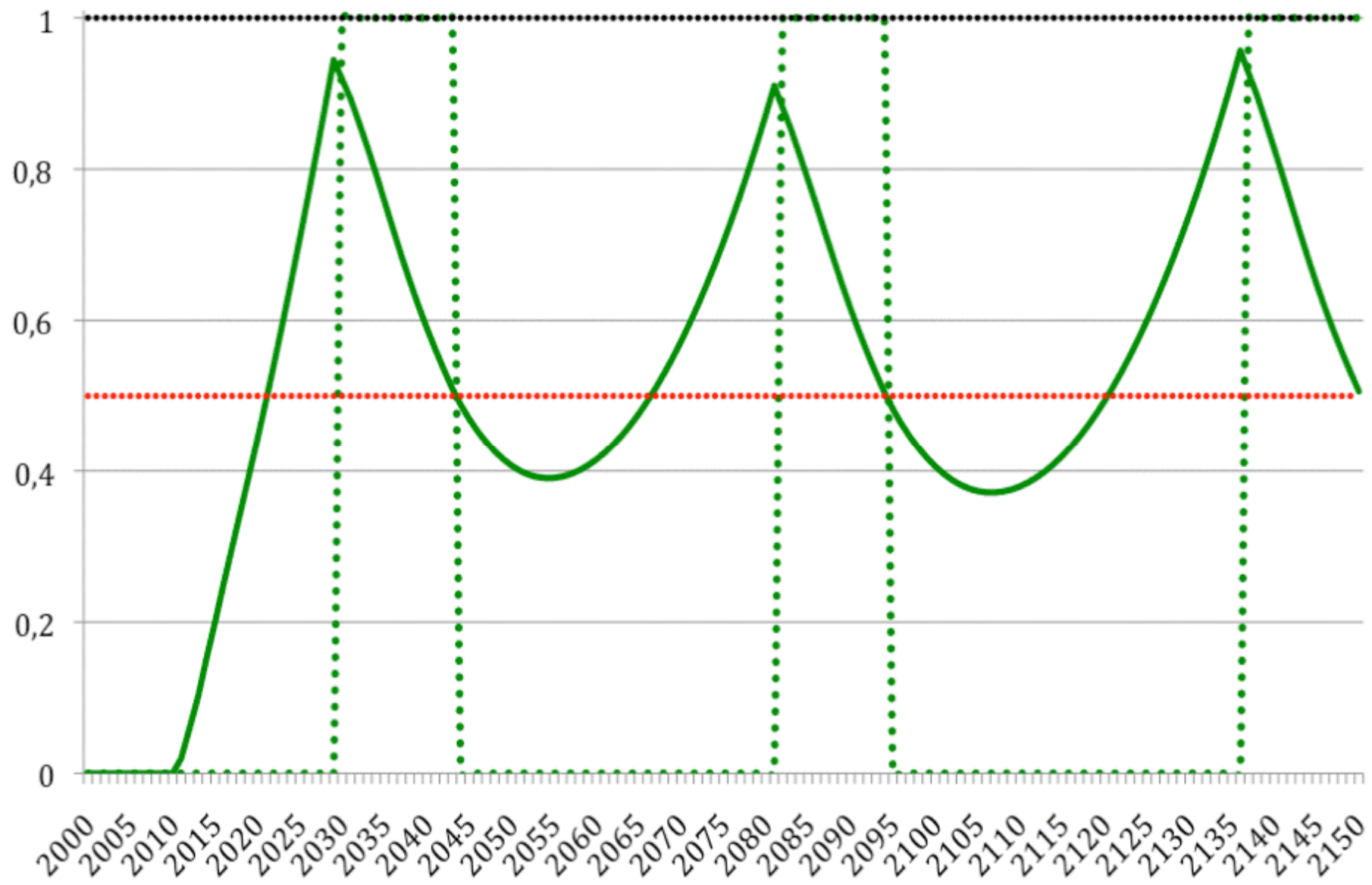


Figure 7-B Effects on marginal propensity to consume of Wp (EXP 4)

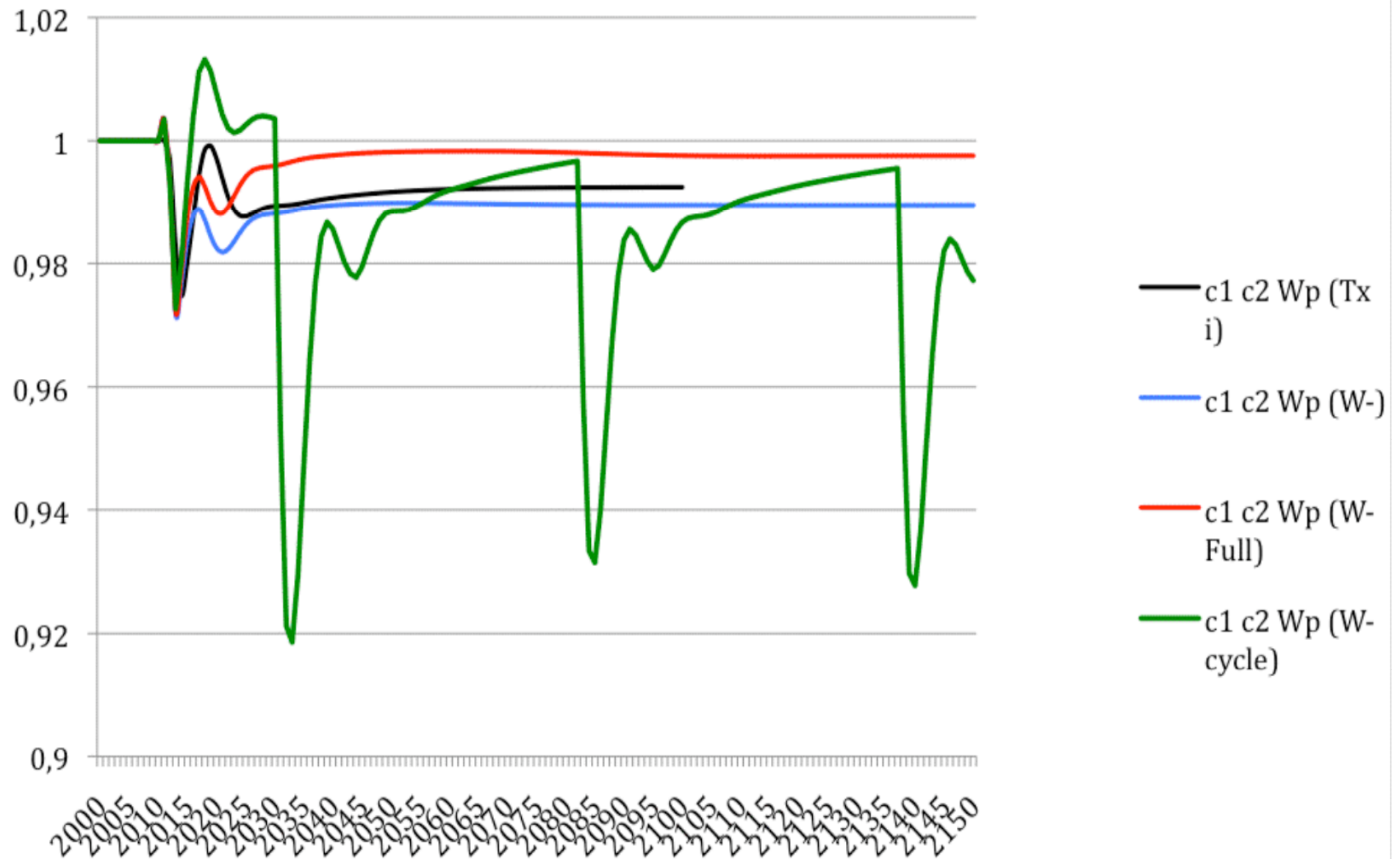


Figure11-E Effects on structure of households (EXP 4)



Macro-foundations of Micro and Micro-foundations of Macro Income distribution, Increasing risks and Household behaviours

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