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Modelling structural reforms in QUEST

DG ECFIN

Overview:

- Introduction
- Labour market
- Administrative burden
- R & D
- Conclusions

APR Nov 2006

The Effects of Labour and Product Market Reforms 1995-2003

This ex-post analysis used the QUEST II model to examine the impact of observed changes in labour and product markets over the period 1995-2003 on GDP and employment

(Bassanini&Duval (2006) , Griffith&Harrison(2004))

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QUEST II model:

Long run **:** neo-classical growth model, but with imperfect competition (mark-ups, involuntary unemployment)

Short run dynamics :   Keynesian features, but with theoretical foundations (adjustment costs, overlapping contracts)

Theoretical foundations   -   New Neoclassical-Keynesian Synthesis

Derived from dynamic optimisation of utility and profits by households and firms, subject to intertemporal budget constraints

Structural models :

• Each of the EU member states

• US

• Japan

Trade feedback models:

• 11 other countries/regional blocks

References: ECFIN Economic papers no. 123 and 178

Economic Modelling, 2004, Vol. 21/5, pp. 785-832.

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Labour market in QUEST II: Bargaining framework (Pissarides)

If there is a successful job match, workers and firms both benefit relative to the
alternative state of :

- being unemployed and only receiving "reservation wage" (workers)
- having an unfilled vacancy (firms)

Wage costs depend on three factors:
- the reservation wage z_t (unemployment benefits, leisure)
- labour productivity Y_t / N_t
- labour market tightness (probability unemployed U, vacancy costs)

β bargaining strength workers
- $\beta=0$ competitive labour market, no bargaining strength of workers
- $\beta=1$ insider-outsider model, complete bargaining strength workers

$$wc_t = (1 - \beta)\frac{1}{(1 - t_l)} z_t + \beta\{\alpha Y_t / N_t + vc_t PROB(U_t)\}$$

Bassanini and Duval (2006)

Unemployment rate = f (policy variables , output gap)

Policy variables:
- **Tax wedge between labour cost and take-home pay**
- **Unemployment benefit generosity (average replacement rates)**
- **Stringency of EPL**
- **Stringency product market regulation (PMR)**
- **Union membership rates**
- **Degree of centralisation/co-ordination of age bargaining**

Table 2	Average replacement rate	Tax wedge (NA)	Labour tax rates (NA)	Cons. tax rates (NA)
Austria	-1.0	1.7	1.2	0.6
Belgium	3.4	0.2	0.9	-0.6
Germany	0.9	-1.6	-1.0	-0.6
Denmark	-15.4	3.1	1.4	1.8
Spain	-4.7	2.0	0.6	1.4
Finland	-0.2	-1.8	-2.2	0.3
France	2.0	-1.2	-0.1	-1.1
UK	-1.4	0.0	1.6	-1.6
Ireland	11.8	-6.8	1.3	-8.2
Italy	14.4	0.4	2.2	-1.8
Netherlands	0.0	-4.5	-5.7	1.2
Portugal	5.4	0.0	0.6	-0.6
Sweden	-2.4	0.2	1.1	-1.0
EU unweighted average	1.0	-0.6	0.1	-0.8
EU weighted average	1.8	-0.5	0.2	-0.7

Source: Database OECD (see Bassanini and Duval (2006); changes 2003-1995.

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Table 3	Change in Fraser Institute Indicators 1995-2003			Estimated change in mark-ups 1995-2003	
Countries:	5Civ Starting a new business	5Ci Price controls	4Aii Mean tariff rate	Starting a new business + Price controls	Starting a new business + Price controls + Mean tariff rate
Austria	1.8	0.0	1.1	-0.022	-0.050
Belgium	-0.1	0.0	0.7	0.001	-0.018
Denmark	-0.2	-2.0	1.1	-0.014	-0.042
Finland	-0.9	-1.0	1.1	0.002	-0.026
France	1.1	-1.0	1.1	-0.021	-0.049
Germany	0.2	-2.0	1.1	-0.019	-0.047
Greece	-0.5	-2.0	1.1	-0.010	-0.041
Ireland	-1.6	-4.0	1.1	-0.013	-0.033
Italy	-0.3	-1.0	1.1	-0.005	-0.020
Netherlands	-1.4	-1.0	1.1	0.008	-0.028
Portugal	0.0	0.0	1.1	0.000	-0.022
Spain	-1.2	-1.0	1.1	0.006	-0.063
Sweden	2.3	-1.0	1.1	-0.035	-0.056
United Kingdom	-0.4	-4.0	1.1	-0.027	-0.050
EU15 (average)	-0.03	-1.70	1.05	-0.013	-0.041

Source: Gwartney&Lawson (2006) and estimates based on Griffith&Harrison (2004)

Table 4: Simulated long run effects of changes in labour and product markets 1995-2003 on GDP and the rate of unemployment

	Benefit replacement rate		Labour and consumption tax rates (NA)		*Of which: labour taxes*		*Of which: consumption taxes*		Mark-up		All changes combined		Favourable changes only	
	GDP	**U**	**GDP**	**U**	*GDP*	*U*	*GDP*	*U*	**GDP**	**U**	**GDP**	**U**	**GDP**	**U**
BE	-0.52	0.60	-0.07	0.21	*-0.21*	*0.37*	*0.14*	*-0.15*	0.37	-0.20	-0.23	0.62	0.81	-0.53
DK	1.93	-2.75	-0.95	1.34	*-0.62*	*0.86*	*-0.32*	*0.47*	1.63	-0.95	2.61	-2.34	4.00	-3.91
DE	-0.29	0.25	0.55	-0.75	*0.39*	*-0.57*	*0.16*	*-0.18*	1.75	-1.13	2.00	-1.62	2.46	-1.94
GR	*-0.06*	*0.01*	*0.02*	*-0.01*	*0.01*	*-0.00*	*0.01*	*-0.01*	0.10	0.03	0.06	0.03	0.63	-0.15
ES	0.25	-0.57	-0.21	0.31	*-0.07*	*0.14*	*-0.14*	*0.17*	-0.03	0.11	0.01	-0.16	0.82	-0.62
FR	-0.38	0.38	0.27	-0.30	*0.06*	*-0.05*	*0.22*	*-0.25*	1.72	-0.72	1.61	-0.64	2.10	-1.05
IE	-2.39	3.07	1.07	-1.13	*-0.35*	*0.48*	*1.42*	*-1.61*	1.31	-0.54	-0.11	1.53	2.91	-2.22
IT	-1.53	1.91	-0.21	0.37	*-0.46*	*0.64*	*0.25*	*-0.27*	0.45	-0.09	-1.32	2.22	0.80	-0.37
NL	-0.11	0.04	1.19	-1.62	*1.31*	*-1.81*	*-0.13*	*0.19*	-0.31	0.17	0.77	-1.41	1.70	-2.01
AT	-0.03	-0.03	-0.21	0.35	*-0.18*	*0.29*	*-0.02*	*0.06*	1.29	-0.47	1.05	-0.20	1.48	-0.60
PT	-0.38	0.47	0.00	0.03	*-0.05*	*0.08*	*0.05*	*-0.05*	0.08	-0.00	-0.31	0.50	0.16	-0.06
SF	-0.16	0.01	0.73	-0.95	*0.71*	*-1.00*	*0.01*	*0.04*	0.51	-0.16	1.07	-1.10	1.69	-1.35
SW	0.25	-0.28	-0.22	0.27	*-0.41*	*0.47*	*0.19*	*-0.21*	3.55	-1.38	3.58	-1.40	4.11	-1.94
UK	0.21	-0.26	0.20	0.22	*-0.49*	*0.60*	*0.29*	*-0.37*	2.71	-1.45	2.72	-1.49	3.25	-2.12
EU12	-0.52	0.52	0.25	-0.29	*0.10*	*-0.14*	*0.15*	*-0.15*	1.04	-0.52	0.76	-0.28	1.68	-1.14
EU15	-0.34	0.30	0.14	-0.16	*-0.02*	*0.02*	*0.17*	*-0.18*	1.38	-0.71	1.18	-0.56	2.04	-1.38

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	Simulated contribution of all observed policy changes	Simulated contribution of favourable policy changes	*1995-2003*
Cumulative GDP growth :			
EU12	0.76	1.68	*18.48*
EU15	1.18	2.04	*19.66*
Change in NAIRU:			
EU12	-0.28	-1.14	*-0.75* *(9.22 - 8.47)*
EU15	-0.56	-1.38	*-0.78* *(8.71 - 7.93)*

Robustness of results:

The effects of policy shocks on the unemployment rate - econometric simulations (Alfonso Arpaia, ECFIN)

Simulate the estimated relationship reported in Bassanini and Duval (2006) with observed changes in average unemployment benefit replacement rates, tax wedges and PMR indicators between 1995-2003:

➔ Policy induced changes in unemployment rate (weighted EU average) : -0.8

Future evaluations of structural reforms

Use the new QUEST III model

- multi-region version of estimated DSGE model for the euro area (ECFIN Economic Paper 266)

Labour market in DSGE models:

Monopolistically competitive unions, which act as wage setters for the differentiated labour services

=> Mark-up of wages over equilibrium wage depends on elasticity of substitution between different types of labour

Reforms can affect adjustment costs of firms, benefit replacement rate affects labour supply

Extend this by introducing search based elements - adds a link between structural rigidities and vacancy costs and bargaining strength

The effects of a reduction in administrative burden

QUEST III Model

Production in the QUEST III Model

Technology

$$Y_t^j = (ucap_t^j K_t^j)^{1-\alpha} (L_t^j - LO_t^j)^{\alpha} U_t^{\alpha}$$

Maximise market value

$$Max\, V_0^{r\,j} = E_0 \sum_{t=0}^{\infty} d^t \frac{\left[(1-t_t^p)(P_t^j(.))Y_t^j - W_t L_t^j - adc^P(P_t^j) - adj^L(L_t^j) - adj^{CAP}(ucap_t^j)) - PI_t I_t^j - adj^K(K_t^j) \right]}{P_t}$$

Adjustment costs:

$$adj^L(L_t^j) = W_t \frac{\gamma_L}{2} \Delta L_t^{j\,2}$$

$$adj^P(P_t^j) = \frac{\gamma_P}{2} \frac{(P_t^j - P_{t-1}^j)^2}{P_{t-1}^j}$$

$$adj^K(K_t^j, I_t^j) = PI_t \left(\frac{\gamma_K}{2} \frac{I_t^{j\,2}}{K_{t-1}} + \frac{\gamma_I}{2} \frac{(I_t^j - I_{t-1}^j)^2}{I_{t-1}^j} \right)$$

$$adj^{CAP}(ucap_t^j) = PI_t K_t (a_1(ucap_t^j - ucap^*) + a_2(ucap_t^j - ucap^*)^2)$$

Starting Point:

Estimate of the Dutch Central Planning Bureau (Kox, 2005)

- Administrative burden (AB) for European companies are 3.4% of GDP

- There is a wide country variation: Min: UK, SE, FI 1.5%;   Max: GR 6.8%

- Start up costs are part of AB and amount to .6% of GDP.

On the nature of these costs, the CPB concludes:
Administrative costs are to large extent size independent overhead costs.

The economic effects of reducing AB by 25%

1)   Fixed cost reduction for firms
2)   Increase in competition (possible)

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Implementing a reduction of AB in the QUEST III model
Via a reduction of overhead labour

$$Y_t = (UCAP_t K_t)^{1-\alpha} (L_t - LO_t)^{\alpha} U_t^{\alpha}$$

L: Total Employment
LO: Overhead Labour

Implications for average productivity

$$\frac{Y}{L} = \frac{K_t^{1-\alpha}(L_t - LO_t)^{\alpha} U_t^{\alpha}}{L_t}$$

$$LO \downarrow \quad \Rightarrow \quad \frac{Y}{L} \uparrow$$

Implications for marginal productivity and real wages

$$\frac{\partial Y}{\partial L} = \frac{\alpha K_t^{1-\alpha} U_t^{\alpha}}{(L_t - LO_t)^{1-\alpha}} = (1 + mup)\frac{W}{P}$$

$$LO \downarrow \quad \Rightarrow \quad \frac{\partial Y}{\partial L} \downarrow \Rightarrow \frac{W}{P} \downarrow$$

Implications for labour demand

$$L = \left(\frac{(1-mup)\alpha K^{1-\alpha} U^{\alpha}}{W/P} \right)^{\frac{1}{1-\alpha}} + LO$$

$$LO \downarrow \quad \Rightarrow \quad L \downarrow$$

Implications for profits (mark ups)

$$\Pr ofit_t = mup\left[W_r(L_t - LO_t) + (r_t + \delta)P_t^I K_t \right]$$

$$LO \downarrow \quad \Rightarrow \quad \Pr ofit \uparrow \quad \Rightarrow mup \downarrow (?)$$

Simulation results

Table 1: Reducing administrative Burden
(0.9% of GDP)

No reduction of mark ups

	Y	C	I	K	WR	L
2006	0.2	0.1	-0.0	-0.0	0.1	0.0
2007	0.1	0.3	-0.4	-0.0	0.3	-0.2
2010	0.6	0.5	0.3	-0.0	-0.1	-0.4
2015	0.9	0.8	0.4	0.1	-0.2	-0.4
2025	0.9	0.9	0.5	0.3	-0.2	-0.4
2055	1.0	0.9	0.5	0.5	-0.1	-0.4

Source QUEST model

Positive GDP effect
Negative employment effect
Negative real wage effect

Table 2: Reducing administrative Burden (0.9% of GDP)

Reduction of mark ups

	Y	C	I	K	WR	L
2006	0.2	0.1	0.5	0.0	0.1	0.1
2007	0.4	0.3	0.9	0.1	0.5	0.1
2010	1.3	0.7	2.1	0.3	1.2	0.1
2015	1.6	1.1	2.4	1.0	1.5	0.1
2025	1.8	1.2	2.5	1.7	1.7	0.1
2055	2.0	1.4	2.7	2.5	1.9	0.1

Larger positive GDP effect
Positive employment effect
Positive real wage effect

More empirical evidence is needed on the competitiveness effect!

Some evidence:

OECD (1996):
Countries with lower administrative burdens seem to have lower mark ups.

Griffith et al. (2007):
Government bureaucracy has negative effect on mark ups (only weakly significant)

Cincera et al. (2005):
Administrative burden has no significant effect on firm entry.

Ciccone et al. (2006)
Cutting government procedures to business start ups increases entry in industries which experience increasing (global) demand and technology.

Conclusions

Reducing AB increases GDP and productivity.

Employment effects are less certain.

The effects of increasing R & D expenditure

QUEST III
(endogenous growth version)

QUEST III (endogenous growth version)

Three Modifications:

(1)   Three regions: EU country(i) – RoEU – RoW

(2)   Three skill groups: Low, medium and high
         (only high skilled can work in either production or R&D sector)

(3)   Three production sectors:

         - Final goods

         - Intermediate producer durables

         - Patents

Final-goods sector

Market: monopolistically competitive.

Technology: produces final goods using labour, and *A* varieties of intermediate goods:

$$Y_t = L_{Y,t}^{\ \alpha} \left(\sum_{i=1}^{A_t} x_{it}^{\theta} \right)^{\frac{1-\alpha}{\theta}} = L_{Y,t}^{\ \alpha} A^{(1-\alpha)\left(\frac{1}{\theta}-1\right)} K_t^{\ 1-\alpha},$$

$$\text{where } \sum_{i=1}^{A_t} x_{it} = K_t$$

Intermediate goods sector

Market: monopolistically competitive, buys designs from R&D sector for price P_A (cost of entry). Rents capital at rate r.

Technology: transform each unit of capital into a single unit of intermediate output.

$$\max_{x} \; p(x)x - (r+\delta)k \; (-P_{A,t})$$

$$Free \; entry \; condition:$$

$$P_{A,t} = \int_{t}^{\infty} e^{-\rho(\tau-t)} \pi(x) d\tau$$

R&D sector

Market: Fully competitive, Sells designs to the intermediate sector at price P_A.

Technology: high skilled labour, plus domestic and foreign knowledge capital

$$\Delta A_{D,t} = \delta A_{F,t-1}^{\xi} A_{D,t-1}^{\phi} L_{A,t}^{\lambda}$$

R&D sector

$$\Delta A_{D,t} = \delta A_{F,t-1}^{\xi} A_{D,t-1}^{\phi} L_{R\&D,t}^{\lambda} \qquad -1 < \phi, \xi < 1, \quad 0 < \lambda$$

ϕ Strength of research spillovers
    < 0 "fishing out effect"
    > 0 "standing on shoulders effect"
    = 1 scale effect

ξ International Spillovers

λ Elasticity of R&D production with respect to the number of researchers

Calibration

$$\Delta A_{D,t} = \delta A_{F,t-1}^{\xi} A_{D,t-1}^{\phi} L_{R\&D,t}^{\lambda} \qquad -1 < \phi, \xi < 1, \quad 0 < \lambda$$

Calibration of the R&D block: EU25 vs. US

Parameter/Variable	EU25	US	Source
$L_{R\&D}$/L	0.010	0.015	OECD(2006) EU25/US data for 2004 Total R&D personnel/total employment.
λ	0.602	0.701	Using information on Y, P_Y, W and $L_{R\&D}$.
ξ	0.549	0.363	Botazzi and Peri (2007) for EU25 Eaton and Kortum (1999) for US
ϕ	0.370	0.544	Botazzi and Peri (2007) for EU25 Eaton and Kortum (1999) for US
δ	0.074	0.085	obtained from knowledge production function.

The model

Final-goods sector

Market: monopolistically competitive, hires labour for wage *w*, buys intermediate goods for *p*.

Technology: produces final goods using labour, and *A* variety of intermediate goods:

$$Y_t = (L_{Y,t} - FC_L)^\alpha \left(\sum_{i=1}^{A_t} x_{it}^\theta \right)^{\frac{1-\alpha}{\theta}} - FC_Y$$

p – price of intermediate good

$\sum_{i=1}^{A_t} x_i$ - intermediate inputs

Intermediate goods sector

Market: monopolistically competitive, buys designs from R&D sector for price P_A. Rents capital at rate *r*.

Technology: transform each unit of capital into a single unit of intermediate output.

P_A – price of design

ΔA – new designs

R&D sector

Market: Research Institute hires researchers from the labour market paying wage *w*. Sells designs for the intermediate sector for price P_A.

Technology: produces new designs according to
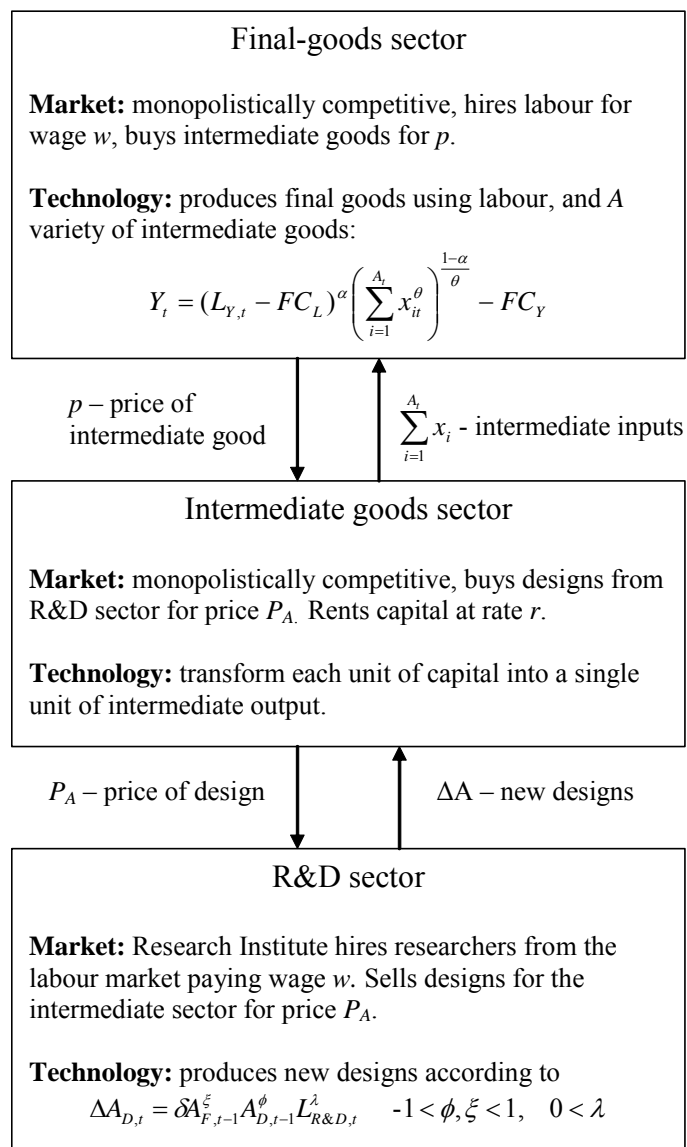$$\Delta A_{D,t} = \delta A_{F,t-1}^\xi A_{D,t-1}^\phi L_{R\&D,t}^\lambda \qquad -1 < \phi, \xi < 1, \quad 0 < \lambda$$

R&D subsidies and the cost of R&D

The QUEST III model provides a rich environment to model the R&D promoting fiscal policy measures.

Subsidies can be financed by taxes on consumption, on capital and labour income or by lump-sum taxes.

Four ways to introduce R&D promoting subsidies:

- subsidy on wages paid by the R&D sector;
- price subsidy on the R&D sector products;
- reduction of taxes paid by the R&D sector;
- reduction of taxes paid the intermediate sector

Simulation:
Reaching the R&D target of NRP

- Target:

  Increase R&D intensity from the current level of 1.9% to 2.7% (of GDP).

- Policy:

  Subsidizing the intermediate sector (R&D using sector).

- Financing:

  Consumption tax

Simulation results: Consumption tax financed subsidy for R&D using sector

<table>
<tr><td colspan="8" align="center">APR 2006</td></tr>
<tr><td colspan="8">EU:</td></tr>
<tr><td>Year</td><td>GDP</td><td>Cons.</td><td>Emp.</td><td>Emp.(low)</td><td>Emp.(high)</td><td>Capital</td><td>TFP</td></tr>
<tr><td>2025</td><td>4.4</td><td>4.8</td><td>-.9</td><td>-</td><td>-</td><td>-2.2</td><td>7.5</td></tr>
<tr><td colspan="8" align="center">New Results</td></tr>
<tr><td colspan="8" align="center">Increase of R&D in NL only</td></tr>
<tr><td>NL:</td><td colspan="7">Welfare: = 2.1% of perm. consumption</td></tr>
<tr><td>Year</td><td>GDP</td><td>Cons.</td><td>Emp.</td><td>Emp.(low)</td><td>Emp.(high)</td><td>Capital</td><td>TFP</td></tr>
<tr><td>2025</td><td>4.1</td><td>2.4</td><td>-.2</td><td>-.2</td><td>0.04</td><td>0.4</td><td>5.5</td></tr>
<tr><td>EU:</td><td colspan="7">Welfare: = 0.09% of perm. consumption</td></tr>
<tr><td>Year</td><td>GDP</td><td>Cons.</td><td>Emp.</td><td>Emp.(low)</td><td>Emp.(high)</td><td>Capital</td><td>TFP</td></tr>
<tr><td>2025</td><td>-.02</td><td>0.2</td><td>-.01</td><td>-.02</td><td>-.00</td><td>-.08</td><td>-.02</td></tr>
<tr><td colspan="8" align="center">Joint increase of R&D in EU and NL</td></tr>
<tr><td>NL:</td><td colspan="7">Welfare: = 4.1% of perm. consumption</td></tr>
<tr><td>Year</td><td>GDP</td><td>Cons.</td><td>Emp.</td><td>Emp.(low)</td><td>Emp.(high)</td><td>Capital</td><td>TFP</td></tr>
<tr><td>2025</td><td>3.5</td><td>3.8</td><td>-.3</td><td>-.4</td><td>-.07</td><td>-.6</td><td>5.0</td></tr>
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</table>

Where do welfare gains from subsidising R&D come from?

Market solution is too low relative to efficient solution because….

1) R&D firms do not take into account the benefits of higher knowledge capital for productivity of future research.

2) Mark ups in the intermediate goods production sector.

GDP in % of baseline
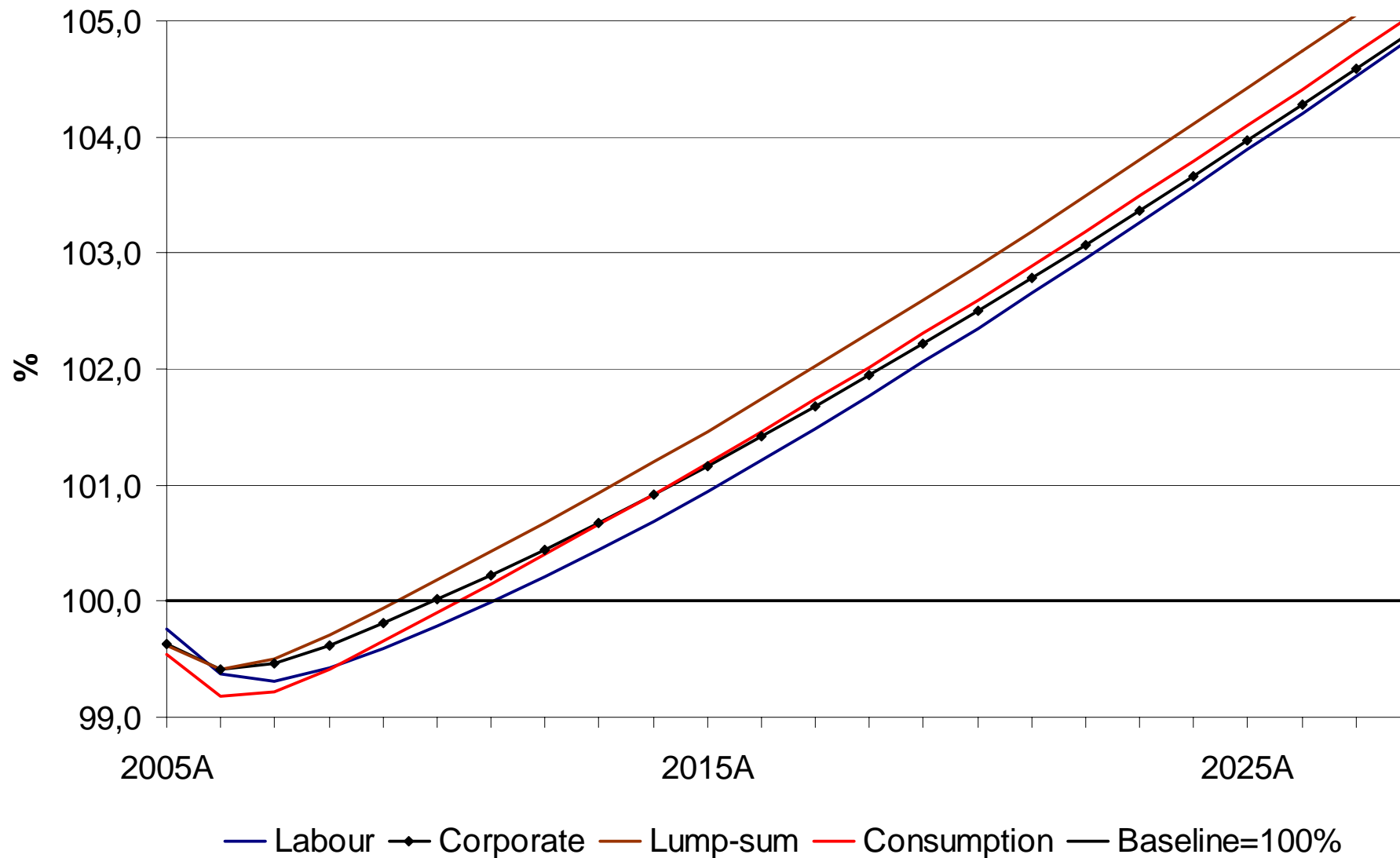
Future extensions

- More work on R&D spillovers.

- R&D and international market share.

- Goods and financial market reforms and R&D.

- Policies to increase the employment rate of low skilled workers.

- Policies to change the skill distribution of the labour force (Education)