



The QUEST Model

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Overview of QUEST 3 model variants

Model	Country disaggregation	Sector disaggregation	Note
QUEST3	EA; EA-US-RoW	Core model	Estimated
QUEST3H	Euro area,US,ES,DE	Adds housing	Estimated
QUEST3TNT(H) (G)	Flexible	Tradable-nontrad. Housing Property tax Government empl.	Fiscal policy, Credit constraints, Financial crisis
QUEST3B	Euro area	Adds banking sector	Estimated/Calib. Bubbles Financial crisis
QUEST3(RD)	All E28	Final/interm./R&D	Structural reforms Cohesion Policy
QUEST3sec (CLIM/SEC)	E27 RoW	IO-structure,energy	Carbon tax/oil Services Dir.

QUEST models in use to support policy making

Fiscal policy:

- Fiscal stimulus measures in response to crisis
- Effects of fiscal consolidations
- Sovereign risk channel

Finance/Banking reforms:

- Financial crisis, boom&bust, house prices,
- Financial transaction taxes
- Banking reform, capital requirements
- Insolvency procedures
- EBU

MIP and Forecasting:

- Determinants of CA movements
- Assessing the forecast

Structural reforms:

- Labour market reform,
- Product market reform,
- Promoting R&D
- Structural and Cohesion Funds
- Benchmarking exercise

Links to publications: see webpage:

[European Commission](#) > [Economic and Financial Affairs](#) > [Economic research](#) > [Macroeconomic_models_en.htm](#)

General modeling principles

Stick closely to the macro literature. Don't re-invent the wheel.

Make the model adaptable to new policy issues.

QUEST model went through various adaptation phases.

Originally, only calibrated versions have been used (also difficult to estimate models for all MS).

Now we have estimated models for the EA and for DE, ES, FR, IT

We also have baseline projections (up to T+50) for all MS from our potential growth analysis, using a Production Function methodology. Projections are essentially based on a Solow Growth Model.

Projections are made/used for POPW, PART, UR, AHW, TFP, IY-ratio

1) Initially mostly used for fiscal policy:

1. Ric. vs. liquidity constrained consumption
2. Ric: infinitely lived vs. OLG (differences not so large MPC(W))
3. Price and wage rigidities: Nominal and real wage rigidities.
4. Detailed break down of revenues (TL, TC, TVAT, SSC) and expenditures (G, IG, TR, BEN, (Public Employment))

Government investment

Public capital accumulation K^G

- Demand effect: : GDP expenditure
- Productivity effect:

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

Government consumption:

. Purchases goods and services:
. Government wages

- Demand effect: GDP expenditure
- Disposable income

$$Y_t^{disp} = (1 - t_t^w)(W_t^P L_t^P + W_t^G L_t^G) + \dots$$

Investment subsidies

- Budget constraint investors

$$\dots + \sum_j p_t^{K,j} (1 - itc_t) I_t^j + \dots$$

2) After 2009: Financial Markets/Banks, Housing:

- Add housing investment and credit constrained households.
- Add banking sector with a capital and liquidity constraint. (regulatory constraint, no moral hazard consideration).
- Analysis of cost and benefits of bank regulation.
- Empirical assessment of booms and busts (respective role of bubbles and LTVs).
- Interaction between banks and sovereigns: fiscal multiplier of bank rescue measures.
- Risk sharing mechanisms within EMU: deposit insurance, bail in, ESM backstop.

Features:

Multi country dimension (e. g. core vs. periphery)

Within country financial market segmentation (large share of bank deposits)

Fragmentation across EU countries: low cross ownership of financial assets

3) Structural reforms:

Make the model useful for European semester.

Provide a tool for benchmarking analysis within the EU (explain income differentials)

Allow for wide array of structural measures:

Labour market: benefits, taxation, market power

Calibrate parameters such that model can replicate results from panel regressions on structural unemployment rates.

Goods market: market power, entry

Estimate elasticities between OECD PMR indicators and mark ups in service sectors.

Link policy measures to PMR indicators.

Technology (semi-endogenous growth (Jones (1996))):

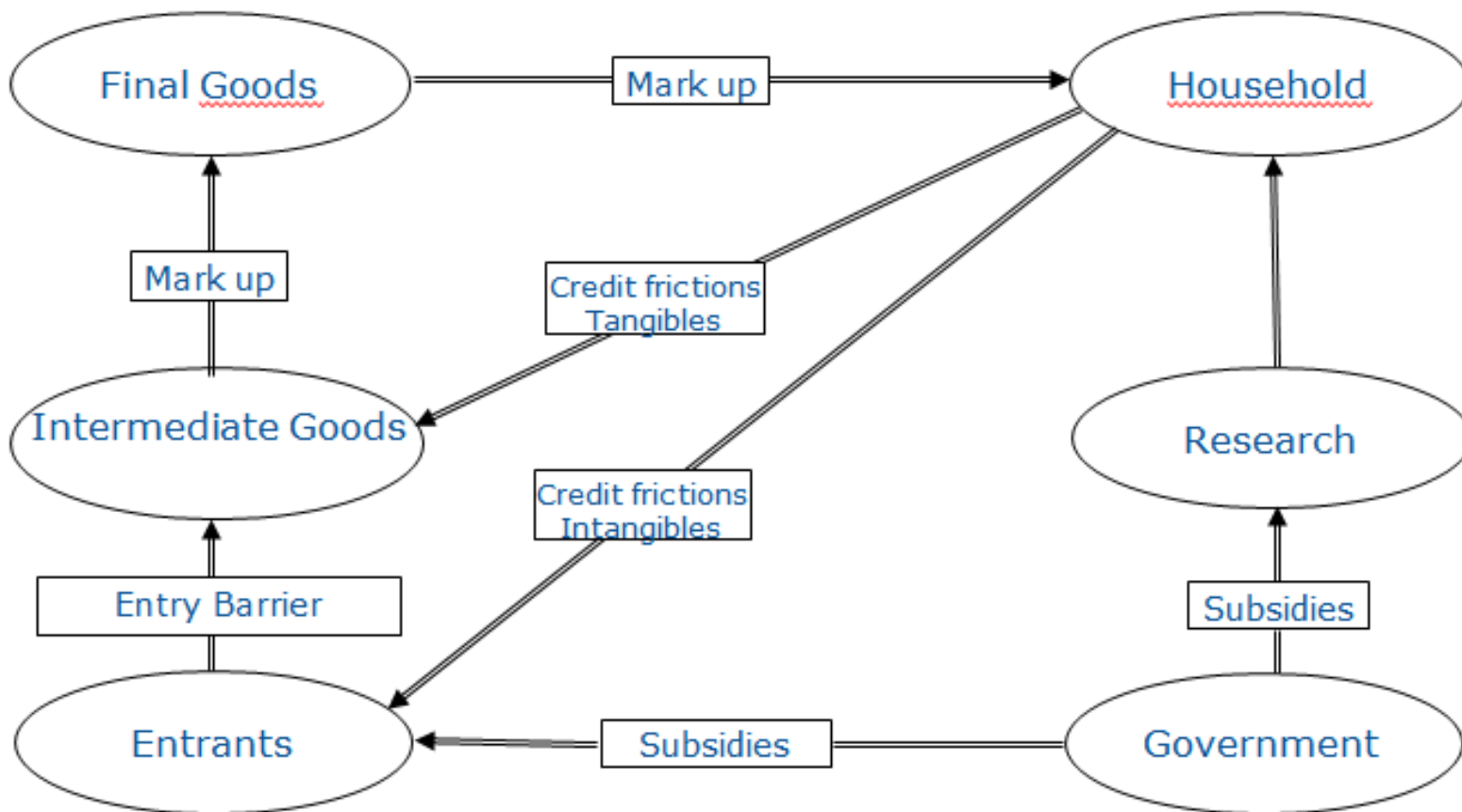
Physical and intangible capital (R&D)

Skill differentiation, R&D investment is related to high skilled intangible investment.

Model can also be used for some fiscal issues:

Public R&D support (crowding out effects, tax progressivity (across skill groups))

The QUEST III R&D model



References: Roeger et al. 2008, [Varga et al. 2014](#)

Multi country: All EU member states and RoW

Structural indicators

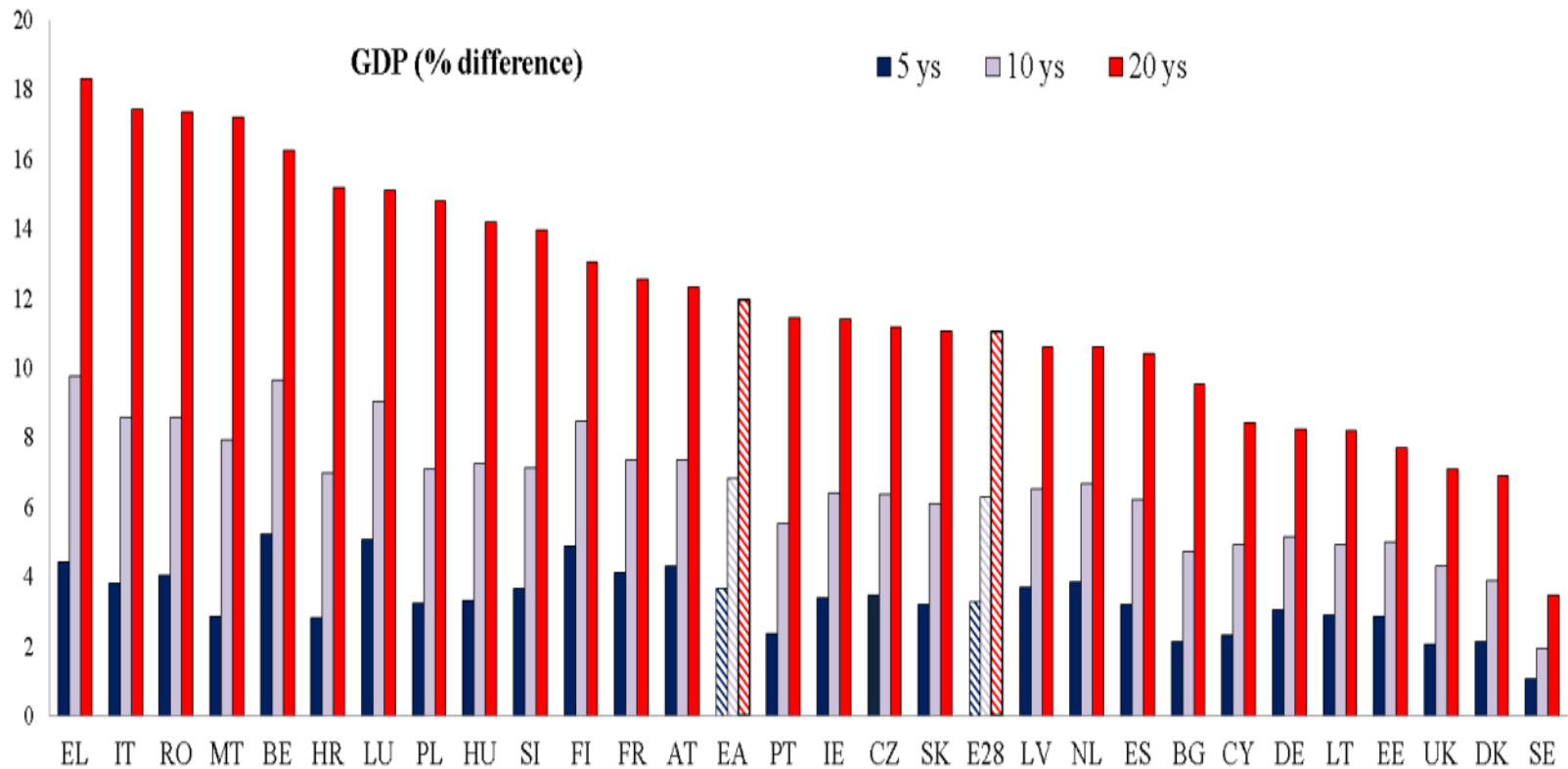
		AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK	Average 3 best EU performers		
Market competition	Services sector markups (%)	15.3	15.9	11.9	13.4	17.0	15.0	12.7	16.4	19.7	14.9	17.3	15.7	n.a.	15.2	13.8	14.1	17.6	18.2	19.1	10.6	13.9	15.4	15.1	20.8	13.3	15.2	17.2	12.2	11.6		
Market regulation	Entry costs (%)	11.7	6.3	5.9	14.3	12.6	9.1	1.8	3.3	23.8	12.3	4.9	2.7	9.2	9.5	2.6	18.0	6.2	4.8	6.5	20.3	6.4	22.1	3.2	5.3	5.0	1.6	5.4	3.9	2.0		
Tax reform	Labour to consumption tax revenue ratio	2.4	3.0	0.7	1.1	1.7	2.5	1.9	1.3	1.7	2.6	2.0	2.8	1.0	1.4	1.6	3.0	1.4	1.9	1.4	1.2	2.6	1.5	1.3	1.0	1.9	1.7	1.7	1.5	0.9		
Skill enhancing reforms	Share of high-skilled (%)	6.4	7.9	6.4	9.1	6.0	9.2	7.5	11.4	7.3	9.8	12.2	8.5	4.5	4.9	9.3	4.2	9.9	8.2	7.2	3.5	6.3	6.0	4.1	4.9	9.0	6.7	5.2	9.4	11.2		
	Expenditure on high-skilled education (% GDP)	0.4	0.2	0.2	0.4	0.3	0.4	0.5	0.3	0.4	0.3	0.7	0.3	0.2	0.2	0.4	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.5	0.4	0.2	0.3	0.5		
	Share of low-skilled (%)	16.9	27.2	18.2	21.5	7.2	13.7	21.7	9.4	32.8	44.5	14.1	24.9	18.7	17.5	23.3	41.8	6.6	19.5	10.6	59.4	24.2	9.9	60.2	23.7	16.8	14.6	8.1	21.6	7.3		
	Expenditure on medium-skilled education (% GDP)	3.8	4.0	2.1	4.8	2.8	3.3	4.8	3.1	3.2	2.6	4.3	3.5	1.6	2.8	3.5	2.6	3.4	2.6	2.5	6.2	3.9	2.6	3.0	1.7	3.9	3.1	2.5	3.4	2.9		
Labour market reforms	Female non-participation (% 25-55ys):																															
	- low-skilled	30.1	44.4	47.1	28.8	34.1	38.2	32.0	34.3	39.9	27.8	38.4	33.2	47.3	43.6	54.4	50.2	36.5	27.1	36.3	59.1	34.7	46.9	22.4	46.5	31.8	29.2	39.8	40.5	25.8		
	- medium-skilled	12.9	19.6	18.1	20.4	17.2	16.2	13.9	17.4	27.8	17.8	17.6	15.3	22.9	20.6	31.2	27.7	14.9	22.5	17.3	21.7	15.4	24.8	8.7	27.6	11.6	11.4	18.9	19.8	10.8		
	- high-skilled	8.8	9.0	10.0	11.2	19.1	11.1	7.3	13.6	10.9	10.3	11.7	8.7	8.0	17.2	15.8	17.3	4.5	13.3	9.1	10.8	7.3	9.3	4.8	8.5	6.6	4.9	17.1	11.8	4.8		
	Low-skilled male non-participation (% 25-55ys)	17.1	19.6	33.2	12.3	20.2	16.5	20.2	19.2	7.9	10.4	21.1	13.6	25.4	27.8	20.6	15.0	28.4	8.0	17.6	7.7	14.9	28.0	10.6	22.1	13.9	18.7	24.7	18.0	7.9		
	Elderly non-participation (% 55-64ys):																															
	- low-skilled	22.9	25.0	19.9	19.5	29.5	13.2	16.0	14.4	20.5	15.0	23.6	22.4	28.7	25.6	17.9	20.0	18.3	19.5	16.4	22.6	17.6	32.1	14.5	19.6	12.6	31.4	28.2	14.5	13.4		
	- medium-skilled	10.5	10.6	11.2	7.0	11.2	8.3	8.1	9.3	9.9	6.1	9.7	11.9	12.9	14.0	6.7	7.6	11.4	13.9	10.3	6.8	6.9	15.6	4.2	12.3	4.8	15.9	11.4	7.1	5.0		
	- high-skilled	5.5	6.5	6.7	4.6	3.5	4.6	4.4	4.5	7.5	3.5	5.4	5.6	8.0	7.0	4.1	4.4	4.0	4.6	4.3	4.4	4.2	4.6	5.0	5.0	2.6	7.3	5.2	5.5	3.2		
	ALMP (% of GDP over unemployment share)	25.2	18.9	3.8	7.5	4.4	12.3	36.7	3.9	3.9	6.5	22.7	15.2	2.4	12.7	10.3	7.7	2.3	19.8	2.4	1.8	22.9	7.3	5.7	1.0	24.0	4.3	2.8	2.0	28.6		
Benefit replacement rate* (%)	68.8	65.1	38.5	n.a.	57.4	60.9	73.1	42.8	10.8	46.9	71.7	57.8	n.a.	30.1	74.1	9.2	52.5	72.5	56.6	52.8	71.7	45.6	48.8	25.6	64.3	61.0	39.0	62.2	52.3			
R&D measure	R&D tax-credit rates	0.12	0.15	n.a.	n.a.	0.18	-0.02	-0.01	n.a.	0.01	0.34	0.25	0.38	n.a.	0.25	0.26	0.12	n.a.	-0.01	n.a.	n.a.	0.23	0.00	0.49	n.a.	-0.01	0.16	-0.01	0.17	0.41		

Note: Darker shades correspond to larger gap vis-à-vis the benchmark.

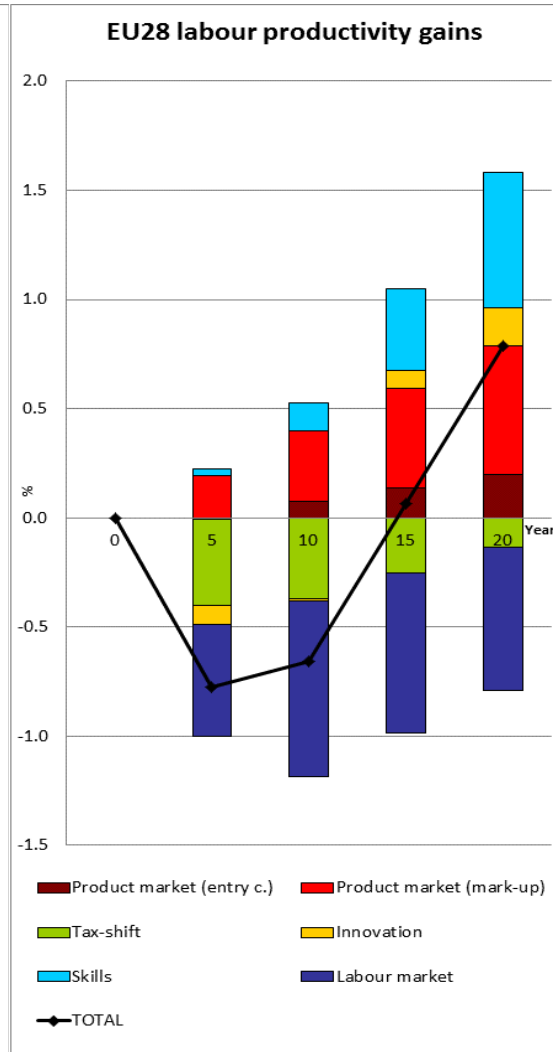
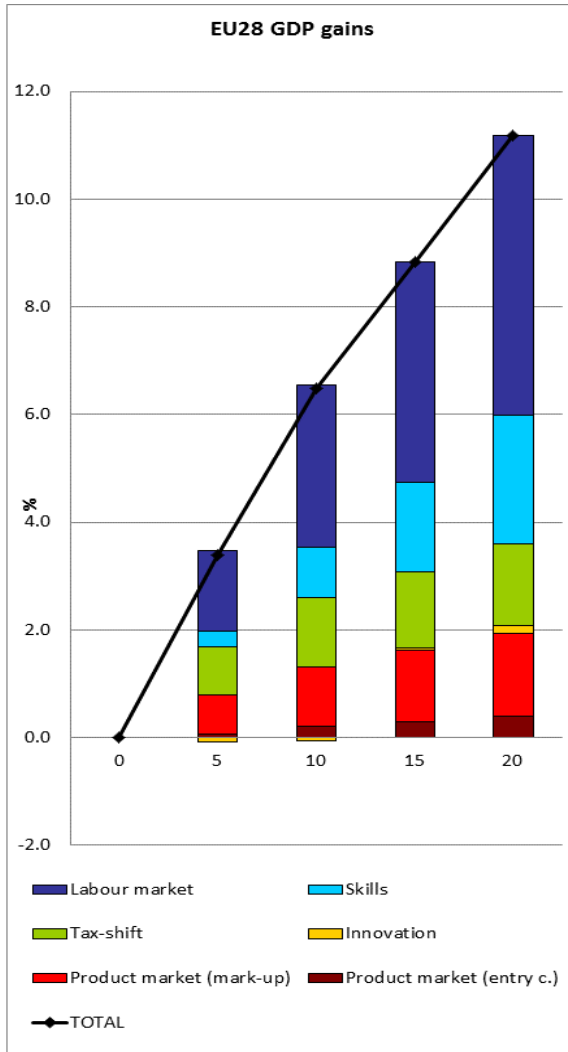
* For benefit replacement rate: EU average

Sources: 2013 or latest available data

GDP effects closing half the gap with best practice



Example: Closing half the gap with best performers



➤ Potentially large GDP effects if each MS closes half the gap vis-à-vis best performers:

- GDP after 5 years: EU +3½%

< SE +1% ; EL +5% >

- GDP after 10 years: EU +6½%

< SE +2% ; EL +10% >

➤ Effects take time to materialise

- Effects of tax shift relatively fast

- Labour market reforms (participation↑) slower

- Innovation and education slowest

➤ Productivity effects of labour market reforms can be negative in short run (but large employment effects).

3) Structural reforms New Dimension:

Distributional impact of structural reforms

Structural reforms 1.0 (reducing the reservation wage) vs. 2.0 (skill upgrading)

Labour income distribution: skill distribution of the labour force.

Two types of capital income

Returns to tangible capital (capital cost, monopoly rents vs. fixed costs)

Returns to intangible capital (capital cost, monopoly rents vs. price of patents)

4) Use of estimated models in the forecast + empirical analysis

Estimated models exist for the EA (US+RoW) and DE, FR, IT, ES, RoEA+RoW.

Some applications:

- German CA surplus.
- Boom-bust cycle in Spain
- Long slump in the EA.

Models are also used in the forecast, mostly for interpreting the forecast.

E. g. how to interpret the current upswing in terms of demand, supply and policy shocks.

Procedure: estimated model identifies exogenous shocks within sample, plus the impact of projected shocks over the forecast horizon.

ECFIN forecast provides additional innovations over the forecast horizon

Household sector:

We now distinguish between up to 4 types of households:

Financially constrained households:

- Liquidity constrained households: significant fraction of the population does not own any wealth.
- (Mortgage) credit constrained households (Iachoviello): mortgage loans are a source of financial instability.

Financially unconstrained households:

- Risk averse unconstrained households: invest in deposits and government bonds (Households in the EU hold a high share of deposits)
- Risk taking unconstrained households : Hold equity of banks and non financial corporations.

Saver segmentation allows for amplification of mortgage losses.

General features of households

Habit persistence

Infinitely lived

Population break down: $POP = NON-PART + EMPL + UNEMPL$

NON-PART: population older than 74 and younger than 14

Housing: relevant for analysis of financial crises.

1. OLG vs. Infinite Horizon Models

For a macroeconomist the OLG specification proposed by Blanchard is a clever way of introducing an OLG setting into macro models.

Especially attractive for small open economy models, since the NFA position becomes determinate

However also a few drawbacks:

No bequests

For realistic life expectancies, the results do not differ that much from the infinite horizon model (only small differences in the marginal propensity to consume out of wealth).

Attempts have been made (e. g. by the IMF modelling department to use this framework but allow for a very short planning horizon (ca. 10 years))

$MPC(Wealth) = \text{rate of time preference} + 1/\text{planning horizon}$

Corporate sector

Non financial firms:

Tradable vs. non tradables: intra industry trade

Physical capital/intangible capital

Bank financing/ financial accelerator

Labour demand (differentiated by skill group)

Monopolistic competition: Mark up pricing, partly pure rents and partly covering fixed costs and price of patents.

Recently: adding monopsony power in low skilled segment of the labour market

Rents in non tradable sector are larger than in tradable sector

In (semi)-endogenous growth version of the model:

$PDV(\text{rents}) = \text{price of patent}$

Labour Market

Standard New Keynesian:

Monopolistically competitive firms demand labour, s. t. quadratic adjustment costs, hybrid Phillips curve

Monopolistically competitive unions supply variants of labour.

Quadratic wage adjustment costs, hybrid Phillips curve, real wage rigidity.

NAWRU models are estimated for all MS: significant variation of NAWRU over time in EU.

Disaggregation by skill and sector (no sectoral adjustment frictions).

Experiments with monopsonistic labour demand (low skilled).

Experiments with DNWR.

International trade

Goods produced in one country are imperfect substitutes for goods produced abroad.

Consumption, Investment, government purchases are traded as well as intermediate inputs in tradeable and non tradeable sector.

Long run: domestic cost pricing

Short run: pricing to market:

Avoid long run real exchange rate adjustments due to growth differentials via adjustments to import shares.

Thank You