Structural Reforms in Education and Justice: A Model-Based Assessment of Macroeconomic Impacts for Portugal

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Overview

1. Introduction
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3. Areas of Intervention & Results
   - Justice
   - Education
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1. Introduction

- This presentation is work-in-progress, as part of an exercise that considers **structural reforms put forward by Portugal in the period 2010-2014** and covers the areas of **Justice and Education**.
- The purpose is to describe the **methodological approach** underlying the exercise and to present a **summary of the results**, which appeared in an intermediate draft report prepared for GPEARI, Ministry of Finance of Portugal.

1. Introduction

- The **macroeconomic effects** of the measures of structural reforms are **usually indirect and essentially non-observable**, since the transmission mechanisms linking those measures to the economic variables (micro and macro level) tend to be complex and diffuse.

  Moreover, their impacts usually **take long to emerge**, making their direct quantitative assessment impossible after only a few years from implementation.

- With a view to identifying and quantifying the chain of effects in place, and thereby **assessing the intertemporal (potential) macro-economic impact** of the structural reforms, we **simulate an analytical macroeconomic model calibrated for the Portuguese economy**.

1. Introduction

- The macro model we use belongs to the class of **micro-founded New-Keynesian Dynamic Stochastic General Equilibrium** (DSGE) models now widely used for quantitative policy analysis.
- The model is an extension of the **European Commission's QUEST III model with endogenous growth** (e.g., Roeger et al., 2008, Varga et al., 2014):
  - The model's solutions are explicitly derived from intertemporal optimisation under technological, institutional and budgetary constraints and the model incorporates nominal, real and financial frictions.
  - The model considers the product variety framework in line with Dixit and Stiglitz (1977) and applies the Jones' (1995) endogenous growth framework to explicitly model R&D as the engine of long-run growth.
  - Reform measures are translated into quantitative shocks that can be simulated with the QUEST model.

2. Methodology

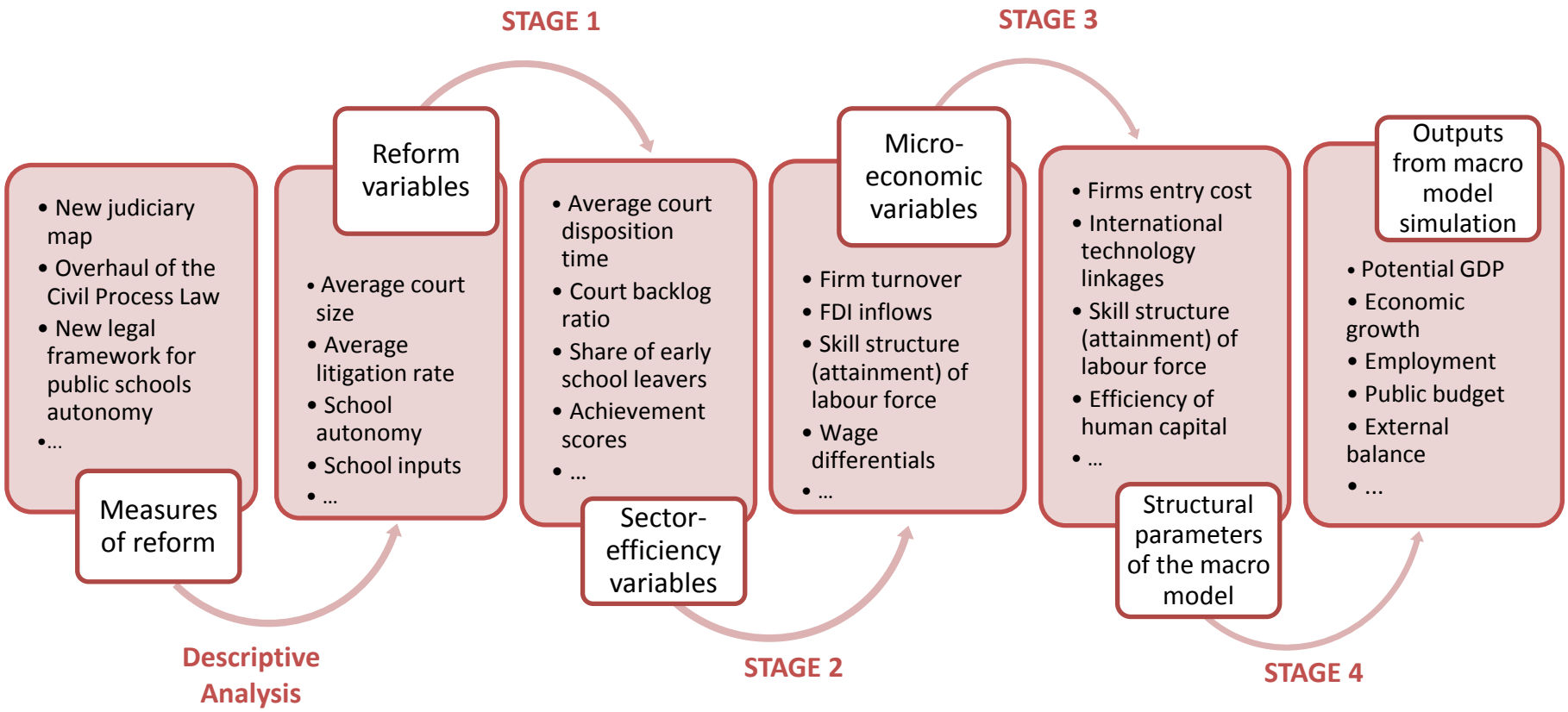
We assume that **the transmission mechanisms of the structural reforms unfold** in the following way:

- **(STAGE 1)** The measures of reform and the respective reform variables (assessed by implementation/output indicators) have a direct downstream effect on sector-efficiency variables (assessed by result/outcome indicators);

- **(STAGE 2)** The sector-efficiency variables have a downstream effect on several microeconomic variables (microeconomic impact);

- **(STAGES 3 and 4)** Finally, the microeconomic variables have an effect on a number of macroeconomic variables (macroeconomic impact).

Methodological stages



Methodological stages

- In the Descriptive Analysis, we **quantify the change in the reform variables** based on data from official sources.
- In STAGES 1 and 2, we **collect from the existing literature the empirical estimates of the relationship** between (i) reform variables and sector-efficiency variables and between (ii) sector-efficiency variables and microeconomic variables.
- In STAGE 3, we use the **empirically estimated** effects of STAGES 1 and 2 **to quantify the exogenous shocks** that will apply to the key structural parameters of the macro model.
- In STAGE 4, we apply the shocks and **simulate the macro model to produce impacts on final macroeconomic variables**.

Overview of the model

This is a macroeconomic model from the class of **New-Keynesian DSGE** models, built for a **small open economy belonging to a monetary union**.

The model has the following analytical blocks and features:

- **Households** (workers/consumers)
  - Two types of agents – agents without liquidity constraints, who maximise intertemporal utility by choice of consumption and leisure; liquidity constrained agents, characterised by a Keynesian behaviour;
  - Three types of labour/human capital, measured by the level of educational attainment (high-skilled, medium-skilled, and low-skilled) and weighed by quality factors;
  - Imperfect competition in the labour market, with the presence of labour unions (collective wage setting) and nominal indexation of wages.

Overview of the model

- **Firms** (producers/investors)
  - Three sectors of activity: final-good sector, intermediate-good sector and R&D sector, with imperfect competition in the former two (thus implying the existence of a profit-maximising mark-up over marginal cost).
  - Fixed entry costs into the final-good and the intermediate-good sectors.
  - R&D activities featuring intertemporal externalities and international technology linkages.
- Fiscal policy authority (government) that follows feedback budget rules, linking the dynamics of the public budget and the ratio of public debt to GDP.
- Open economy (international trade flows and technological spillovers via FDI inflows).

3. Areas of Intervention & Results

Selected policy areas:

Justice
Overall system efficiency
Insolvency regime
Corruption
Intellectual property rights
Bureaucracy and court management

Education
Development of early intervention strategies
Promotion of school autonomy
Introduction of vocational tracks with strengthening of vocational training
Consolidation of the implementation of curricula goals
Improvement of lifelong learning
Management / Infrastructures

3. Areas of Intervention & Results

- Only a **selection of the identified reforms can be translated and assessed quantitatively**, namely because:
  - Suitable quantifiable reform indicators are lacking for several reform measures given their qualitative nature **(STAGE 1)**;
  - Empirical (microeconometric) estimates on which the assessment has to rely are not available **(STAGE 1 and 2)**;
  - Appropriate analytical mechanisms to translate reforms into macro model shocks are lacking given the features of the macro models **(STAGE 3)**.

Reform variables that we use:

Justice	Education
Courts-to-population ratio	Share of early school leavers
Courts size	School autonomy
Litigation rate	Instruction time
Judges-to-population ratio	Grade retention
Share of public budget for courts ICT	
Overall index of pre-insolvency framework	

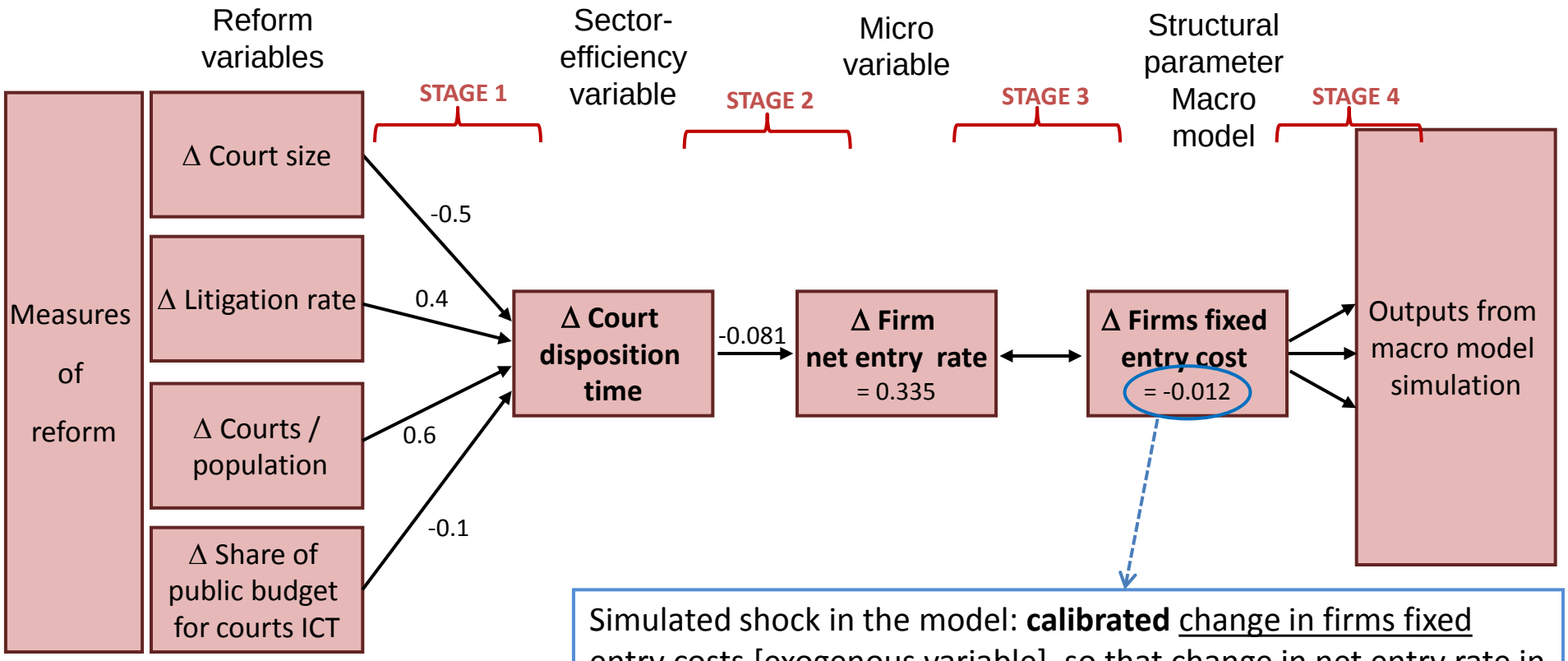
Transmission mechanisms from (groups of) reforms to the macroeconomy:

Justice	Education
Firms' entry cost	School attainment
Allocative efficiency	School achievement
Financing cost – interest rate spreads	
International technology linkages - FDI inflows	
Entrepreneurship/self-employment	
Liquidity constraint	

		Transmission mechanism	Reform variable	Efficiency variable / micro variable	Shock in the Macro Model
A - Reforms in Justice					
A1	System efficiency	Firms' entry cost	Court size, litigation rate, courts-to-population ratio, share of public budget for courts ICT	Disposition time / firms net entry	Firms' entry costs (calibrated)
		Allocative efficiency	Court size, litigation rate, courts-to-population ratio, share of public budget for courts ICT	Disposition time / allocative efficiency	Labour productivity (estimated)
		Financing cost – interest rate spreads	Courts-to-population ratio, judges-to-population ratio	- /Rule of law index	Interest rate risk premium on capital (estimated)
		International technology linkages - FDI inflows	Court size, litigation rate, courts-to-population ratio, share of public budget for courts ICT	Backlog ratio / FDI inflows	International technology linkages (calibrated)
A2	Insolvency regime	Entrepreneurship/self-employment	Overall index of pre-insolvency framework	- / Self-employment rate	Leisure preferences (calibrated)
		Liquidity constraint	Overall index of pre-insolvency framework	- / -	Share of liquidity constrained households (calibrated)
B - Reforms in Education					
B1	Schooling attractiveness	School attainment	Share of early school leavers	- / Skill shares	Skill shares (simulated stock-flow model)
B2	Schooling quality	School achievement	Grade retention, school autonomy, instruction time	Achievement scores / wage differentials	Human capital efficiency (calibrated)

Justice – an example

Firms' entry cost transmission mechanism (empirical estimates: *EC 2014*) and translation into shocks in the macro model



Justice – an example

STAGES 1 and 2: Changes in selected reform variables from 2010 to 2012/2014

Reform variables	Reform variable before reform	Reform variable after reform	% change	Disposition time elasticity	Estimated impact on disposition time	Net entry rate elasticity w.r.t. disposition time	Estimated impact on firm net entry rate (pp)
(1) Judges/Court *(Min Justice data, 2010-2013)*	4.140	4.217	1.848	-0.5	**-0.924**	-0.081	**0.075**
(2) Courts/population x 1000 *(CEPEJ data, 2010-2012)*	0.032	0.030	-4.006	0.6	**-2.404**	-0.081	**0.195**
(3) Litigation rate *(Min Justice data, 2010-2013)*	4548.996	4457.525	-2.011	0.4	**-0.804**	-0.081	**0.065**
(4) Share of courts ICT expenditure on Public Budget *(CEPEJ 2010, avg Min Justice 2012-14)*	0.120	0.120	0	-0.1	**-0.8925**	-0.081	**0**
Total							**0.335**

Justice – an example

STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a change in fixed entry costs (exogenous variable) = - 0.012(*)

	t+1	t+5	t+10	t+20	t+50
Public budget/GDP (p.p)	0.019	0.006	0.004	-0.002	0.002
Employment	0.028	0.013	0.017	0.017	0.010
Real wages	0.066	0.087	0.109	0.135	0.164
GDP	**-0.013**	**0.023**	**0.063**	**0.100**	**0.124**
External balance/GDP (p.p)	-0.003	0.016	0.024	0.035	0.049

Note: 500-period simulation for convergence.
(*) Calibrated change in firms fixed entry costs so that change in firm net entry rate in the model matches estimated change in firm net entry rate in the data (0.335).

Justice – summary of results

Overall system efficiency: impacts on selected macro variables (% change from initial steady state)

Transmission mechanism		t+1	t+2	t+3	t+4	t+5	t+10	t+20	t+50
Firms' entry cost	Employment	0,028	0,017	0,013	0,013	0,013	0,017	0,017	0,010
	GDP	-0,013	-0,011	0,000	0,012	0,023	0,063	0,100	0,124
Allocative efficiency	Employment	-0,032	-0,014	-0,005	-0,002	-0,001	0,001	0,001	-0,004
	GDP	0,068	0,093	0,103	0,108	0,111	0,122	0,137	0,151
Risk premium - intangibles	Employment	0,011	0,005	0,003	0,001	0,001	-0,001	-0,002	-0,001
	GDP	-0,005	-0,005	-0,002	0,002	0,006	0,018	0,030	0,041
Risk premium - tangibles	Employment	0,045	0,099	0,125	0,132	0,130	0,111	0,085	0,053
	GDP	0,051	0,150	0,231	0,299	0,361	0,634	1,026	1,527
International technology linkages - FDI inflows	Employment	0,014	0,003	0,000	-0,001	-0,001	0,000	-0,001	-0,009
	GDP	0,008	0,030	0,056	0,081	0,104	0,182	0,255	0,315

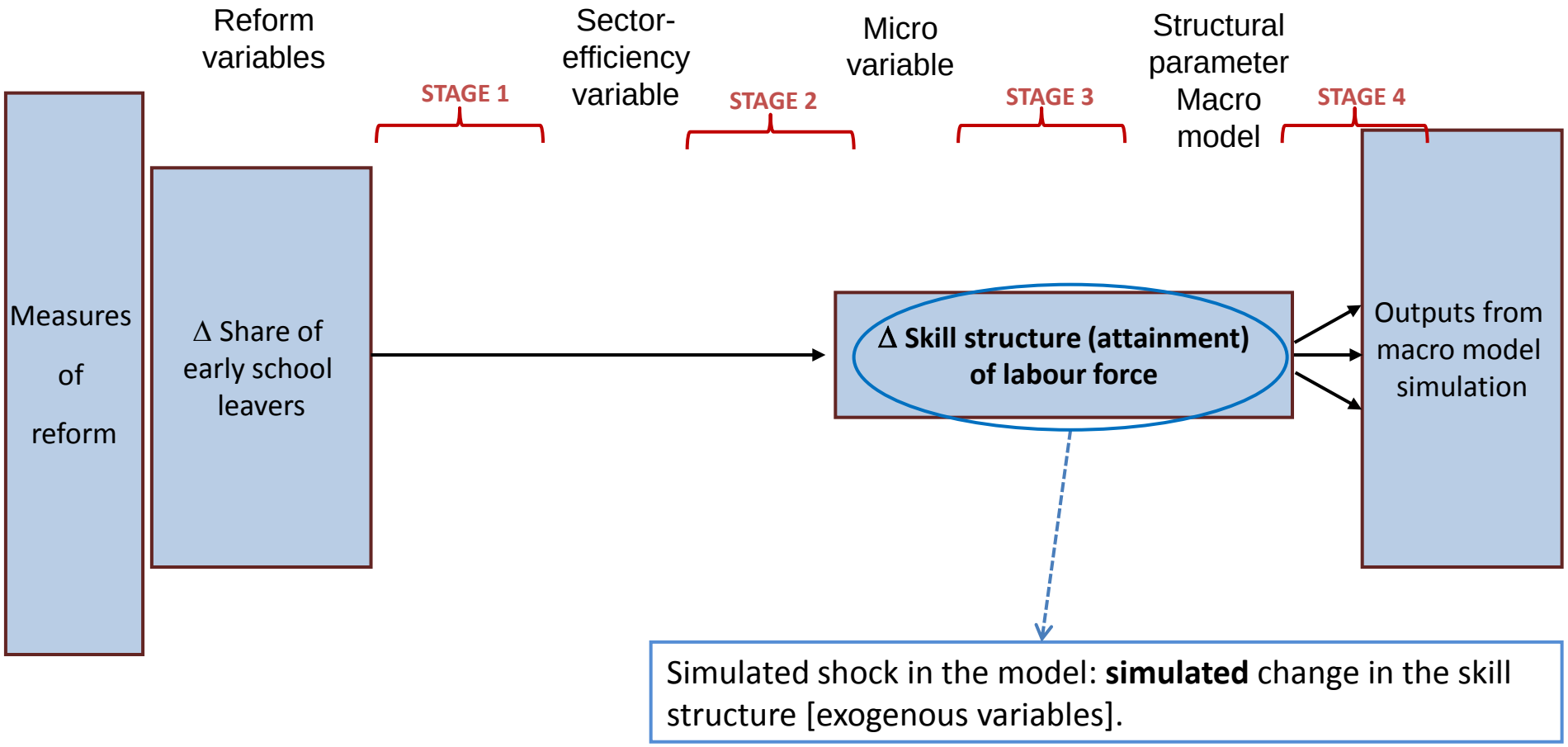
Insolvency regime: impacts on selected macro variables (% change from initial steady state)

Transmission mechanism		t+1	t+2	t+3	t+4	t+5	t+10	t+20	t+50
Entrepreneurship/self-employment	Employment	1,327	2,484	3,197	3,577	3,771	4,109	4,234	3,890
	GDP	0,797	1,685	2,254	2,586	2,795	3,418	4,057	4,346
Liquidity constraint	Employment	0,251	0,346	0,626	0,909	1,156	1,949	2,167	1,435
	GDP	0,150	0,204	0,456	0,698	0,912	1,703	2,254	1,874

Note: 500-period simulation for convergence.

Education

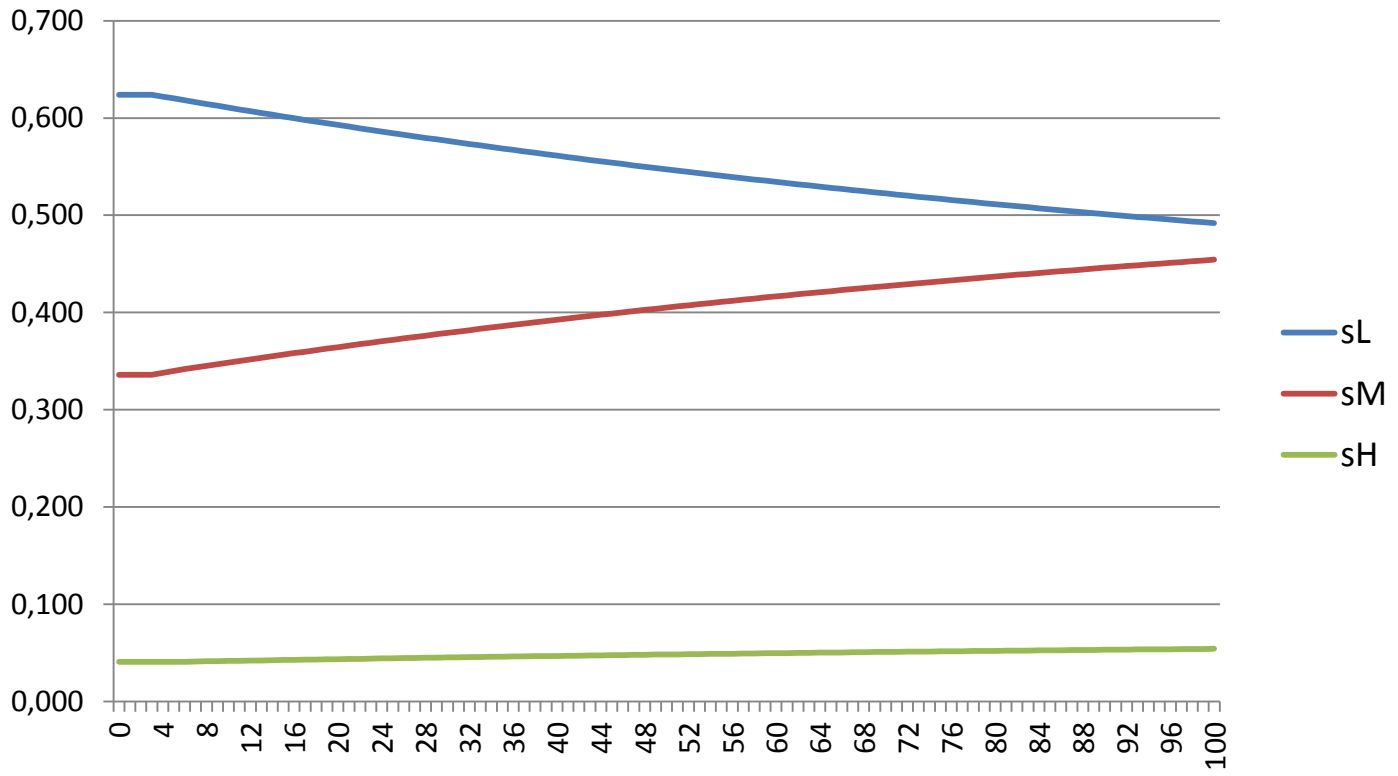
School attainment transmission mechanism and translation into shocks in the macro model



Education

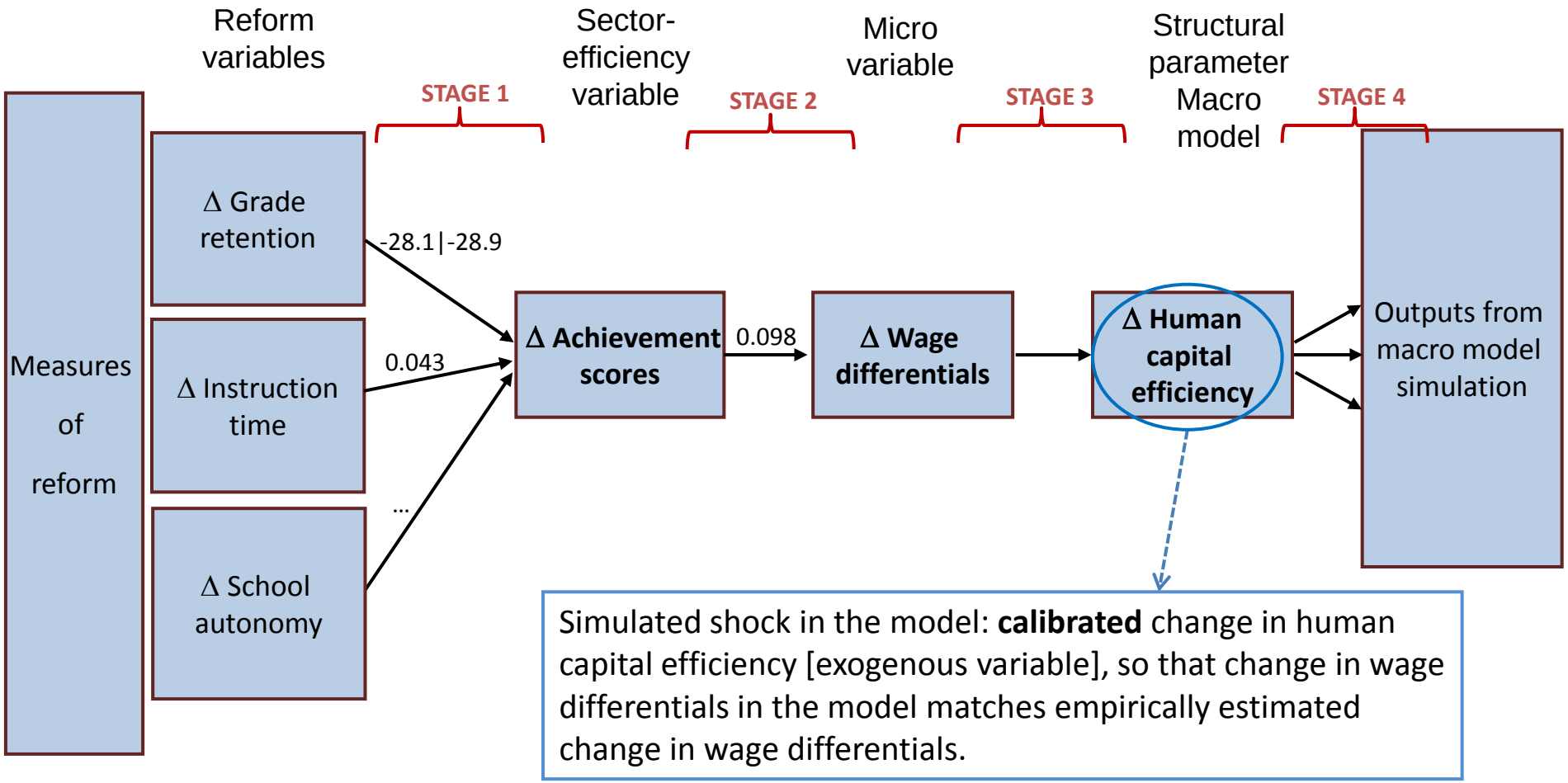
→ Lagged impact due to gradual transition between skill groups. Shock simulation on the skill structure based on a stock-flow model:

- Skill structure with low (L), medium (M) and high-skilled (H) workers.
- At t=1, one-off 40.4% reduction in the drop-out rate (INE, 2011-2015), with a 3-year lagged impact on transition into M and a 6-year lagged impact on transition into H.



Education

School achievement transmission mechanism (empirical estimates from the literature) and translation into shocks in the macro model



Education

STAGES 1 and 2: Changes in selected reform variables from 2009 to 2012/2015

Reform variables	Reform variable before reform	Reform variable after reform	Change	PISA Math score estimated coefficient	Estimated impact on PISA Math score	Annual earnings semi-elasticity relative to PISA Math score	Estimated impact on annual earnings (%)
(1) Instruction time (minutes per week) (OECD-PISA data, 2009-2012)	718.5	763.5	45.0	0.043	1.935		
(2) School autonomy (OECD-PISA data, 2009-2012)							
Determining course content	8	34	26	11.200	2.912		
Establishing teachers' salaries	5	9	4	6.420	0.257		
Choosing textbooks	100	100	0	57.898	0		
Deciding on budget allocations within school	92	97	5	8.513	0.412		
Formulating school budget	73	82	9	-5.734	-0.516		
Hiring teachers	72	76	4	6.483	0.274		
(3) Grade retention rate (Min. Education data, 2013-2015)							
in Primary	0.113	0.088	0.025	-28.102	0.703		
in Secondary	0.185	0.170	0.015	-20.900	0.314		
Total					5.929	0.084	0.496

Education

→ Lagged impact due to:

- Initial student cohort effect (3 to 6 years to be exposed to the reform measures);
- Gradual entry of student cohorts into the workforce: $\frac{1}{\text{working lifetime}} \cdot 100$ percent of workers are replaced per year;

Example, if working lifetime = 40 years:

$$\begin{cases} \Delta Wages_t = wage\ coefficient \cdot \Delta Achievment \cdot \frac{1}{40} + \Delta Wages_{t-1}, & 0 < t \leq 40, \\ \Delta Wages_t = wage\ coefficient \cdot \Delta Achievment\ , & t > 40. \end{cases}$$

Education – summary of results

Schooling attractiveness: impacts on selected macro variables (% change from initial steady state) of a 50-year recursive shock to the skill structure variables

Transmission mechanism		t+1	t+2	t+3	t+4	t+5	t+10	t+20	t+50
School attainment (1)	Employment	0,001	0,013	0,032	0,058	0,084	0,203	0,387	0,746
	GDP	0,099	0,194	0,287	0,384	0,484	1,025	2,230	5,827
School attainment (2)	Employment	0,001	0,006	0,015	0,028	0,041	0,103	0,205	0,444
	GDP	0,051	0,097	0,144	0,192	0,243	0,524	1,178	3,361

Note: 800-period simulation for convergence.

Schooling quality: impacts on selected macro variables (% change from initial steady state) of a 50-year recursive shock to human capital efficiency

Transmission mechanism		t+1	t+2	t+3	t+4	t+5	t+10	t+20	t+50
School achievement	Employment	-0,008	-0,010	-0,011	-0,012	-0,013	-0,019	-0,035	-0,079
	GDP	0,010	0,021	0,033	0,045	0,057	0,124	0,286	0,738

Note: 800-period simulation for convergence.

4. Final remarks

- This exercise is **work-in-progress** (still lacking updated data on several reform variables).

- Only a **selection of the identified reforms can be translated and assessed quantitatively**, namely because:
  - Suitable quantifiable reform indicators are lacking for several reform measures given their qualitative nature (STAGE 1);
  - Empirical (microeconometric) estimates on which the assessment has to rely are not available (STAGE 1 and 2)
  - Appropriate analytical mechanisms to translate reforms into macro model shocks are lacking given the features of the macro models (STAGE 3).

4. Final remarks

- The reform measures that are considered quantifiable are **translated into changes in structural indicators** (shocks) that are used in the macro model.
- **Suggested translation (mapping)** of measures into shocks:
  - Justice:
    - Firms fixed entry costs;
    - Labour productivity;
    - International technology linkages;
    - Interest rate risk premium;
    - Leisure preferences;
    - Share of liquidity constrained households
  - Education:
    - Skill structure of working population;
    - Human capital efficiency.

4. Final remarks

- This methodology quantifies **potential macroeconomic impacts**:
  - Model simulations suggest reform measures can have a **sizeable positive** macroeconomic impact.
  - For each area of reforms, the **different transmission channels** allow us to **build a range of values for those impacts**.
  - However, the translation of reform measures into quantifiable changes in structural indicators is **surrounded by uncertainty**, related to the:
    - Direct quantification of the reform measures;
    - Assumed implementation speed of reforms;
    - Robustness of empirical estimates on which the assessment has to rely.
  - The impact assessment is based on a macroeconomic model and hence results are **sensitive to certain model assumptions**.

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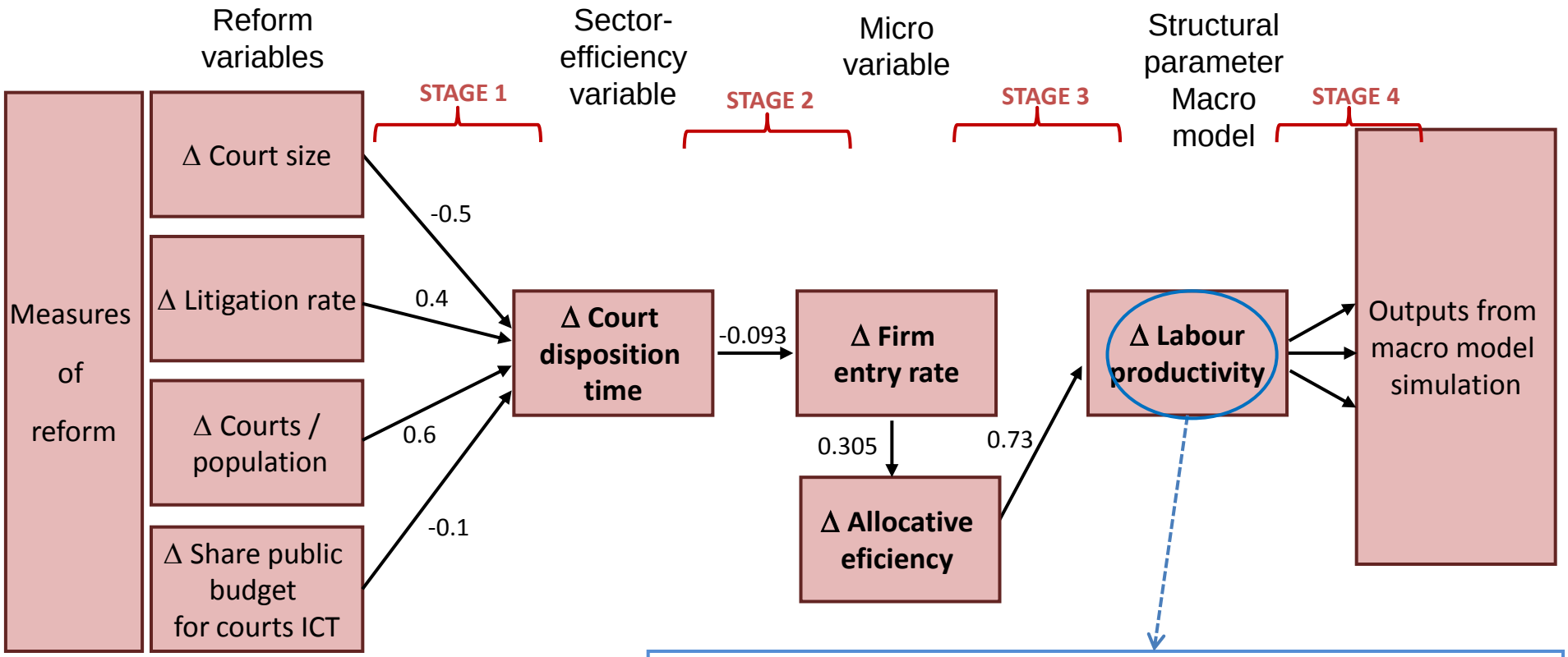
Appendix of Figures

Justice

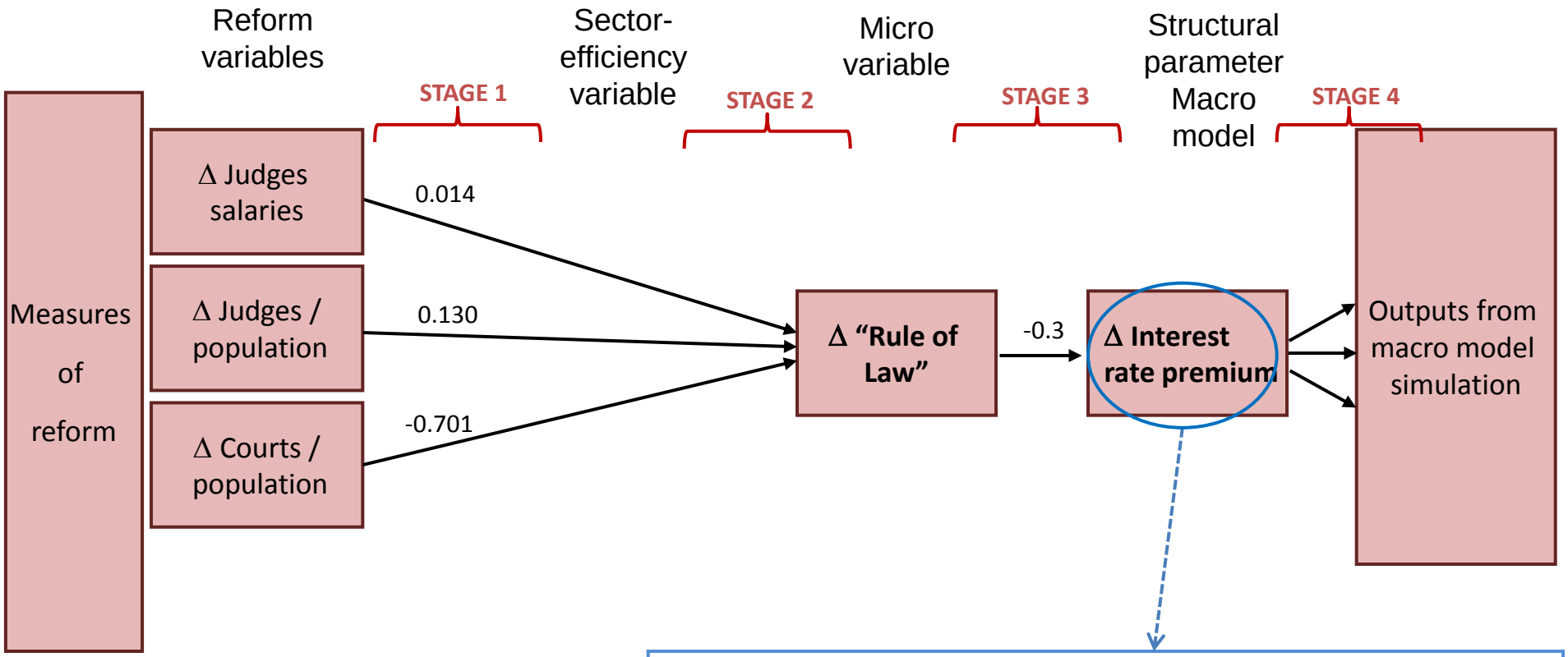
Selected transmission mechanism (stylised elasticities; *EC 2013, 2014*) and translation into shocks in the macro model.



Simulated shock in the model: **estimated** change in labour productivity [exogenous variable].

Justice

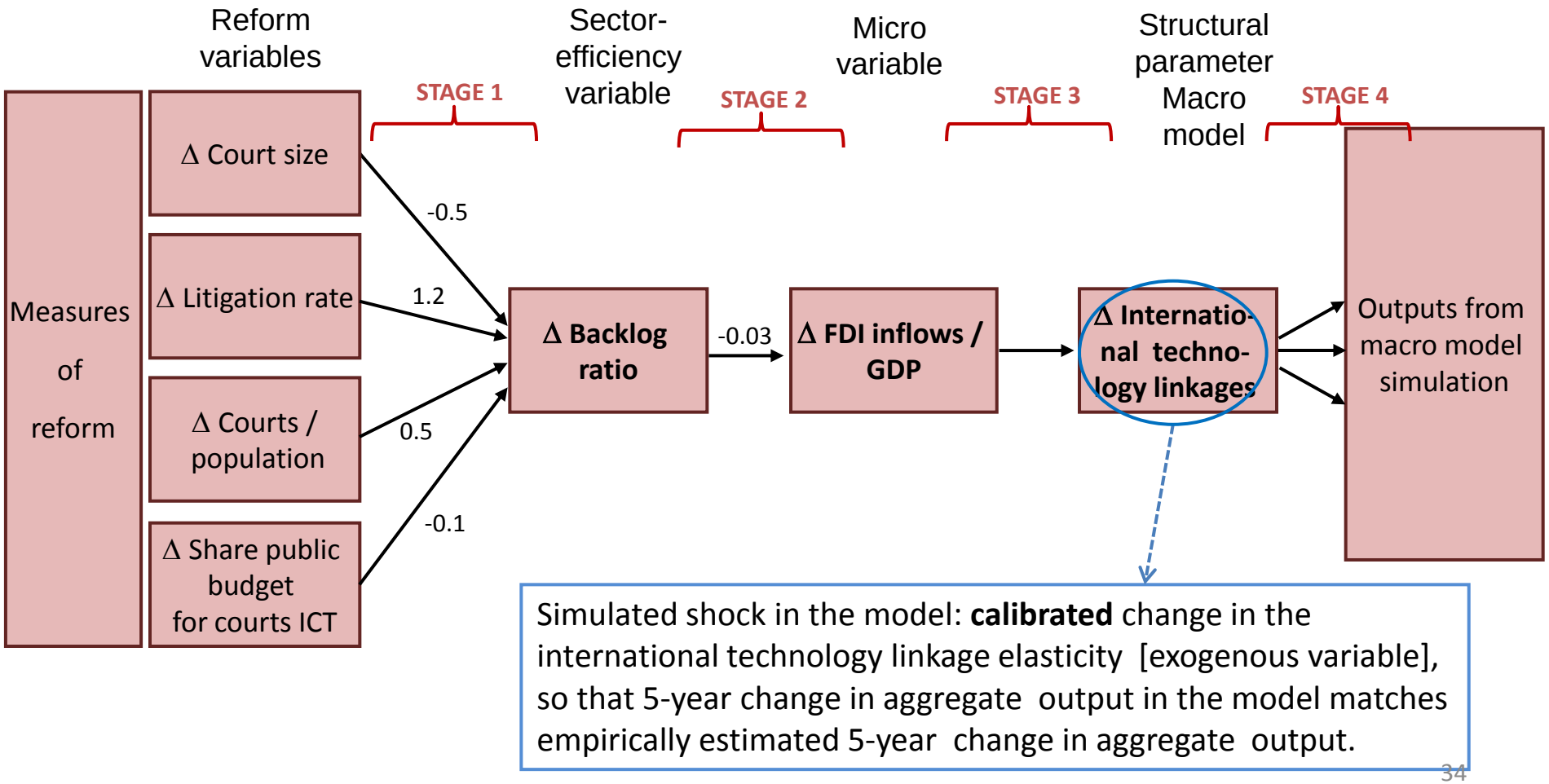
Selected transmission mechanism (stylised elasticities; e.g., *Bae and Goyal, 2009*) and translation into shocks in the macro model



Simulated shock in the model: **estimated** change in interest rate (risk) premium [parameters].

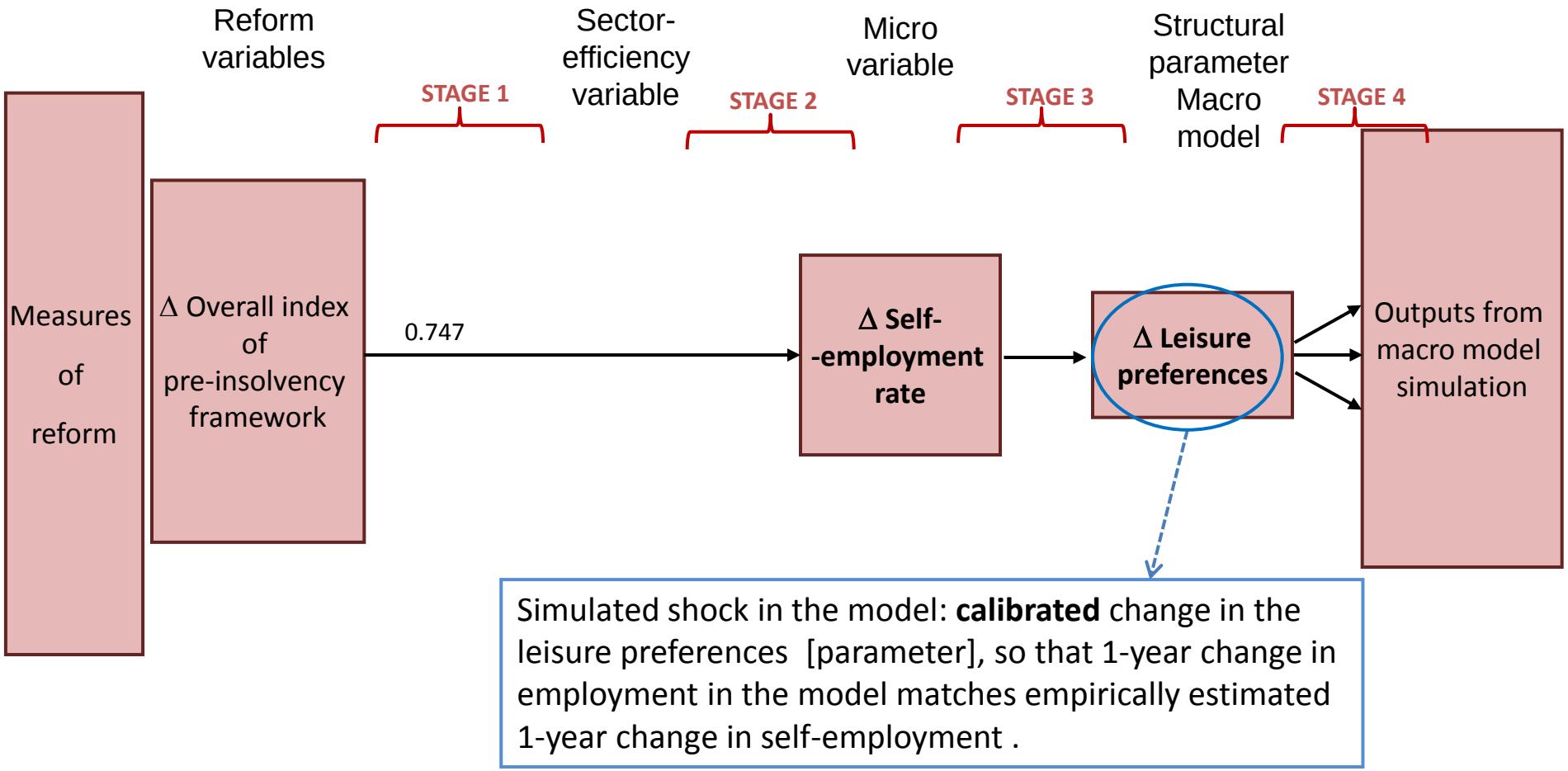
Justice

Selected transmission mechanism (stylised elasticities; *EC 2014*) and translation into shocks in the macro model



Justice

Selected transmission mechanism (stylised elasticities) and translation into shocks in the macro model



Justice

Selected transmission mechanism (stylised elasticities) and translation into shocks in the macro model