Structural reforms in justice and education: a model-based assessment of macroeconomic impacts for Portugal

Álvaro Aguiar, Ana Paula Ribeiro, Pedro Mazeda Gil *

Abstract

Within a partnership between GPEARI and CEF.UP, this report relies on a dynamic stochastic general equilibrium model with endogenous growth to assess the macroeconomic impact of some of the structural reforms put forward over 2010-2014 by Portugal in the areas of Justice and Education. In Justice, we cover for reforms impacting "Overall system efficiency" and "Insolvency regime", while in Education the focus is on "Development of early intervention strategies", "Promotion of school autonomy", "Introduction of vocational tracks" and "Consolidation of the implementation of curricula goals". In a first step, reform measures are associated with the impact on sectoral (Justice or Education) indicators. In a second step, these indicators are linked with microeconomic outcomes, which are then translated into shocks to the European Commission's QUEST III model with endogenous growth, allowing us to derive the expected impact on macroeconomic aggregates. Our results show that reforms deliver large potential effects in the medium-to-long-run, although dependent on the transmission mechanism. In Justice, the strongest effects stem from improvements in the insolvency regime (through both entrepreneurship and liquidity constraint mechanisms) that may potentially increase annual GDP up to 6.2% in 50 years. As for Education, the results (through both quantity and quality of schooling) are quite strong in the long-run, potentially reaching a 6.6% improvement in annual GDP over 50 years.

Foreword

The Office for Economic Policy and International Affairs (GPEARI) at the Ministry of Finance is responsible for quantifying the macroeconomic impact of structural reforms. In this context, and in line with the Portuguese National Reforms Programme 2015, GPEARI established a partnership with CEF.UP - Center for Economics and Finance at the University of Porto, Faculty of Economics, to assess the macroeconomic impact of structural reforms put forward in the recent years by Portugal in the sectors of Justice and Education.

This is the final report, which builds upon and completes two previous drafts – a preliminary one focused mainly on the definition of the methodology, with some illustrative results; and an intermediate one focusing already on the full operation of the methodology. This work was prepared by Álvaro Aguiar, Ana Paula Ribeiro, and Pedro Mazeda Gil, Professors at the Faculty of Economics, University of Porto, and researchers at CEF.UP.

Parts of the results and analysis have been previously presented and discussed in various meetings with GPEARI, the Ministry of Finance and other Portuguese Public Administration staff - namely from the Ministries of Justice and Education, to whom we thank the provision of data and very useful clarifications/explanations of relevant details; and with European Commission, European Central Bank and EU governments' representatives, in the context of the 39th meeting of the LIME working group of the Economic Policy Committee and of a technical meeting of the third post-programme surveillance mission

* Faculty of Economics and CEF.UP, University of Porto. Parts of the results were discussed in various meetings with the Ministry of Finance, Ministry of Justice and Ministry of Education, to whom we thank the provision of data and the very useful comments; and with the European Commission, European Central Bank and EU governments' representatives, in the context of the LIME working group of the Economic Policy Committee and of a technical meeting of the third post-programme surveillance mission. A presentation took also place at the Ministry of Finance on June 22, 2016, at the GPEARI/GEE Seminar, in the context of which several comments have been received, including from the session's discussants, Kevin Wiseman (IMF) and José R. Maria (Banco de Portugal). We thank, in particular, Ana Fontoura Gouveia and Sílvia Santos (Ministry of Finance) for continued fruitful collaboration, support and valuable comments on the successive drafts. We use the QUEST III model of the European Commission (DG ECFIN), to whom we thank. We are grateful to Jan in't Veld and Erik Canton and, in particular, to Janos Varga for the very timely help with the code. The opinions expressed are those of the authors and not necessarily of the institutions.

to Portugal. The most recent presentation has taken place at the Ministry of Finance on June 22, 2016, at the GPEARI/GEE Seminar “Structural reforms and economic performance – applied research”, in the context of which several useful comments have been received, including from the session’s designated discussants, Kevin Wiseman (IMF) and José R. Maria (Banco de Portugal).

We thank, in particular, Ana Gouveia and Sílvia Santos (of the Research and Economic Policy Unit, GPEARI, Ministry of Finance) for continued fruitful collaboration, support and valuable comments on the successive drafts.

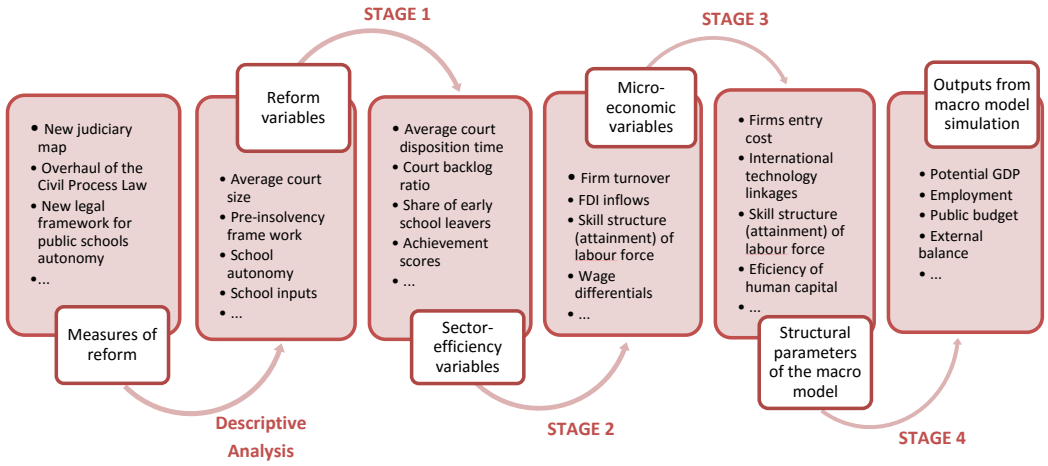
We use the QUEST III macroeconomic model of the European Commission (DG ECFIN), to whom we thank. We are grateful to Jan in’t Veld and Erik Canton and, in particular, to Janos Varga for the very timely help with the code of the QUEST III model.

Executive Summary

1. The Office for Economic Policy and International Affairs (GPEARI) at the Ministry of Finance is responsible for quantifying the macroeconomic impact of structural reforms. In this context, and in line with the Portuguese National Reforms Programme 2015, GPEARI established a partnership with CEF.UP - Center for Economics and Finance at the University of Porto, Faculty of Economics, to assess the macroeconomic impact of structural reforms put forward in the recent years by Portugal in the areas of Justice and Education. This final report starts with an introductory section that sets up the framework of analysis; Section 2 briefly reviews the relevant literature on the economic role of the sectors of Justice and Education; thereafter, the report proceeds with the two main blocks of this work: the definition and layout of the methodology (Section 3) and the results from the application of that methodology to the reforms in Justice and Education in Portugal over 2010-2014 (Section 4). This executive summary focuses on these two main blocks.

2. The **methodology** follows and extends the standard approach used by the European Commission (*e.g.*, Roeger *et al.*, 2008). It is based on two fundamental processes: (i) the quantification of the microeconomic effects of structural reforms, and (ii) the reaction of the macroeconomic model to such microeconomic effects. In order to quantify the microeconomic effects, we typically collect the reform measures, associate them with reform variables that impact on sectoral (Justice or Education) indicators which, in turn, affect some microeconomic variables – a process that requires detailed information from, and interaction with, the competent Ministries. These microeconomic effects are then translated into shocks to the (micro-founded) macroeconomic model, a key process that corresponds to the identification of the mechanisms of reform transmission to the macroeconomy. The ensuing computation (through simulation) of the dynamic system’s reaction to those shocks delivers the results of the reforms in terms of the main macroeconomic aggregates.

The following figure presents a general scheme that systematises the full methodological process, from the reform measures to the macroeconomic impacts. In Section 4, this scheme is applied/adapted to the transmission mechanisms of each reform (or group of reforms).



Source: own elaboration.

3. The general equilibrium dynamic **macroeconomic model** (DSGE), with microeconomic behavior of the economic agents that supports aggregate demand and supply, provides the quantification of the effects on the level of output, as well as on other macroeconomic aggregates, relevant for the different analytical time dimensions – short, medium and long run horizon -, *e.g.*, accumulation of production factors, employment, domestic and foreign components of aggregate demand, and public and external indebtedness. We use the existing extension of the European Commission's QUEST III model with endogenous growth, calibrated for the Portuguese economy by Varga *et al.* (2014). This choice has the paramount advantage of its previous and current use by the Directorate-General Economic and Financial Affairs of the European Commission in various simulation exercises concerning structural reform policy in both the European Union as a whole and the individual Member States.

4. The methodology requires that reform measures, individually or grouped, are translatable into quantitative (or quantifiable) reform variables (implementation/output indicators) and the availability of empirical (microeconometric) estimates of the quantitative relationship between the latter and sector-efficiency and micro variables. These requirements provide the main pre-conditions for selecting and grouping the reform measures for which we were able to quantify the corresponding macroeconomic effects.

The 2010-2014 **structural reforms in Justice and Education in Portugal** for which macroeconomic effects are computed and analysed in this work can be broadly grouped along the following policy areas:

Justice
Overall system efficiency
Insolvency regime
Education
Development of early intervention strategies
Promotion of school autonomy
Introduction of vocational tracks with strengthening and upgrading of vocational training
Consolidation of the implementation of curricula goals

The following table summarises the **transmission mechanisms** from (groups of) reforms to the macroeconomy that are explored in this work. The table singles out, for each implemented mechanism, the corresponding reform, sector-efficiency and micro variables, as well as the selected shock variables/parameters in the macro model**.**

		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)

Source: own elaboration.

5. The results – **macroeconomic impacts** of the selected reforms – are presented and explained in detail in Section 4, for each area of reform and through each transmission mechanism. The following two tables (Justice and Education, respectively) present a summary of those results, providing a short description of each transmission mechanism and the respective macroeconomic results from the (in general) 2010-2014 reform measures.

Transmission mechanism / modelisation				Impacts on selected macro variables				
A - Reforms in Justice								
				1Y	5Y	10Y	20Y	50Y
A1	Overall system efficiency	Firms' entry cost	Public budget/GDP	0,042	0,013	0,008	-0,004	0,003
			Employment	0,060	0,028	0,036	0,038	0,023
			Real wages	0,143	0,188	0,236	0,293	0,356
			GDP	-0,029	0,049	0,135	0,214	0,268
			External balance/GDP	-0,003	0,009	0,001	-0,003	0,002
				1Y	5Y	10Y	20Y	50Y
		Allocative efficiency	Public budget/GDP	-0,028	0,019	0,005	-0,005	0,002
			Employment	-0,070	-0,002	0,002	0,001	-0,009
			Real wages	0,120	0,219	0,238	0,268	0,308
			GDP	0,147	0,239	0,264	0,295	0,326
			External balance/GDP	0,040	-0,002	-0,004	-0,003	0,001
				1Y	5Y	10Y	20Y	50Y
		Risk premium - intangible capital	Public budget/GDP	0,000	-0,003	0,000	0,002	0,000
			Employment	0,011	0,001	-0,001	-0,002	-0,001
			Real wages	0,026	0,035	0,044	0,053	0,062
			GDP	-0,005	0,006	0,018	0,030	0,041
			External balance/GDP	-0,002	0,001	0,001	0,000	0,000
				1Y	5Y	10Y	20Y	50Y
		Risk premium - tangible capital	Public budget/GDP	-0,038	-0,001	0,009	0,018	0,009
			Employment	0,045	0,130	0,111	0,085	0,053
			Real wages	-0,027	0,186	0,451	0,839	1,334
			GDP	0,051	0,361	0,634	1,026	1,527
			External balance/GDP	0,015	-0,046	-0,032	-0,010	0,015
				1Y	5Y	10Y	20Y	50Y
		International technology linkages - FDI inflows	Public budget/GDP	0,016	0,014	0,018	0,004	0,006
			Employment	0,040	-0,003	0,000	-0,003	-0,026
			Real wages	0,185	0,354	0,494	0,650	0,824
			GDP	0,025	0,297	0,515	0,718	0,887
			External balance/GDP	0,011	0,018	0,001	-0,005	0,003
				1Y	5Y	10Y	20Y	50Y
A2	Insolvency regime	Entrepreneurship/self-employment	Public budget/GDP	0,165	0,802	0,285	-0,221	0,067
			Employment	1,327	3,771	4,109	4,234	3,890
			Real wages	-2,002	-1,633	-1,365	-0,953	-0,330
			GDP	0,797	2,795	3,418	4,057	4,346
			External balance/GDP	0,448	0,070	-0,068	-0,099	0,029
				1Y	5Y	10Y	20Y	50Y
		Liquidity constraint	Public budget/GDP	2,511	1,468	0,327	-0,620	0,131
			Employment	0,251	1,156	1,949	2,167	1,435
			Real wages	-0,205	-0,483	-0,618	-0,365	0,103
			GDP	0,150	0,912	1,703	2,254	1,874
			External balance/GDP	0,036	0,114	-0,090	-0,143	0,044

Source: own elaboration. Note: Employment, real wages and GDP -- % change from initial steady state; public budget/GDP and external balance/GDP -- p.p. change from initial steady state. The impacts result from changes in reform variables between 2010 and 2012-2015, depending on the latest year with available data.

Transmission mechanism / modelisation			Impacts on selected macro variables				
B - Reforms in Education							
			1Y	5Y	10Y	20Y	50Y
B1 Schooling attractiveness	School attainment (baseline fertility rate scenario)	Public budget/GDP	0,007	0,026	0,026	0,034	0,040
		Employment	0,001	0,084	0,203	0,387	0,746
		Real wages	0,035	0,277	0,588	1,366	3,924
		GDP	0,099	0,484	1,025	2,230	5,827
		External balance/GDP	0,020	0,026	0,015	0,001	-0,022
			1Y	5Y	10Y	20Y	50Y
	School attainment (low fertility rate scenario)	Public budget/GDP	0,005	0,014	0,014	0,019	0,023
		Employment	0,001	0,041	0,103	0,205	0,444
		Real wages	0,019	0,140	0,300	0,719	2,248
		GDP	0,051	0,243	0,524	1,178	3,361
		External balance/GDP	0,008	0,013	0,008	0,002	-0,014
			1Y	5Y	10Y	20Y	50Y
B2 Schooling quality	School achievement	Public budget/GDP	0,001	0,007	0,008	0,008	-0,007
		Employment	-0,008	-0,013	-0,019	-0,035	-0,079
		Real wages	0,013	0,057	0,116	0,258	0,672
		GDP	0,010	0,057	0,124	0,286	0,738
		External balance/GDP	0,007	0,008	0,006	0,003	-0,005

Source: own elaboration. Note: Employment, real wages and GDP -- % change from initial steady state; public budget/GDP and external balance/GDP -- p.p. change from initial steady state. The impacts result from changes in reform variables between 2009 and 2012-2015, depending on the latest year with available data.

The results show that the considered reforms have sizeable and positive potential macroeconomic impacts in the medium-to-long-run, although dependent on the transmission mechanism (particularly in Justice).

Considering the reforms that have improved the overall system efficiency, the lon-run (50 years) impacts on annual GDP range from a 0.268% (0.135% in the medium-run – 10 years) increase through the firms' entry cost mechanism to a 1.568% (0.652% already in the medium-run) increase through the risk premium channel. However, the strongest effects, by far, come potentially from improvements in the insolvency regime (accounting for both entrepreneurship and liquidity constraint mechanisms): if credible, such improvements can be perceived as a regime change and potentially increase annual GDP by about 5.1% in 10 years and 6.2% in 50 years.

As for the considered Education reforms, the results (accounting for both quantity and quality of schooling) take longer to materialise due to the typical cohort effects, but are quite strong in the long-run, potentially reaching about a 4.1% to 6.6% (depending on the scenario for the fertility rate) improvement in annual GDP over 50 years.

6. The translation of reform measures into quantifiable changes in structural indicators in the macroeconomic model and the ensuing impact assessment through simulation embody a substantial degree of **uncertainty**. For that reason, it must be stressed that these are **just potential** effects of the considered reforms, to be interpreted with caution.

The work reported here is inevitably work in progress. In some cases, reform variables and sector-efficiency indicators need to be updated as soon as more recent ones become available – the schooling quality reform variables available from OECD-Pisa database (instruction time and school autonomy), currently available up to 2012 only, constitute an obvious case. This process of assessing macroeconomic impacts of reforms will largely gain, both in quantity and quality, as more (and more detailed) microeconometric assessments of individual reforms become available. In general, future design of reforms can also help this process of assessment substantially by improving the quantification of reform variables end sector-efficiency objectives or expected outcomes.

Introduction

Structural reforms are improvements triggered by public policies in a country's political, economic and social institutions, with the ultimate objective of increasing social welfare in a sustained way. In a narrow microeconomic/sectoral definition, structural reforms are improvements in the effectiveness and efficiency of institutions. However, as the functioning of those institutions impinges on the creation and distribution of wealth, reforms have macroeconomic effects and, ultimately, affect social welfare.

Structural reforms are pursued with a view to permanent effects, sustained over time, and, very often, through a gradual implementation process. Moreover, macroeconomic and welfare effects are slower to phase in than the direct immediate effects on institutions. Therefore, the analysis of the macroeconomic effects of reforms requires a **medium/long-run horizon**.

The key macroeconomic effect of structural reforms is on (i) the capacity of the economy to produce wealth, which can be assessed through the level of medium/long-run output and productivity (**"potential output"**); although not explored in this report, in addition to the level of output reforms may also affect (ii) its long-run rate of growth ("economic growth"), (iii) the flexibility of the economy in reaction to external shocks and institutional changes ("volatility"), including the improvements in the effectiveness of economic policy brought about by structural reforms; and (iv) income and wealth distribution. The latter requires a heterogeneous-agent macro model, which seems at the moment too complex to consider within the DSGE-QUEST model used in this study; it is, therefore, outside the current scope of the work, but it is a promising candidate for future developments within this research.[1] This report focuses mainly on the improvements in the level of medium/long-run output (and related macroeconomic aggregates) brought about by the improvements in the sectors of **Justice** and **Education**.[2]

The methodology of this study, following the standard approach used by the European Commission, is based on two fundamental processes: (i) the **quantification of the microeconomic effects of structural reforms**, and (ii) the **reaction of the macroeconomic model** to such microeconomic effects.

As for the quantification of microeconomic effects, we try to follow - when possible and constrained by the existing theoretical and empirical economic literature - the impact path of each reform measure or group of measures:

$$\text{reform measure(s)} \rightarrow \text{reform variable(s)} \rightarrow \text{sectoral parameter indicator(s)}.$$

In many cases, however, it is clearly far-fetched to establish a direct mapping from each reform measure (or group of measures), or even each reform variable(s), to sectoral performance. We nevertheless reasonably interpret the improvements in sectoral performance indicators as resulting largely from past and ongoing structural reforms. It follows that the conversion of sectoral performance indicators into quantified microeconomic indicators (based on the existent theoretical and empirical literature) provides a proxy for the **quantification of microeconomic effects of structural reforms**; such effects, in turn, are used as **shocks to the parameters** (or to exogenous variables) **of the macroeconomic model**, in the context of the microeconomic foundations on which the model is built. By changing the structural parameters, the shocks trigger the general equilibrium dynamic inter-relations between the macroeconomic aggregates, yielding the short, medium and long-run results, which, in this way, can be consistently interpreted as macroeconomic impacts of the structural reforms.

In fact, using a general equilibrium framework with microeconomic behavior of the economic agents that support aggregate demand and supply, the **macroeconomic model** provides the quantification of the effects on the level of output, as well as on other variables and macroeconomic equilibria/disequilibria, relevant for the different analytical time dimensions – short, medium and long run horizon -, *e.g.*, accumulation of production factors, employment creation and structural unemployment, domestic and foreign components of aggregate demand, and public and external indebtedness. For this purpose, it is advisable to use a dynamic stochastic general equilibrium (DSGE) model of the Portuguese economy, in

[1] The full consideration of the economic growth effect (permanent increases in the rate of growth) would also require a more complex integration of a fully endogenous growth mechanism within the DSGE model, which we did not attempt in this report.

[2] The reform measures considered in this report are described In the following documents of the Portuguese government: "Managing the Adjustment Programme" Estrutura de Acompanhamento dos Memorandos - ESAME, May 2014; "Programa Nacional de Reformas 2015," Ministério das Finanças, April 2015; and Programa de Estabilidade 2015-2019," Ministério das Finanças, April 2015.

the context of the European Union. In particular, we use an existing extension of the European Commission's QUEST III model with endogenous growth, calibrated for the Portuguese economy by Varga *et al.* (2014). The choice of the QUEST III model has the paramount advantage of its previous and current use by the Directorate-General Economic and Financial Affairs of the European Commission in various simulation exercises concerning structural reform policy in both the European Union as a whole and the individual Member States.

Future improvements in both processes - microeconomic effects of structural reforms and the reaction of the macroeconomic model - require research investment along the following lines (i) further exploration of the macroeconomic model in the context of the Portuguese economy and in possible developments of its building blocks in order to accommodate some specific objectives/effects; ii) further quantification of the microeconomic effects of the reforms, which depends, to a great extent, on the actual degree of implementation and on the timing of propagation of effects, thus requiring specific information and knowledge about several dimensions of the reforms; and (iii) further interpretation and analysis of the macroeconomic model's reaction to the structural shocks, so that the potential benefits from this methodology can be fully reaped.

This report describes and explains the methodology for assessing macroeconomic impacts of reforms and applies it to the selected structural reforms in Justice and Education. To do so, we review, in Section 2, the economic literature on selected channels through which Education and Justice may impact the macroeconomic variables; Section 3 presents the methodology followed in this study; Section 4 puts the methodology to use, by concretising the sequence of processes mentioned above, running the macroeconomic model with shocks to the parameters/exogenous variables coming from the reform measures, and concluding with the interpretation of the results, *i.e.*, the simulated impacts of the reforms on the main macroeconomic indicators. Section 5 concludes with a focus on the main results, also calling the attention to their potential nature due to the uncertainty involved in this type of modeling, and suggesting some future improvements related to the process of assessment.

1. Literature review on the effects of Justice and Education on the macroeconomy

The impact of efficiency improvements in **Justice** on macroeconomic performance has received renewed attention from recent literature.[3] The main focus falls on longer term effects on economic growth (*e.g.*, Haidar, 2012; Djankov *et al*., 2006), through higher competition between firms (measured, for instance, by higher entry rates), attractiveness of foreign direct investment (FDI), better financing conditions (longer maturity and lower interest rates) and incentives to investment - in the sense that investment is a vehicle for the incorporation of technological advances and for improvements in the allocation of resources, promoting more productive, innovative and better dimensioned firms (*e.g.*, Gianfreda and Vallanti, 2013; Garcia-Posada and Mora-Sanguinetti, 2012).

According to the relevant literature, for instance a smaller number of courts coupled with high judicial fees tend to lower the incentives towards the inflows of litigious cases and towards successive reassessments from higher-order courts. Consequently, this is expected to decrease the number of unsolved cases *per capita* (backlog ratio), thereby improving the efficiency of the judicial system (*e.g.*, Chiarloni, 1999). The existence of rather strict criteria for lawyers to be allowed to plead before different high-order courts also reduces the inflows of litigious cases (Lupo, 2013).

Regarding court restructuring, the reduction in the number of courts allows the exploitation of scale economies that improve the specialisation degree of each judge, the resolution time of the case (supply-side impacts) and the consistency of decisions, and is also expected to increase the number of resolved cases (OECD, 2015). Besides the number and the average size of courts, the literature refers to the relationship between other indicators of implementation of reforms (*e.g.*, fraction of the public budget devoted to ICT, the incidence of specialised courts, or even indicators capturing the average duration of the different stages of a litigious process or the system of governance of the courts) and a number of result indicators of reform implementation (Palumbo *et al.*, 2013).

As regards the empirical link between judicial efficiency and economic performance, *e.g.*, Ardagna and Lusardi (2008) and Berkowitz *et al.* (2006) find a significantly positive relationship between efficiency of the judicial system and the technological component of net exports. Several other empirical studies highlight

[3] See, *e.g.*, the recent survey by Gouveia *et al*. (2016).

the channel from judiciary efficiency to the ease of creation of new firms (*e.g.*, Giacomelli and Menon, 2013; García-Posada and Mora-Sanguinetti, 2014). As for FDI inflows - which can be another powerful channel of technological transmission - Lorenzani and Lucidi (2014) and Barkbu *et al.* (2012) estimate positive impacts from the efficiency of the judicial system. The literature adds evidence of positive correlation between judicial efficiency and the average size of firms (*e.g.*, Giacomelli and Menon, 2013; Beck *et al.*, 2006), which, in turn, is positively correlated downstream with productivity, survival rates and profitability (*e.g.*, Beck *et al.*, 2005) and, thus, with economic growth.

A strong contract enforcement system, including in handling insolvency processes, reduces the costs of firms' external finance and increases loan maturities (*e.g.*, Bae and Goyal, 2009; Laeven and Majnoni, 2005). This improves firms' financial restrictions and, in particular, the access to longer term financing, which is crucial for investment decisions (Jappelli *et al.*, 2005; Djankov *et al.*, 2008).

Contract enforcement is strongly related to the extent to which property rights are protected in a country as they affect the lenders incentives to monitor as well as their ability to recontract. Declining credit quality often results in lenders raising interest rates, demanding more collateral, shortening loan maturity, and further restricting future activities. This recontracting is costly when property rights are poorly enforced. Poor enforcement lowers recovery rates and increases the time spent in repossessing collateral following default (Bae and Goyal, 2009).

Laeven and Majnoni (2005) examine the effect of judicial protection of property rights on country-level interest rate spreads for bank financing. The impact of a more efficient organization and enforcement of justice on interest rates is not unambiguous. While there is clearly a positive effect of an increased recovery in the event of default on (reducing) the lending spread, there is also a negative impact related to a composition bias effect as riskier and previously rationed bank customers may represent a larger share of borrowers, as a result of more efficient judicial procedures, and will, in fact, carry higher rates that may offset the lower rates possibly charged. This may explain contradicting empirical results.

Strong contract enforcement also reduces the probability of a temporary liquidity shortage becoming an insolvency situation, often with weak creditor protection (*e.g.*, Safavian and Sharma, 2007) and negative impact in output and employment. In addition, the incidence of cases increases with the time it takes for case resolution: longer processes, during which the Law may actually change, may compromise the consistency of decisions, generating uncertainty and reducing the trust of the economic agents in the judicial system (Muiznieks, 2012).

Considering, in particular, the insolvency regime, Carpus Carcea *et al.* (2015) argue that an efficient pre-insolvency framework, besides enabling early rescue of some business (Djankov *et al.*, 2008) and limiting economic and social consequences of bankruptcy (Fan and White, 2003; European Commission, 2011), may reduce legal consequences of personal insolvency and can promote entrepreneurship (Jackson, 1985; Adler *et al*., 2000; Lee *et al.*, 2007). Moreover, in the context of several countries experiencing a situation of private sector debt reversal (as studied by Carpus Carcea *et al.*, 2015), well-functioning insolvency frameworks - especially if combined with incentives to use other options, including out-of-court procedures and early rescue mechanisms - reduce the deleveraging costs on domestic demand, thereby helping relax liquidity constraints, smoothing the adjustment and mitigating its macroeconomic costs (Ruscher and Wolff, 2012; IMF, 2013b).[4]

In what concerns **Education**, its relationship with macroeconomic performance has been approached in the literature, both theoretical and empirical, along two main vectors: (i) the level and/or pace of accumulation of human capital, commonly measured by schooling level indicators (*e.g.*, seminal studies by Lucas, 1988; and Mankiw *et al.*, 1992); and (ii) the quality of human capital, measured by indicators of cognitive and occupational skills (*e.g.,* Hanushek e Kimko, 2000).

The traditional approach to the determinants of human capital measures the stock of human capital through school attainment (number of years in school). School attainment has been the central focus of the literature and politicians since Mincer's (1970, 1974) seminal work identified schooling as the prime proxy for human capital and individual labour market skills.

Earlier studies relating the quantitative measures of human capital (in level or in changes) to economic growth, based on the rationale that human capital improves efficiency in production, where somewhat

[4] For a more comprehensive review of the channels through which the bankruptcy regime affects the economic variables, see, *e.g.*, Gouveia *et al.* (2016).

disappointing, often yielding a statistically nonsignificant relationship, namely in cross-section and panel data samples. However, more recent research, by controlling for measurement errors contained in the international databases, has been able to present more clearly a positive and significant relationship between human capital and economic growth (*e.g.*, De la Fuente and Doménech, 2006; Cohen and Soto, 2007).

A recent alternative approach recognises instead that a problem with the school attainment approach comes from the lack of adjustment for schooling quality. In order to tackle the measurement problem of labour force quality directly, a strand of the literature emerged that constructs measures of quality based on student cognitive performance (achievement) on various international tests of academic achievement in mathematics and science (*e.g.*, PISA and TIMSS scores; see OECD, 2013; see also Hanushek and Kimko, 2000, for an early academic contribution on this topic). Research has found a strong positive relationship between achievement and several outcome variables, namely labour-market outcomes and macroeconomic (GDP) growth (*e.g.*, Hanushek and Woessmann, 2012).

Yet simply knowing that the individuals' cognitive skills differences are important does not provide a guide to policies that might promote more skills. Indeed, a wide variety of policies have been implemented within various countries without much evidence of success in either achievement (acquired skills) or economic terms (Hanushek and Woessmann, 2011).

Much research has focused on why achievement differs across students and across countries, by studying what is often called the 'international education production function'. The literature has taken a variety of perspectives and approaches and faced a number of technical and methodological challenges. The general objective is to sort out the causal impacts of school and institutional factors (features that can potentially be manipulated through policy) from other influences on achievement including family background, students' characteristics, neighborhood influences, and the like (see, *e.g.*, Hanushek and Woessmann, 2010, for an extensive review of the empirical literature).

Another, parallel, strand of literature, consisting of structural analysis based on theoretical models of economic growth, has been exploring the connections between human capital and innovation and/or technology absorption processes (in the line of, *e.g.*, Nelson and Phelps, 1966; and Romer, 1990), as well as between human capital and institutions (*e.g.*, Jones and Romer, 2010; Acemoglu *et al.*, 2005). Recent research along these lines explores how economic growth is linked to the structure of human capital (the share of high-skilled individuals - *i.e.* with higher education level of formal schooling – in the labour force), highlighting a positive relationship after properly controlling for the distance of each economy to the technological frontier (Vandenbussche *et al.*, 2006; Ang *et al.*, 2011) or for the level of barriers to entry in high-tech *versus* low-tech industries (Gil *et al.*, 2012, 2015).

From this review of the existing literature, we conclude that structural reforms that bring about improvements in Justice and Education are expected to have medium and long term macroeconomic effects in light of the most recent empirical literature; in the case of Justice through their impact on firms' entry and exit, inflows of FDI and firms' external finance costs, for instance; and, in the case of Education, through their impact on the stock and quality of human capital in the economy.

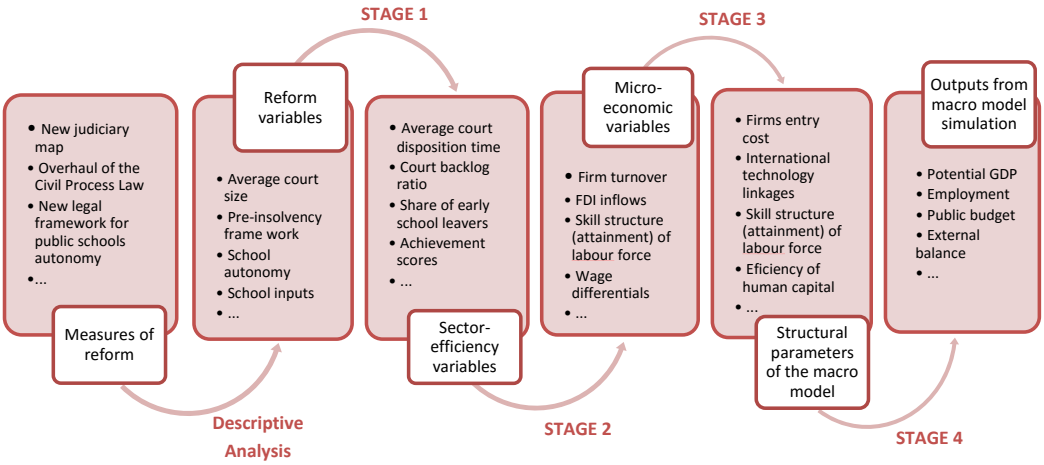
2. Adopted methodology: from the measures of structural reform to the analytical macroeconomic model

The economic effects arising from structural reforms are necessarily indirect and essentially non-observable, since the transmission mechanisms linking those measures to the economic variables (firstly, at the micro level and, secondly, at the macro level) tend to be complex and diffuse. In addition, the economic variables are certainly subject to the influence of a number of factors beyond those strictly connected with the structural reforms under study.

Moreover, the timing of the effects is hard to pin down and, as such, it complicates the analysis, both because the full effects of structural reforms are typically only accrued in the medium to long run and because reforms have their largest impact once confidence and economic activity pick up and recovery takes place under the better functioning market conditions created by the reforms.

Thus, with a view to identifying and quantifying the chain of effects in place, we adopt the approach depicted in Figure 1 for examples of structural in Justice and Education, in line with the state-of-the-art described in the literature (*e.g.*, OCDE, 2013; Lorenzani and Lucidi, 2014; Roeger *et al.*, 2008).

Figure 1. Methodological stages with a view to assessing the macroeconomic impact of structural reforms in Justice and Education



Source: own elaboration.

We assume that the transmission mechanisms unfold in the following stylized way:

(STAGE 1) the measures of reform and the respective reform variables (assessed by implementation/output indicators) have a direct downstream effect on the sectoral efficiency variables (assessed by result/outcome indicators – either observed or estimated);

(STAGE 2) the sectoral efficiency variables have a downstream effect on several microeconomic variables (microeconomic impact);

(STAGE 3) the changes in these microeconomic variables are translated into shocks to parameters in the macroeconomic model;

(STAGE 4) The estimated shocks are simulated in the macroeconomic model and the resulting impact on the macroeconomic variables is interpreted as the quantified macroeconomic impact of the reform.

In this context, we will first conduct a descriptive analysis which allows us to group the specific measures of structural reform already implemented into broader categories of structural reforms, namely bearing in mind the direct effect of each specific measure on the selected sectoral efficiency variables. Secondly, we consider the results of previous econometric studies available in the literature, which, based on cross-section or panel data for a number of countries, compute estimates of the effects of STAGES 1 and 2 described earlier.

Thirdly, the quantification of the macroeconomic effects (STAGES 3 and 4) are undertaken by means of simulation under the framework of an analytical macroeconomic model. In STAGE 3, we use the (estimated) effects on the microeconomic variables (STAGE 2) in order to quantify the exogenous shocks that will apply to the key structural parameters (or exogenous variables) of the macroeconomic model. [5] These shocks are a proxy of the measures of structural reform in the context of the analytical macroeconomic model. Finally, in STAGE 4, we use the analytical model, which captures several macroeconomic transmission mechanisms, to assess the impact of the reforms on potential aggregate output and economic growth, as well as on several other macroeconomic variables with relevance over the different time horizons (short, medium, and long run), *e.g.*, production factors accumulation, structural unemployment, domestic and external aggregate demand, public budget and external balances dynamics.

[5]Figure A1 in Appendix A, depicting a schematic structure of the selected macroeconomic model, provides two examples of integration of microeconomic variables as vehicles of reform measures: the impact of Justice reforms on FDI is carried through the parameter with a shadowed circle (A^w); and in Education, impacts on microeconomic variables can be mimicked by a shock in the skill composition of the workforce, variables under the shadowed rectangle.

The impact of the structural reforms over these macroeconomic dimensions is assessed by comparing the scenario with structural reform shocks and the baseline scenario, without any shocks. To consider the impact on the economy of changes in policy, the shocks are introduced individually in the model, holding all other parameters unchanged at their baseline levels and letting the endogenous variables respond appropriately. The simulation results are then compared to the baseline scenario, thereby isolating the effect of each structural reform shock on the relevant macroeconomic variables.

Nevertheless, special attention should be paid to the qualitative and/or protracted nature of many of the measures of structural reform and, as remarked above, the complex and diffuse character of their transmission mechanisms vis-à-vis the necessarily stylized structure of the analytical macroeconomic model. In this context, the mapping of specific policy interventions within the structure of the model may not always be obvious. Indeed, the process of selection, quantification[6] and interconnection of the three types of variables (reform, sectoral efficiency, and microeconomic variables) and the respective mapping into the structural parameters of the model – with a view to operationalizing the different stages of the transmission mechanisms described above – may not be unequivocal, requiring the use of microeconomic evidence and theory, but also a degree of judgment. Therefore, the interaction between the team of consultants and GPEARI, as well as other entities familiar with the suite of measures of reform under study, is deemed of utmost importance in order to guarantee a sound and sensible implementation of the model-based evaluation of the macroeconomic impact of structural reforms.

Summing up, the quantification of the macroeconomic impact of structural reforms in the sectors of Justice and Education relies on two fundamental blocks:

(i) The **previous quantification of the microeconomic effects of the structural reforms**, *i.e.*, the estimated quantitative relationship between typical reform and sectoral efficiency variables (output and outcome indicators) and the relevant microeconomic variables, by considering the econometric studies available from the recent literature pertaining to the estimation of the microeconomic impact of structural reforms in Justice and Education on country samples of cross-section or panel data.

(ii) These results, in turn, allow us to quantify the exogenous (policy) **shocks on the key structural parameters of the macroeconomic model**, and are a proxy of the measures of structural reform under study. This approach is feasible because the macroeconomic model is built on microeconomic fundamentals, which allow one to give a precise economic interpretation to the structural (primitive) parameters of the model.

Dynamic general equilibrium macroeconomic model

The macroeconomic model follows the structure typically found in the state-of-the-art dynamic general equilibrium macroeconomic models with microeconomic fundamentals (*e.g.*, Roeger *et al*., 2008 – QUEST model of the European Commission; Kumhof *et al*., 2010 – GIMF model of the IMF; Almeida *et al.*, 2013 – PESSOA model of the Banco de Portugal), now widely used for the structural quantitative analysis of the effects of macroeconomic policies. Therefore, it is a macroeconomic model that belongs to the class of micro-founded New-Keynesian Dynamic Stochastic General Equilibrium (DSGE) models, built for a small open economy belonging to a monetary union.

In particular, we use an existing extension of the European Commission's QUEST III model with endogenous growth, as developed by Roeger *et al*. (2008). This extension of the QUEST III model is sufficiently detailed to be able to address a large array of areas of structural reforms and has been applied in various simulation exercises concerning structural reform policy scenarios by the Directorate-General Economic and Financial Affairs of the European Commission, considering both the European Union as a whole and the individual Member States (see, e.g., Roeger *et al*., 2008; D'Auria *et al*., 2009; Varga and in't Veld, 2014; Varga *et al*., 2014). In our exercises, we consider the calibration of the model for the Portuguese economy as detailed in Varga *et al*. (2014).

The model has the following four analytical blocks and features:

(I) Households (workers/consumers)

[6]Herein the process includes an assessment of the degree of implementation of each structural reform, which in many cases is also not obvious.

- Two types of agents – agents without liquidity constraints, who maximize intertemporal utility by choice of consumption and leisure; liquidity constrained agents, characterized by Keynesian behavior;
- Three types of labour/human capital, measured by the level of educational attainment and occupation (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.

(II) 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.

(III) Fiscal policy authority (government) that follows feedback budget rules, linking the dynamics of the public budget balance and the ratio of public debt to GDP, with a view to stabilising the latter in the long run at a given target.[7]

(IV) Open economy (international trade flows and technological spillovers via FDI inflows).

We underline the fact that this is a version of the macroeconomic DSGE model that features endogenous economic growth (based on R&D activities and human capital), combining a long-run dynamic equilibrium (a "balanced growth path") with transitional dynamics effects. Therefore, it is well fit to study the macroeconomic impact of structural reforms, as the latter tend to have relevant effects over the medium to the long run. We also emphasise that the model considers imperfections at the financial and labour market levels (liquidity constraints, collective wage setting, etc.), features that deserve special attention under the present context of the Portuguese economy.

Appendix A presents a simplified flow chart of the model developed by Roeger *et al.* (2008). For a detailed analytical description of the model, we refer the reader to Roeger *et al*. (2008) (a similar description can also be found in, e.g., Varga *et al*., 2014, and the Appendix of D'Auria *et al*., 2009).

4. Reforms, transmission mechanisms and resulting macroeconomic impacts

As explained above in Section 3, the methodology requires that reform measures, individually or grouped, are translatable into quantitative (or quantifiable) reform variables (implementation/output indicators) and the availability of empirical (microeconometric) estimates of the quantitative relationship between the latter and sector-efficiency and micro variables. These requirements provide the main pre-conditions for selecting and grouping the reform measures for which we are able to quantify the corresponding macroeconomic effects.

The **structural reforms in Justice and Education in Portugal** [8] can be broadly grouped along the following policy areas:

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

[7] That is, the stabilisation is not instantaneous but is only achieved when the economy approaches the (new) steady state. The assumption of no change in the steady-state debt ratio allows one to focus on the direct effects of structural reforms excluding debt-consolidation effects.

[8] As reported in ESAME (2014) and in Ministério das Finanças (2015a and 2015b).

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

Tables B1 and B2 in Appendix B present the detailed list of reform measures in Justice and Education put forward by Portugal, corresponding to the reform areas described above. Those tables also present a qualitative relationship between each identified reform measure and the selected reform variables. Reform measures regarding the **judicial system** may produce **supply-side** impacts, namely those related to the reorganization of courts (*e.g.*, restructuring and reduction in the number of courts, increasing the number and the specialization of judges), improvement in the efficiency of courts (*e.g.*, adoption of information and communication technology systems) and to improvements in the efficiency of procedures regarding claims enforcement and processual backlog. They may also impact on the **demand side** of the judicial services, *i.e.*, those referring to diminishing incentives towards a litigious resolution of conflicts by courts through the implementation of out-of-court settlements. Indeed, a lower litigation rate may result from, *e.g.*, tighter eligibility criteria for accessing high-order courts or from the existence of alternative dispute resolution schemes.

In turn, reform measures regarding **education** are targeted to improve **schooling attractiveness** and **schooling quality**. While most of the reform areas are expected to impact on both targets, measures for "Improvement of lifelong learning" clearly promote **schooling attractiveness** and those related to "Management/infrastructures", "Promotion of school autonomy" and "Consolidation of the implementation of new curricula goals" are mainly aimed at improving **schooling quality**.

The calculations presented in this section refer to the highlighted/selected reform areas highlighted above, thus focusing on the assessment of the macroeconomic impact of structural reforms concerning judicial "Overall system efficiency" (*e.g.*, judicial organisation, claims enforcement, out-of-court settlement) and the "Insolvency regime", in the case of Justice; and "Development of early intervention strategies", "Promotion of school autonomy", "Introduction of vocational tracks with strengthening and upgrading of vocational training" and "Consolidation of the implementation of curricula goals", in the case of Education.

Although the implementation of several of these reform measures may have implied some direct budgetary costs – which, in turn, would have implied additional sort-run macroeconomic effects -, we assume that they have been financed by reallocating public expenditure rather than by increasing it,[9] in order to isolate the structural effects of the reforms, which is the main focus of this exercise.

It should also be noted that although the macroeconomic model features the frictions and nominal rigidities that are now common in macroeconomics - thus allowing for a business-cycle-type analysis of the effects of the reform shocks -, the short-run results must be further interpreted in the light of the transitional dynamics triggered through the (more structural) R&D-driven transmission mechanism also featured in the model.

Table 1 summarises the **transmission mechanisms** from (groups of) reforms to the macroeconomy that will be explored in the next two subsections. The table singles out, for each implemented mechanism, the corresponding **reform, sector-efficiency** and **micro variables**, as well as the selected **shock variables/parameters** in the macro model**.** For an overview, Appendix C depicts the evolution of selected reform and sector-efficiency variables in Portugal compared with other European countries.

[9]However, as the budgetary rule adopted in the model indexes the level of total government expenditure to the level of GDP, total expenditure levels are allowed to change over time.

Table 1. Transmission mechanisms and translation into shocks in the macro model (summary)

		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)

Source: own elaboration.

4.1. Justice

4.1.1. Overall system efficiency

In this section, we simulate the impacts of the set of reform measures pertaining to the reform area "Overall system efficiency" (A1 in Table 1; see the details on the reform measures in Table B1 and on the reform variables in Table B3, Appendix B), by relying on the following transmission mechanisms in the model: (i) firms' entry cost; (ii) allocative efficiency; (iii) financing cost (interest rate spreads); and (iv) international technology linkages (FDI inflows).[10]

i) Firms' entry cost mechanism

We start by simulating the impact of the set of reform measures regarding the efficiency of the judicial system on several macroeconomic indicators through the estimated impact of the former on the firms' net entry rate.

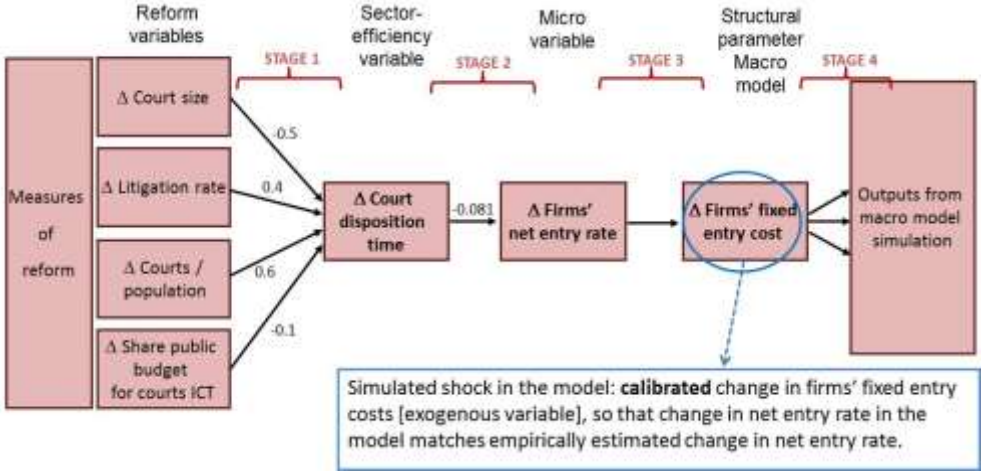
Well-functioning judiciaries guarantee security of property rights and contract enforcement that stimulates agents to enter into economic relationships, by reducing arbitrary behavior and transaction costs (OECD, 2013). We take, as reference, the estimated impact of the change in several reform variables (court size measured as judges per court, litigation rate, the number of courts over population, and the share of public budget for courts ICT) on the firms' net entry rate, as in European Commission (2014). The shock operates through the impact of reforms (assessed by changes in reform variables) on the fixed costs of intermediate-goods firms, so as to produce the estimated impact on the net entry rate. This relies on (i) assessing the estimated impacts on selected indicators of reform efficiency (sector-efficiency variables) – disposition time or backlog ratio – and ii) the impacts of the latter on the net entry rate, based on estimates from European Commission (2014, p. 48).

In the model, the firms' net entry rate is captured by the change in the number of intermediate goods (manufacturing) firms (ΔA in equation (22) in Roeger *et al.*, 2008).

Figure 2 depicts the selected transmission mechanism and the translation of the change in the reform variables into shocks in the macro model (Stages 1 to 4).

[10]The results pertaining to a larger set of macroeconomic variables and time periods are presented in Appendix D.

Figure 2. Efficiency of Justice: firms' entry cost transmission mechanism and translation into shocks in the macro model



Source: own elaboration.

Note: the numbers next to the arrows are estimated elasticities provided by European Commission (2014) and are the same as those reported in Table 2, in columns (b) and (d).

In this exercise, we assume changes in reform variables from 2010 to 2012-2015, depending on the latest year with available data. We use data from the Ministry of Justice of Portugal and from CEPEJ. Table 2 shows the details of the results pertaining to Stages 1 and 2 of Figure 1.

Table 2. STAGES 1 and 2: Changes in selected reform variables from 2010 to 2012-2015 – firms' entry cost mechanism

Reform variables	Reform variable before reform	Reform variable after reform	% change (a)	Disposition time elas-ticity (b)	**Estimated impact on disposition time (c)=(a)*(b)**	Semi-elasticity of net entry rate relative to disposition time (d)	**Estimated impact on firm net entry rate (p.p.) (c)*(d)**
(1) Judges/Court *(Min Justice data, 2010-2013, 1st instance, legal entities)*	4.140	4.217	1.848	-0.5	**-0.924**	-0.081	**0.075**
(2) Courts/population (x 1000) *(CEPEJ data, 2010-2012, all courts, geo-graphical location)*	0.032	0.030	-4.006	0.6	**-2.404**	-0.081	**0.195**
(3) Litigation rate *(Min Justice data, 2010-2015 "ações" and "execu-ções cíveis")*	4548.996	3908.684	-14.076	0.4	**-5.63**	-0.081	**0.456**
(4) Share of Public Budget for courts ICT (x 1000) *(CEPEJ 2010, avg Min Justice 2011-2014)*	0.12	0.12	0	-0.1	**0**	-0.081	**0**
Total							**0.726**

Source: own elaboration based on the estimated elasticities provided by the empirical literature (European Commission, 2014) and on the data from the Ministry of Justice (Portugal) and CEPEJ: (1) Ministry of Justice; (2) No. of courts (CEPEJ, 2014, Table 5.1, "All the courts", p. 112, and CEPEJ, 2012, Table 5.1, "All the courts", p. 98); Population (CEPEJ, 2014, Table 1.1, p. 12, and CEPEJ, 2012, Table 1.1, p. 12); (3) Ministry of Justice and INE; data for 2015 were collected from several issues of "Estatísticas trimestrais - ações e ações executivas cíveis e processos de falência" at http://www.siej.dgpj.mj.pt/; (4) Annual public budget allocated to computerization (CEPEJ, 2012, Table 2.9, p. 30); Total annual State public expenditure (CEPEJ, 2012, Table 1.1, p. 12); Ministry of Justice. (d) Elasticity is computed from the elasticities shown in European Commission (2014, Table V.4, p. 48), taking into account that [net entry rate = entry rate – exit rate] and, in turn, [exit rate = churn rate - entry rate].

Given the values reported for the reform variables, the overall impact on the net entry rate is positive and expected to be of 0.726 p.p.. This implies calibrating a change in firms' entry costs as to impact 0.00726 on the net entry rate in the model[11], which requires a change in firms' entry costs[12] of -0.026. Although this is broadly equivalent to the calibrated value for the firms' entry cost in the simulation of the QUEST model (see Varga *et al*., 2014), it yields the potential impact through this mechanism in the model. We will follow,

[11] ΔA in equation (22) of Roeger *et al.* (2008) (PT_DPAT in the dyn file, which contains the MatLab code for the European Commission's QUEST model; hereafter, we will refer to similar code names).
[12] See equation (13) of Roeger et al. (2008) (PT_FCA in the dyn file).

however, another benchmark mechanism (allocative efficiency mechanism) later in this section to simulate the impact of the same set of reform measures in the judicial system.

Table 3 depicts the results of the simulation exercise (Stage 4 of Figure 1) regarding five key macroeconomic variables (GDP, employment, real wages, public budget-to-GDP ratio and external balance-to-GDP ratio).

Table 3. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a change in fixed entry costs of - 0.026(*)

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP (p.p.)	0.042	0.019	0.014	0.013	0.013	0.008	-0.004	0.003
Employment	0.060	0.037	0.029	0.027	0.028	0.036	0.038	0.023
Real wages	0.143	0.152	0.164	0.176	0.188	0.236	0.293	0.356
GDP	-0.029	-0.024	-0.001	0.025	0.049	0.135	0.214	0.268
External balance/GDP (p.p.)	-0.003	0.007	0.011	0.011	0.009	0.001	-0.003	0.002

Source: own elaboration.

Note: 500-period simulation for convergence. (*) Calibrated change in firms fixed entry costs so that a change in firm net entry rate in the model matches the empirically estimated change in firm net entry rate (0.726 p.p.).

The reduction in fixed entry costs first impacts the intermediate-good sector (representing the manufacturing sector in the model), as it lowers the present discounted value of profits at which firms break even and thus increases entry of new firms. The ensuing increased demand for patents raises the demand for high skilled workers in the R&D activities, which target the creation of new varieties of intermediate goods. Thus, employment increases by a relatively large amount in the R&D sector. Since resources are diverted from the production sector, aggregate output falls (although only slightly) below the pre-shock steady-state level in the first two years of the simulation. After that period, aggregate output gradually increases above the previous steady state reflecting the total productivity gains induced by the expanded R&D activities. Aggregate output reaches 0.27% above the pre-shock steady-state level after 50 years, while real wages are increased by 0.36%. Aggregate employment increases only slightly, by 0.023%.

Exports also fall in the first two years, reflecting the decrease in aggregate output. However, even larger reductions in imports and the recovery of exports after the second year, reflecting the impact of productivity gains, improve the current account balance. After 50 years, the ratio of the current account to GDP is similar to the initial steady-state level.

The public budget balance ratio to GDP also increases, but only over the short-run and by a small amount, reflecting the feedback budget rules assumed in this exercise, which link the dynamics of the public budget and the ratio of public debt to GDP in order to stabilise the latter in the long run (see equation (33) in Roeger *et al.*, 2008).

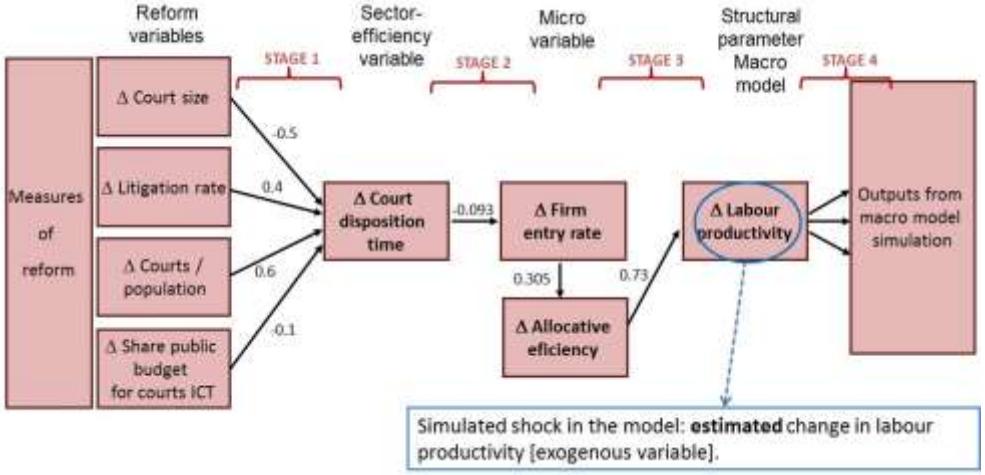
ii) Allocative efficiency mechanism

Another approach is to simulate the macroeconomic impacts of the above reform measures in the judicial system through the estimated impact of the latter on allocative efficiency and, thereby, on labour productivity.

The European Commission (2013) estimates the relationship between the entry rate of new firms and allocative efficiency and between the latter and labour productivity. This then allows us to translate changes in the reform variables in Table 2 into labour productivity shocks, through the changes in the entry rate of new firms and the changes in allocative efficiency (see Figure 3 and Table 4).

In the model, the labour productivity shock can be introduced by changing the exogenous variable corresponding to labour productivity in the final-good aggregate production function (A^{exog} ; see equation (13) in Roeger *et al.*, 2008).

Figure 3. Efficiency of Justice: allocative efficiency transmission mechanism and translation into shocks in the macro model



Source: own elaboration.

Note: the numbers next to the arrows are estimated elasticities provided by European Commission (2013, 2014) and are the same as those reported in Table 2, in columns (b) and (d), and in Table 4, in columns (b) and (d).

We again use data from the Ministry of Justice (Portugal) and CEPEJ and assume changes in reform variables from 2010 to 2012-2015, depending on the latest year with available data. Table 4 shows the details of the results pertaining to Stages 1 to 2 of Figure 3.

Table 4. STAGES 1 to 3: Changes in selected reform variables from 2010 to 2012-2015 – allocative efficiency mechanism

Reform variables	% change	**Estimated impact on firm entry rate (pp)**	Semi-elasticity of allocative efficiency relative to entry rate	**Changes in allocative efficiency (%)**	Elasticity of labour productivity relative to allocative efficiency	**Estimated impacts on labour productivity (%)**
		(a)	(b)	**(c)=(a)*(b)**	(d)	**(c)*(d)**
(1) Judges/Court (Min Justice data, 2010-2013, 1st instance, legal entities)	1.848	0.086	0.305	**0.026**	0.73	**0.019**
(2) Courts/population (x 1000) *(CEPEJ data, 2010-2012, all courts, geographical location)*	-4.006	0.224	0.305	**0.068**	0.73	**0.050**
(3) Litigation rate (Min Justice data, 2010-2015, "ações" and "execuções cíveis")	-14.076	0.524	0.305	**0.160**	0.73	**0.117**
(4) Share of Public Budget for courts ICT (x 1000) *(CEPEJ 2010, avg Min Justice 2011-2014)*	0	0	0.305	**0**	0.73	**0**
Total						**0.185**

Source: own elaboration based on data from Ministry of Justice (Portugal) and CEPEJ (see notes to Table 2) and the estimated elasticities provided by the empirical literature (European Commission, 2013, 2014).

As can be seen from Table 4, given the values reported for the reform variables, the overall impact on labour productivity is estimated to be of about 0.185%. Table 5 depicts the results of the simulation exercise (Stage 4 of Figure 3).

Table 5. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a change in labour productivity in the final-good aggregate production function of 0.185%

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP (p.p.)	-0.028	0.011	0.021	0.022	0.019	0.005	-0.005	0.002
Employment	-0.070	-0.030	-0.011	-0.004	-0.002	0.002	0.001	-0.009
Real wages	0.120	0.171	0.198	0.212	0.219	0.238	0.268	0.308
GDP	0.147	0.202	0.223	0.233	0.239	0.264	0.295	0.326
External balance/GDP (p.p.)	0.040	0.017	0.005	0.000	-0.002	-0.004	-0.003	0.001

Source: own elaboration.

Note: 500-period simulation for convergence.

The increase in the level of labour productivity through the allocative-efficiency channel impacts directly the efficiency of the final-good sector, with a short-run positive effect on aggregate output and real wages. At the same time, this shock increases the demand for intermediate goods and, thereby, stimulates entry of firms in this sector. The ensuing rising demand for patents increases the demand for high skilled R&D workers and amplifies the positive impact on aggregate output. Aggregate output reaches 0.33% above the pre-shock steady-state level after 50 years, while real wages are increased by 0.31%.

In contrast, aggregate employment starts by decreasing reflecting the fall in employment in the production sector, as the labour productivity shock raises firms' production capacity but short-run price rigidities prevent demand from increasing proportionally. However, in the medium run there is a recovery of employment reflecting the adjustment of relative prices and the continuous increase in aggregate output. Aggregate employment is almost unchanged vis-à-vis the pre-shock steady-state after 50 years.

Exports increase throughout time, reflecting the impact of productivity gains and increased aggregate output. This effect, combined with the (slight) decrease in imports, leads to a positive effect on the current account. After 50 years, the current account-to-GDP ratio is close to the initial steady-state level.

The public budget balance displays a small improvement in the medium run but stays barely unchanged after 50 years, again reflecting the assumed feedback budget rules.

iii) Financing cost mechanism (interest rate spreads)

An important dimension of an efficient judicial system is the strength of contract enforcement / property rights protection, which, in turn, is a key determinant of the firms' financing costs premia and thus of investment.

In the model, the cost of borrowing can be mimicked by the exogenous variable corresponding to the risk premium on tangible capital (*rpK*) or the parameter referring to the risk premium on intangible capital (*rpA*) (see equation (1) in Roeger *et al.*, 2008). Risk premium on intangible capital is taken to be larger than that on physical capital because, on the one hand, in case of project failure, the second has always a market resale value that is used as collateral and, on the other hand, new entrants (modelled by firms that only produce intangibles) usually face higher business risks and have no market track records when compared to established firms (Roeger *et al.*, 2008). Shocks decreasing risk premia reduce the borrowing costs and increase optimal capital of both already established firms (tangible capital) and of new firms that introduce new products (intangible capital). Thus we can identify the impacts of better property rights protection on the interest rate spread through a reduction in such capital costs.

We rely on several pieces of literature (see Box 1) to calibrate this exercise.

Box 1. Impact of reforms in Justice on the strength of property rights protection

In the literature, the privileged variable to account for the efficiency and enforcement practices of property rights by the judiciary (and other legal institutions) is the rule of law in the country as measured by an index relying on data from the International Country Risk Guide (ICRG), produced by the country-risk rating agency Political Risk Services Group. Laeven and Majnoni (2005) and Bae and Goyal (2009) use such index from La Porta *et al.* (1998) (see Table IV, p. 44, line "Rule of Law" in Bae and Goyal, 2009, and Tables 4, 6 and 7 in Laeven and Majnoni, 2005), scale 0-6. An additional variable, also used in both studies, is the Index of Economic Freedom from the Heritage Foundation (see Table VI, p. 44, line "Property Rights" in Bae and Goyal, 2009, and Tables 3, 5 and 7 in Laeven and Majnoni, 2005), scale 1-5. Bae

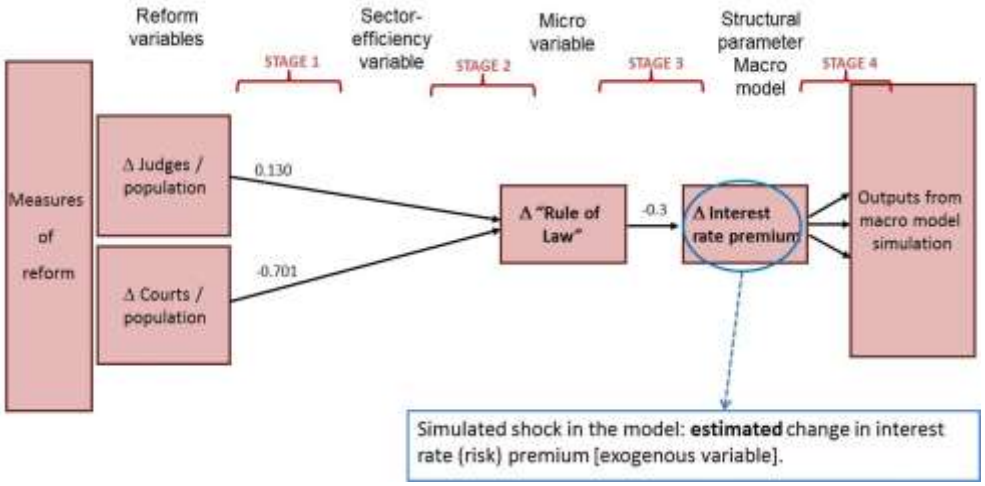
and Goyal (2009) also use the Rule of Law index by the ICRG, scale 0-10. These studies assess the impact of changes in the "rule of law" on interest rate spreads.

To the best of our knowledge, there are not, however, empirical studies relating traditional judicial reform variables with these specific "rule of law" indicators. The study by Cross and Donelson (2010) investigates how, in practice, judicial changes can be implemented to increase the quality of the legal framework as measure, among others, by the "rule of law" indicators. Using data from CEPEJ, they assess how different judicial resources, based on measures of judicial salary, overall judicial budget, number of courts, and number of judges, affect the legal quality of a country. The rule-of-law indicator is that included in the computation of Worldwide Governance Indicator of the World Bank, ranging from -2.5 (week legal environment) up to 2.5 (strong legal environment). They conclude that, for instance, a decrease in the number of courts of general jurisdiction per 100,000 inhabitants, and an increase in the number of professional judges per 100,000 inhabitants, have statistically significant positive impact on the rule of law. These results rely on a panel of 29 European countries.

Our proposed methodology is to link, in a first step, the reform measures to the alternative "rule of law" indicators and, in a second step, the "rule of law" to the interest rate spread. Since the "rule of law" in Cross and Donelson (2010) is taken from the World Bank, we take the average value of the corresponding sample (0.72, p. 500) and make a proportional correspondence to the different "rule of law" measures used in second step studies. Coefficients on reform variables were then transformed as to deliver equivalent effects on (average) alternative "rule of law" measures.

Figure 4 depicts the selected transmission mechanism and the translation of the change in the reform variables into shocks in the macro model (Stages 1 to 4).

Figure 4. Efficiency of Justice: financing cost transmission mechanism and translation into shocks in the macro model



Source: own elaboration.

Note: the numbers above the arrows are estimated coefficients provided by the empirical literature (Cross and Donelson, 2010 – stage 1 coefficients; Laeven and Majnoni, 2005 and Bae and Goyal, 2009, for stage 3 coefficient). The coefficients in Stage 1 are used to compute the values in the 7th column of Table 6a. The coefficient in Stage 3 is reported in Table 6b, in the 4th column.

We assume changes in reform variables from 2010 to 2012-2013, depending on the latest year with available data. We use data from the Ministry of Justice of Portugal, INE (Portugal), and CEPEJ. Tables 6a and 6b give the details on the results pertaining to Stages 1 to 3 of Figure 4, using alternative estimates from the empirical literature.

Table 6a. STAGE 1: Changes in selected reform variables from 2010 to 2012-2013 – financing cost mechanism

Reform variables	Reform variable before reform	Reform variable after reform	Change	Estimated Impact on ROL (ICRG)	Estimated Impact on ROL (LLSV)	Estimated Impact on Economic Freedom
(1) Courts/population*100 000 (*CEPEJ data, 2010-2012*)	3.159	3.032	-0.127	0.160	0.096	0.089
(2) Judges/population*100 000 (*Min Justice data, 2010-2013*)	16.808	17.226	0.417	0.098	0.059	0.054

Table 6b. STAGES 2 and 3: Changes in selected reform variables from 2010 to 2012-2013 – financing cost mechanism

Reform variables	Change in spread (pp) from unit change in ROL (ICRG)	Change in spread (pp) from unit change in ROL (LLSV)	Change in spread (pp) from unit change in Economic Freedom	Estimated Impact on spread (ICRG), p.p.	Estimated Impact on spread (LLSV), p.p.	Estimated Impact on spread (Economic Freedom), p.p.
(1) Courts/population *100 000 (*CEPEJ data, 2010-2012*)	-8.7	-17.9	-0.3	-1.393	-1.720	-0.02
(2) Judges/population*100 000 (*Min Justice data, 2010-2013*)	-8.7	-17.9	-0.3	-0.850	-1.049	-0.016
Total				**-2.243**	**-2.769**	**-0.043**

Source: own elaboration based on the estimated coefficients provided by the empirical literature (Cross and Donelson, 2010; Laeven and Majnoni, 2005; Bae and Goyal, 2009) and on the data from Ministry of Justice, INE (Portugal) and CEPEJ: (1) Gross salary 1st instance professional judge (CEPEJ, 2014, Table 11.4.1, p. 301, and CEPEJ, 2012, Table 11.4.1, p. 262); (2) No. of courts (CEPEJ, 2014, Table 5.1, "All the courts", p. 112, and CEPEJ, 2012, Table 5.1, "All the courts", p. 98); Population (CEPEJ, 2014, Table 1.1, p. 12, and CEPEJ, 2012, Table 1.1, p. 12).

The impact of reform measures on the interest rate spread is estimated to be bounded between -2.77 and -0.043 p.p.. We selected the less ambitious scenario, as argued by Roeger *et al.* (2008) referring to Hardouvelis *et al.* (2004) that, from the 1990s onwards, risk premium already fell by 1.5 p.p.. Moreover, according to London Economics (2002), financial market integration in the European Union could reduce capital costs by about 0.5 p.p.. Thus, a more effective justice system is not expected to entail large changes in spreads.

For this simulation, we apply a shock on the risk premia on intangible capital (*rpA*; equation (1) in Roeger *et al*., 2008) of -0.043 p.p.. The initial value for this risk premia is calibrated to 3.286%. Table 7a summarises the results of the simulation exercise (Stage 4 of Figure 4).

Table 7a. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a change in the risk premia on intangible capital of -0.043 p.p.

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP (p.p.)	0.000	-0.004	-0.004	-0.004	-0.003	0.000	0.002	0.000
Employment	0.011	0.005	0.003	0.001	0.001	-0.001	-0.002	-0.001
Real wages	0.026	0.028	0.030	0.033	0.035	0.044	0.053	0.062
GDP	-0.005	-0.005	-0.002	0.002	0.006	0.018	0.030	0.041
External balance/GDP (p.p.)	-0.002	0.000	0.001	0.001	0.001	0.001	0.000	0.000

Source: own elaboration.

Note: 500-period simulation for convergence.

The reduction in the risk premia on intangible capital (the technological knowledge stock built up through R&D activities) amounts to improving access to credit for potential entrants in the market (start-ups). This lowers the threshold at which projects break even by increasing the respective present discounted value of profits and thereby stimulates entry of new firms and the introduction of new products.

Overall, the effects of this shock are qualitatively similar to those arising from a reduction in fixed entry costs in the intermediate-good sector. The magnitudes of the effects are much smaller, however, also reflecting the distinct size of the shock. After 50 years, the level of aggregate output is increased by 0.04% and of real wages by 0.06%, while no noticeable effect is expected on employment (it is barely unchanged in the long run, after some small increase in the short run).

Exports slightly increase throughout time, reflecting the impact of productivity gains and increased aggregate output. After 50 years, however, the current account-to-GDP ratio is at the initial steady-state level.

This shock could also be implemented on the risk premia on tangible capital (*rpK*; equation (1) in Roeger *et al*., 2008). Risk premia on tangible capital is calibrated at 0.927% and, as in the case of *rpA*, we shock it by -0.043 p.p. Results are shown in Table 7b below.

Table 7b. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a change in the risk premia on tangible capital of -0.043 p.p.

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP (p.p.)	-0.038	-0.019	-0.007	-0.003	-0.001	0.009	0.018	0.009
Employment	0.045	0.099	0.125	0.132	0.130	0.111	0.085	0.053
Real wages	-0.027	0.011	0.068	0.127	0.186	0.451	0.839	1.334
GDP	0.051	0.150	0.231	0.299	0.361	0.634	1.026	1.527
External balance/GDP (p.p.)	0.015	-0.015	-0.036	-0.045	-0.046	-0.032	-0.010	0.015

Source: own elaboration.

Note: 500-period simulation for convergence.

The reduction in the risk premia on tangible capital entails larger effects than those accruing in the case of intangible capital. As a first effect, the reduction in physical capital costs induces higher demand for physical capital and increases investment by a significant amount. This, in turn, stimulates market entry in the intermediate-good sector, patent creation and the demand for high skilled workers in the R&D sector. However, since higher physical capital also increases labour productivity in production activities, total employment increases (although by a small amount) in both the R&D sector and the production sector.

Over time, aggregate output and real wages gradually increase above the pre-shock steady state level reflecting the higher physical capital stock and, as a smaller effect, the productivity gains from R&D activities. After 50 years, the level of aggregate output is increased by 1.53% and of real wages by 1.33%. Aggregate employment increases only slightly (0.05% above the previous steady state).

Exports increase throughout time, reflecting the impact of productivity gains and increased aggregate output, while imports remain roughly unchanged. After 50 years, the current account-to-GDP ratio rises by about 0.015 p.p. above the initial steady-state level.

iv) International technology linkages mechanism (FDI inflows)

The efficiency of the judicial system is often singled out as a determinant of foreign investment. This can be a mechanism worth analyzing on its own, as long as FDI brings about specific benefits in addition to domestic investment.

European Commission (2014) finds a negative relationship between the backlog ratio and the net FDI inflows as a percentage of GDP. They also provide elasticities of this sector-efficiency reform variable to several justice reform variables (*e.g.*, average number of judges or the litigation rate). In turn, FDI is expected to induce macroeconomic impacts (see Box 2).

Box 2. Macroeconomic impact of FDI

FDI is expected to have positive macroeconomic impacts through two main channels: capital accumulation (*e.g.*, Alguacil *et al.* 2008, Bosworth and Collins, 1999) or international technology spillovers, amplifying the existing level of knowledge through labor training, skill acquisition, and the introduction of alternative management practices and technologies (see Blomström and Kokko, 1998). However, empirical evidence is rather mixed on the effects of FDI on growth: some studies find a positive relation but depending on the destiny country-specific situation (*e.g.*, Borensztein *et al.*, 1998, Alfaro *et al.*, 2009), on the FDI inflows origin country and on the type of FDI (*e.g.*, Driffield and Love, 2007). Some other studies, and, in particular, under some model specifications, find no statistically significant relationship.

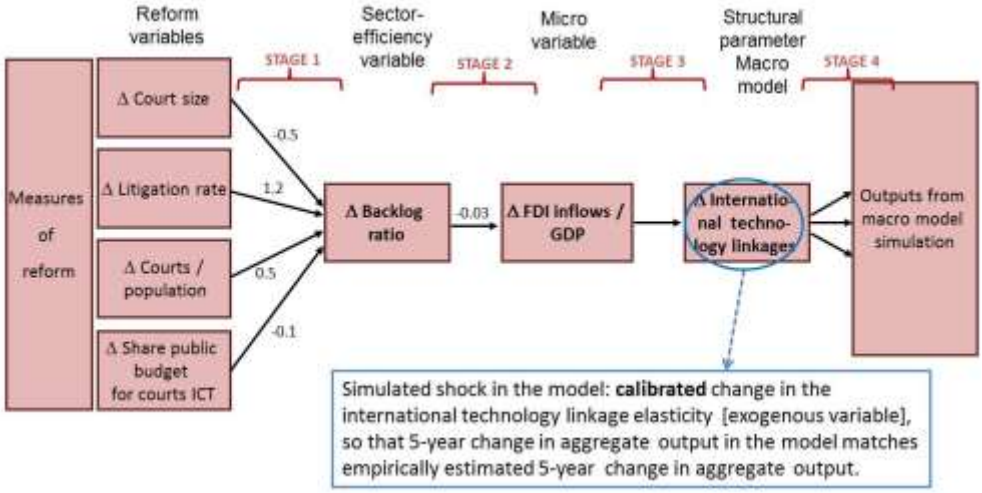
Using a sample of developing countries and data from 1976-2005 (5-year period per time observation), Alguacil *et al.* (2011) find mixed evidence on the effects of FDI on GDP *per capita* growth: a 1 p.p. change in FDI/GDP is estimated to produce impacts on 5-year average growth of GDP *per capita*, either non-significant or positive (in the positive case, with a lower-bound of 0.3 p.p. and an upper-bound of 0.44 p.p).

In the context of the macro model, the international technology spillovers shock can be introduced by impacting the elasticity of the international stock of knowledge in the R&D production function, since this elasticity captures the spillover effects from that stock of knowledge to domestic R&D activities, i.e., the international technology linkages (parameter ϖ, equation (22) of Roeger *et al.*, 2008). We link FDI to that shock by calibrating this elasticity such that the resulting 5-year average growth matches the one from the empirical estimations of Alguacil *et al.* (2011) described in the above Box.

Figure 5 depicts the selected transmission mechanism and the translation of the change in the reform variables into shocks in the macro model (Stages 1 to 4).

As before, we took data from the Ministry of Justice of Portugal and CEPEJ and assume changes in reform variables from 2010 to 2012-2015, depending on the latest year with available data. Tables 8a and 8b show the details of the results pertaining to Stages 1 to 3 of Figure 5.

Figure 5. Efficiency of Justice: international technology linkages transmission mechanism and translation into shocks in the macro model



Source: own elaboration.

Note: the numbers next to the arrows are estimated elasticities provided by European Commission (2014) and are also reported in Table 8a, column (b), and in Table 8b, column (b).

Table 8a. STAGE 1: Changes in selected reform variables from 2010 to 2012-2015 – international technology linkages mechanism

Reform variables	Reform variable before reform	Reform variable after reform	% change (a)	Backlog ratio elasticity (b)	**Estimated impact on backlog ratio (c)=(a)*(b)**
(1) Judges/Court *(Min Justice data, 2010-2013, 1st instance, legal entities)*	4.140	4.217	1.848	-0.5	**-0.924**
(2) Courts/population (x 1000) *(CEPEJ data, 2010-2012, all courts, geographical location)*	0.032	0.030	-4.006	0.5	**-2.00**
(3) Litigation rate *(Min Justice data, 2010-2015, "ações" and "execuções cíveis")*	4548.996	3908.684	-14.076	1.2	**-16.891**
(4) Share of Public Budget for courts ICT (x 1000) *(CEPEJ 2010, avg Min Justice 2012-2014)*	0.12	0.12	0	-0.1	**0**
Total					**-19.818**

Source: own elaboration based on data from Ministry of Justice (Portugal) and CEPEJ (see notes to Table 2). (b) European Commission (2014), Table V.3, p. 48.

Table 8b. STAGES 2 and 3: Changes in selected reform variables from 2010 to 2012-2015 – international technology linkages mechanism

Reform variables	Estimated change in Backlog ratio (a)	Estimated change in Net FDI inflows/GDP per 100 cases change in backlog (p.p) (b)	Estimated change in Net FDI/GDP (p.p) (c)=(a)*(b)	Lower-bound positive estimated impact on 5-year average growth rate per 1 p.p in FDI/GDP (p.p) (d)	Estimated impact on 5-year average growth rate (%) (c)*(d)
(1)+(2)+(3)+(4) (as described in Table 8a)	-682.17	-0.03	0.205	0.3	0.061

Source: own elaboration based on the estimated elasticities of FDI to backlog ratio (b) and output growth to FDI (d) provided by the empirical literature (European Commission, 2014, Table V.4, p. 48, and Alguacil et al., 2011, Table 1, p. 489, respectively). (a) Estimated change based on pre-reform backlog ratio 2010 (European Commission, 2014, Table V.5, p. 48) and on the estimated growth rate (Table 8a, column (c) - Total): 3442.1*(-0.19818) = - 682.17.

Using the lower-bound (positive) estimates from Aguacil *et al.* (2011), the expected impact on output growth is 0.061% as a 5-year average. In order to capture the impact on FDI in the model, we calibrate the elasticity that measures the spillover effects from the international stock of knowledge (*i.e.*, the international technology linkages elasticity,[13] such that the resulting 5-year growth effect matches 0.3%, *i.e.,* 0.061% average *per* year. This requires increasing the elasticity from 0.6509 to 0.668. Table 9 summarises the results of the simulation exercise (Stage 4 of Figure 5).

Table 9. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a change in the international technology linkages elasticity of 0.0171(*)

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP (p.p.)	0.016	0.001	0.004	0.009	0.014	0.018	0.004	0.006
Employment	0.040	0.008	-0.002	-0.004	-0.003	0.000	-0.003	-0.026
Real wages	0.185	0.231	0.275	0.317	0.354	0.494	0.650	0.824
GDP	0.025	0.088	0.164	0.234	0.297	0.515	0.718	0.887
External balance/GDP (p.p.)	0.011	0.024	0.026	0.023	0.018	0.001	-0.005	0.003

Source: own elaboration.

Note: 500-period simulation for convergence. (*) Calibrated change in the international technology linkage elasticity so that a 5-year change in aggregate output in the model matches the empirically estimated 5-year change in aggregate output (0.3%).

The increase in the international technology spillovers elasticity amounts to improving the productivity of (domestic) R&D activities. Similar to the case of a downward shock on the risk premia on intangible capital (financing cost transmission mechanism), this implies a lower threshold at which projects break even by increasing the respective present discounted value of profits and thereby stimulates entry of new firms and the introduction of new products.

Overall, the effects of this shock are also qualitatively similar to those arising from a reduction in fixed entry costs in the intermediate-good sector. The magnitudes of the effects are only somewhat smaller, mainly reflecting the distinct size of the shocks. After 50 years, the level of output is increased by about 0.89% and of real wages by 0.82% vis-à-vis the pre-shock steady state level, while the reallocation of labour between the production sector and the R&D sector over time ends up implying almost no change in aggregate employment.

However, differently from the transmission mechanisms explored above, in this case there is also a permanent growth effect, since the reform shock impinges on the structure of the R&D production function. This effect amounts to an increase of 0.029 p.p. in the long-run growth rate of GDP.[14]

4.1.2. Insolvency regime

In this section, we compute the impacts of the set of reform measures pertaining to the reform area "Insolvency regime" (A2 in Table 1; see the details on the reform measures in Table B1 and on the reform variables in Table B3, Appendix B), by relying on the following transmission mechanisms in the model: (i) incentives to entrepreneurship/self-employment and (ii) relaxation of liquidity constraints.

[13] Parameter ϖ, equation (22) of Roeger *et al*, (2008) (PT_PSI in the dyn file).
[14] From equation (22) in Roeger *et al.* (2008), we have $(1+gA) = [(1+gA^*)^{PSI} \cdot (1+gLRD)^{lambda}]^{1/(1-PHI)}$. Steady state *gA* moves from 1.15% to 1.179% when *PSI* changes from 0.6509 to 0.668.

i) Entrepreneurship/self-employment mechanism

Box 3 provides a summary of a study that addresses the impacts of improvements in the pre-insolvency framework on entrepreneurship. We rely on it in order to calibrate the shock in our exercise.

Box 3. Impact of improvements in the pre-insolvency framework on self-employment

Carpus Carcea *et al.* (2015) focus on the pre-insolvency framework, as a crucial component of the insolvency regime. They propose composite indices to analyse the efficiency of national pre-insolvency frameworks alongside four dimensions: "Easiness/availability" (availability of early restructuring possibilities, the conditions for initiating the procedure, and the existence of alternative preventive procedures); "Facilitations to continuation of operations" (absence of short-term constraints on operations during a pre-insolvency procedure, such as the debtor remaining in possession of the assets and the possibility of stay of enforcement actions by individual creditors); "Direct and indirect costs" (financing flexibility or administrative as well as reputational costs) and "Debt restructuring" (increasing the probability of debt restructuring to sustainable levels).

Considering self-employment rate as a good proxy for entrepreneurship (following, among others, Armour and Cumming, 2008), Carpus Carcea *et al.* (2015) test the hypothesis that more efficient pre-insolvency frameworks tend to stimulate entrepreneurship. They regress the (log) self-employment rate along the four relevant dimension indices as well as the overall efficiency measure for insolvency procedures, using panel annual data covering 2003 to 2010 and 24 EU countries.

According to the results presented in Carpus Carcea *et al.* (2015, Table 1), a one p.p. change in the overall efficiency of the national rescue and recovery systems will statistically significantly increase the self-employment rate by 0.747% (see Table 10, below).

Table 10. Pre- and post-reform indices by dimension and overall efficiency of pre-insolvency framework in Portugal

	Easiness / availability	Facilitations to continuation of operations	Direct and indirect costs	Debt restruc-turing	Overall efficiency
Pre-reform, 2010	0.15	0.21	0.24	0.14	0.74
Post-reform, 2012	0.23	0.21	0.24	0.14	0.82
Semi-elasticity of self-employment rate	0.411	3.148***	1.592*	-1.625	0.747*

Source: Carpus Carcea *et al.* (2015) – indices, p. 10; semi-elasticities, p. 13. Note: *10%, **5% and ***1% significance levels.

Portugal has evolved positively mainly on the "Easiness/availability" dimension (see Carpus Carcea *et al.*, 2015; p. 10). Although this dimension is, by itself, not statistically significant, it contributes positively to the index of framework's overall efficiency index, on which we rely to draw the semi-elasticity of self- employment rate.

The self-employment rate (over employment) in Portugal was 21.5% in 2011.[15] For the following simulation, we make two assumptions:

i) First, an increase in the self-employment rate fully reflects on the total employment rate. The underlying assumption is that a better pre-insolvency framework would increase employed labor force that, otherwise, would be either unemployed or out of the labor force.

ii) Second, the increase in the employment rate is produced across all skill types (L, M and H).

We also rely on Carpus Carcea *et al*.'s (2015) statement that most of the changes in the index for Portugal operated in 2012.

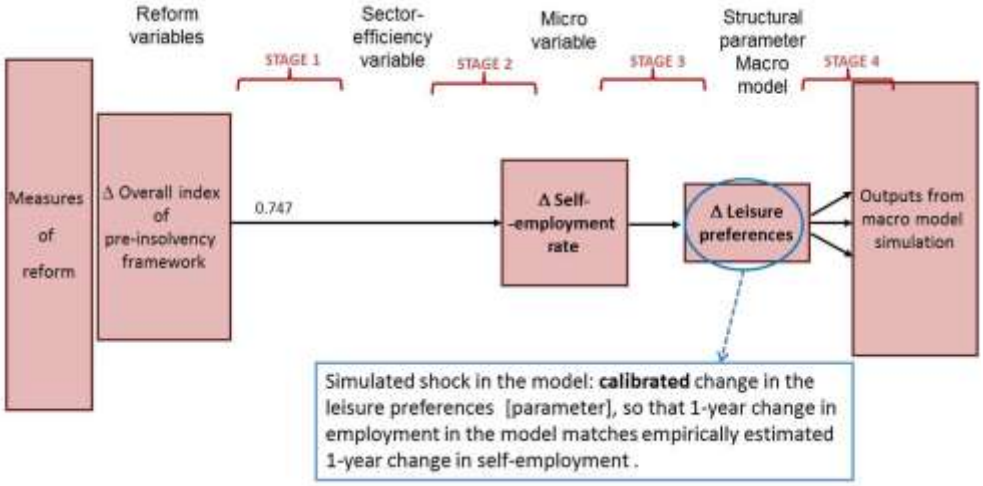
In the context of the macro model, by considering that the individuals perceive a more efficient pre-insolvency framework as a regime change in the economy that incentivizes labour supply, we mimic the employment effects on the three skill types through producing a downward shock on leisure[16] by 0.14, as to achieve an increase in aggregate employment of 1.3% (0.009 units) in the year of the shock (see Table 11, below).

Figure 6 depicts the selected transmission mechanism and the translation of the change in the reform variables into shocks in the macro model (Stages 1 to 4). Table 11 shows the details of the results corresponding to Stages 1 and 2 of Figure 6, while Table 12 depicts the results of the simulation exercise (Stage 4 of Figure 6).

Figure 6. Insolvency regime: entrepreneurship transmission mechanism and translation into shocks in the

[15] The data is from the World Bank database, at http://data.worldbank.org/indicator/SL.EMP.SELF.ZS.
[16] See equation (2b) in Roeger *et al.* (2008) (PT_EPS_LL, PT_EPS_LM, and PT_EPS_LH in the dyn file).

macro model



Source: own elaboration.

Note: the numbers next to the arrows are estimated elasticities provided by Carpus Carcea et al. (2015) and are also reported in Table 11, column (b).

Table 11. STAGES 1 and 2: Changes in selected reform variables from 2010 to 2012 – entrepreneurship/self-employment mechanism

Reform Variables				Self-employment rate semi-elasticity	Estimated impact on self-employment rate (%)	Estimated self-employment rate
Description	Value before reform (2010)	Value after reform (2012)	Change in p.p. (a)	(b)	(c)=(a)*(b)	
Overall index of pre-insolvency framework (Carpus Carcea *et al.*, 2015)	0.74	0.82	8	0.747	6%	21.5% *1.06 = 22.8% (1.3 pp change)

Source: own elaboration based on data from Carpus Carcea et al. (2015).

Table 12. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a change in the leisure preferences of -0.14 (*)

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP (p.p.)	0.165	0.602	0.822	0.861	0.802	0.285	-0.221	0.067
Employment	1.327	2.484	3.197	3.577	3.771	4.109	4.234	3.890
Real wages	-2.002	-2.189	-1.977	-1.770	-1.633	-1.365	-0.953	-0.330
GDP	0.797	1.685	2.254	2.586	2.795	3.418	4.057	4.346
External balance/GDP (p.p.)	0.448	0.405	0.260	0.145	0.070	-0.068	-0.099	0.029

Source: own elaboration.

Note: 500-period simulation for convergence. (*) Calibrated change leisure preferences so that a 1-year change in aggregate employment in the model matches the empirically estimated 1-year change in self-employment (1.3%).

The shock in the labour supply across all types of skills increases aggregate employment and output. This short-run effect is then amplified over the medium and long run reflecting the endogenous adjustment of R&D activities. The decrease in real wages induced by the relative abundance of labour (which also affects the high-skilled labour) lowers the present discounted value of profits at which intermediate-good firms break even through a patent-price effect. This increases entry of new firms and, thus, the demand for patents and for high skilled workers in the R&D activities targeting the creation of new varieties of intermediate goods. Total productivity gains, induced by the expanded R&D activities, then further increase aggregate output and employment, while real wages recover towards the pre-shock level. Aggregate output and employment rise, respectively, 4.35% and 3.89% above the pre-shock steady-state level after 50 years, while real wages remain at 0.33% below the pre-shock steady-state.

Exports also increase throughout the adjustment, reflecting the increase in aggregate output and total productivity gains, whereas imports first decrease and then gradually recover towards their pre-shock level. After 50 years, the ratio of the current account to GDP is increased by 0.029 p.p. vis-à-vis the initial steady-state level.

The ratio of the public budget balance to GDP also increases significantly in the short and medium run, rising 0.8 p.p. above the pre-shock steady-state level after 5 years. However, the change in this ratio turns out to be very small in the long run, reflecting the feedback budget rules assumed in this exercise, which link the dynamics of the public budget to the stabilisation of the ratio of public debt to GDP over the long run.

ii) Liquidity constraint mechanism

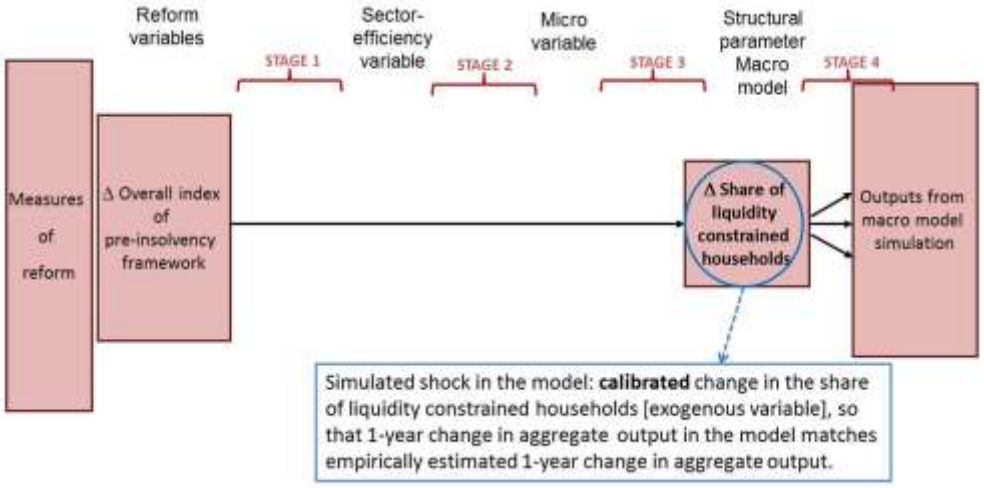
We now turn to the second mechanism elected to assess the impacts of efficiency in pre-insolvency frameworks, relying on the impact of deleveraging on overall economic activity.

In the context of the macro model, we let the leverage mechanism operate through the share of liquidity constrained households[17], in the sense that credibly increasing the efficiency of rescue and recovery frameworks reduces deleveraging costs which, in turn, can be perceived as a regime change, thereby structurally relaxing liquidity constraints. Thus, we propose to mimic this relaxation through a smaller share of the liquidity constrained households.

To assess whether early restructuring possibilities recently affected the macroeconomic outcomes of corporate deleveraging, Carpus Carcea *et al.* (2015) regress GDP growth on previous year's GDP growth and on the change in the stock of outstanding corporate debt divided by the stock of previous periods' total financial assets, for a panel of EU countries and for the period comprised between 2007-2012. Considering their results[18], a reduction in 1 p.p. in the ratio of corporate debt to financial assets will negatively impact by 0.379 p.p. the real GDP *per capita* growth rate of the following year. Moreover, if the country engages in reforms to improve overall efficiency in pre-insolvency frameworks as to move from the middle to the upper tercile of the EU28, this will produce net average impacts of 0.147 p.p. on the real GDP *per capita* growth rate of the following year, per percentage point reduction in the leverage ratio. Portugal is placed on the 3rd tercile according to data in Carpus Carcea *et al.* (2015; p. 8). But the move from the 2nd to the 3rd tercile is estimated to have increased output growth by 0.147 p.p. in the current year. We thus shock the share of liquidity constrained households in such a way as to produce an impact of 0.00147 in the first year in aggregate output and then assess the short and long-run adjustments produced on the macroeconomic variables. The shock on the share of liquidity constrained households is required to be of -0.105.

Figure 7 illustrates the selected transmission mechanism and the translation of the change in the reform variable into a shock in the macro model (Stages 1 to 4). Table 13 summarises the results of the simulation exercise.

Figure 7. Insolvency regime: liquidity constraint transmission mechanism and translation into shocks in the macro model



Source: own elaboration.

Table 13. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a change in the share of liquidity constrained households of -0.105 (*)

[17] See equation (10) in Roeger *et al.* (2008) (PT_SLC in the dyn file).
[18] See Table 3.5, rows 2-4, in Carpus Carcea *et al.* (2015).

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP (p.p.)	2.511	2.157	1.941	1.713	1.468	0.327	-0.620	0.131
Employment	0.251	0.346	0.626	0.909	1.156	1.949	2.167	1.435
Real wages	-0.205	-0.285	-0.369	-0.431	-0.483	-0.618	-0.365	0.103
GDP	0.150	0.204	0.456	0.698	0.912	1.703	2.254	1.874
External balance/GDP (p.p.)	0.036	0.275	0.247	0.178	0.114	-0.090	-0.143	0.044

Source: own elaboration.

Note: 500-period simulation for convergence. (*) Calibrated change the share of liquidity constrained households so that a 1-year change in aggregate output in the model matches the empirically estimated 1-year change in aggregate output (0.00147).

In the model, liquidity constrained households consume their disposable income each period and offer labour inelastically. A reduction in the share of this type of households in the economy produces overall qualitatively similar effects to those arising from a downward shock on leisure preferences by increasing the labour supply and, thereby, increasing aggregate employment and output. The decrease in real wages induced by the relative abundance of labour induces an endogenous adjustment of R&D activities through a favourable patent-price effect, which then amplifies the impact on employment and output in the medium and long run. Aggregate output and employment rise, respectively, 1.87% and 1.44% above the pre-shock steady-state level after 50 years, while real wages are only slightly increased (by 0.1%).

Exports build up over time, reflecting the increase in aggregate output and total productivity gains, whereas imports first decrease and then gradually recover towards their pre-shock level. After 50 years, the current account-to-GDP ratio is increased by 0.044 p.p. vis-à-vis the initial steady-state level.

The ratio of public budget balance to GDP increases significantly in the short run, rising 2.2 p.p. above the pre-shock steady-state on annual average over the first 3 years after the shock. This reflects the impact of the increased share of liquidity unconstrained households on tax revenue. The change in the public budget balance ratio turns out to be very small in the long run, reflecting the already mentioned feedback budget rules assumed in this exercise.

4.1.3. Summary of results – Justice

The results concerning Justice are summarised below in Table 14, organised by areas of reform and transmission mechanisms; it presents the macroeconomic impacts of the reforms in Justice that result from the evolution of the quantified reform variables, in general over the period 2010-2015 (in some cases the periods covered are different, as referred throughout this section). Appendix E presents a slightly different way of looking at the same results: it summarises the long-run (50-year horizon) aggregate output effects of a 1% change/improvement in each reform variable, across transmission mechanisms.

The results show that the considered reforms have sizeable and positive potential macroeconomic impacts in the medium-to-long-run, although dependent on the transmission mechanism. This dependence on the transmission mechanisms provides a range of values for those impacts.

Considering first the reforms that have improved the overall system efficiency, the long-run (50 years) impacts on annual GDP range from a 0.268% (0.135% in the medium-run – 10 years) increase through the firms' entry cost mechanism to a 1.568% (0.652% already in the medium-run) increase through the risk premium channel. However, the strongest effects come from (credible and structural) improvements in the insolvency regime (accounting for both entrepreneurship and liquidity constraint mechanisms) potentially increasing annual GDP by about 5.1% in 10 years and 6.2% in 50 years.

Table 14. Summary of the macroeconomic impacts of reforms in Justice

Transmission mechanism / modelisation				Impacts on selected macro variables				
A - Reforms in Justice								
A1	Overall system efficiency	Firms' entry cost Given the values reported for the reform variables, the overall impact on the net entry rate is expected to be of 0.726 p.p.. This implies calibrating a change in firms' entry costs as to impact 0.00726 on the net entry rate in the model, which requires a change in firms' entry costs of -0.026.		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	0,042	0,013	0,008	-0,004	0,003
			Employment	0,060	0,028	0,036	0,038	0,023
			Real wages	0,143	0,188	0,236	0,293	0,356
			GDP	-0,029	0,049	0,135	0,214	0,268
			External balance/GDP	-0,003	0,009	0,001	-0,003	0,002
		Allocative efficiency Given the values reported for the reform variables, the overall impact on labour productivity (final-good sector) is estimated to be of about 0.185%.		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	-0,028	0,019	0,005	-0,005	0,002
			Employment	-0,070	-0,002	0,002	0,001	-0,009
			Real wages	0,120	0,219	0,238	0,268	0,308
			GDP	0,147	0,239	0,264	0,295	0,326
			External balance/GDP	0,040	-0,002	-0,004	-0,003	0,001
		Risk premium - intangibles The impact of reform measures on the interest rate spread is estimated to be of -0.043 (lower boundary), by considering that, from the 1990s onwards, risk premium already fell by 1.5 p.p. and also financial market integration in the EU could reduce capital costs by about 0.5 p.p..		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	0,000	-0,003	0,000	0,002	0,000
			Employment	0,011	0,001	-0,001	-0,002	-0,001
			Real wages	0,026	0,035	0,044	0,053	0,062
			GDP	-0,005	0,006	0,018	0,030	0,041
			External balance/GDP	-0,002	0,001	0,001	0,000	0,000
		Risk premium - tangibles The impact of reform measures on the interest rate spread is estimated to be of -0.043 (lower boundary), by considering that, from the 1990s onwards, risk premium already fell by 1.5 p.p. and also financial market integration in the EU could reduce capital costs by about 0.5 p.p..		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	-0,038	-0,001	0,009	0,018	0,009
			Employment	0,045	0,130	0,111	0,085	0,053
			Real wages	-0,027	0,186	0,451	0,839	1,334
			GDP	0,051	0,361	0,634	1,026	1,527
			External balance/GDP	0,015	-0,046	-0,032	-0,010	0,015
		International technology linkages - FDI inflows Given the values reported for the reform variables, the estimated cumulative impact on output growth is 0.1% in a 5 year-horizon (lower boundary). In order to capture the impact on FDI in the model, we calibrate a change in the elasticity that measures the spillover effects from the international stock of knowledge of 0.0171 to produce that cumulative change in output.		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	0,016	0,014	0,018	0,004	0,006
			Employment	0,040	-0,003	0,000	-0,003	-0,026
			Real wages	0,185	0,354	0,494	0,650	0,824
			GDP	0,025	0,297	0,515	0,718	0,887
			External balance/GDP	0,011	0,018	0,001	-0,005	0,003
A2	Insolvency regime	Entrepreneurship/self-employment Given the values reported for the reform variable, the estimated 1-year impact on employment (through self-employment) is of 1.3%. In order to capture the employment effect in the model, we calibrate a change in the leisure preferences of -0.14.		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	0,165	0,802	0,285	-0,221	0,067
			Employment	1,327	3,771	4,109	4,234	3,890
			Real wages	-2,002	-1,633	-1,365	-0,953	-0,330
			GDP	0,797	2,795	3,418	4,057	4,346
			External balance/GDP	0,448	0,070	-0,068	-0,099	0,029
		Liquidity constraint Given the values reported for the reform variable, the estimated impact on aggregate output growth is of 0.147 p.p. in the current year. In order to capture the aggregate output effect in the model, we calibrate a change in the share of liquidity constrained households of -0.105.		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	2,511	1,468	0,327	-0,620	0,131
			Employment	0,251	1,156	1,949	2,167	1,435
			Real wages	-0,205	-0,483	-0,618	-0,365	0,103
			GDP	0,150	0,912	1,703	2,254	1,874
			External balance/GDP	0,036	0,114	-0,090	-0,143	0,044

Source: own elaboration. Note: Employment, real wages and GDP -- % change from initial steady state; public budget/GDP and external balance/GDP -- p.p. change from initial steady state. The impacts result from changes in reform variables between 2010 and 2012-2015, depending on the latest year with available data.

4.2. Education

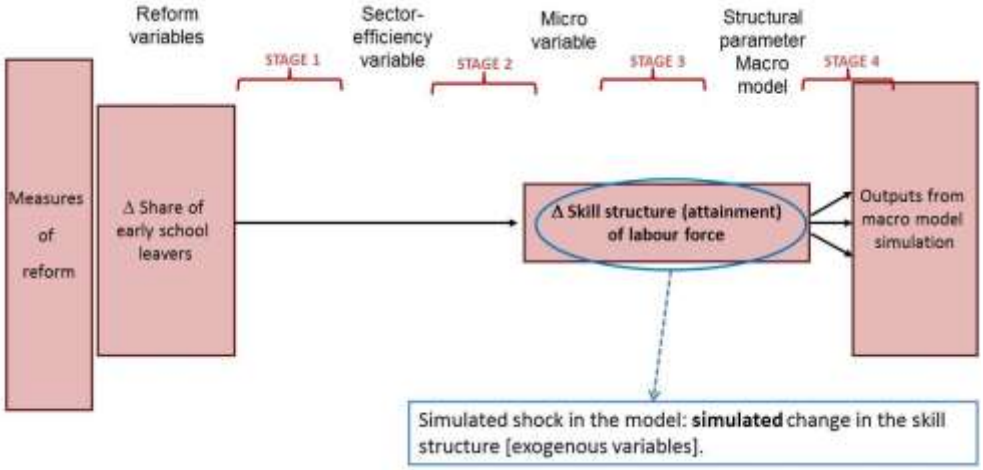
4.2.1. Schooling attractiveness – school attainment mechanism

In this section, we simulate the impacts of the set of reform measures pertaining to the reform areas "Development of early intervention strategies" and "Introduction of vocational tracks with strengthening and upgrading of vocational training" (B1 in Table 1; see the details on the reform measures in Table B2 and on the reform variables in Table B3, Appendix B), by relying on the school attainment transmission mechanism in the model.

In the context of the transmission mechanism of reforms in Education through school attainment, a key sector-efficiency variable is the share of early school leavers. However, given the lack of empirical studies on the quantitative relationship between reform variables in Education and the share of early school leavers and bearing in mind that this variable appears frequently as a direct educational policy target (see, *e.g.*, De Witte *et al.*, 2013), we conduct our evaluation exercise by considering the latter as a proxy reform variable (see Figure 8, STAGE 1).

Then, as usual in the literature (e.g., Roeger *et al.*, 2008, and Varga *et al.*, 2014), we shock the exogenous variables representing the skill structure of the labour force in the model, s_L, s_M and s_H (see equation (14) in Roeger *et al.*, 2008), in order to capture the reform shock in Education (STAGE 3).

Figure 8. Education: school attainment transmission mechanism and translation into shocks in the macro model



Source: own elaboration.

Following the approach just described, we first compute the evolution of the share of early school leavers from the data (based on INE and Ministério da Educação data). Between 2011 and 2015, this rate decreased 40.4% (from 23% to 13.7%).

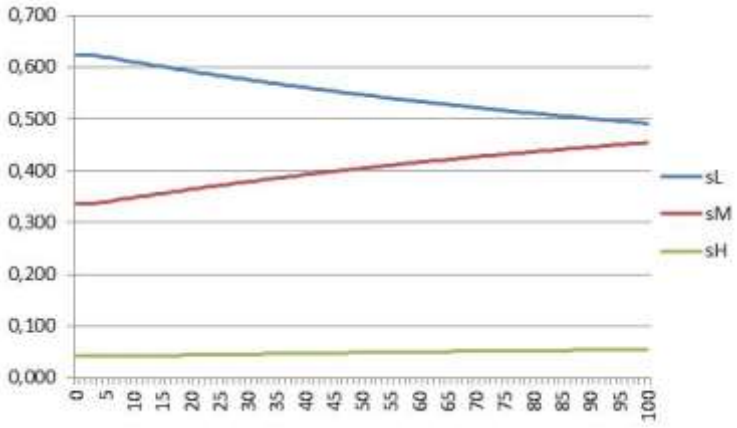
Then, we compute the impact of the decrease in the share of early school leavers on the skill structure. In order to take into account the lagged impact of this change due to the gradual transition between skill groups, we simulate the effect of a decrease in the share of early school leavers by means of a stock-flow model of the skill structure. In this simulation, we consider:

- A skill structure with low (L), medium (M) and high-skilled (H) workers, as in Roeger *et al.* (2008) and Varga *et al*. (2014),[19] with transition rates between skill groups inferred from the data on the skill structure for Portugal.
- A one-off 40.4% reduction in the share of early school leavers, with a 3-year lagged impact on the transition rate into the group of medium-skilled workers and a 6-year lagged impact on the transition rate into the group high-skilled workers.

As shown in Figure 9, the change in the skill structure is very gradual, which reflects the slow turnover of the Portuguese population and, hence, of the labour force. This, in turn, reflects the low fertility rate in Portugal (we have considered that the fertility rate remains constant at its 2014 value, 0.8%, throughout the simulation periods).

[19] See these papers for the exact definition of low, medium, and high-skilled workers that is used in the calibration of the DSGE model QUEST III.

Figure 9. Adjustment of the shares of low, medium, and high-skilled workers (s_L, s_M, s_H) in the labour force, after a one-off 40.4% reduction in the share of early school leavers, in a stock-flow model of the skill structure – baseline scenario



Source: own elaboration.

Note: simulation in a stock-flow model of the skill structure considering a fertility rate of 0.8% per year (data from INE for Portugal, 2014) and constant total population; the skill structure reaches the new steady state after 500 periods.

We then use the simulated change in the shares of each skill group over time, as depicted by Figure 9, to quantify the (exogenous) shock to the skill structure that feeds the macroeconomic model. In particular, we do this by considering a recursive exogenous shock to the skill structure variables, s_L, s_M and s_H, over 50 years, such that their time paths match those observed in Figure 8 over 50 periods. Table 15 depicts the results of the simulation exercise in the macroeconomic model (Stage 4 of Figure 8).

Table 15. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a cumulative change in the skill structure variables, s_M and s_H, of, respectively, 0.0835 p.p. and 0.00814 p.p., over 50 years – baseline scenario

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP (p.p.)	0.007	0.016	0.022	0.025	0.026	0.026	0.034	0.040
Employment	0.001	0.013	0.032	0.058	0.084	0.203	0.387	0.746
Real wages	0.035	0.100	0.160	0.220	0.277	0.588	1.366	3.924
GDP	0.099	0.194	0.287	0.384	0.484	1.025	2.230	5.827
External balance/GDP (p.p.)	0.020	0.028	0.030	0.029	0.026	0.015	0.001	-0.022

Source: own elaboration.

Note: 800-period simulation for convergence after a 50-period recursive shock to the skill structure variables.

First, medium-skilled workers replace low-skilled workers. The former are employed in the production sector at higher efficiency than the latter, thus gradually increasing aggregate output. At a later stage, high-skilled workers also start replacing low-skilled (and medium-skilled) workers. The productivity gains gradually raise real wages and aggregate employment. In the short-run (first four years of the simulation), however, the shift in relative wages across skill types reduces R&D employment and R&D production. After that period, the increase in firms' expected profits overweighs the relative wages effect and thus R&D employment and the technological-knowledge stock (measured by patents in the model) start to grow above the pre-shock steady-state level. These variables also benefit from the increase in the share of high-skilled workers that starts to show up by the fifth year. After 50 years, aggregate output is increased by 5.82%, real wages by 3.92% and aggregate employment by 0.75% from the pre-shock steady-state level.

The increase in exports induced by the productivity gains increase the current account balance-to-GDP ratio at first, but this moves to a slightly negative change vis-à-vis the initial steady state over 50 years as imports also respond to increased aggregate demand.

The ratio of the public budget balance to GDP also increases but only slightly, reflecting the stabilizing effect of the feedback budget rules assumed in this exercise.

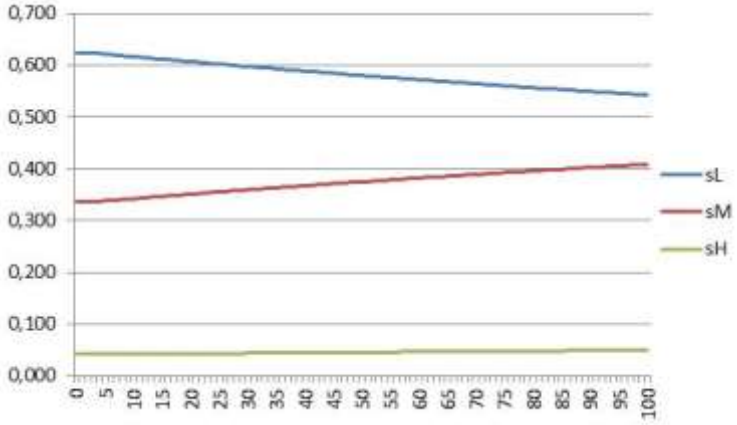
It is important to note that education reforms that increase the amount of schooling take time to build up due to the cohort effects that generate an only gradual impact on the labour force, as illustrated above by

Figure 9. Nevertheless, sizable macroeconomic effects are to be expected in the long-run, according to our simulation exercise.

We have also run a pessimistic scenario, by considering a different assumption on the fertility rate for Portugal. Instead of considering this demographic variable remains constant at its 2014 value (0.8%), we take the downward trend over 2000-2014 and extrapolate it for 2015-2050. By taking the resulting year average, we fix 0.4% as the value of the fertility rate in the new simulation.

Figure 10 depicts the change in the skill structure after a one-off 40.4% reduction in the rate of early school leavers in this case, with the same lagged impact as in Figure 8, and Table 16 summarises the results of the simulation exercise in the macroeconomic model (Stage 4 of Figure 8).

Figure 10. Adjustment of the shares of low, medium, and high-skilled workers (s_L, s_M, s_H) in the labour force, after a one-off 40.4% reduction in the rate of early school leavers, in a stock-flow model of the skill structure – "low fertility rate" scenario



Source: own elaboration.

Note: simulation in a stock-flow model of the skill structure considering a fertility rate of 0.4% per year ("low fertility rate" scenario) and constant total population; the skill structure reaches the new steady state after 800 periods.

Table 16. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a cumulative change in the skill structure variables, s_M and s_H, of, respectively, 0.0458 p.p. and 0.00443 p.p., over 50 years – "low fertility rate" scenario

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP	0.005	0.009	0.012	0.013	0.014	0.014	0.019	0.023
Employment	0.001	0.006	0.015	0.028	0.041	0.103	0.205	0.444
Real wages	0.019	0.052	0.082	0.111	0.14	0.3	0.719	2.248
GDP	0.051	0.097	0.144	0.192	0.243	0.524	1.178	3.361
External balance/GDP	0.008	0.013	0.014	0.014	0.013	0.008	0.002	-0.014

Source: own elaboration.

Note: 800-period simulation for convergence after a 50-year recursive shock to the skill structure variables.

As expected, the effects are qualitatively similar to those obtained in the baseline scenario (Table 15), but of smaller magnitude. After 50 years, output is increased by 3.36%, real wages by 2.25% and employment by 0.44% from the pre-shock steady-state level. That is, by considering a fertility rate that is 50% of the one in the baseline scenario, the impact of the skill-structure shock on those macroeconomic variables is of about 58% of the one in that scenario. This is still quite a sizeable impact in spite of the very low fertility rate considered in this case.

4.2.2. Schooling quality – school achievement mechanism

In this section, we simulate the impacts of the set of reform measures pertaining to the reform areas "Development of early intervention strategies", "Promotion of school autonomy", and "Consolidation of the implementation of curricula goals" (B2 in Table 1; see the details on the reform measures in Table B2 and on the reform variables in Table B3, Appendix B), by relying on the school achievement transmission mechanism in the model.

Box 4. Reforms that improve school achievement

Comprehensive studies of determinants of achievement (proxy for the individuals' cognitive skills) have studied a number of potential factors (see, *e.g.*, Hanushek and Woessmann, 2010, for an extensive review of the empirical literature). However, not all of them have been found relevant or statistically significant. In Table 17, we synthetise the main results concerning the determinants usually regarded as more sensitive to policy intervention.

Table 17. Policy-driven determinants of school achievement

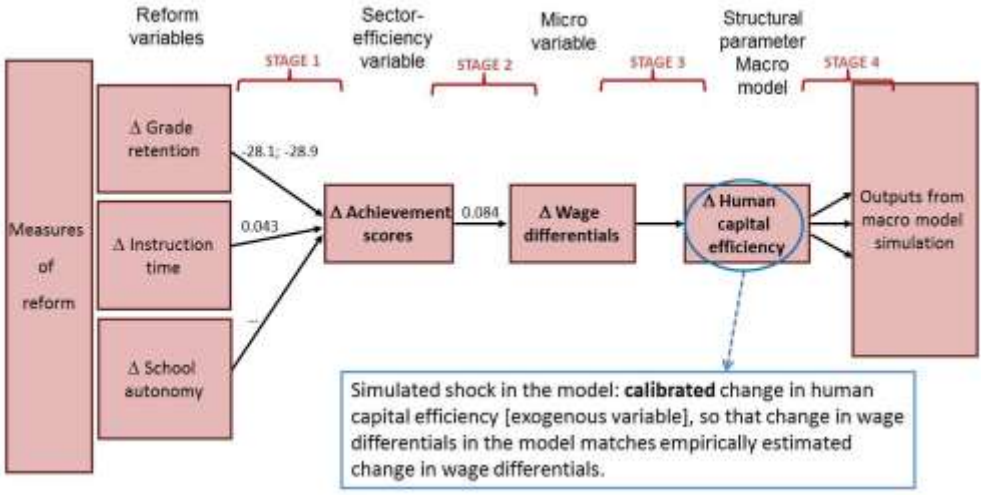
Input	Significance (sign of the relationship)
School inputs	Yes (+): teacher education; shortage of material; instruction time. No: class size; expenditure *per* student.
Institutions	
Accountability	Yes (+): exit exams/standardized tests; measures aimed at teachers; measures aimed at schools.
Autonomy	Yes (+): above a certain threshold of economic development / combined with accountability measures.
Competition	Yes (+): share of private operated schools in the country; share of public funding in the country.
Grade retention	Yes (-)
Pre-primary education system	Yes (+)

Source: own elaboration.

Bearing in mind the scope of the implemented set of reform measures, as described in Table B2, we take, as reference, the estimated impact of the change in selected reform variables - instruction time, school autonomy combined with accountability, and grade retention - on the achievement score (e.g., measured by the PISA Math score), where the latter is the key sector-efficiency variable (see Figure 11, STAGE 1). As regards instruction time, empirical estimates of its impact on school achievement can be found in the cross-section/panel studies by Woessmann (2003), Fuchs and Woessmann (2007), Schultz (2009), Hanushek and Woessmann (2010), and West and Woessmann (2010). Also, Woessmann (2003), Woessmann (2005), Fuchs and Woessmann (2007), and Hanushek and Woessmann (2010) provide empirical estimates regarding school autonomy, conditional on the existence of external exit exams (as a measure of school accountability). Finally, recent empirical estimates with respect to grade retention can be found in Schultz (2009), West and Woessmann (2010), and Pereira and Reis (2014).

Figure 11, below, depicts the selected transmission mechanism and the translation of the change in the reform variables into shocks in the macro model (Stages 1 to 4).

Figure 11. Education: school achievement transmission mechanism and translation into shocks in the macro model



Source: own elaboration.

Note: the numbers next to the arrows are estimated coefficients provided by Fuchs and Woessmann (2007), Hanushek and Woessmann (2010), Schultz (2009), and Hanushek and Zhang (2009), and are the same as those reported in Table 18, in columns (b) and (d) (data on school autonomy coefficients are presented in Table 18).

Following the described approach, we first compute the evolution of the selected reform variables in 2009-2012/2015, depending on the latest year with available data. We use data from the OECD PISA database and from the Ministry of Education (Portugal) BI database. Then, using the more conservative available empirical estimates of the relationship between reform variables and sector-efficiency variable (the achievement score), we compute the estimated change in the PISA Math achievement score.

Next, we consider the relationship between the sector efficiency variable and the micro variable. Hanushek and Zhang (2009) estimate the impact of changes in an adult achievement score (IALS – International Adult Literacy Survey) on the annual earnings from employment, with the estimated semi-elasticity being of 0.098 for the average of 12 developed countries. The tests on the IALS surveys are identified as being very practical, but they have been shown to be closely related to the PISA scores for individuals, with a correlation of 0.85 (see Hanushek and Woessmann, 2010). Considering this correlation and the fact that both PISA and IALS provide standardized scores, we get a semi-elasticity of annual earnings with respect to PISA Math scores of 0.084, which allows us to estimate the change in wage differentials.

Finally, we consider the relationship between human capital efficiency, skill groups, and wages implied by the labour demand equations in the model (see the equations in Roeger *et al.*, 2008, p. 16) in order to calibrate human capital efficiency such that the change in wage differentials in the model matches the estimated change in wage differentials implied by the improvements in achievement.

In other words, the micro evidence shows that reforms improve achievement scores and that these are reflected in higher wages (Stages 1 and 2 in Figure 11 and calculations in Table 18); in the macro model's labour market (Stage 3), these higher wages must be a reward for the human-capital-efficiency gains brought about by the reforms.

Table 18. STAGES 1 and 2: Changes in selected reform variables from 2009 to 2012/2015 – school achievement mechanism

Reform variables	Reform variable before reform	Reform variable after reform	Change (a)	PISA Math score esti-mated coefficient (b)	**Estimated impact on PISA Math score** (c)=(a)*(b)	Annual earnings semi-elasticity relative to PISA Math score (d)	**Estimated impact on annual earnings (%)** (c)*(d)
(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' starting salaries	6	9	3	6.420	**0.193**		
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	70	76	6	6.483	**0.411**		
(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					**6.002**	0.084	**0.502**

Source: own elaboration based on the data from OECD PISA database and the Ministry of Education BI database and on the estimated elasticities provided by the empirical literature: (1) Hanushek and Woessmann (2010); (2) Fuchs and Woessmann (2007); (3) Schultz (2009); (d) Hanushek and Zhang (2009).

The estimated impact of the reform measures on the achievement score is of 6.002 (lower bound) and the estimated impact of the latter on annual earnings is of 0.502%.

However, one must account for the lagged impact of reforms 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.

For an average working lifetime of 40 years, we will consider the following time-piecewise relationship between the sector-efficiency variable and the micro variable:

$$\Delta Wages_t = wage\ coefficient \cdot \Delta Achievment \cdot \frac{1}{40} + \Delta Wages_{t-1},\ 0 < t \leq 40,$$

$$\Delta Wages_t = wage\ coefficient \cdot \Delta Achievment\ ,\quad t > 40.$$

Therefore, considering the relationship between wages and human capital efficiency in the model, as well as the lagged impact of reforms, as explained above, we capture the employment earnings effect in the model by calibrating a cumulative change in the human capital efficiency of medium and high-skilled labour of, respectively, 0.00766 and 0.01614, over 50 years.

Table 19 summarises the results of the simulation exercise in the macroeconomic model (Stage 4 of Figure 11).

Table 19. STAGE 4: Impacts on selected macro variables (% change from initial Steady State) of a cumulative change in the human capital efficiency of medium and high-skilled labour of, respectively, 0.00766 and 0.01614, over 50 years

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y
Public budget/GDP	0.001	0.003	0.005	0.006	0.007	0.008	0.008	-0.007
Employment	-0.008	-0.010	-0.011	-0.012	-0.013	-0.019	-0.035	-0.079
Real wages	0.013	0.024	0.035	0.046	0.057	0.116	0.258	0.672
GDP	0.010	0.021	0.033	0.045	0.057	0.124	0.286	0.738
External balance/GDP	0.007	0.008	0.008	0.008	0.008	0.006	0.003	-0.005

Source: own elaboration.

Note: 800-period simulation for convergence after a 50-year recursive shock to human capital efficiency.

The increase in human capital efficiency for medium and high-skilled workers raises labour productivity in both production and R&D activities. The fact that the efficiency shock is more pronounced for high-skilled workers (namely reflecting the amplifying effect of the skill premium of high- over medium-skilled workers) and the ensuing relative increase in high-skilled wages leads to a reallocation of labour from R&D to production activities, and, within the latter, from low- and medium-skilled to high-skilled workers. However, the direct increase in the efficiency of high-skilled workers more than compensates the reduction in R&D labour after the first year of the simulation, such that the technological-knowledge stock starts to grow above the pre-shock steady-state level. The direct productivity gains plus those arising from more efficient R&D activities induce an increase in aggregate output throughout the adjustment towards the new steady state. After 50 years, aggregate output and real wages rise, respectively, 0.74% and 0.67% above the pre-shock steady-state, while aggregate employment is slightly decreased (by 0.08%).

Exports increase throughout time, reflecting the impact of productivity gains and increased aggregate output. This effect leads to a positive effect on the current account, but it vanishes in the long run, as imports respond to the increase in aggregate demand.

The ratio of the public budget balance to GDP also increases but only slightly, reflecting the stabilizing effect of the feedback budget rules assumed in this exercise.

As in the case of the reforms feeding in through the school attainment mechanism, it is noteworthy that education reforms that increase school achievement take time to build up due to the cohort effects that generate an only gradual impact on the labour force. Nevertheless, the expected macroeconomic effects are quite sizable in the long-run, according to our simulation exercise.

4.2.3. Summary of results – Education

The results concerning Education are summarised below in Table 20, presenting the macroeconomic impacts of the reforms in Education that result from the evolution of the quantified reform variables, in general over the period 2010-2015 (in some cases the periods covered are different, as referred throughout this section); while Appendix E presents the impacts from the same reforms in a different way, summarising the long-run (50-year horizon) aggregate output effects of a 1% change/improvement in each reform variable.

The results show that the considered reforms (accounting for both quantity and quality of schooling) take time to materialise due to the typical cohort effects (as the somewhat small short-to-medium-run impacts show) but have quite sizeable and positive potential macroeconomic impacts in the long-run: they reach

about a 4.1% to 6.6% (depending on the scenario for the fertility rate) improvement in annual GDP over 50 years.

Table 20. Summary of the macroeconomic impacts of reforms in Education

Transmission mechanism / modelisation				Impacts on selected macro variables				
B - Reforms in Education								
B1	Schooling attractiveness	School attainment (1) Given the values reported for the reform variable and the resulting simulated impact on the skill structure over 50 years, we consider a cumulative change in the shares of medium-skilled and of high-skilled workers of, respectively, 0.0835 p.p. and 0.00814 p.p., over 50 years – baseline scenario		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	0,007	0,026	0,026	0,034	0,040
			Employment	0,001	0,084	0,203	0,387	0,746
			Real wages	0,035	0,277	0,588	1,366	3,924
			GDP	0,099	0,484	1,025	2,230	5,827
			External balance/GDP	0,020	0,026	0,015	0,001	-0,022
		School attainment (2) Given the values reported for the reform variable and the resulting simulated impact on the skill structure over 50 years, we consider a cumulative change in the shares of medium-skilled and of high-skilled workers of, respectively, 0.0458 p.p. and 0.00443 p.p., over 50 years – "low fertility rate" scenario		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	0,005	0,014	0,014	0,019	0,023
			Employment	0,001	0,041	0,103	0,205	0,444
			Real wages	0,019	0,140	0,300	0,719	2,248
			GDP	0,051	0,243	0,524	1,178	3,361
			External balance/GDP	0,008	0,013	0,008	0,002	-0,014
B2	Schooling quality	School achievement The estimated impact of the reform measures on the achievement score is of 6.002 (lower boundary) and the estimated impact of the latter on annual earnings is of 0.502%. To capture the earnings effect in the model, we calibrate a cumulative change in the human capital efficiency of medium and high-skilled labour of, respectively, 0.00766 and 0.01614, over 50 years.		1Y	5Y	10Y	20Y	50Y
			Public budget/GDP	0,001	0,007	0,008	0,008	-0,007
			Employment	-0,008	-0,013	-0,019	-0,035	-0,079
			Real wages	0,013	0,057	0,116	0,258	0,672
			GDP	0,010	0,057	0,124	0,286	0,738
			External balance/GDP	0,007	0,008	0,006	0,003	-0,005

Source: own elaboration. Note: Employment, real wages and GDP -- % change from initial steady state; public budget/GDP and external balance/GDP -- p.p. change from initial steady state. The impacts result from changes in reform variables between 2009 and 2012-2015, depending on the latest year with available data.

5. Conclusions

This report is an exercise of evaluation of the macroeconomic impacts of the structural reforms put forward by Portugal in the areas of Justice and Education. Apart from the necessary review of relevant literature, the two main blocks of this work are the definition and layout of the methodology (Section 3) and the results from the application of that methodology to the reforms in Justice and Education in Portugal over 2010-2014 (Section 4).

The methodology follows and extends the standard approach used by the European Commission (*e.g.*, Roeger *et al.*, 2008). It is based on two fundamental processes: (i) the quantification of the microeconomic effects of structural reforms, and (ii) the reaction of the macroeconomic model to such microeconomic effects. In order to quantify the microeconomic effects, we typically collect the reform measures, associate them with reform variables that impact on sectoral (Justice or Education) indicators which, in turn, affect some microeconomic variables. These microeconomic effects are then translated into shocks to the (micro-founded) macroeconomic model, a key process that corresponds to the identification of the mechanisms of reform transmission to the macroeconomy. The ensuing computation (through simulation) of the dynamic system's reaction to those shocks delivers the results of the reforms in terms of the main macroeconomic aggregates.

Two important caveats are in order in what concerns the application of this methodology. First, in many cases it is not possible to establish a direct mapping from each reform measure into reform variables and/or variables of sectoral performance. This is why in several instances we have to consider groups of reform measures. The second caveat is that the consideration of various mechanisms of transmission from reforms to macroeconomic outcomes does not necessarily allow for the computation of total effects by adding up the results of the various mechanisms. This is due to the interdependence between some mechanisms, and the fact that, for each mechanism, we collect microeconomic elasticities from existing individual studies that are not necessarily fully compatible with each other. Thus, rather than adding up all the mechanisms' results, we prefer a more cautious interpretation of the different mechanisms as a sensitivity analysis of the macroeconomic impacts of the reforms.

The selection of the identified reforms in Justice and Education for which macroeconomic impacts could be computed following the proposed methodology refers to the following areas of reform: judicial "Overall system efficiency" (*e.g.*, judicial organisation, claims enforcement, out-of-court settlement) and the "Insolvency regime", in the case of Justice; and mainly "Development of early intervention strategies", "Promotion of school autonomy", "Introduction of vocational tracks with strengthening and upgrading of vocational training" and "Consolidation of the implementation of curricula goals", in the case of Education.

The results (from Section 4, summarized in Tables 14 and 20 and in Appendix E) show that the considered reforms have sizeable and positive potential macroeconomic impacts in the medium-to-long-run, although dependent on the transmission mechanism (particularly in Justice).[20]

Considering the reforms that have improved the overall system efficiency, the long-run (50 years) impacts on annual GDP range from a 0.268% (0.135% in the medium-run – 10 years) increase through the firms' entry cost mechanism to a 1.568% (0.652% already in the medium-run) increase through the risk premium channel. However, the strongest effects, by far, come potentially from improvements in the insolvency regime (accounting for both entrepreneurship and liquidity constraint mechanisms): if credible, such improvements can be perceived as a regime change and potentially increase annual GDP by about 5.1% in 10 years and 6.2% in 50 years.[21]

As for the considered Education reforms, the results (accounting for both quantity and quality of schooling) take longer to materialise due to the typical cohort effects, but are quite strong in the long-run, potentially reaching about a 4.1% to 6.6% (depending on the scenario for the fertility rate) improvement in annual GDP over 50 years.

The magnitude of the impacts simulated in our work is in line with previous work that has shown that the potential effect of reforms can be large. For instance, based on a benchmarking approach applied to the EU countries, it was found that closing half the gap *vis-à-vis* best performers in a number of key structural indicators can add around 6% to EU GDP after 10 years (Varga and in't Veld, 2014; see also Bouis and Duval, 2011).

It must be stressed that these are just potential effects of the considered reforms, to be interpreted with caution. The translation of reform measures into quantifiable changes in structural indicators in the macroeconomic model and the ensuing impact assessment through simulation are **surrounded by uncertainty**, namely related to the:

- Direct quantification of the reform measures, given the uncertainty regarding the speed of implementation of reforms, their effectiveness, and protracted direct outcomes;
- Robustness of the (few) empirical estimates on which the assessment has to rely;
- Sensitiveness to certain assumptions of the macroeconomic model.

Similarly to the reforms process itself, the work that has been conducted here is inevitably work in progress. In some cases, reform variables and sector-efficiency indicators need to be updated as soon as more recent ones become available – the schooling quality reform variables available from OECD-Pisa database (instruction time and school autonomy), currently available up to 2012 only, constitute an obvious case. This process of assessing macroeconomic impacts of reforms will largely gain, both in quantity and quality, as more (and more detailed) microeconometric assessments of individual reforms become available. In general, future design of reforms can also help substantially by improving the quantification of reform variables end sector-efficiency objectives or expected outcomes.

[20] In addition to the reported results, we have conducted some tentative exercises that can be taken as future directions for improvement and deepening of this work. For instance, in order to start assessing effects of reforms on the volatility of the business cycle, we simulated a 1 p.p. shock in the Euro Area imports as percentage of GDP, and compared the output gap dynamics with and without reforms. We confirmed, for example, that the Justice-sector reforms operating through the firms' entry cost or the allocative efficiency mechanisms have the additional benefit of reducing the cycle phase duration; and reforms operating through the international technology linkages mechanism reduce both the duration and the amplitude of the cycle phase.

[21] We are aware that we miss an important additional mechanism concerning the insolvency regime mechanism: the reduction in firms' interest rate spreads resulting from the improvements in the rescue and recovery framework. This effect would operate through the financing cost mechanism already included in the assessment of reforms in the overall judicial system efficiency; however, for the insolvency regime we could not find estimates of its impacts on aggregate non-performing loans. This provides a concrete example of how useful a specific microeconometric study could be.

References

Acemoglu, D., Johnson, S., and Robinson, A. (2005) “Institutions as a Fundamental Cause of Long-Run Growth”, in *Handbook of Economic Growth, Amsterdam: North Holland.*

Adler, B., Polak, B., Schwartz A. (2000) "Regulating Consumer Bankruptcy: A Theoretical Inquiry", *Journal of Legal Studies*, 585-613.

Alfaro, L., Kalemli-Ozcan, S., and Sayek, S. (2009) “Foreign direct investment, productivity and financial development”, *World Economy*, 32(1), 111–135.

Alguacil, M., Cuadros, A., and Orts, V. (2008) “EU enlargement and inward FDI”, *Review of Development Economics*, 12(3), 594–604.

Alguacil, M., Cuadros, A., and Orts, V. (2011) “Inward FDI and growth: The role of macroeconomic and institutional environment”, *Journal of Policy Modeling*, 33, 481–496.

Almeida, V., Castro, G., Félix, R. M., Júlio, P. and Maria, J.R. (2013) “Inside PESSOA - A detailed description of the model”, *Banco de Portugal Working Papers*, 16, 1-122.

Ang, J. B., Madsen, J. B. and Islam, M. R. (2011) “The Effects of Human Capital Composition on Technological Convergence”, *Journal of Macroeconomics,* 33, 465-476.

Ardagna, S. and Lusardi, A. (2008) “Explaining International Differences in Entrepreneurship: The Role of Individual Characteristics and Regulatory Constraints”, *NBER Working Paper Series*, No. 14012.

Armour J., Cumming, D. (2008), "Bankruptcy Law and Entrepreneurship", *American Law Economic Review*, 10 (2), 303-350.

Bae, K. and Goyal, V. K. (2009) “Creditor rights, enforcement, and bank loans”, *Journal of Finance*, Volume 64, Issue 2, April, 823–860.

Barkbu, B., Rahman, J., and Valdés, R. (2012) "Fostering Growth in Europe Now", *IMF Staff Discussion Note*, No. 12/07, June 2012.

Barnes, S., Bouis, R., Briard, P., Dougherty, S., and Eris, M. (2013) “The GDP Impact of Reform: A simple simulation framework”, *OECD Economics Department Working Papers*, no. 834.

Beck, T., Demirgüç-Kunt, A., and Maksimovic, V. (2005) “Financial and Legal Constraints to Growth: Does Firm Size Matter?”, *Journal of Finance*, Vol. 60, No. 1 (Feb.), 137-177.

Beck, T., Demirguc-Kunt, A., and Maksimovic, V. (2006) “The influence of financial and legal institutions on firm size”, *Journal of Banking and Finance*, Vol. 30, 2995-3015.

Berkowitz D., Moenius, J., and Pistor, K. (2006) “Trade, Law and Product Complexity,” *Review of Economics and Statistics,* Vol. 88 (2), 363–373.

Blomström, M., and Kokko, A. (1998), “Multinational corporations and spillovers”, *Journal of Economic Surveys*, 12, 247–277.

Borensztein, E. J., De Gregorio, J., and Lee, J. W. (1998), “How does foreign direct investment affect economic growth”, *Journal of International Economics*, 45, 115–135.

Bosworth, B. P. and Collins, S. M. (1999) “Capital flows to developing economies: Implications for saving and investment”, *Brookings Papers on Economic Activity*, 1, 146–169.

Bouis, R. and Duval, R. (2011) "Raising potential growth after the crisis: a quantitative assessment of the potential gains from various structural reforms in the OECD area and beyond", *OECD Economics Department Working Papers*, no. 835.

Carpus Carcea, M., Ciriaci, D., Cuerpo, C., Lorenzani, D. and Pontuch, P. (2015), “The Economic Impact of Rescue and Recovery Frameworks in the EU”, *European Economy - Economic Discussion Paper* 004, September.

Chiarloni, S. (1999) “Civil justice and its paradoxes: an Italian perspective,” in *Civil justice in crisis: Comparative perspectives of civil procedure*, ed. by A.A.S. Zuckerman, S. Chiarloni, and P. Gottwald, Oxford: Oxford University Press.

Cohen, D. and Soto, M. (2007) “Growth and human capital: good data, good results”, *Journal of Economic Growth,* 12, 51-76

Cross, F. B. and Donelson, D. C. (2010) “Creating quality courts”, *Journal of Empirical Legal Studies*, Volume 7, Issue 3, September, 490–510.

D’Auria, F., Pagano, A., Ratto, M., and Varga, J. (2009) “A comparison of structural reform scenarios across the EU member states—simulation-based analysis using the QUEST model with endogenous growth”, *European Economy Economic Papers* 392.

De la Fuente, A. and Doménech, R. (2006) “Human capital in growth regressions: how much difference does data quality make?”, *Journal of the European Economic Association,* 4(1), 1-36.

De Witte, K., Cabus, S., Thyssen, G., Groot, W., and Maassen van den Brink, H. (2013) “A critical review of the literature on school dropout”, *Educational Research Review*, 10, 13-28.

Djankov, S., Hart, O., McLiesh, C. and Shleifer, A. (2008) “Debt Enforcement around the World”, *Journal of Political Economy*, Vol. 116 (December), pp. 1105–1149.

Djankov, S., McLiesh, C., and Ramalho, R. (2006) “Regulation and growth”, *Economics Letters*, 92(3), 395-401.

Driffield, N. and Love, J. H. (2007) “Linking FDI Motivation and Host Economy Productivity Effects: Conceptual and Empirical Analysis”, *Journal of International Business Studies*, 38, No. 3, 460-473.

ESAME - Estrutura de Acompanhamento dos Memorandos (2014), *Managing the Adjustment Programme*, Ministério das Finanças, May 2014, 146 p.

European Commission (2011), *A second chance for entrepreneurs: Prevention of bankruptcy, simplification of bankruptcy procedures and support for a fresh start*, Final Report of the Expert Group, DG Enterprise and Industry, January 2011.

European Commission (2013), "Product Market Review 2013: Financing the real economy", *European Economy* 8, DG Economic and Financial Affairs.

European Commission (2014), “Market Reforms at Work in Italy, Spain, Portugal and Greece”, *European Economy* 5, DG Economic and Financial Affairs.

Fan, W., and White, M. (2003) "Personal Bankruptcy and the Level of Entrepreneurial Activity", *Journal of Law and Economics*, 46, October 2003, 543-567.

Freitas, Pedro, Nunes, L., Reis, A., Seabra, C. and Ferro, A. (2015) “Correcting for sample problems in PISA and the improvement in Portuguese students’ performance”, *Assessment in Education*, *forthcoming*.

Fuchs, T., and Ludger Woessmann (2007) "What accounts for international differences in student performance? A reexamination using PISA data." *Empirical Economics* 32 (2-3), 433-462.

Garcia-Posada, M. and Mora-Sanguinetti, J. S. (2012) “Why do Spanish firms rarely use the bankruptcy system? The role of the mortgage institution”, *Bank of Spain Working Document*, No. 1234.

García-Posada, M. and Mora-Sanguinetti, J. S. (2014) “Entrepreneurship and enforcement Institutions: Disaggregated evidence for Spain”, *European Journal of Law and Economics*, 40 (1), 49-74.

Giacomelli, S. and Menon, C. (2013) "Firm size and judicial efficiency: evidence from the neighbour's court," *Temi di discussione* (*Economic working papers*) 898, Bank of Italy.

Gianfreda, G. and Vallanti, G. (2015) “Labour court delays and the composition of employment: is labour encouraged or endangered by institutions?”, *LLEE Working Paper Series*, Working Paper No. 121, September.

Gil, P. M., Afonso, O. and Brito, P. (2012) “Skill Structure and Technology Structure: Innovation and Growth Implications”, *FEP Working Papers,* 470, 1-35.

Gil, P. M., Afonso, O. and Brito, P. (2015) “Economic Growth and the High Skilled: the Role of Scale Effects and of Barriers to Entry into the High Tech”, *mimeo*, presented at the Workshop “Adjustment in European Economies in the Wake of the Economic Crisis”, Banco de Portugal, January.

Gouveia, A, Santos, S., and Herber, C. (2016) “The impact of structural reforms of the judicial system: a survey”, Artigo 05/2016 GPEARI-MFAP.

Haidar, J. I. (2012) “The impact of Business Regulatory Reforms on Economic Growth”, *Documents de travail du Centre d'Economie de la Sorbonne* 2012.44.

Hanushek, E.A. and Kimko, D. (2000) “Schooling, Labor Force Quality, and the Growth of Nations”, *American Economic Review,* 90(5), 1184-1208.

Hanushek, E. A. and Woessmann, L. (2006) “Does Educational Tracking Affect Performance and Inequality? Differences-in-Differences Evidence Across Countries”, *Economic Journal*, 116 (March), C63–C76.

Hanushek, E. A., and Woessmann, L. (2010) “The economics of international differences in educational achievement”, *NBER Working Paper* 15949.

Hanushek, E. A., and Woessmann, L. (2011) “How much do educational outcomes matter in OECD countries?”, *Economic Policy*, July, 427-491.

Hanushek, E. A., and Woessmann, L. (2012) “The Economic Benefit of Educational Reform in the European Union”, *CESifo Economic Studies*, 58, 73-109.

Hanushek, E.A., Link, S., and Woessmann, L. (2013) “Does School Autonomy Make Sense Everywhere? Panel Estimates from PISA”, *Journal of Development Economics*, 104, 212–232.

Hanushek, E. A., and Zhang, L. (2009) "Quality-consistent estimates of international schooling and skill gradients”, *Journal of Human Capital* 3 (2), 107-143.

Hardouvelis, G. A., Malliaropulos, D. and Priestley, R. (2004), The Impact of Globalisation on the Equity Cost of Capital. *CEPR Working Paper* No. 4346.

International Monetary Fund (2013a), "Indebtedness and deleveraging in the euro area", *Article IV consultation Selected Issues Paper*, *IMF Country Report* No. 13/232.

International Monetary Fund (2013b), *Global Financial Stability Report: Transition Challenges to Stability,* October 2013.

Jackson, T.H. (1985) "The fresh-start policy in bankruptcy law", *Harvard Law Review* 1393-1448.

Jappelli, T., Pagano, M., and Bianco, M. (2005) "Courts and Banks: Effects of Judicial Enforcement on Credit Markets," *Journal of Money, Credit and Banking*, 37 (April), 223–44.

Jones, C. I. and Romer, P. M. (2010) “The New Kaldor Facts: Ideas, Institutions, Population, and Human Capital”, *American Economic Journal: Macroeconomics,* 2(1), 224-245.

Kumhof, M., Laxton, D., Muir, D. and Mursula, S. (2010) “The Global Integrated Monetary and Fiscal Model (GIMF) – Theoretical Structure”, *IMF Working Paper*, 10/34, 1-74.

La Porta, R., López-de-Silanes, F., Shleifer, A., and Vishny, R. (1998) “Law and Finance,” *Journal of Political Economy*, 100, pp. 1113-19155.

Laeven, L. and Majnoni, G. (2005) “Does judicial efficiency lower the cost of credit?”, *Journal of Banking & Finance*, Volume 29, Issue 7, July, pp. 1791–1812.

Lee, S.-H., Peng, M., and Barney, J. (2007) "Bankruptcy Law and Entrepreneurship Development: A Real Options Perspective", *Academy of Management Review*, 257-72.

London Economics (2002), *Quantification of the macroeconomic Impact of Integration of EU financial Markets*. Final Report to the European Commission - Directorate-General for the Internal Market.

Lorenzani, D. and Lucidi, F. (2014) “The Economic Impact of Civil Justice Reforms”, *European Economy Economic Papers*, no. 530.

Lucas, R. E. (1988) “On the Mechanics of Economic Development”, *Journal of Monetary Economics,* 22, 3-42.

Lupo, E. (2013) “Relazione sull’amministrazione della giustizia”,

(www.cortedicassazione.it/Documenti/Linee_di_fondo_2013.pdf).

Mankiw, N. G., Romer, D., and Weil, D. N. (1992) “A Contribution to the Empirics of Economic Growth”, *Quarterly Journal of Economics,* 107(2), 407-437.

Mincer, J. (1970) "The distribution of labor incomes: a survey with special reference to the human capital approach." *Journal of Economic Literature*, 8(1), 1-26.

Mincer, J. (1974) *Schooling, Experience, and Earnings*. New York: NBER.

Ministério das Finanças (2015a), *Programa Nacional de Reformas 2015*, Abril, 133 pp.

Ministério das Finanças (2015b), *Programa de Estabilidade 2015-2019*, Abril, 124 pp.

Muiznieks, N. (2012), *Italy Report 2012*, Council of Europe.

Nelson, R. R. and Phelps, E. S. (1966) “Investment in Humans, Technological Diffusion, and Economic Growth”, *American Economic Review,* 56(1/2), 69-75.

OECD (2013) *PISA 2012 Results: What Makes Schools Successful?, Resources, Policies and Practicies*, Volume IV.

OECD (2013), “What makes civil justice effective?”, *OECD Economics Department Policy Notes*, No. 18, June.

OECD (2015), *Italy: Structural reforms in Italy: impact on growth and employment*, February, 15 pp.

Palumbo, G., Giupponi, G. Nunziata, L., and Mora-Sanguinetti, J.S. (2013) “Judicial performance and its determinants: a cross-country perspective”, *OECD Economics Policy Paper,* No. 05.

Pereira, M, and Reis, H. (2014) “Grade retention during basic education in Portugal: determinants and impact on student achievement”, *Economic Bulletin Banco de Portugal*, 61-83.

Roeger, W., Varga J., and in’t Veld, J. (2008) “Structural Reforms in the EU: A simulation-based analysis using the QUEST model with endogenous growth”, *European Economy Economic Papers*, no. 351.

Romer, P. M. (1990) “Endogenous Technological Change”, *Journal of Political Economy,* 98(5), 71-102.

Ruscher, E. and G. Wolff (2012), "Corporate Balance Sheet Adjustment: Stylised Facts, Causes and Consequences", *European Economy Economic Papers* no. 449.

Safavian, M., and S. Sharma (2007) “When Do Creditor Rights Work?” *Journal of Comparative Economics*, Vol. 35, No. 3, 484–508.

Varga, J., and in't Veld, J. (2014) “The potential growth impact of structural reforms in the EU: a benchmarking exercise ", *European Economy Economic Papers*, no. 541.

Varga J., Roeger, W., and in’t Veld, J. (2014) “Growth Effects of Structural Reforms in Southern Europe”, *Empirica*, 41, 323-363.

Vandenbussche, J., Aghion, P., and Meghir, C. (2006) “Growth, Distance to Frontier and Composition of Human Capital”, *Journal of Economic Growth,* 11, 97-127.

West, M.R., and L. Woessmann (2010) "'Every Catholic child in a Catholic school': Historical resistance to state schooling, contemporary school competition, and student achievement." *Economic Journal*, 120, F229–F255.

Woessmann, L. (2003) "Schooling resources, educational institutions, and student performance: The international evidence." *Oxford Bulletin of Economics and Statistics* 65 (2), 117-170.

Woessmann, L. (2005) "Educational production in Europe." *Economic Policy* 20 (43), 446-504.

Webgraphy

European Commission for the Efficiency of Justice (CEPEJ),

www.coe.int/t/dghl/cooperation/cepej/evaluation/default_en.asp

CEPEJ (2012), Report on “European judicial systems – Edition 2012 (2010 data): efficiency and quality of justice”,

www.coe.int/t/dghl/cooperation/cepej/evaluation/2012/Rapport_en.pdf, accessed November 2015.

CEPEJ (2014), Report on “European judicial systems – Edition 2014 (2012 data): efficiency and quality of justice”,

www.coe.int/t/dghl/cooperation/cepej/evaluation/2014/Rapport_2014_en.pdf, accessed November 2015.

Eurostat, online database, http://ec.europa.eu/eurostat, accessed May 2016.

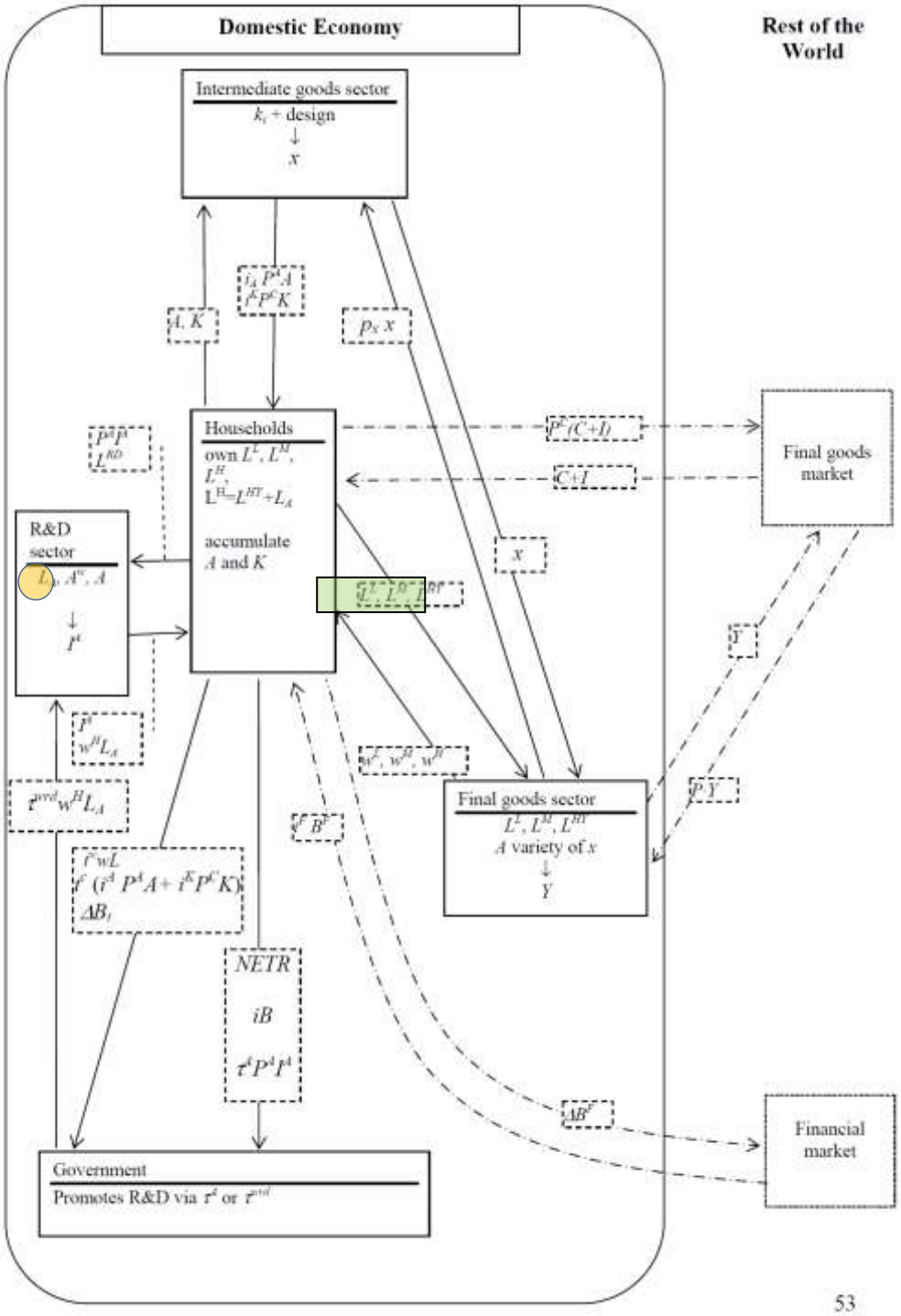
INE, online database, www.ine.pt, accessed May 2016.

Ministério da Educação, BI online database, http://bi.dgeec.mec.pt, accessed May 2016.

OECD, PISA online database, www.oecd.org/pisa/keyfindings/, accessed May 2016.

Appendix A. Flows representation in the Roeger *et al.*'s (2008) model

Figure A1. Simplified representation of the flows in the model by Roeger *et al.* (2008)



Source: own elaboration, based on Roeger et al. (2008)

Appendix B. Reform areas/measures and reform variables in Justice and Education

In this appendix, we group the specific measures of structural reform already implemented into broader categories (areas) of structural reforms, bearing in mind the expected direct effect of each specific measure on the reform and sectoral efficiency variables analysed in Section 4.

Table B1 covers the reforms in Justice. The simulation exercises presented in Section 4 focus on the assessment of the macroeconomic impact of structural reforms in Justice concerning the areas of "Overall system efficiency" and "Insolvency regime". The remaining areas (in grey in Table B1) are not covered by our simulation exercises.

Table B2 lists the reforms in Education. The simulation exercises presented in Section 4 focus on the transmission mechanisms that cover mainly the areas of "Development of early intervention strategies", "Promotion of school autonomy", "Introduction of vocational tracks with strengthening and upgrading of vocational training", and "Consolidation of the implementation of curricula goals, in the case of Education".

Table B3 summarises the selected reform variables in Justice and Education, providing details on the respective data source and latest year with available data.

Table B1. Justice: reform areas / measures and respective reform variables

Reforms in Justice										
Reform area		Reform measure	Reform variable							
			Demand side		Supply side					
			Litigation rate	Other	Number of courts per population	Court size (jugdes per court)	Number of judges per population	Share of public budget for courts ICT	Overall index of pre-insolvency framework	Other
Overall system efficiency	Data and IT infrastructure	*Implementação do sistema CITIUS*						↑		
	Judicial reorganisation	*Implementação do novo mapa judiciário*			↓	↑	↑			
		Instituição dos Tribunais da Propriedade Intelectual e da Concorrência, Regulação e Supervisão								√
	Claims enforcement and processual backlog	*Novo Código de Processo Civil*								√
		Criação da Comissão para o Acompanhamento dos Auxiliares de Justiça (CAAJ)								√
		Procedimento extrajudicial pré-executivo (PePEX)								√
	Out-of-court settlement	*Revisão do Regime Jurídico dos Julgados de Paz*	↓							
		Regime Jurídico da Mediação (regimes jurídicos da mediação civil e comercial, dos mediadores e da mediação pública)	↓							
		Nova Lei da Arbitragem Voluntária	↓							
		Novo Regime de Arbitragem Tributária	↓							
Insolvency regime	Rescue and recovery framework of firms	*Alteração ao Código de Insolvência e Recuperação de Empresas (CIRE) aditando o Processo de Revitalização de Empresas (PER)*							↑	
Corruption	*Melhoria do enquadramento jurídico relativo aos crimes por corrupção*	*Alteração ao Código Penal*								
		Alteração à Lei dos Crimes de Responsabilidade dos Titulares de Cargos Políticos (Lei n.º 34/87, de 16 de julho)								
		Alteração à Lei da corrupção no comércio internacional e no sector privado (Lei n.º 20/2008, de 21 de abril)								
		Alteração à Lei do regime de responsabilidade penal por comportamentos suscetíveis de afetar a verdade, a lealdade e a correção da competição e do seu resultado na atividade desportiva (Lei n.º 50/2007, de 31 de agosto)								
		Alteração à Lei que aprova medidas de combate à corrupção (Lei n.º 19/2008, de 21 de abril)								
Intellectual property rights	*Criação de tribunais especializados*	*Instalação do Tribunal de Propriedade Intelectual*								
Bureaucracy and court management	*Melhoria do procedimento administrativo*	*Novo Código do Procedimento Administrativo*								
	Melhoria do funcionamento dos tribunais administrativos e fiscais	*Revisão do Código de Processo dos Tribunais Administrativos*								
		Revisão do Estatuto dos Tribunais Administrativos e Fiscais								
Other	*Reforma Penal e Processual Penal*	*Alteração ao Código de Processo Penal*								
	Inventários	*Revisão do Regime Jurídico do Inventário*								
	Registos e Notariado	*Revisão do Regulamento Emolumentar dos Registos e Notariado*								

Source: GPEARI and own elaboration. Note: whenever a reform measure is expected to have a relevant impact on a given reform variable, we use an arrow (↑, ↓) to indicate its direction (upward/downward impact); a tick mark (√) is used whenever the direction is not definable.

Table B2. Education: reform areas / measures and respective reform variables (continues)

Reforms in Education								
Reform area	Reform measure	Reform variable						
		Schooling attractiveness	Schooling quality					
		Share of early school leavers	School inputs	Autonomy / Accountability	Grade retention	Competition	Pre-primary education system	Other
Development of early intervention strategies	*Reforço do apoio ao estudo no 1.º ciclo*	↓			↓			
	Acompanhamento extraordinário dos alunos nos 1.º e 2.º ciclos	↓			↓			
	Ensino à distância	↓						
	Implementação de sistema modular como alternativa ao currículo do ensino básico geral para os alunos maiores de 16 anos	↓			↓			
	Implementação do Programa Mais Sucesso Escolar (lançado no ano letivo 2009/2010) e respetivo alargamento	↓			↓			
	Medidas de combate à exclusão no âmbito da autonomia dos agrupamentos de escolas/escolas não agrupadas	↓			↓			
	Definição de planos individuais de transição para alunos com necessidades educativas especiais	↓			↓			
	Constituição temporária de grupos de homogeneidade relativa em termos de desempenho escolar em disciplinas estruturantes	↓			↓			
	Reforço dos serviços de Psicologia e Orientação	↓			↓			
	Portal de Estatísticas das Escolas do Ensino Secundário - disponibilização de mais dados/informação			↑				
	Revisão do Estatuto do Aluno e Ética Escolar							√
	Reconfiguração da rede de escolas do continente		√			√		
	Programa Territórios Educativos de Intervenção Prioritária	↓			↓			
	Ensino vocacional no Básico e no Secundário	↓			↓			
Promotion of school autonomy	*Descentralização - delegar competências nos municípios e aumentar as competências desconcentradas para os agrupamentos de escolas*			↑				
	Sistema de acompanhamento e monitorização do sistema escolar - acompanhamento permanente do funcionamento de cada escola			↑				
	Modelo de avaliação e financiamento das escolas			↑				
	Alargamento da rede de escolas com contratos de autonomia			↑				
Introduction of vocational tracks with strengthening and upgrading of vocational training	*Revisão dos currículos dos cursos profissionais*	↓						
	Diploma que regula os Cursos Técnicos Superiores Profissionais (TeSP), de 120 ECTS e de nível ISCED 5.	↓						
	Reorientação do percurso formativo do aluno através dos regimes de permeabilidade ou de equivalências para cada um dos regimes.	↓			↓			
	Fortalecimento da formação profissional ao nível do ensino secundário, aumentando a carga horária da formação em contexto de trabalho e a participação das empresas na formação, bem como a criação de cursos com planos próprios em consonância com as necessidades regionais/nacionais	↓			↓			
	Encaminhamento para percurso vocacional de ensino	↓			↓			
	Lista georrefenciada de todas as ofertas de cariz profissionalizante	↓						
	Sistema de escolas profissionais de referência empresarial (EPRE)	↓						
	Ligação investigação pública-sector empresarial: Agenda Nacional de Inovação, Política de clusterização, Agenda Portugal Digital e Estratégia Nacional de Investigação e Inovação para a Especialização Inteligente							√
	Implementação de garantia de qualidade do ensino e formação profissional em linha com o European Quality Assurance in Vocational Education and Training (EQAVET)	↓						

Table B2. (continued)

Reforms in Education								
Reform area	Reform measure	Reform variable						
		Schooling attractiveness	Schooling quality					
		Share of early school leavers	School inputs	Autonomy / Accountability	Grade retention	Competition	Pre-primary education system	Other
Improvement of lifelong learning	*Centros para a Qualificação e Ensino Profissional (CQEP) - orientação profissional de jovens e adultos*	↓						
	Adoção de percursos curriculares alternativos e programas integrados de educação e formação	↓						
	Medida Vida Ativa	↓						
Consolidation of the implementation of curricula goals	*Introdução de avaliação externa no final de cada ciclo e de metas curriculares*			↑				
	Reorganização das matrizes curriculares do ensino básico e secundário		↑					
	Harmonização curricular e da avaliação da aprendizagem		↑					
	Criação de equipas multidisciplinares nas escolas		↑					
	Criação de sistemas de recolha de informação e de monitorização dos resultados dos alunos			↑				
	Optimização da gestão dos recursos docentes		↑					
	Aplicação de novo regime da formação contínua de professores e reforço das componentes científicas nos cursos de formação de docentes		↑					
	Aplicação da prova de avaliação de conhecimentos e capacidades aos docentes		↑					
	Revisão dos programas curriculares		↑					
Management / Infrastructures	*Sistema interno de BI no MEC*			↑				
	Restruturação do Parque Escolar, E.P.E							√
	Simplificação das estruturas orgânicas do MEC							√
	Centralização dos processamentos dos vencimentos (conclusão prevista para 2020)							√

Source: GPEARI and own elaboration. Note: whenever a reform measure is expected to have a relevant impact on a given reform variable, we use an arrow (↑, ↓) to indicate its direction (upward/downward impact); a tick mark (√) is used whenever the direction is not definable.

Table B3. Selected reform variables, data sources and data availability (summary)

Reform variables	Latest year with available data
Justice	
Judges/Court *(Min. Justice data, 1st instance, legal entities)*	2013
Courts/population *(CEPEJ data, all courts, geographical location)*	2012
Litigation rate *(Min. Justice data, "ações" and "execuções cíveis")*	2015
Share of Public Budget for courts ICT *(CEPEJ, Min. Justice data)*	2014
Judges/population (*Min. Justice data*)	2013
Overall index of pre-insolvency framework (Carpus Carcea *et al.*, 2015)	2012
Education	
Share of early school leavers (*INE and Min. Education data*)	2015
Instruction time (minutes per week) *(OECD-PISA data)*	2012
School autonomy *(OECD-PISA data)*	2012
Grade retention rate *(Min. Education data)*	2015

Source: own elaboration.

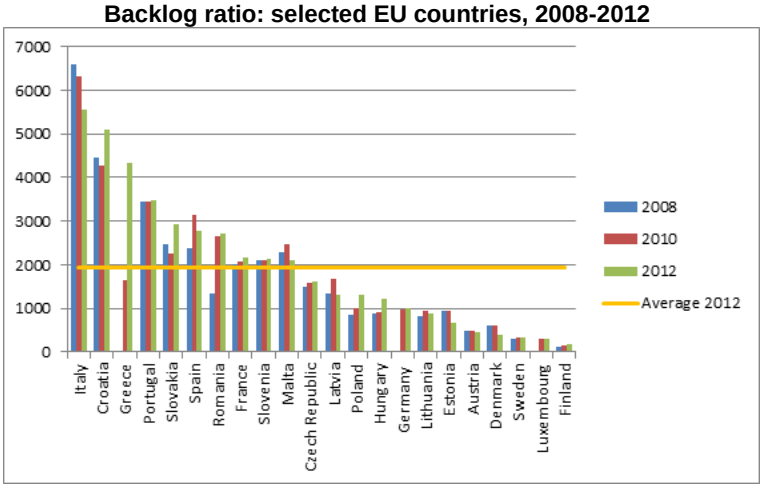
Appendix C. Evolution of key indicators (reform and efficiency variables) in Justice and Education in Portugal within Europe

As regards Justice, we compare Portugal within the European Union (EU) and across time, using data from the CEPEJ reports on "European judicial systems: efficiency and quality of justice" (2010, 2012 and 2014 editions)

Regarding court performance, there have been some improvements in the reduction of the disposition time (the time it takes for a pending case to be solved in a certain year); yet, in 2012, Portugal was still above the EU average in regards to both the backlog ratio (the number of unsolved cases *per capita*) and disposition time.

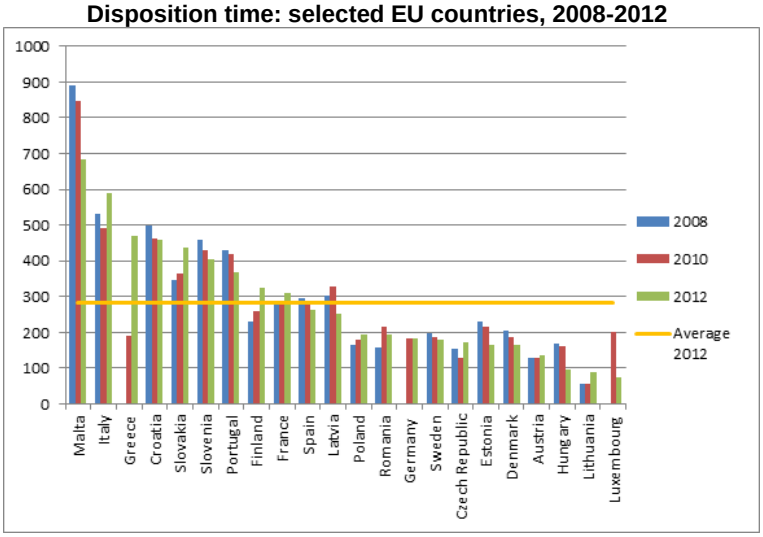
Among others, these improvements may have accrued from an increase in the number of judges per court, a reduction in the number of courts-to-population ratio, in spite of no significant changes in the share of public budget for courts ICT have occurred and a rise in the litigation rate (incoming cases per population) observed between 2008 and 2012. In 2012, the number of courts-to-population and the litigation rate were above EU average, while the number of judges per court and the share of public budget for courts ICT were still amongst the lowest records for the EU countries.

Backlog ratio: selected EU countries, 2008-2012



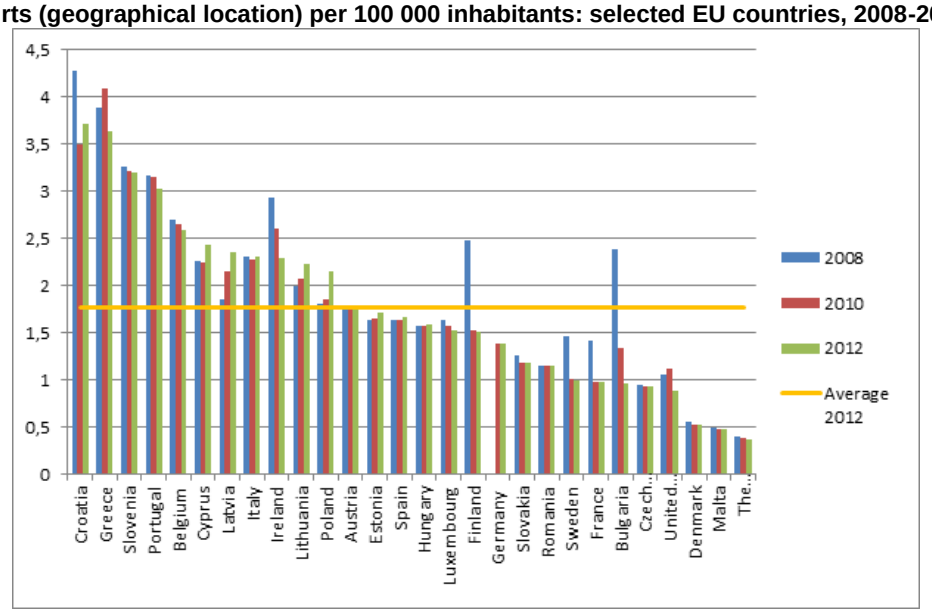
Source: own elaboration based on CEPEJ reports on "European judicial systems: efficiency and quality of justice" (2010, 2012 and 2014 editions), http://www.coe.int/t/dghl/cooperation/cepej/evaluation/default_en.asp in June 2016.

Disposition time: selected EU countries, 2008-2012



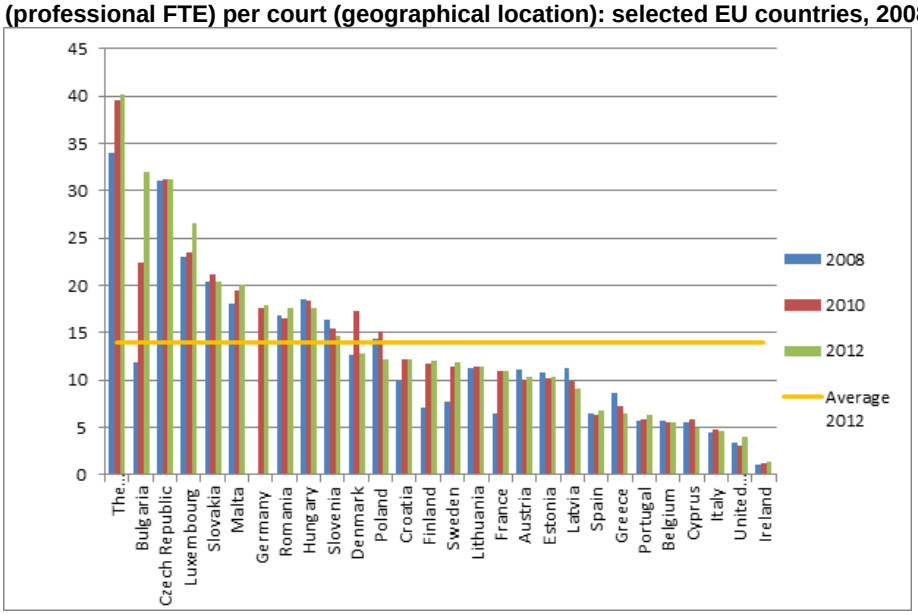
Source: own elaboration based on CEPEJ reports "European judicial systems: efficiency and quality of justice" (2010, 2012 and 2014 editions), http://www.coe.int/t/dghl/cooperation/cepej/evaluation/default_en.asp in June 2016.

Courts (geographical location) per 100 000 inhabitants: selected EU countries, 2008-2012



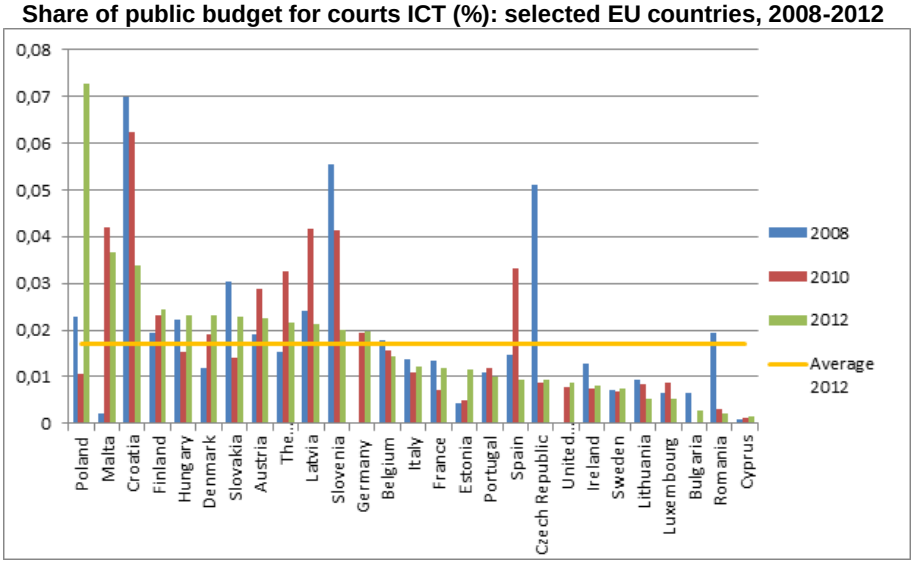
Source: own elaboration based on CEPEJ reports "European judicial systems: efficiency and quality of justice" (2010, 2012 and 2014 editions), http://www.coe.int/t/dghl/cooperation/cepej/evaluation/default_en.asp in June 2016.

Judges (professional FTE) per court (geographical location): selected EU countries, 2008-2012



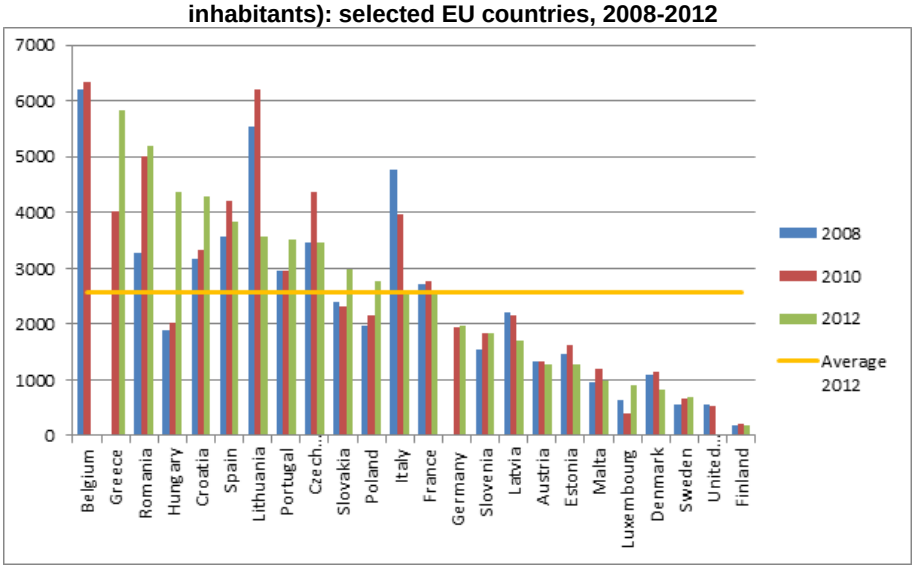
Source: own elaboration based on CEPEJ reports "European judicial systems: efficiency and quality of justice" (2010, 2012 and 2014 editions), http://www.coe.int/t/dghl/cooperation/cepej/evaluation/default_en.asp in June 2016.

Share of public budget for courts ICT (%): selected EU countries, 2008-2012



Source: own elaboration based on CEPEJ reports "European judicial systems: efficiency and quality of justice" (2010, 2012 and 2014 editions), http://www.coe.int/t/dghl/cooperation/cepej/evaluation/default_en.asp in June 2016.

Litigation rate (number of 1st instance civil and commercial litigious incoming cases per 100 000 inhabitants): selected EU countries, 2008-2012



Source: own elaboration based on CEPEJ reports "European judicial systems: efficiency and quality of justice" (2010, 2012 and 2014 editions), http://www.coe.int/t/dghl/cooperation/cepej/evaluation/default_en.asp in June 2016.

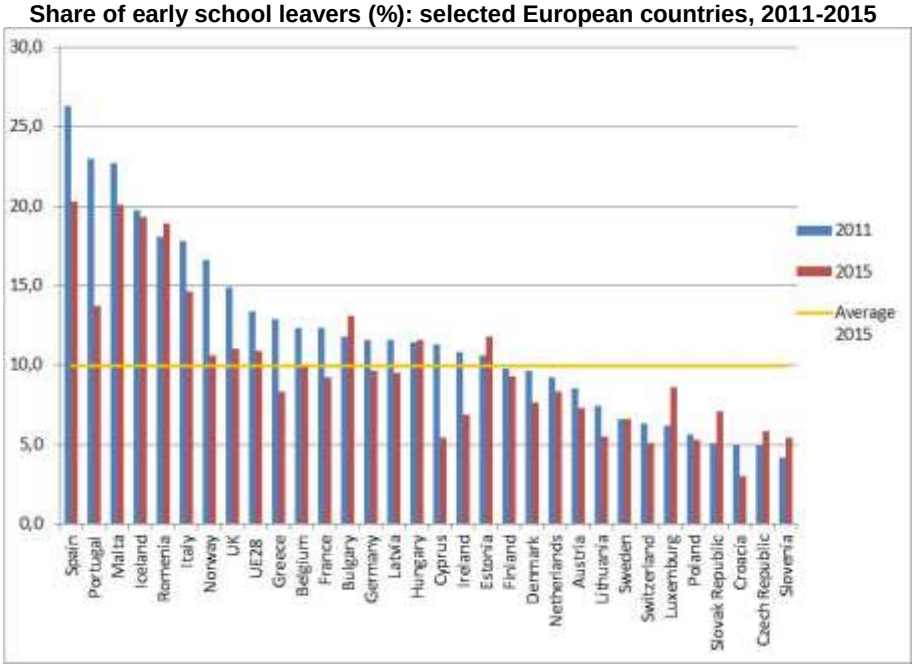
As far as Education is concerned, we compare Portugal within Europe / OECD and across time, using data from the OECD-PISA, Eurostat, and Ministry of Education-BI online databases.

As regards schooling attractiveness indicators, Portugal had the second largest rate of early school leavers in Europe (35 countries) in 2011, well above the UE-28 average, but experienced the largest fall in that rate in 2011-2015 (-9.3 p.p.), while the EU-28 average decreased by 2.5 p.p..

Looking at the indicators of schooling quality Portugal already had the largest instruction time (minutes per week) in Europe (33 countries) in 2009, and somewhat above the OECD average. Even so, instruction time increased in Portugal from 2009 to 2012, while it (slightly) decreased in the OECD average. In contrast, Portugal had the third largest rate of grade retention in Europe (primary and secondary school, 24 countries) in 2003, well above the OECD average, and that rate increased until 2012 (4.1 p.p.), while the OECD average decreased (by 0.5 p.p.). However, from 2013 to 2015, the rate in Portugal decreased by about 2 p.p.. Finally, regarding the school autonomy indicators (six indicators), Portugal was at or above the OECD average in 2009 in three cases ('Deciding on budget allocations within school'; 'Formulating school budget'; 'Choosing textbooks') and below or very well below in the other three ('Hiring

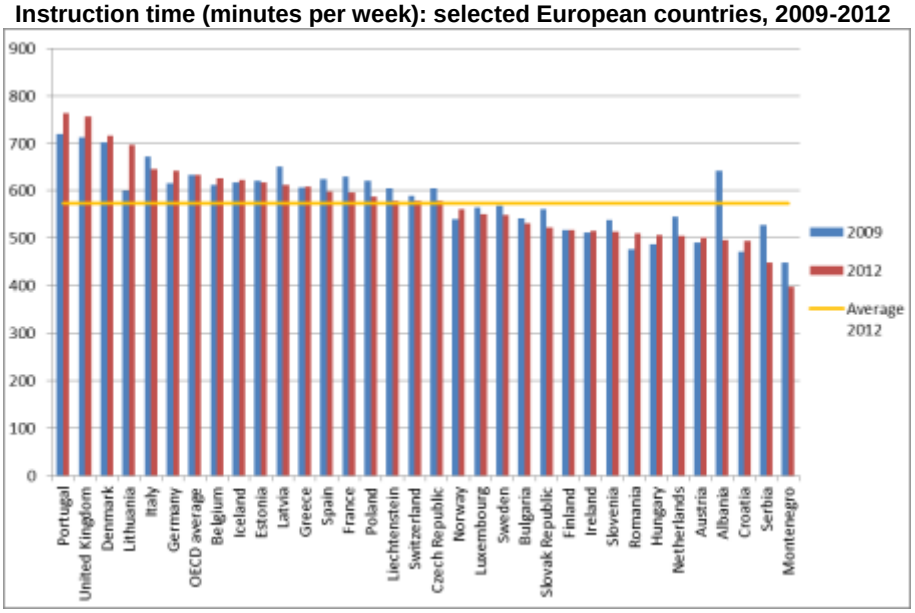
teachers'; 'Establishing teachers' starting salaries'; 'Determining course content'). From 2009 to 2012, all indicators increased in Portugal, except in the case of 'Choosing textbooks' (which already had a 100 percentage-point score). The largest increase occurred in 'Determining course content'. Yet, in spite of the upward movement, both 'Establishing teachers' starting salaries' and 'Determining course content' remained well below the OECD average.

Share of early school leavers (%): selected European countries, 2011-2015



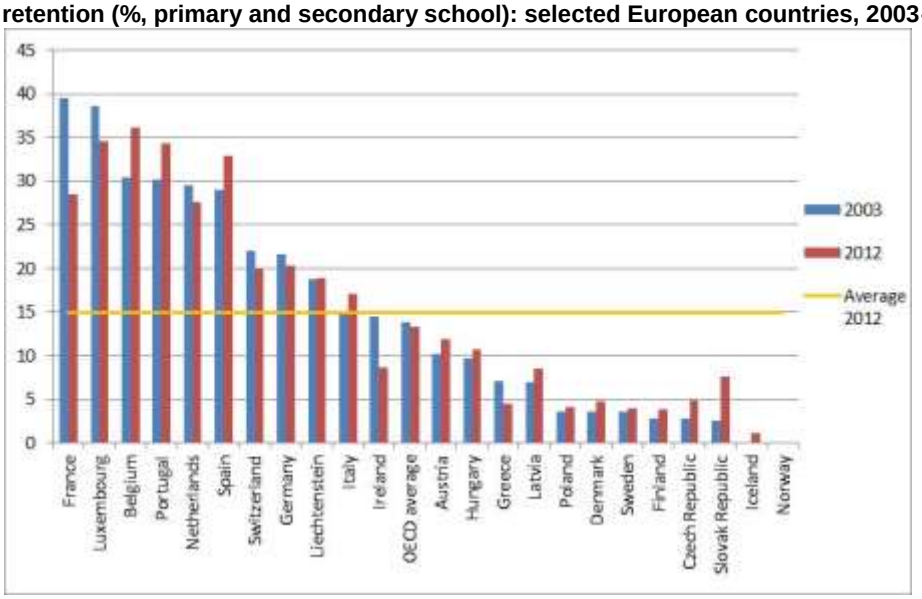
Source: own elaboration based on Eurostat online database, http://ec.europa.eu/eurostat

Instruction time (minutes per week): selected European countries, 2009-2012



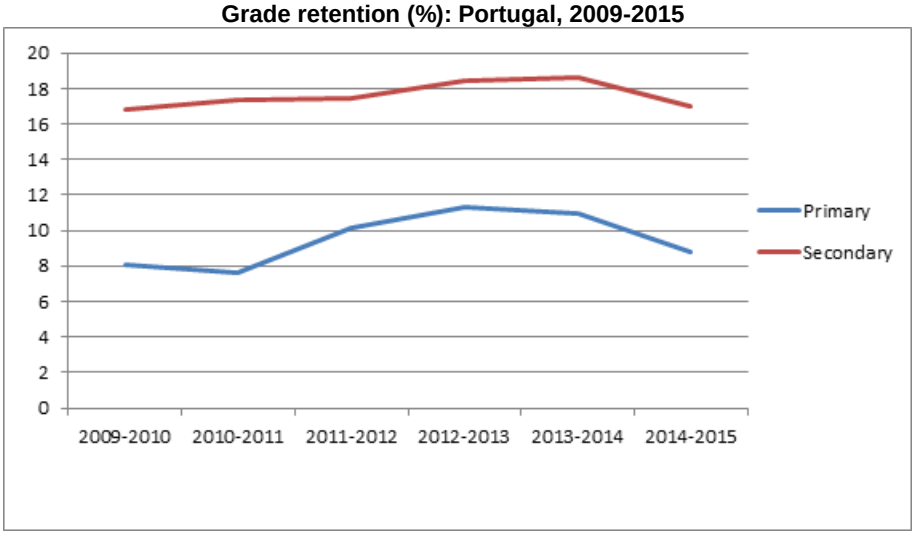
Source: own elaboration based on OECD PISA online database, www.oecd.org/pisa/keyfindings/

Grade retention (%, primary and secondary school): selected European countries, 2003-2012



Source: own elaboration based on OECD PISA online database, www.oecd.org/pisa/keyfindings/

Grade retention (%): Portugal, 2009-2015



Source: own elaboration based on Ministry of Education of Portugal, BI online database, http://bi.dgeec.mec.pt

School autonomy indicators: selected European countries, 2009 and change (p.p.) 2009-2012

	School autonomy over resource allocation								School autonomy over curricula and assessments			
	Deciding on budget allocations within school		Formulating school budget		Establishing teachers' starting salaries		Hiring teachers		Determining course content		Choosing textbooks	
	2009	Change 09-12	2009	Change 09-12	2009	Change 09-12	2009	Change 09-12	2009	Change 09-12	2009	Change 09-12
Albania	69	21	45	24	3	7	22	-9	43	23	99	-3
Austria	96	0	20	10	1	6	48	6	77	-3	99	1
Belgium	83	8	74	5	1	3	88	2	74	2	99	0
Bulgaria	99	-1	95	-29	86	-4	98	0	35	4	99	0
Croatia	91	-1	60	15	2	0	100	-1	61	-6	97	-4
Czech Republic	99	0	91	0	92	0	100	0	99	1	99	1
Denmark	100	-1	92	0	30	0	100	0	88	4	100	0
Estonia	99	-3	91	-2	27	-1	100	0	96	1	98	2
Finland	99	0	77	-6	16	-1	75	11	84	-8	100	0
Germany	98	-2	33	-18	3	0	66	-1	68	4	97	1
Greece	66	19	41	38	0	5	1	5	4	1	15	-4
Hungary	98	-3	88	-11	56	-8	100	0	85	1	100	0
Iceland	100	-8	87	0	20	3	100	-1	87	2	97	3
Ireland	94	-7	73	3	2	3	86	1	66	6	100	0
Italy	79	14	14	9	3	4	18	-4	86	2	100	0
Latvia	97	-1	88	7	25	31	98	2	64	-2	98	1
Liechtenstein	100	-11	37	26	6	28	41	52	41	39	60	34
Lithuania	72	15	52	27	19	59	100	0	85	5	99	1
Luxembourg	92	8	88	-6	6	15	62	8	80	-11	93	-7
Montenegro	87	-2	32	13	5	-3	100	0	39	-14	35	-13
Netherlands	100	0	100	0	80	8	100	0	99	-1	100	0
Norway	99	-1	83	-2	12	0	94	3	70	-4	99	0
OECD average	92	2	68	4	23	3	75	1	76	0	92	0
Poland	69	3	49	0	29	-10	99	-1	100	0	100	0
Portugal	92	4	73	9	6	3	70	6	8	26	100	0
Romania	53	9	32	20	3	31	9	58	80	-11	99	-19
Serbia	90	-1	36	0	10	-2	99	-2	43	-4	77	11
Slovak Republic	97	-3	85	-8	66	-8	100	0	95	1	95	0
Slovenia	99	-2	74	1	18	4	99	1	94	-6	99	0
Spain	97	1	67	18	5	1	34	0	63	-6	100	-1
Sweden	98	1	84	5	73	-9	100	0	92	-11	100	0
Switzerland	96	0	65	7	16	8	97	1	62	1	80	-5
UK	99	0	86	5	75	5	100	0	98	-1	100	0
Average:	91	2	65	5	24	6	78	4	70	1	91	0

Source: own elaboration based on OECD PISA online database, www.oecd.org/pisa/keyfindings/.

Note: Percentage of students in schools whose principals reported that only "principals and/or teachers" or both "principals and/or teachers" and "regional and/or national education authority" or "school governing board" has/have a considerable responsibility for the described tasks.

Appendix D. Detailed results of the simulation exercises

In this appendix, we present the results of our simulation exercises (Section 4) for a larger number of macroeconomic variables and for a larger number of time periods.

Firms' entry cost mechanism

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	-0.023	-0.003	0.024	0.048	0.068	0.137	0.210	0.277	0.299
PT_GBY (pp)	0.042	0.019	0.014	0.013	0.013	0.008	-0.004	0.003	0.000
PT_I	-0.103	-0.136	-0.123	-0.091	-0.054	0.093	0.186	0.198	0.202
PT_IG	-0.024	-0.023	-0.006	0.015	0.034	0.106	0.170	0.210	0.226
PT_IM	-0.005	-0.024	-0.029	-0.027	-0.023	-0.002	0.008	-0.006	-0.007
PT_INFLATION (pp)	0.001	-0.007	-0.006	-0.005	-0.005	-0.003	-0.001	0.000	0.000
PT_L	0.060	0.037	0.029	0.027	0.028	0.036	0.038	0.023	0.024
PT_LHY	-1.837	-2.030	-1.936	-1.842	-1.763	-1.514	-1.361	-1.350	-1.348
PT_LLY	0.035	0.031	0.023	0.021	0.021	0.029	0.032	0.018	0.018
PT_LMY	0.036	0.022	0.014	0.015	0.017	0.026	0.028	0.014	0.015
PT_LRD	7.752	7.055	6.693	6.396	6.142	5.348	4.847	4.707	4.709
PT_PAT	0.716	1.364	1.908	2.369	2.761	3.991	4.768	4.927	4.933
PT_WR	0.143	0.152	0.164	0.176	0.188	0.236	0.293	0.356	0.374
PT_WRH	1.225	1.263	1.213	1.177	1.149	1.067	1.041	1.091	1.109
PT_WRL	0.000	0.026	0.051	0.070	0.086	0.146	0.211	0.276	0.294
PT_WRM	0.022	0.042	0.055	0.069	0.086	0.149	0.214	0.278	0.296
PT_Y	-0.029	-0.024	-0.001	0.025	0.049	0.135	0.214	0.268	0.289
PT_TBY (pp)	-0.003	0.007	0.011	0.011	0.009	0.001	-0.003	0.002	0.002

Source: own elaboration.

Note: 500-period simulation for convergence (LR = Long run). GDP (PT_Y), Patents (PT_PAT), Employment (PT_L) [high-skilled in production (PT_LHY), medium-skilled (PT_LMY), low-skilled (PT_LLY), and high-skilled in R&D (PT_LRD)], Real wages (PT_WR) [high-skilled (PT_WRH), medium-skilled (PT_WRM), low-skilled (PT_WRL)], Private and Public investment (PT_I and PT_IG), Current account (PT_TBY), Public budget balance (PT_GBY), Inflation (PT_INFLATION).

Allocative efficiency mechanism

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	0.192	0.224	0.230	0.233	0.237	0.259	0.294	0.335	0.350
PT_GBY (pp)	-0.028	0.011	0.021	0.022	0.019	0.005	-0.005	0.002	0.000
PT_I	0.078	0.155	0.199	0.220	0.229	0.238	0.239	0.235	0.238
PT_IG	0.107	0.155	0.175	0.184	0.189	0.209	0.233	0.255	0.266
PT_IM	-0.053	-0.027	-0.008	0.001	0.005	0.009	0.006	-0.005	-0.006
PT_INFLATION (pp)	-0.021	-0.004	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.000
PT_L	-0.070	-0.030	-0.011	-0.004	-0.002	0.002	0.001	-0.009	-0.009
PT_LHY	-0.104	-0.014	-0.012	-0.007	-0.004	0.004	0.003	-0.015	-0.014
PT_LLY	-0.068	-0.039	-0.016	-0.005	-0.001	0.002	0.000	-0.010	-0.009
PT_LMY	-0.076	-0.022	-0.003	-0.001	-0.001	0.003	0.002	-0.008	-0.007
PT_LRD	0.177	0.053	0.002	-0.007	-0.006	0.014	0.013	0.001	0.003
PT_PAT	0.011	0.019	0.019	0.017	0.014	0.011	0.015	0.001	0.004
PT_WR	0.120	0.171	0.198	0.212	0.219	0.238	0.268	0.308	0.320
PT_WRH	0.065	0.183	0.212	0.219	0.222	0.237	0.267	0.311	0.323
PT_WRL	0.153	0.180	0.195	0.208	0.217	0.238	0.268	0.308	0.321
PT_WRM	0.104	0.155	0.195	0.214	0.222	0.237	0.268	0.307	0.319
PT_Y	0.147	0.202	0.223	0.233	0.239	0.264	0.295	0.326	0.340
PT_TBY (pp)	0.040	0.017	0.005	0.000	-0.002	-0.004	-0.003	0.001	0.001

Source: own elaboration.

Note: 500-period simulation for convergence (LR = Long run). See notes to Table "Firms' entry cost mechanism"

Risk premium – intangibles mechanism

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	-0.006	-0.004	0.001	0.005	0.008	0.019	0.030	0.042	0.045
PT_GBY (pp)	0.000	-0.004	-0.004	-0.004	-0.003	0.000	0.002	0.000	0.000
PT_I	-0.018	-0.025	-0.024	-0.019	-0.013	0.011	0.026	0.030	0.031
PT_IG	-0.003	-0.004	-0.002	0.001	0.004	0.014	0.023	0.032	0.034
PT_IM	0.003	-0.001	-0.002	-0.003	-0.003	-0.001	-0.001	0.000	-0.001
PT_INFLATION (pp)	0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.000
PT_L	0.011	0.005	0.003	0.001	0.001	-0.001	-0.002	-0.001	-0.002
PT_LHY	-0.325	-0.362	-0.345	-0.329	-0.316	-0.274	-0.249	-0.243	-0.243
PT_LLY	0.006	0.005	0.002	0.000	0.000	-0.002	-0.002	-0.002	-0.002
PT_LMY	0.006	0.003	0.000	-0.001	-0.001	-0.002	-0.003	-0.003	-0.003
PT_LRD	1.378	1.244	1.174	1.117	1.067	0.915	0.826	0.808	0.808
PT_PAT	0.129	0.244	0.340	0.420	0.488	0.695	0.817	0.845	0.846
PT_WR	0.026	0.028	0.030	0.033	0.035	0.044	0.053	0.062	0.065
PT_WRH	0.217	0.223	0.214	0.207	0.203	0.189	0.185	0.191	0.194
PT_WRL	0.000	0.006	0.011	0.014	0.017	0.028	0.039	0.049	0.052
PT_WRM	0.005	0.009	0.012	0.014	0.017	0.029	0.039	0.049	0.052
PT_Y	-0.005	-0.005	-0.002	0.002	0.006	0.018	0.030	0.041	0.044
PT_TBY (pp)	-0.002	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.000

Source: own elaboration.

Note: 500-period simulation for convergence (LR = Long run). See notes to Table “Firms’ entry cost mechanism“

Risk premium – tangibles mechanism (overall efficiency)

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	0.056	0.087	0.125	0.176	0.236	0.549	1.009	1.587	1.789
PT_GBY (pp)	-0.038	-0.019	-0.007	-0.003	-0.001	0.009	0.018	0.009	0.001
PT_I	2.123	3.178	3.680	3.907	4.002	4.017	3.929	3.869	3.885
PT_IG	0.040	0.132	0.205	0.262	0.311	0.518	0.813	1.192	1.324
PT_IM	-0.032	0.039	0.092	0.115	0.120	0.085	0.021	-0.048	-0.070
PT_INFLATION (pp)	-0.010	-0.007	-0.010	-0.013	-0.015	-0.014	-0.009	-0.002	0.000
PT_L	0.045	0.099	0.125	0.132	0.130	0.111	0.085	0.053	0.044
PT_LHY	-0.023	0.036	0.051	0.055	0.055	0.040	0.007	-0.036	-0.050
PT_LLY	0.051	0.112	0.148	0.161	0.161	0.137	0.109	0.074	0.064
PT_LMY	0.037	0.082	0.098	0.097	0.092	0.078	0.057	0.030	0.023
PT_LRD	0.222	0.174	0.109	0.077	0.065	0.064	0.063	0.062	0.065
PT_PAT	0.016	0.035	0.044	0.049	0.051	0.057	0.064	0.067	0.081
PT_WR	-0.027	0.011	0.068	0.127	0.186	0.451	0.839	1.334	1.505
PT_WRH	0.004	0.078	0.136	0.186	0.238	0.498	0.889	1.390	1.563
PT_WRL	-0.027	-0.008	0.042	0.105	0.168	0.441	0.828	1.325	1.495
PT_WRM	-0.028	0.025	0.096	0.160	0.217	0.475	0.859	1.351	1.520
PT_Y	0.051	0.150	0.231	0.299	0.361	0.634	1.026	1.527	1.702
PT_TBY (pp)	0.015	-0.015	-0.036	-0.045	-0.046	-0.032	-0.010	0.015	0.024

Source: own elaboration.

Note: 500-period simulation for convergence (LR = Long run). See notes to Table “Firms’ entry cost mechanism“.

Risk premium – tangibles mechanism (insolvency)

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	0.081	0.126	0.179	0.250	0.334	0.772	1.421	2.240	2.530
PT_GBY (pp)	-0.054	-0.027	-0.010	-0.004	-0.001	0.012	0.025	0.013	0.001
PT_I	2.975	4.456	5.162	5.484	5.621	5.659	5.553	5.486	5.513
PT_IG	0.054	0.183	0.287	0.367	0.437	0.728	1.143	1.680	1.870
PT_IM	-0.049	0.050	0.124	0.157	0.165	0.117	0.028	-0.068	-0.100
PT_INFLATION (pp)	-0.014	-0.010	-0.014	-0.018	-0.021	-0.020	-0.012	-0.003	0.000
PT_L	0.063	0.138	0.176	0.186	0.184	0.156	0.121	0.076	0.064
PT_LHY	-0.033	0.050	0.072	0.077	0.077	0.055	0.011	-0.050	-0.070
PT_LLY	0.071	0.156	0.208	0.227	0.227	0.194	0.155	0.106	0.092
PT_LMY	0.051	0.115	0.138	0.136	0.130	0.110	0.081	0.044	0.033
PT_LRD	0.311	0.247	0.155	0.110	0.093	0.091	0.089	0.088	0.092
PT_PAT	0.023	0.049	0.062	0.069	0.072	0.080	0.090	0.096	0.115
PT_WR	-0.039	0.014	0.094	0.178	0.260	0.633	1.178	1.881	2.126
PT_WRH	0.004	0.108	0.190	0.262	0.334	0.699	1.249	1.960	2.209
PT_WRL	-0.038	-0.012	0.058	0.146	0.235	0.617	1.164	1.867	2.112
PT_WRM	-0.040	0.033	0.133	0.223	0.304	0.667	1.208	1.904	2.147
PT_Y	0.071	0.210	0.324	0.420	0.507	0.891	1.443	2.154	2.405
PT_TBY (pp)	0.023	-0.019	-0.049	-0.061	-0.063	-0.045	-0.013	0.021	0.034

Source: own elaboration.

Note: 500-period simulation for convergence (LR = Long run). See notes to Table “Firms’ entry cost mechanism“.

International technology linkages - FDI inflows mechanism

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	0.058	0.142	0.220	0.284	0.338	0.523	0.717	0.911	0.977
PT_GBY (pp)	0.016	0.001	0.004	0.009	0.014	0.018	0.004	0.006	0.000
PT_I	-0.215	-0.239	-0.171	-0.071	0.033	0.397	0.616	0.653	0.661
PT_IG	0.013	0.058	0.117	0.175	0.226	0.405	0.567	0.694	0.739
PT_IM	-0.034	-0.061	-0.065	-0.057	-0.046	-0.005	0.010	-0.014	-0.020
PT_INFLATION (pp)	-0.018	-0.021	-0.018	-0.015	-0.012	-0.007	-0.003	-0.001	0.000
PT_L	0.040	0.008	-0.002	-0.004	-0.003	0.000	-0.003	-0.026	-0.027
PT_LHY	-1.664	-1.640	-1.359	-1.112	-0.906	-0.282	0.076	0.114	0.113
PT_LLY	0.014	0.001	-0.008	-0.011	-0.009	-0.002	-0.004	-0.027	-0.029
PT_LMY	0.018	0.000	-0.008	-0.007	-0.005	0.000	-0.001	-0.022	-0.023
PT_LRD	7.064	5.593	4.589	3.760	3.064	0.972	-0.251	-0.530	-0.527
PT_PAT	1.999	3.731	5.183	6.407	7.437	10.598	12.490	12.871	12.884
PT_WR	0.185	0.231	0.275	0.317	0.354	0.494	0.650	0.824	0.879
PT_WRH	1.149	1.107	0.994	0.906	0.836	0.644	0.608	0.749	0.804
PT_WRL	0.060	0.136	0.202	0.257	0.305	0.478	0.655	0.833	0.888
PT_WRM	0.073	0.139	0.196	0.250	0.300	0.477	0.653	0.830	0.885
PT_Y	0.025	0.088	0.164	0.234	0.297	0.515	0.718	0.887	0.945
PT_TBY (pp)	0.011	0.024	0.026	0.023	0.018	0.001	-0.005	0.003	0.006

Source: own elaboration.

Note: 500-period simulation for convergence (LR = Long run). See notes to Table “Firms’ entry cost mechanism“.

Entrepreneurship/self-employment mechanism

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	1.553	2.385	2.736	2.884	2.964	3.312	3.903	4.498	4.720
PT_GBY (pp)	0.165	0.602	0.822	0.861	0.802	0.285	-0.221	0.067	0.000
PT_I	0.117	1.003	1.803	2.337	2.655	3.129	3.276	3.128	3.180
PT_IG	0.472	1.182	1.675	1.974	2.165	2.711	3.222	3.385	3.564
PT_IM	-0.885	-0.846	-0.583	-0.354	-0.193	0.157	0.236	-0.110	-0.094
PT_INFLATION (pp)	-0.323	-0.148	-0.061	-0.028	-0.018	-0.018	-0.011	-0.002	0.000
PT_L	1.327	2.484	3.197	3.577	3.771	4.109	4.234	3.890	3.926
PT_LHY	0.698	1.060	1.282	1.512	1.722	2.431	2.790	2.290	2.349
PT_LLY	1.391	2.742	3.693	4.238	4.512	4.859	4.982	4.640	4.675
PT_LMY	1.244	2.161	2.576	2.733	2.812	3.112	3.232	2.907	2.943
PT_LRD	2.716	4.428	4.491	4.361	4.272	4.228	3.862	3.263	3.334
PT_PAT	0.100	0.490	0.889	1.240	1.548	2.676	3.663	3.424	3.493
PT_WR	-2.002	-2.189	-1.977	-1.770	-1.633	-1.365	-0.953	-0.330	-0.170
PT_WRH	-1.447	-0.894	-0.487	-0.328	-0.290	-0.310	-0.023	0.699	0.846
PT_WRL	-1.968	-2.525	-2.489	-2.278	-2.072	-1.681	-1.261	-0.637	-0.478
PT_WRM	-2.074	-1.937	-1.422	-1.080	-0.920	-0.704	-0.277	0.343	0.504
PT_Y	0.797	1.685	2.254	2.586	2.795	3.418	4.057	4.346	4.573
PT_TBY (pp)	0.448	0.405	0.260	0.145	0.070	-0.068	-0.099	0.029	0.022

Source: own elaboration.

Note: 500-period simulation for convergence (LR = Long run). See notes to Table “Firms’ entry cost mechanism“.

Liquidity constraint mechanism

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	0.309	0.749	0.953	1.068	1.156	1.522	1.976	2.009	2.107
PT_GBY (pp)	2.511	2.157	1.941	1.713	1.468	0.327	-0.620	0.131	-0.001
PT_I	-0.397	-0.172	0.187	0.514	0.785	1.597	1.915	1.299	1.406
PT_IG	0.086	0.047	0.256	0.473	0.668	1.380	1.834	1.449	1.576
PT_IM	-0.092	-0.651	-0.612	-0.459	-0.303	0.232	0.368	-0.132	-0.067
PT_INFLATION (pp)	-0.156	-0.081	-0.039	-0.025	-0.021	-0.017	-0.006	-0.001	0.000
PT_L	0.251	0.346	0.626	0.909	1.156	1.949	2.167	1.435	1.533
PT_LHY	0.331	0.653	1.104	1.433	1.728	2.779	3.230	2.315	2.449
PT_LLY	0.231	0.300	0.554	0.838	1.095	1.919	2.152	1.403	1.503
PT_LMY	0.313	0.359	0.650	0.924	1.145	1.861	2.053	1.377	1.468
PT_LRD	-0.918	1.206	1.884	2.295	2.648	3.600	3.193	2.108	2.242
PT_PAT	-0.135	-0.064	0.108	0.311	0.531	1.671	2.921	2.204	2.345
PT_WR	-0.205	-0.285	-0.369	-0.431	-0.483	-0.618	-0.365	0.103	0.128
PT_WRH	-0.397	-0.688	-0.669	-0.720	-0.803	-1.094	-0.976	-0.415	-0.410
PT_WRL	-0.183	-0.200	-0.322	-0.427	-0.499	-0.637	-0.371	0.112	0.136
PT_WRM	-0.194	-0.336	-0.436	-0.471	-0.495	-0.586	-0.309	0.127	0.155
PT_Y	0.150	0.204	0.456	0.698	0.912	1.703	2.254	1.874	2.023
PT_TBY (pp)	0.036	0.275	0.247	0.178	0.114	-0.090	-0.143	0.044	0.019

Source: own elaboration.

Note: 500-period simulation for convergence (LR = Long run). See notes to Table “Firms’ entry cost mechanism“.

School attainment (1) mechanism

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	0.141	0.260	0.361	0.459	0.555	1.076	2.267	5.870	7.272
PT_GBY (pp)	0.007	0.016	0.022	0.025	0.026	0.026	0.034	0.040	0.000
PT_I	-0.590	-0.804	-0.840	-0.789	-0.698	-0.080	1.186	4.683	4.930
PT_IG	0.070	0.140	0.212	0.288	0.367	0.797	1.749	4.567	5.540
PT_IM	-0.039	-0.066	-0.076	-0.077	-0.073	-0.046	-0.017	0.030	-0.059
PT_INFLATION (pp)	-0.033	-0.027	-0.024	-0.023	-0.023	-0.027	-0.030	-0.020	0.000
PT_L	0.001	0.013	0.032	0.058	0.084	0.203	0.387	0.746	0.659
PT_LHY	0.019	0.031	0.189	0.574	0.988	3.109	7.289	17.763	17.946
PT_LLY	-0.372	-0.704	-1.004	-1.288	-1.563	-2.906	-5.457	-11.848	-11.988
PT_LMY	0.588	1.130	1.622	2.076	2.513	4.623	8.539	18.109	18.109
PT_LRD	-0.393	-0.343	-0.153	0.395	0.940	3.192	6.473	13.812	12.756
PT_PAT	-0.039	-0.070	-0.089	-0.061	0.019	0.946	3.796	12.011	13.426
PT_WR	0.035	0.100	0.160	0.220	0.277	0.588	1.366	3.924	5.183
PT_WRH	-0.041	-0.021	-0.075	-0.288	-0.509	-1.578	-3.398	-6.863	-5.865
PT_WRL	0.264	0.469	0.647	0.823	1.002	1.964	4.064	10.538	11.826
PT_WRM	-0.407	-0.697	-0.945	-1.168	-1.389	-2.424	-4.059	-7.088	-5.941
PT_Y	0.099	0.194	0.287	0.384	0.484	1.025	2.230	5.827	7.105
PT_TBY (pp)	0.020	0.028	0.030	0.029	0.026	0.015	0.001	-0.022	0.007

Source: own elaboration.

Note: 800-period simulation for convergence (LR = Long run). See notes to Table “Firms’ entry cost mechanism“.

School attainment (2) mechanism

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	0.069	0.128	0.180	0.229	0.279	0.552	1.202	3.380	4.248
PT_GBY (pp)	0.005	0.009	0.012	0.013	0.014	0.014	0.019	0.023	0.000
PT_I	-0.318	-0.440	-0.467	-0.447	-0.406	-0.102	0.560	2.731	2.887
PT_IG	0.036	0.071	0.106	0.144	0.184	0.407	0.924	2.641	3.246
PT_IM	-0.016	-0.030	-0.036	-0.037	-0.036	-0.026	-0.015	0.022	-0.036
PT_INFLATION (pp)	-0.016	-0.013	-0.012	-0.012	-0.012	-0.014	-0.017	-0.013	0.000
PT_L	0.001	0.006	0.015	0.028	0.041	0.103	0.205	0.444	0.387
PT_LHY	0.011	0.015	0.086	0.266	0.472	1.549	3.741	9.705	9.823
PT_LLY	-0.187	-0.355	-0.507	-0.651	-0.792	-1.486	-2.846	-6.534	-6.626
PT_LMY	0.296	0.569	0.818	1.049	1.273	2.368	4.469	10.075	10.076
PT_LRD	-0.198	-0.174	-0.089	0.164	0.437	1.594	3.360	7.791	7.138
PT_PAT	-0.019	-0.035	-0.046	-0.034	0.003	0.462	1.939	6.630	7.504
PT_WR	0.019	0.052	0.082	0.111	0.140	0.300	0.719	2.248	3.033
PT_WRH	-0.019	-0.009	-0.033	-0.132	-0.244	-0.798	-1.794	-3.944	-3.297
PT_WRL	0.133	0.235	0.324	0.412	0.502	0.987	2.068	5.607	6.388
PT_WRM	-0.203	-0.349	-0.478	-0.596	-0.712	-1.268	-2.200	-4.177	-3.428
PT_Y	0.051	0.097	0.144	0.192	0.243	0.524	1.178	3.361	4.151
PT_TBY (pp)	0.008	0.013	0.014	0.014	0.013	0.008	0.002	-0.014	0.004

Source: own elaboration.

Note: 800-period simulation for convergence (LR = Long run). See notes to Table “Firms’ entry cost mechanism“.

School achievement mechanism

	1Y	2Y	3Y	4Y	5Y	10Y	20Y	50Y	LR
PT_EX	0.023	0.039	0.053	0.065	0.076	0.140	0.296	0.739	0.816
PT_GBY (pp)	0.001	0.003	0.005	0.006	0.007	0.008	0.008	-0.007	0.000
PT_I	-0.080	-0.109	-0.115	-0.109	-0.098	-0.026	0.137	0.608	0.557
PT_IG	0.005	0.013	0.022	0.031	0.041	0.095	0.223	0.583	0.627
PT_IM	-0.015	-0.021	-0.022	-0.022	-0.022	-0.018	-0.010	0.011	-0.006
PT_INFLATION (pp)	-0.005	-0.003	-0.003	-0.003	-0.003	-0.003	-0.004	0.003	0.000
PT_L	-0.008	-0.010	-0.011	-0.012	-0.013	-0.019	-0.035	-0.079	-0.080
PT_LHY	0.020	0.021	0.018	0.016	0.014	0.014	0.024	-0.024	0.024
PT_LLY	-0.012	-0.016	-0.019	-0.021	-0.023	-0.038	-0.069	-0.140	-0.141
PT_LMY	-0.005	-0.003	-0.002	0.000	0.000	0.005	0.012	0.009	0.005
PT_LRD	-0.056	-0.035	-0.022	-0.013	-0.006	0.011	-0.002	-0.071	-0.140
PT_PAT	-0.002	0.000	0.007	0.018	0.031	0.125	0.380	1.098	1.027
PT_WR	0.013	0.024	0.035	0.046	0.057	0.116	0.258	0.672	0.739
PT_WRH	0.005	0.025	0.043	0.060	0.075	0.154	0.330	0.795	0.856
PT_WRL	0.008	0.011	0.013	0.017	0.020	0.046	0.121	0.415	0.492
PT_WRM	0.015	0.029	0.044	0.059	0.074	0.150	0.326	0.806	0.866
PT_Y	0.010	0.021	0.033	0.045	0.057	0.124	0.286	0.738	0.799
PT_TBY (pp)	0.007	0.008	0.008	0.008	0.008	0.006	0.003	-0.005	0.000

Source: own elaboration.

Note: 800-period simulation for convergence (LR = Long run). See notes to Table “Firms’ entry cost mechanism“.

Appendix E. Long-run output effect of a 1% change in each reform variable

Expected % change in output in 50 years from 1% change in a reform variable	
	% change in Y relative to initial steady state
JUSTICE	
Financing cost mechanism - intangibles	
increase in the judges per population ratio	0.006
reduction in the courts per population ratio	0.006
Financing cost mechanism - tangibles	
increase in the judges per population ratio	0.233
reduction in the courts per population ratio	0.236
Firms' entry cost mechanism	
increase in the judges per court ratio	0.015
decrease in the courts per population ratio	0.018
decrease in the litigation rate	0.012
increase in the share of public budget for courts ICT	0.003
Allocative efficiency mechanism	
increase in the judges per court ratio	0.018
decrease in the courts per population ratio	0.022
decrease in the litigation rate	0.015
increase in the share of public budget for courts ICT	0.004
International technology linkages mechanism	
increase in the judges per court ratio	0.022
decrease in the courts per population ratio	0.022
decrease in the litigation rate	0.054
increase in the share of public budget for courts ICT	0.004
Entrepreneurship/self-employment mechanism	
increase in the overall index of pre-insolvency framework	0.402
Liquidity constraint mechanism	
decrease in the share of liquidity constrained households	0.071
EDUCATION	
Schooling attractiveness – school attainment mechanism	
decrease in the rate of early school leavers (baseline scenario)	0.144
decrease in the rate of early school leavers (low fertility rate scenario)	0.083
Schooling quality – school achievement mechanism	
increase in the PISA math score	0.601

Source: own elaboration, assuming changes in each variable alone.