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The quantification of structural reforms

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THE QUANTIFICATION OF STRUCTURAL REFORMS: TAKING STOCK OF THE RESULTS FOR OECD AND NON-OECD COUNTRIES

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Abstract/Résumé

The quantification of structural reforms: Taking stock of the results for OECD and non-OECD countries

This paper summarises earlier OECD work aimed at quantifying the impact of structural reforms on economic outcomes. It overviews: i.) insights obtained for the linear relationships linking policies and economic outcomes (including multi-factor productivity, capital deepening and employment) for an almost complete set of OECD countries, ii.) non-linear results on how policies interact with each other in OECD countries, and iii.) results extended for emerging-market economies looking at whether policy effects vary across countries depending on the level of economic development and whether institutions have an influence on economic outcomes. The paper lists of policies and institutions that could be used to quantify the effect of reforms. It also gives some guidance on how to quantify reforms in OECD and non-OECD countries. It provides mid-point estimates of the long-run effects on per capita income levels through the three supply-side channels. Finally, it raises the issue of estimation and model uncertainty.

***JEL Classification*:** D24, E17, E22, E24, J08

***Keywords*:** structural reform, product and labour market regulation, institutions, productivity, investment, employment, OECD, emerging market

La quantification des réformes structurelles: Bilan des résultats pour les pays de l'OCDE et les pays non membres de l'OCDE

Ce document résume les travaux antérieurs de l'OCDE visant à quantifier l'impact des réformes structurelles sur l'économie. Il donne une vue d'ensemble des relations linéaires liant les politiques et l'économie (y compris la productivité multifactorielle, l'approfondissement du capital et l'emploi) pour un ensemble presque complet de pays de l'OCDE, ii) les résultats non linéaires sur la façon dont les politiques interagissent dans les pays de l'OCDE, et iii.) les résultats étendus aux pays émergents pour déterminer si les effets des politiques varient selon les pays en fonction du niveau de développement économique et si les institutions ont une influence sur les résultats économiques. Le papier liste des politiques et des institutions qui pourraient être utilisées pour quantifier l'effet des réformes. Il donne également des indications sur la manière de quantifier les réformes dans les pays de l'OCDE et les pays non membres de l'OCDE. Il fournit des estimations des effets de long terme sur les niveaux de revenu par habitant à travers les trois canaux de l'offre. Enfin, il soulève la question de l'incertitude liée aux estimations économétriques.

***JEL Classification*:** D24, E17, E22, E24, J08

***Mots-clés*:** réformes structurelles, règlementation des marchés du travail et des produits, institutions, productivité, investissement, emploi, OCDE, pays émergents.

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THE QUANTIFICATION OF STRUCTURAL REFORMS: TAKING STOCK OF THE RESULTS AND NON-OECD and NON-OECD COUNTRIES

By Balázs Égert[1]

1. Introduction

1. This document presents a summary of previous OECD studies aimed at quantifying the impact of structural reforms on economic outcomes (Égert and Gal, 2016 and 2018 and Égert, 2017). It tries to distil the results which are consistent across different country groups (OECD and non-OECD countries) and across the three supply side channels including multi-factor productivity, capital deepening and employment. The impacts of structural reforms are presented for OECD countries and for a larger group of countries including advanced, emerging and developing countries, and for less advanced countries for a limited set of variables.

2. This document combines three strands of empirical results. First, insights obtained for the linear relationships linking policies and economic outcomes (including multi-factor productivity, capital deepening and employment) for an almost complete set of OECD countries. Second, new non-linear results on how policies interact with each other when affecting outcomes in OECD countries. Finally, results extended for emerging-market economies look at whether policy effects vary across countries depending on the level of economic development and whether institutions have an influence on economic outcomes.

3. This document provides the list of policies and institutions that could be used to quantify the effect of reforms. It also gives some guidance on how to quantify reforms in OECD and non-OECD countries. It provides mid-point estimates of the long-run effects on per capita income levels through the three supply-side channels. Finally, it raises the issue of estimation and model uncertainty, giving an idea of the magnitude of these uncertainties, and proposes ways how to calculate more country-specific reform effects. The results presented in this document will be integrated into a policy simulator, to provide a user-friendly transparent starting point for country desks to evaluate the impact of planned or past reforms in OECD and non-OECD countries.

4. The document is structured as follows. Section 2 provides a brief reminder of the main features of the quantification framework. Section 3 describes the main results of the three analytical studies presented at earlier WP1 meetings. Section 4 discusses the overlaps and complementarities across different estimation results. Section 5, presents an overview of the policy effects and provides guidance on how to use them. Section 6 deals with uncertainty surrounding the policy effects. Finally, Section 7 shows how the

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framework can to some extent be tailored to allow for country-specific estimates of reform impacts.

2. Some guidance on the use of the quantification framework

5. This section first gives an overview of the policy and regulatory variables that can be used for quantification. It then goes on to provide guidance on which particular estimates should be given priority in quantifying policy packages and how this depends on the country where the reforms are being implemented, including in some cases the particular characteristics of that country.

2.1. Variables included in the quantification framework for OECD and non-OECD countries

6. A large number of policy variables have been scrutinised with a view to including them into the quantification framework. A number of them were found to be connected to at least one of the three supply-side channels (MFP, capital deepening and employment). Table 1 summarises the variables for which effects on per capita income levels could be quantified through the three supply-side channels in the new framework.

7. The effects of more policies can be assessed directly for OECD countries compared to non-OECD countries. This is notably the case for many labour market and social policies. There are two reasons for this. First, some policy indicators are not available for non-OECD countries. These include for instance spending on active labour market policies, the unemployment benefit replacement rate, the coverage of wage bargaining agreements relative to the coverage of unions (so-called excess coverage variable), the minimum wage or the tax wedge. Second, in the case of some variables which are available for both OECD and non-OECD countries, the empirical estimates coming from regression analysis over a wider country sample turned out not very robust. An example is the OECD's EPL indicator. While it is available for OECD and non-OECD countries, no robust empirical link between EPL and economic outcomes could be established for the large country sample including non-OECD countries. The same is true for variables such as trade openness and R&D spending, which more often than not are found non-significant in different MFP regressions run on the larger sample.

8. The two groups of variables which are available for OECD and non-OECD countries and for which economic effects can be estimated are the PMR indicator and two variables capturing the quality of institutions (rule of law and corruption). For a further set of variables such as the World Bank's Doing Business Indicators (cost and time of starting a business, cost of contract enforcement, cost and time of insolvency procedures), significant empirical results could be obtained only for a sample that include both OECD and non-OECD countries.

Table 1. List of variables whose effect could be quantified in the framework

	OECD countries	large sample (OECD and non-OECD)
MFP		
ETCR	YES	
ETCR public ownership	YES	
PMR - overall	**YES**	**YES**
PMR - barriers to entry	**YES**	**YES**
PMR barriers to trade & investment	**YES**	**YES**
PMR - scope of state control	**YES**	**YES**
trade openness	YES	
R&D (business exp)	YES	
ALMP spending (log)	YES	
ALMP spending	YES	
EPL - permanent contracts	YES	
rule of law	**YES**	**YES**
corruption	**YES**	**YES**
government effectiveness		YES
political stability		YES
cost of starting a business		YES
cost of contract enforcement		YES
time of starting a business		YES
time of insolvency procedures		YES
Capital deepening		
ETCR	YES	
corporate taxes	YES	
EPL - permanent contracts	YES	
PMR barriers to entrrepreneurship		YES
PMR scope of state control		YES
cost of contract enforcement		YES
finance - bank branches		YES
Employment rate		
ETCR overall	YES	
ETCR demographic groups	YES	
ETCR skill levels	YES	
PMR overall		YES
PMR barriers to entrepreneurship		YES
PMR scope of state control		YES
EPL OECD demographic groups	YES	
EPL OECD skill levels	YES	
EPL Cambridge		YES
EPL Economic Freedom of the World		YES
minimum wage demographic groups	YES	
maternity leave demographic groups	YES	
ALMP overall	YES	
ALMP demographic groups	YES	
legal retirement age demographic groups	YES	
family benefits in kind demographic groups	YES	
unemployment benefits overall	YES	
unemployment benefits demographic groups	YES	
excess coverage overall	YES	
excess coverage demographic groups	YES	
excess coverage skill groups	YES	
tax wedge overall	YES	
tax wedge demographic groups	YES	
tax wedge skill groups	YES	
tax wedge single earnier	YES	
legal system enforcement		YES
rule of law		YES
political stability		YES
corruption		YES
government effectiveness		YES
time of insolvency procedures		YES

Note: YES indicates that the specific variable was found to have a robust empirical link (statistically significant coefficient estimate) to the supply-side channel under which it is listed. By contrast, empty cells imply the absence of such an empirical link.
Source: OECD.

2.2. Prioritising the empirical results

9. Based on these results, some choices need to be made with respect to the estimated impact of policies that is best suited for quantifying reforms for OECD and non-OECD countries[2]. These choices can be classified into the following categories:

- The first category concerns variables that are generally available for OECD countries but with no or very limited coverage among non-OECD countries. They include most labour market and social policies (e.g. ALMP, family benefits, unemployment benefits, excess coverage, minimum wage, tax wedge) and the corporate income tax (Table 2). To the extent that such policy variables are available or would become available for non-OECD countries, the effects of reforms in these areas can be potentially estimated for non-OECD countries as well, using the estimates obtained over the OECD sample.

- The second category includes variables for which significant and robust coefficient estimates could be obtained for the OECD sample but not for the large sample comprising non-OECD countries. This is notably the case of trade openness and business expenditure on R&D (measured by industry). As in the case of the first category of variables, the proposal is to apply estimates obtained over the OECD sample to non-OECD countries (Table 2).

- For both categories of variables, using estimates from the OECD samples implies that they are derived from regressions that exploit the time-series dimension. One general advantage of using time series cross-country panel estimates is that not only the overall long-term effect, but also effects at shorter horizons (e.g. 5 and 10 years) can be calculated. For regressions run on pure cross-sectional data, only the total long-run effects can be computed.

- The third category covers variables with estimated impacts for both OECD and non-OECD countries, but in some cases with two possible estimates for OECD countries, and in other cases with large differences in the overall policy effects between OECD and non-OECD countries.

- For instance, the impact of PMR can be calculated for OECD and non-OECD countries. However, in the case of the MFP channel, the cross-section (between) estimates obtained for OECD and non-OECD countries are both much higher than the time-series (within) one and in fact seem implausibly large (Table 2).[3] Hence, for the impact of PMR on MFP, the proposal is to apply estimates obtained over the OECD sample in the time-series dimension to non-OECD countries. For the employment and investment channels, the different estimated impacts of PMR obtained from the OECD and non-OECD samples can be used.

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[2]. Countries are grouped into OECD and non-OECD countries. This split broadly corresponds to a distinction between advanced and emerging-market economies even though there are some overlaps as some OECD countries including Chile, Mexico and Turkey are often considered as emerging-market economies.

[3]. One possible reason is that in the cross-section dimension, the PMR indicator may also capture the effect of other policies and institutions.

- In the case of employment protection legislation (EPL), the OECD indicator does not yield significant empirical results for non-OECD countries, but estimates based on alternative measures such as the Cambridge EPL indicator or the labour market regulation indicator of the Economic Freedom of the World (EFW) suggest an impact on employment and investment of a similar magnitude between OECD and non-OECD countries.[4] For employment, the difference in the estimated impacts is nevertheless sufficiently large to justify using separate ones across the two groups of countries
- The effect of the quality of institutions (rule of law) is somewhat smaller for OECD countries compared to non-OECD countries (albeit still large for both groups, see Table 2). This is intuitive and the two estimates could be used for the two country groups. It should be borne in mind that the indicator of rule of law shows strong correlation with other measures of the quality of institutions (e.g. political stability, the effectiveness of government) and hence may vehicle the effects of these other variables as well.
- The final category covers variables with estimated impact available only for the whole sample (i.e. OECD and non-OECD combined). This includes estimates for the World Bank's Doing Business Indicators related to insolvency procedures as well as the cost of contract enforcement (which can also be used a measure of the quality of institution as an alternative to the rule of law). The implied policy effects can be used for OECD and non-OECD countries as well.

10. The set of proposed estimates for the quantification of reforms in the different policy areas is summarised in Table 3. It provides the estimated long-term effect of policy changes whose magnitude is standardised across samples (OECD vs non-OECD) and policies (for the most part calculated as one standard deviation). In the majority of cases, a common estimated impact is used across OECD and non-OECD countries, the main exceptions being PMR, EPL and the rule of law. The set of the impacts reported in Table 3 are the ones that a priori would be used for the development of the simulator of policy reforms, a tool to facilitate the quantification of reforms for interested users, in particular country desks.

11. Overall, Table 3 suggests the use of linear and largely homogeneous estimates for OECD and non-OECD countries for the baseline estimates. Nevertheless, country-specific effects can be introduced by employing country-specific factor shares and the structure of employment (see Section 8.1). Also, selected policy effects derived on the basis of threshold regressions which can add some heterogeneity are presented in Table 2. For instance, the effect of product market regulation may be made conditional on the level of trade openness or spending on ALMP. In an earlier paper (Égert and Gal, 2018), smoother non-linear effects based on interactions were also investigated. One relationship that emerged was for instance the stronger effect of R&D spending in the presence of stronger rule of law.

[4]. The Cambridge EPL indicator (Adams et al. 2016) has a scale of 0 to 1 while the EWF indicator ranges from 0 to 10. When rescaling these two indicators to the scale of 0-6 of the OECD's EPL indicator, the estimated impact of reforms of comparable magnitude are of similar size.

12. Tables 2 and 3 show point estimates. These estimates are, however, inevitably surrounded by different forms of uncertainty. Estimation and model uncertainty is discussed in Section 7 hereafter. The policy simulator will have an option to show the size of uncertainty (by type and the total effect) so that users preferring to present bands rather than (or in addition to) just a single number will be able to do so.

Table 2. Summary of range of long-term effects

Policies supply-side channel	**Size of reform**	**Linear effects** average time (within) effects	**Linear effects** cross-country (between) effects			**Non-linear effects** average time (within) effects	
		OECD countries	OECD countries	non-OECD countries	large sample (OECD & non-OECD)	if below threshold value	if above threshold value
PRODUCT MARKET REGULATION							
Product market regulation (OECD PMR indicator)							
MFP	-0.58	2.3%	17.4%	40.4%	--	threshold var: trade openness	
						1.4%	2.2%
						threshold var: ALMP spending	
						2.7%	1.4%
K/Y	-0.58	1.5%	--	--	4.37%		
Employment	-0.58	1.0%	5.56%	3.20%	1.20%		
Time of insolvency procedures (World Bank Doing Business indicator)							
MFP	-1.23	--	--	20.61%	10.67%		
Employment	-1.23	--	--	--	2.26%		
LABOUR MARKET REGULATION & POLICIES							
Employment protection legislation (EPL permanent contracts)							
OECD's EPL indicator							
MFP	-0.83	--	15.4%	--	--		
K/Y	-0.83	3.6%	--	--	--		
Employment	-0.83	1.1% - 3.7%	--	--	--		
Cambridge EPL indicator							
Employment	-0.16	--			2.65%		
Economic Freedom of the World EPL indicator							
Employment	1.24	--	--	--	1.15%		
Spending on active labour market policies (ALMP)							
MFP	3.18	1.27%	--	--	--		
Employment	3.18	0.27%	--	--	--		
Tax wedge							
Employment	-2.28	0.67%	--	--	--	threshold var: ETCR	
						0.55%	0.82%
						threshold var: ALMP spending	
						0.70%	0.47%
QUALITY OF INSTITUTIONS							
Rule of law							
MFP	1.01	--	35.5%	--	43.4%		
Cost of contract enforcement (World Bank Doing Business indicator)							
MFP	-15.91	--	--	--	7.96%		
K/Y	-15.91	--	--	--	11.76%		
R&D INVESTMENT							
MFP	0.10	0.40%	--	--	--		
TRADE OPENNESS							
MFP	4.01	2.80%	--	--	--	threshold var: R&D investment	
						4.01%	1.60%

Note: Policy effects are standardised across various samples: the same change is used. Policy changes are calculated as a one standard deviation of the cross-sectional data. Exceptions are the tax wedge, ALMP spending, business spending on R&D and trade openness, where the two year reform window used in Égert and Gal (2016) is used. Tax wedge is calculated for a couple with 2 children and a single earner at 100% of the average wage

Source: OECD calculations.

Table 3. Summary of preferred long-term policy effects

Policies	supply-side channel	Size of reform	OECD countries	non-OECD countries
PRODUCT MARKET REGULATION				
Product market regulation (OECD PMR indicator)	MFP	-0.58	2.27%	OECD
	K/Y	-0.58	1.55%	4.37%
	Employment	-0.58	0.99%	1.20%
Time of insolvency procedures (WB Doing Business indicator)	MFP	-1.23	10.67%	
	Employment	-1.23	2.26%	
LABOUR MARKET REGULATION & POLICIES				
Employment protection legislation (EPL permanent contracts)	K/Y	-0.83	3.64%	OECD
	Employment	-0.83	3.70%	2.32%
Spending on active labour market policies (ALMP)	MFP	3.18	1.27%	OECD
	Employment	3.18	0.27%	OECD
Tax wedge	Employment	-2.28	0.67%	OECD
Excess coverage (p.p.)	Employment	-1.89	0.15%	OECD
Minimum wage (% of median)	Employment	-2.48	0.70%	OECD
Unemployment benefits (% of earnings)	Employment	-1.42	0.45%	OECD
QUALITY OF INSTITUTIONS				
Rule of law	MFP	1.01	35.50%	43.4%
Cost of contract enforcement (Doing Business indicator)	MFP	-15.91	7.96%	
	K/Y	-15.91	11.76%	
OTHER POLCIES				
R&D investment	MFP	0.10	0.40%	OECD
Trade openness	MFP	4.01	2.80%	OECD
Corporate income tax (% of GDP)	K/Y	-0.98	1.25%	OECD

Note: OECD' refers to the effects estimated for OECD countries. Numbers in between the columns OECD and non-OECD are derived from the large sample (including OECD and non-OECD countries). Policy effects are standardised across various samples: the same change is used. Policy changes are calculated as a one standard deviation of the cross-sectional data. Exceptions are the tax wedge, ALMP spending, business spending on R&D and trade openness, where the two year reform window used in Égert and Gal (2016) is used

Source: OECD calculations.

3. A brief reminder of the fundaments of the framework

13. The framework, like previous ones used in the OECD Economics Department (Barnes *et al.*, 2013; Bouis and Duval, 2011; Johansson *et al.*, 2013), relies on a production function approach. The influence of policies on GDP is typically assessed through their impact on supply-side components: labour productivity and employment. Each in turn can be further decomposed, into capital intensity and multi-factor productivity, and labour force participation and unemployment (Figure 1). Within the new framework, the impact of structural reforms is quantified from a range of cross-country reduced-form panel regressions on three channels: i) multi-factor productivity, ii) capital deepening, and iii) employment. The overall impact on GDP per capita is obtained by aggregating the policy effects of the various channels through a production function.

Figure 1. Channels of transmission to per capita GDP

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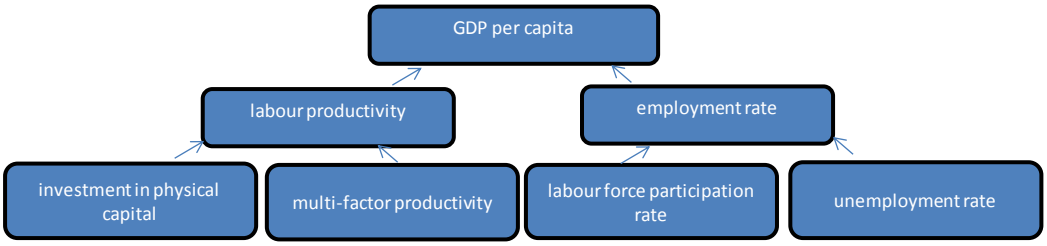


4. A brief reminder of the analytical work carried out so far

4.1. Linear models for OECD countries

14. Among the main features, the linear modelling framework developed for OECD countries i) covers a relatively large number of time-varying policy variables and channels through which they influence GDP per capita; ii) estimates relationships over a period including the immediate post-crisis years (1985-2011); iii) increases internal consistency of the estimated relationships by employing a common sample of countries and time span, and the same dataset (econometric estimates are obtained using the same up-dated dataset SPIDER); iv.) the estimation method is also harmonised for the three supply-side channels; v.) changes in policy measures and the horizons at which their impact is measured are standardised, and; vi.) different levels of disaggregation of the supply side components are not mixed across policy areas (e.g. employment for some policies, the labour force participation and unemployment rate for others) (Égert and Gal, 2016).

4.2. Non-linear models for OECD countries

15. The non-linear framework developed for OECD countries builds on the linear relationships in terms of the increased number of policy variables, country and time coverage and the consistency of the estimates. The addition it brings is the evaluation of non-linear effects. The question asked is whether policy effects depend on the level of the same policies or whether policy impacts depend on the level of other policies (Égert and Gal, 2018). For example, the positive impact on MFP of an increase in business R&D spending is stronger in an environment characterised by lower barriers to firm entry and

exit as well as by better-quality institutions, notably with respect to the legal system, contract enforcement and the protection of property rights. Also, in countries characterised by less strict employment protection legislation, the MFP gains from reducing regulatory barriers to competition are stronger. Next, a loosening of employment protection legislation will have a smaller positive impact on capital deepening (and thus labour productivity) in countries where product markets are more competitive and legal institutions are of better quality. Finally, an increase in spending on active labour market policies (ALMPs) will yield bigger employment gains in countries with lower tax wedges or with less stringent housing market regulation.

4.3. The extension of the linear and non-linear models to emerging market economies

16. The extension to EMEs explores whether policy effects vary across countries depending on the level of economic development, whether the quality of institutions matter for economic outcomes, whether the effect of product and labour market regulations differ if the quality of institutions varies, and whether the effect of one policy (e.g. product market regulation) depends on the stance of another policy (e.g. labour market regulation) (Égert, 2017a).

5. Complementarities and overlaps between the OECD and broader samples

17. The estimation results are derived from two datasets. The first dataset comprises OECD countries. The second dataset contains a larger number of (around 100) countries, including advanced, emerging and developing economies. The major challenge for including more countries into the framework is mainly related to data availability.[5]

18. As a consequence, a large amount of complementarity arises for the results between the OECD and the large sample (including OECD and non-OECD countries). Coefficient estimates capture different effects in different ways. But there are also some limited overlaps for the estimation results for the two samples. The discussion below gives more insights on the complementarities and overlaps.

5.1. Complementarities for identification along the average time (within) and cross-country (between) dimensions

19. The main indicators of regulation used currently in the quantification framework are either not available for non-OECD emerging market economies or if so, they are available for a recent and relatively short time span or even for one year or period only, making their use impossible for regression analysis drawing on the time-series dimension of the data (panels including country and time fixed effects). Therefore, regression results obtained for the OECD and the large country sample are not strictly comparable.

- For the OECD sample, most of the policy effects are mostly identified through the within dimension. This means that **the coefficient estimates mostly reflect the average time variation in policy variables for an average OECD country**. They include most of the labour market regulations and policies.

[5]. Another challenge, mentioned earlier and difficult to tackle here is the widespread informality and the larger difference between *de jure* and *de facto* measures of indicators in less-developed countries.

- Given shorter sample periods, estimations carried out for the large sample of countries including OECD and non-OECD countries identify the policy effects most often through the cross-country (between) dimension. Therefore, the coefficient estimates mostly reflect the cross-country variation in the data and can show **how average cross-country variation is correlated with average cross-country economic outcomes**. It should be noted that some of the policy variables have time series dimension in the large sample and thus also reflect average time effects. But these effects are based on considerably shorter time periods than those obtained for the OECD sample.

5.2. Complementarities across indicators

20. Product market regulation indicators such as the ETCR indicator (the annual variant of a subset of the PMR indicator covering regulation in energy, transport and communication sectors)) or the Employment Protection Legislation (EPL) indicator show how average changes over time in an average OECD country influence economic outcomes. In the absence of time series data for the large sample including EMEs, alternative indicators for PMR and EPL are used.

- For product market regulations and even going beyond them, the World Bank's Doing Business indicators are used. They cover the cost and time of starting a business, insolvency procedures and contract enforcement. They are available on an annual basis since the early 2000s.

- The Fraser Institute's Economic Freedom of the World (EFW) database that provides a measure of business regulation and a measure of labour market regulation (each broken down into six sub-categories). The headline business and labour market regulation indicators are used in the framework.

- The comprehensive dataset of the Cambridge Labour Regulation Indicator (CBR LRI) covers annually labour market-related legal regulations in 117 countries over more than 40 years (Adams et al., 2016). The dataset includes 40 categories of labour market regulations. For the purpose of quantification, the six categories concerning regular contracts are considered. Their simple arithmetic average is used as an alternative to the OECD's EPL indicator (for regular contacts).

21. The coefficient estimates based on these alternative variables cannot be compared directly because: i) the indicators cover broadly comparable policy areas but do not capture the same policies; ii) the time variation in the alternative variables may differ for the two samples. Instead, they could be used in a complementary fashion by zooming in on each indicator's main and differentiated policy focus.

5.3. Complementarities for the very same indicator

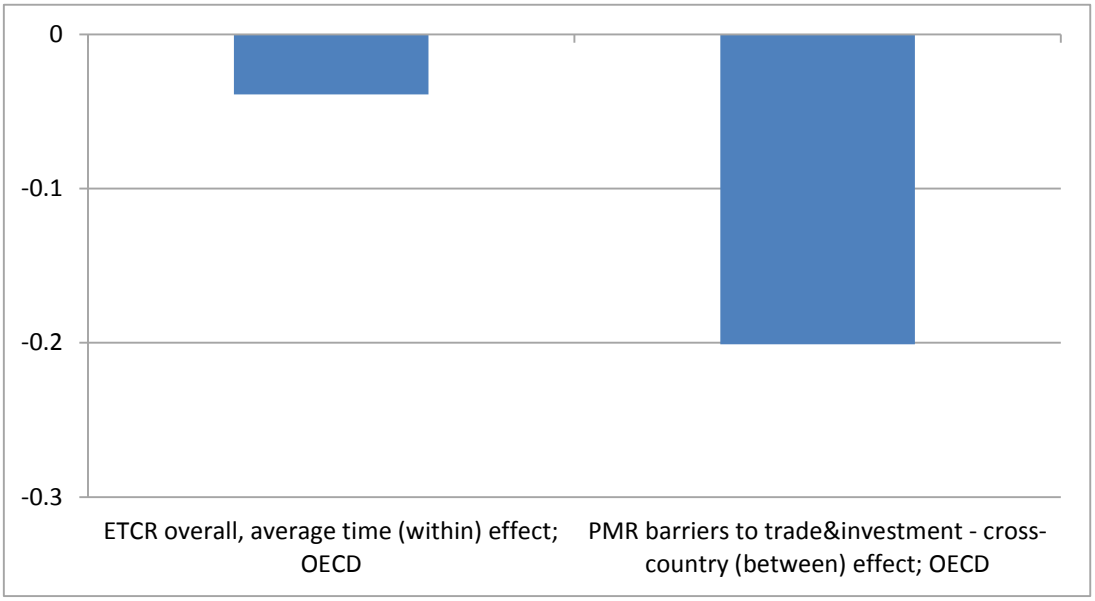
22. Two OECD indicators have been recently expanded to cover non-OECD countries: i.) the overall PMR indicator and its sub-components are available for more than 60 countries. For the countries recently added to the database, only one observation is available for a recent period (usually 2013 or 2014); ii.) the EPL indicator has also become available for additional countries. A similar number of countries are covered by PMR and EPL but they do not cover exactly the same countries.

23. The use of these indicators, among others, gives rise to two types of complementarities. First, policy effects can be obtained in two different ways: they can be identified either on the basis of the average time variation (within effect) or the cross-country variation (between effects). Second, the indicators can be used to analyse whether the effects differ for different country groups (e.g. OECD sample vs. large sample including both OECD and non-OECD countries)

5.3.1. Average time effects vs. cross-country effects

24. The ETCR indicator (i.e. the time series variant of the PMR indicator) and the EPL indicator are used in the OECD panel. The estimates reflect average time effects. The EPL indicator and the broad-based PMR indicator are employed as constants in the OECD and the large samples. Therefore, these different results are complementary: they contrast the average time and average cross-country variations in the data. Figure 2 shows how different the coefficient estimates on PMR can be for the within and between identification from the MFP regressions. The within effects are measured using the ETCR indicator, the time variant version of the PMR indicator. Between effects are estimated using the PMR indicator itself. The coefficient estimates are considerably larger for the cross-sectional dimension.

Figure 2. Long-term coefficient estimates of PMR effect in MFP regressions, OECD sample, within and between dimensions



Source: OECD calculations.

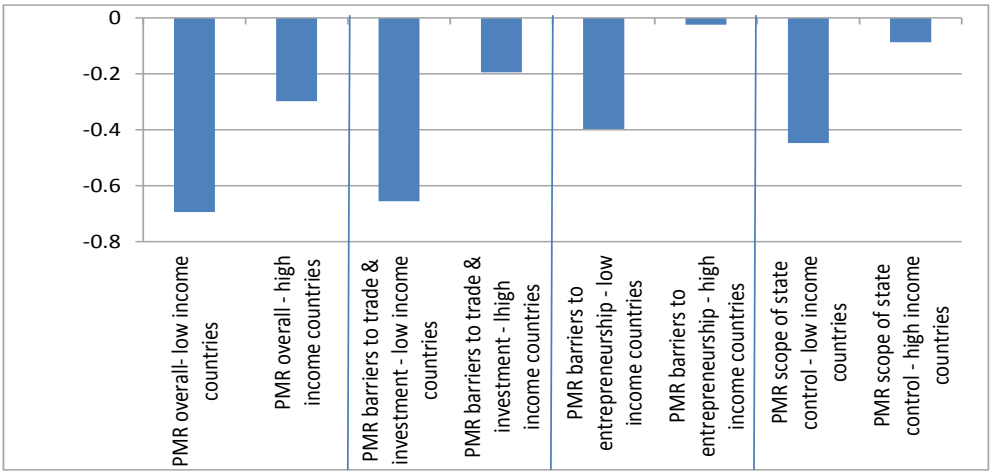
5.3.2. OECD vs. non-OECD countries

25. The PMR and EPL indicators and measures of the quality of institutions are used in regression analysis carried out for the OECD sample and for the large sample. They help to better understand the extent to which the same policy might have different effects in advanced and less developed economies. For instance, the coefficient estimates on the PMR indicator in MFP regression are considerably higher for non-OECD than for OECD countries (Panel A in Figure 3). The estimation results also show that the effect of the rule of law is substantially larger for the large sample (including OECD and non-OECD

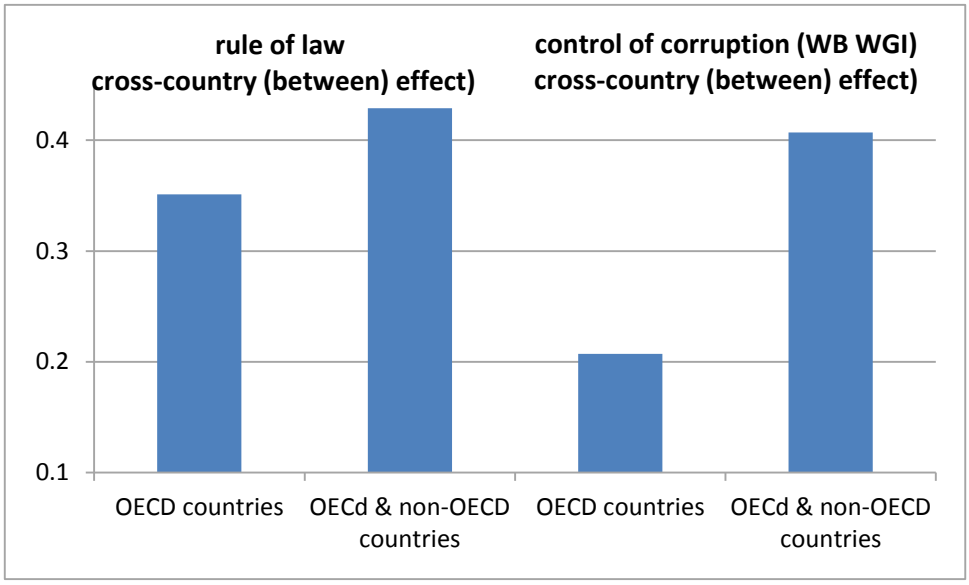
countries) compared to the OECD sample. Cross-country variations in the rule of law and the control of corruption are larger in the large sample and are associated with more pronounced differences in MFP outcomes (Panel B in Figure 3).

Figure 3. Differences in long-run coefficient estimates for different country groups

Panel A. PMR effect on MFP, OECD (high-income) vs. non-OECD (low-income) countries



Panel B. Quality of institutions in MFP regressions, OECD vs. large sample



Note: High income and low income countries refer to the country groups identified on the basis of threshold regressions.
Source: OECD calculations.

5.4. Correlation along the cross-country (between) dimension

26. One question that begs for answer in this context is the extent to which indicators capturing similar policies are correlated with one another. For the indicators sourced from OECD and non-OECD databases, a comparison can be done in the cross section (using country averages over 2002 to 2012) as the OECD's PMR and EPL indicators will be

used to explain cross-country variations and not variations over time. Cross-section correlations show that the correlation coefficient between the OECD's EPL and the EFW's labour market regulation indicator is around 0.7. The same figure is slightly higher than 0.6 for OECD EPL and Cambridge EPL. Correlation is weaker between the OECD's PMR indicator and the alternative measures. The figure is about 0.5 for the EFW business regulation indicator and ranges from 0.1 to 0.5 for the various Doing Business indicators.

27. A similar issue arises for indicators belonging to the same class. For instance, the World Bank's World Governance indicators include six measures of the quality of institutions. The Doing Business indicators comprise eight indicators. The PMR indicator can be broken down into three main sub-components. The Fraser Institute's Economic Freedom of the World (EFW) database includes a number of indicators on business and labour market regulations. In many instances, the correlation between variables belonging to the same class is very strong, especially for the measures of institutional quality and the EFW subcomponents. Therefore, these sub-components cannot enter the empirical analysis simultaneously on the grounds of problems related to multi-collinearity. The bottom line is that even if simulation results are presented for most of them (institutional quality), their effects cannot be cumulated. Rather, they should be viewed as capturing very similar things. Further analysis would be needed to disentangle the cumulated effects of these policies.[6]

6. Quantification of reforms

28. This section describes the effects of policies on per capita income levels of OECD and non-OECD countries. It also discusses how these results could be used to quantify specific reform effects. Tables 4 to 6 give an overview of the policy variables which turned out significant in regressions of MFP, employment and capital deepening, and hence the effect of which can be quantified.[7] They show that the overlap is not very large.

- One of the variables for which significant impact could be estimated for both OECD and non-OECD countries, is the PMR indicator. For MFP, the effect of PMR can be quantified for both OECD and non-OECD countries. For capital deepening and the employment rate, the ETCR indicator, the time series variant of the PMR indicator can be used for the group of OECD countries and the PMR indicator for non-OECD countries.

- The second set of variables available for OECD and non-OECD countries cover the quality of institutions (the rule of law and corruption).

[6]. Correlation is not a real problem for time-varying variables. Once country and time fixed effects are purged from the data, the remaining time variation in the variables exhibit very low correlation with each other.

[7]. The simulation results for the group of OECD countries can be slightly different compared to the ones reported in Égert and Gal (2016). This is due to the fact that a slightly different set of updated regression results are used. Table A1 in the annex reports the specific regression results employed. These results are sourced from Gal and Theising (2015) and Égert (2017b and c).

- The remaining variables relate to product and labour market policies and regulations. They are different. For OECD countries, indicators covering labour market policies and regulations are more specific and considerably detailed. It should be noted that the EPL indicator is not shown for non-OECD countries because this variable does not work very well for this country group in the regression analysis.

29. The impact of policies is substantially larger for non-OECD countries compared to OECD countries for two reasons. First, the coefficient estimates are higher. Second, the policy changes used for the simulations are also larger. For the set of OECD countries, policy changes are determined as the average of pro-reform changes in two consecutive years (see Égert and Gal, 2016). For the non-OECD countries (and the panel including all countries), reform changes are calculated as one cross-country standard deviation in the large sample (see Égert, 2017a). The difference is due to the fact that policies tend to differ more across countries than they change over time.

30. It should be emphasised that the definition of policy changes is somewhat arbitrary. The purpose is mostly illustrative and allows the comparison of the relative policy impacts across different policy variables. Therefore, it is interesting to standardise them for OECD and non-OECD countries. The only variable for which simulation results are available for all country groups is the PMR sub-component barriers to trade and investment. The upper part of Figure 4 reports policy effects for OECD, non-OECD and all the countries taken together using the same policy change (namely the one standard deviation calculated on the cross-section of the large sample). The results suggest that the impact is considerably larger for less developed than for OECD / advanced economies. A reassuring result is that the policy impact is almost identical for the OECD sample (1st bar, upper panel, Figure 4) and the large sample in which threshold regressions are used to obtain coefficient estimates for advanced economies (2nd bar, upper panel, Figure 4). Looking at the headline PMR indicator and its other sub-components also demonstrates that policy effects are greater for less advanced countries (lower panel, Figure 4). This means that developing and emerging market economies face different policy responses compared to more advanced economies when implementing product market reforms.[8]

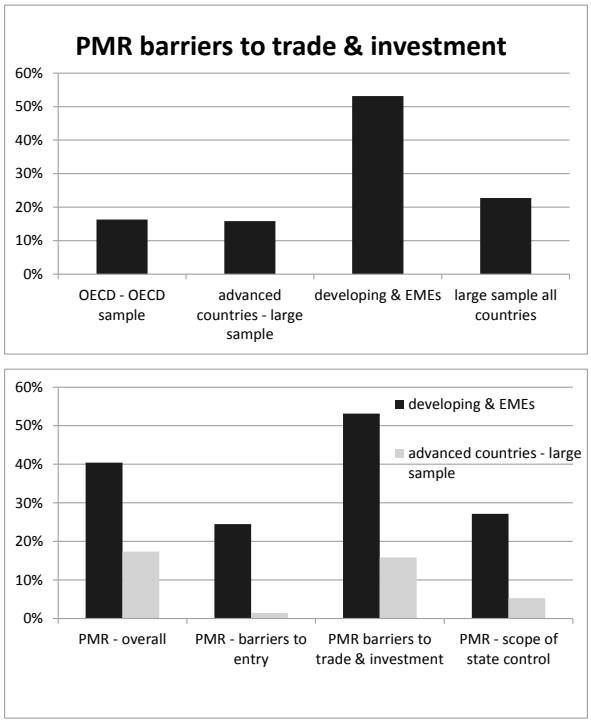
31. A straightforward implication is that if country desks were to quantify the overall impact of reform plans or actual reforms in emerging market economies, results reported for the groups of developing and emerging market economies should be used. These results are available for effects transiting through the MFP channel. For capital deepening and the employment rate channels, simulation results do not differentiate between advanced and less advance countries as the estimations did not reveal significant

[8]. There are several reasons why product market regulation could have different effects in countries at different stages of economic development. In countries with weak institutions, more stringent product market regulation could be less binding given that they can be better enforced. By contrast, in countries with weak institutions, uncertainty may be large regarding how legislated product market reforms are enforced and whether, how often and for which sectors and firms they may be changed in an unpredictable way. These uncertainties can then have a negative effect on MFP through multiple channels (including incentives to innovate and to invest in physical and human capital, just to mention some of the key ones). Furthermore, it could be that as PMR improves in a developed country a lot of other governance issues are improving at the same time: the coefficient estimates on the PMR may reflect these additional effects. The results reported here suggest that the latter effects prevail.

parameter heterogeneity for the two groups of countries. In these cases, country desk could use the results reported for the large sample including both OECD and non-OECD economies.

32. If country desks wish to use these numbers for quantifying reforms in their respective countries, the first step is to figure out the precise change in the policy variable considered due to the reform to be quantified. This may give a different number from the policy changes provided here. Once desks figured out the change in the policy variable of interest, Tables 4 to 6 can be used to work out the overall macroeconomic effect. In fact, these effects are linear and the policy impact will be proportional to the ratio of the actual policy change to the policy changes displayed in Tables 4 to 6.

Figure 4. The long-term effect of PMR reforms on per capita income through MFP, OECD and non-OECD countries



Note: For the OECD sample, the policy change used for the large sample including OECD and non-OECD countries is applied: a one standard deviation in the cross-section variation of the data.
Source: OECD calculations.

Table 4. Linear policy effects on per capita income, through capital deepening and the employment rate, OECD and non-OECD countries

		OECD sample		large sample			
		OECD sample	OECD countries	large sample	OECD & non-OECD together	non-OECD countries	OECD countries
		policy change	long-run effect	policy change	long-run effect	long-run effect	long-run effect
MFP							
ETCR	average time effect	-0.31	1.20%	-0.58			
ETCR public ownership	average time effect	-0.35	0.90%	-0.58			
PMR - overall	cross-country dimension	-0.35		-0.58		40.41%	17.35%
PMR - barriers to entry	cross-country dimension	-0.37		-0.62		24.47%	1.48%
PMR barriers to trade & investment	cross-country dimension	-0.41	8.27%	-0.81	22.71%	53.13%	15.82%
PMR - scope of state control	cross-country dimension	-0.54		-0.61		27.13%	5.28%
trade openness	average time effect	4.01	2.80%				
R&D (business exp)	average time effect	0.10	0.40%				
ALMP spending (log)	average time effect	0.16	0.52%				
ALMP spending	average time effect	3.18	1.27%				
EPL - permanent contracts	cross-country dimension	-0.83	15.44%				
rule of law	cross-country dimension	0.60	21.19%	1.01	43.39%		
corruption	cross-country dimension	0.84	17.39%	1.06	43.13%		
government effectiveness	average time effect			0.13	1.32%		
	cross-country dimension			0.91	47.00%		
political stability	cross-country dimension			0.86	24.04%		
cost of starting a business	cross-country dimension			-15.21	0.76%		
cost of contract enforcement	cross-country dimension			-15.91	7.96%		
time of insolvency procedures	cross-country dimension			-1.23	10.67%		
bank branches	average time effect			8.14	2.44%		
	cross-country dimension			20.60	10.30%		

Note: The policy change for the OECD sample is taken from Égert and Gal (2016). It is defined as the average pro-reform change over a window of two consecutive years. The policy change for the large sample is calculated as one standard deviation of the cross-section data.

Source: OECD calculations.

Table 5. Linear policy effects on per capita income, through capital deepening and the employment rate, OECD and non-OECD countries

		OECD sample	OECD countries	large sample	OECD & non-OECD together
		policy change	long-run effect	policy change	long-run effect
Capital deepening					
ETCR	average time effect	-0.31	0.82%		
corporate taxes	average time effect	-0.98	1.25%		
EPL - permanent contracts	average time effect	-0.09	0.40%		
PMR barriers to entrrepreneurship	cross-country dimension			-0.62	4.37%
PMR scope of state control	cross-country dimension			-0.61	6.34%
cost of contract enforcement	cross-country dimension			-15.91	11.76%
finance - bank branches	cross-country dimension			20.60	10.15%
Employment rate					
ETCR overall	average time effect	-0.31	0.52%		
ETCR demographic groups	average time effect	-0.31	0.22%		
ETCR skill levels	average time effect	-0.31	0.46%		
PMR overall	cross-country dimension			-0.58	1.20%
PMR barriers to entrepreneurship	cross-country dimension			-0.62	1.60%
PMR scope of state control	cross-country dimension			-0.61	3.50%
EPL demographic groups	average time effect	-0.30	0.38%		
EPL skill levels	average time effect	-0.30	1.30%		
EPL Cambridge	cross-country dimension			0.16	2.65%
LMR EFW	average time effect			1.24	1.15%
minimum wage demographic groups	average time effect	-2.48	0.71%		
maternity leave demographic groups	average time effect	4.83	0.61%		
ALMP overall	average time effect	3.18	0.27%		
ALMP demographic groups	average time effect	3.18	0.36%		
legal retirement age demographic groups	average time effect	0.57	0.73%		
family benefits in kind demographic groups	average time effect	0.11	0.77%		
unemployment benefits overall	average time effect	-1.42	0.38%		
unemployment benefits demographic groups	average time effect	-1.42	0.45%		
excess coverage overall	average time effect	-1.89	0.31%		
excess coverage demographic groups	average time effect	-1.89	0.16%		
excess coverage skill groups	average time effect	-1.89	0.58%		
tax wedge overall	average time effect	-2.28	0.67%		
tax wedge demographic groups	average time effect	-2.28	0.51%		
tax wedge skill groups	average time effect	-2.28	0.42%		
tax wedge single earnier	average time effect	-1.39	0.32%		
legal system enforcement	cross-country dimension			0.31	0.54%
rule of law	cross-country dimension			1.01	1.72%
political stability	cross-country dimension			0.86	2.68%
corruption	cross-country dimension			1.06	4.16%
government effectiveness	cross-country dimension			0.91	2.64%
time of insolvency procedures	cross-country dimension			-1.23	2.26%

Note: The policy change for the OECD sample is taken from Égert and Gal (2016). It is defined as the average pro-reform change over a window of two consecutive years. The policy change for the large sample is calculated as one standard deviation of the cross-section data.

Source: OECD calculations.

Table 6. Long-term non-linear policy effects for OECD countries

non-linear variable	threshold variable	threshold value	reform change in nonlinear variable	if below threshold value	if above threshold value
MFP					
trade openness	R&D	1.15	4.01	1.60%	4.01%
R&D	trade openness	5.93	0.10	0.004%	0.01%
ETCR public ownership	trade openness	5.93	-0.35	0.83%	1.32%
ETCR public ownership	ALMP	19.08	-0.35	1.63%	0.83%
ETCR public ownership	ainsolv_cost	14.50	-0.35	0.62%	4.96%
CAPITAL DEEPENING					
ETCR	EPL	2.37	-0.31	1.07%	0.59%
ETCR	etcr	5.17	-0.31	0.44%	0.62%
ETCR	starting a business - cost	6.76	-0.31	0.15%	0.86%
ETCR	rule of law	1.55	-0.31	0.95%	0.18%
EPL	ETCR	5.17	-0.09	0.63%	0.76%
EPL	PMR	1.92	-0.09	0.53%	1.87%
EPL	state control	2.92	-0.09	0.64%	3.77%
EPL	barriers to entrepreneurship	1.85	-0.09	0.00%	0.90%
EPL	barriers to trade and investment	0.41	-0.09	-0.43%	0.85%
EMPLOYMENT					
tax wedge	ETCR	5.37	-2.28	0.55%	0.82%
tax wedge	EPL	2.36	-2.28	0.73%	0.39%
tax wedge	ALMP	24.19	-2.28	0.70%	0.47%
tax wedge	Excess coverage	12.81	-2.28	0.62%	0.81%
tax wedge	PMR overall	1.52	-2.28	0.00%	1.05%
ALMP	tax wedge	32.52	3.18	0.42%	0.19%
ALMP	contract enforcement - cost	15.79	3.18	2.40%	0.29%
ALMP	contract enforcement - time	390.83	3.18	1.59%	0.28%

Note: Policy changes are defined as the average pro-reform change over a window of two consecutive years (see Égert and Gal, 2016).

Source: OECD calculations.

7. Uncertainty surrounding the empirical estimates

33. Presenting policy effects based on point estimates masks the degree of uncertainty surrounding these, and which may vary across variables. There is indeed some uncertainty around the coefficient estimates used for the calculation of the policy effects.[9] First, it is useful to be aware of the precision with which coefficient estimates are obtained in specific regressions. The degree of precision is captured by the standard errors: this type of uncertainty can be measured by confidence intervals. A second type of uncertainty arises due to model uncertainty: the size and statistical significance of coefficient estimates may vary depending on the number and type of variables included in the regressions. The objective of this section is to give an idea on the magnitude of these uncertainties. In doing so, three ranges of uncertainty are considered.

- First, 90% confidence intervals of the baseline coefficient estimates are calculated.
- Second, we collect the maximum and minimum values of the coefficient estimates presented in Gal and Theising (2015) and Égert (2017a,b,c). In these studies, coefficient estimates associated with a given policy variable would essentially vary according to differences in specifications.
- Third, the confidence intervals, equally at the 10% level, are calculated for the minimum and maximum values of the coefficient estimates.

34. This provides us with three bands of uncertainty. The first band concerns the baseline coefficient within a precisely defined regression. The second band is given by the minimum and maximum values of the coefficient estimates derived from alternative modelling choices such as a different set of control variables and a different set of underlying countries. The final band gives the statistical uncertainty of the minimum and maximum values. Only the lowest (minimum coefficient estimates – 1.65*standard error) and the highest (maximum coefficient estimates + 1.65*standard error) values are reported.

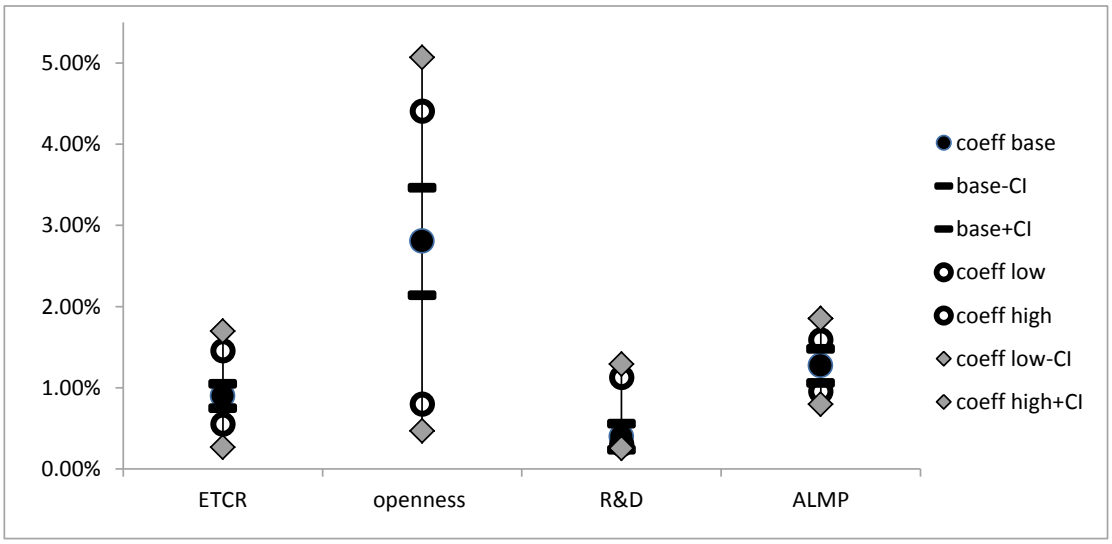
35. The uncertainty around the long-term effects of policies on per capita income through the MFP channel can be large (Figure 5). This is especially the case for trade openness. The confidence intervals around minimum and maximum values vary by a factor of ten. Uncertainty for other policies is less pronounced. However, the lower end of the uncertainty range is relatively close to zero for ETCR and R&D. The effect remains stable between 1% and 2% for ALMP. Another interesting observation is that the baseline (mid) estimate is very close to the minimum value for R&D, whereas the uncertainty range is more symmetric for the other policies.

36. Uncertainty of policies is smaller for capital deepening (Figure 6). Generally speaking, the position of the baseline effect in the uncertainty band is asymmetric: it is located closer to the maximum values. Uncertainty appears to be very low for EPL: the estimated growth on per capita income through capital deepening ranges from about 0.3% to 0.5%.

[9]. The simulation results presented in Égert and Gal (2016, 2018) and Égert (2017a) are based on point estimates.

37. Policy effects through the employment channel are numerous (Figure 7). There are a number of striking features with regard to policy uncertainties. First, only a small number of policies are concerned with heightened uncertainty. They are EPL effects obtained from skill levels and the overall tax wedge effect. Second, uncertainty can vary to a large extent for the same policy depending on how it is derived. For instance, uncertainty for EPL is large through the skill levels channels but is low if obtained through demographic decomposition. Similarly, tax wedge effects are less uncertain if obtained through demographic or skill decomposition. Finally, in many instances, the lower range of the uncertainty band is very close to zero.

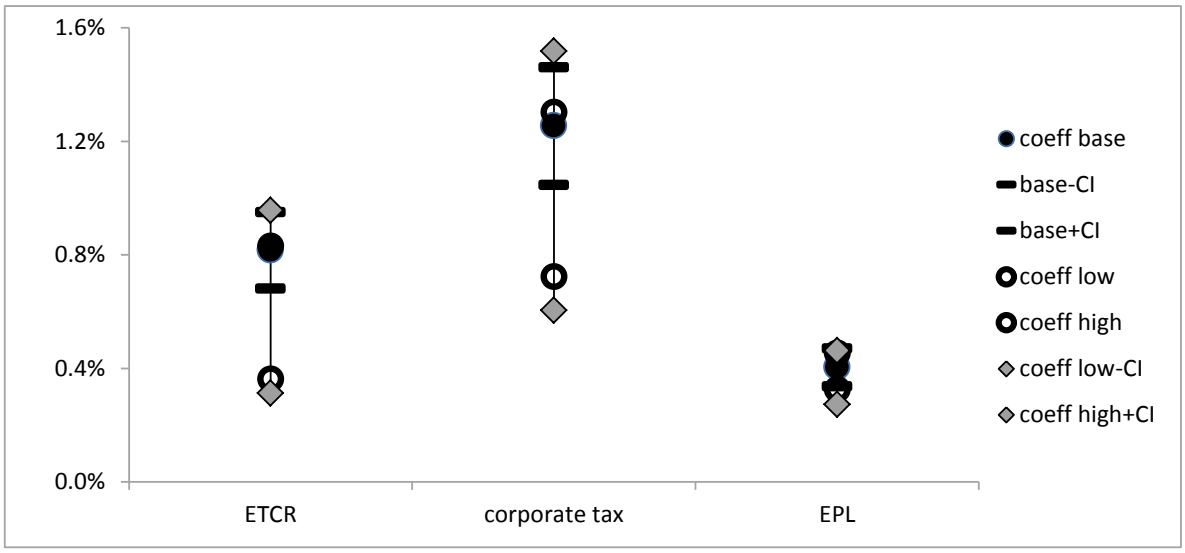
Figure 5. The range of uncertainty of the long-term policy effect on MFP; OECD sample



Note: CI=90% confidence interval. Policy changes are defined as the average pro-reform change over a window of two consecutive years (see Égert and Gal, 2016a). The policy effects are calculated using the following coefficient estimates: coeff base = preferred (mid) coefficient estimate, base-/+CI give the 90% confidence intervals; coeff low and high are the lowest and highest coefficient estimates picked from alternative model specifications. Coeff low-CI and coeff high+CI are the respective 90% confidence intervals.

Source: OECD calculations.

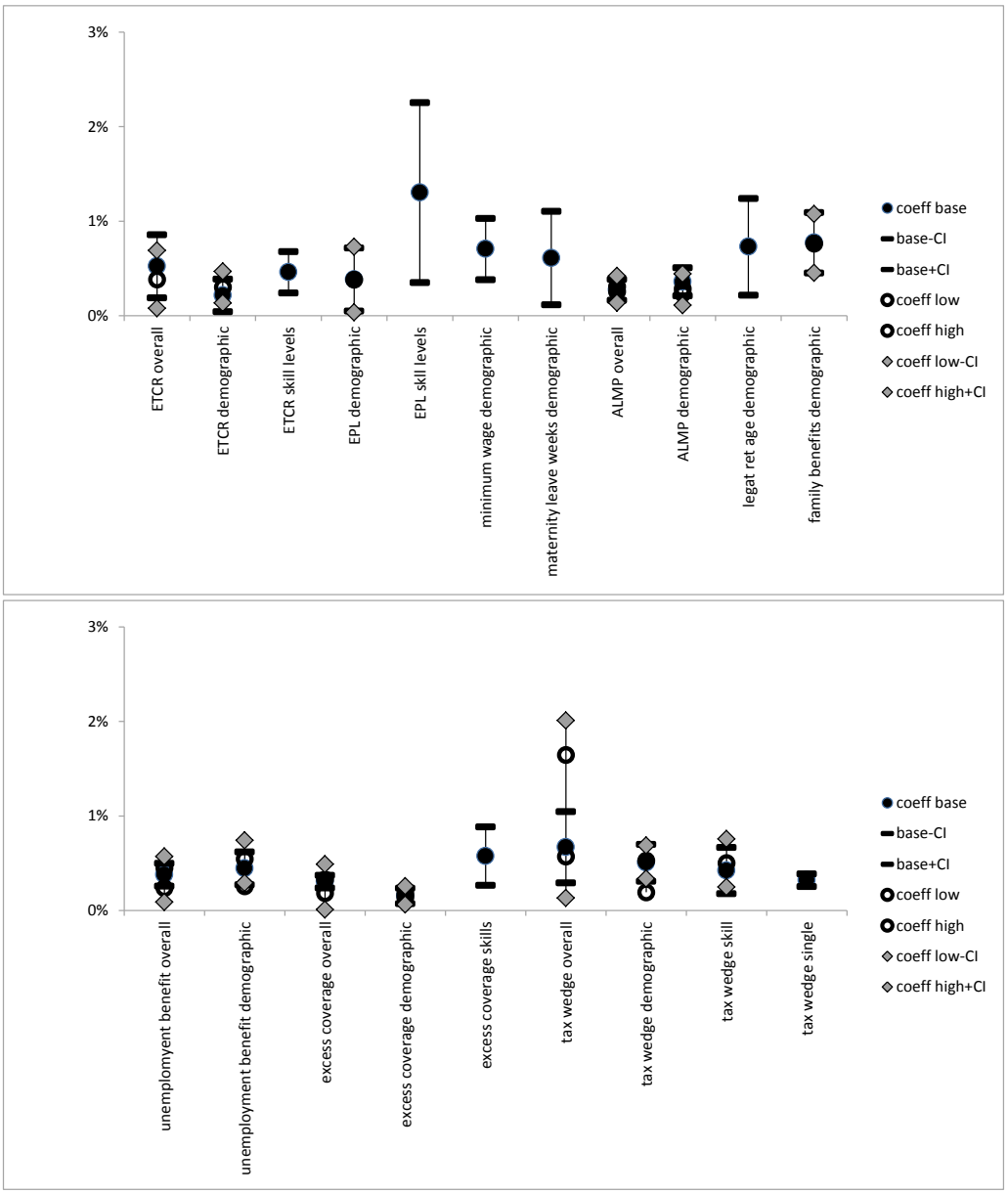
Figure 6. The range of uncertainty of long-term policy effects on capital deepening; OECD sample



Note: CI=90% confidence interval. Policy changes are defined as the average pro-reform change over a window of two consecutive years (see Égert and Gal, 2016a). The policy effects are calculated using the following coefficient estimates: coeff base = preferred (mid) coefficient estimate, base-/+CI give the 90% confidence intervals; coeff low and high are the lowest and highest coefficient estimates picked from alternative model specifications. Coeff low-CI and coeff high+CI are the respective 90% confidence intervals.

Source: OECD calculations.

Figure 7. The range of uncertainty of long-term policy effects on employment; OECD sample



Note: CI=90% confidence interval. Policy changes are defined as the average pro-reform change over a window of two consecutive years (see Égert and Gal, 2016a). ETCR overall indicate that the effect is obtained using the coefficient estimate with the overall employment rate as the dependent variable. For ETCR demographic and ETCR skill levels, the effects are derived using coefficient estimates from regressions where employments were split by demographic and skill groups, respectively. The same applies to other variables ending with overall, demographic and skill levels. The policy effects are calculated using the following coefficient estimates: coeff base = preferred (mid) coefficient estimate, base-/+CI give the 90% confidence intervals; coeff low and high are the lowest and highest coefficient estimates picked from alternative model specifications. Coeff low-CI and coeff high+CI are the respective 90% confidence intervals.

Source: OECD calculations.

8. Dealing with country-specific heterogeneity

38. Panel estimates give us average policy effects. Such average effects may be informative for the OECD as a whole but less satisfactory for individual countries. A number of simple and more sophisticated options are available to produce country-specific estimates even based on time series cross-country panel or purely cross-section regressions. They include the alternative parametrisation of the production function when calculation the policy effects and ways to produce group-specific estimates either by simple sample splitting or through threshold models.

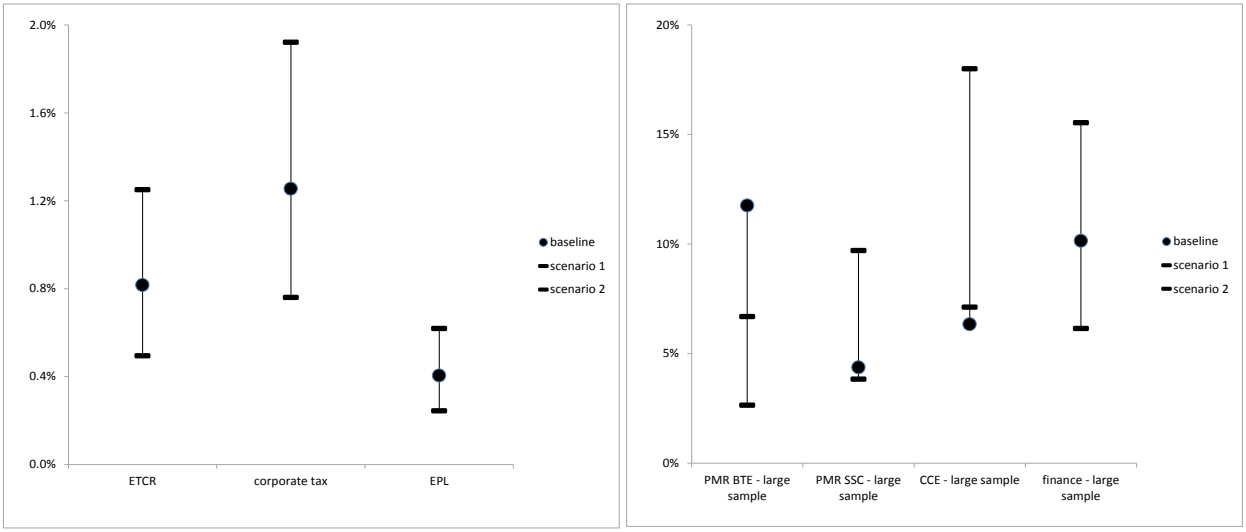
8.1. Country-specific parameters in the production function

39. A simple method to produce growth effects that vary across countries is to apply country-specific parameters to the calculation of the long-term effect on per capita income. This can be done by applying i.) country-specific labour (capital) share and ii.) a country-specific employment rate:

- First, the share of labour of 66% used for the baseline effects can be changed. Alternative scenarios could be used when the capital share is changed by 10% in both directions. Such a change transits through the capital deepening channel (see box 1). Figure 8 shows that altering the capital share can induce noticeable changes in the growth effects. The ETCR impact, for example, widens to a range of almost 1%. The corporate tax effect is even larger whereas EPL is less affected.

- Second, the baseline growth effects coming through the employment rate are calculated using a number of assumptions. The growth contribution is obtained by assuming that the employment rate is 66%, which is the average across the OECD countries in 2013. Also, growth impacts calculated from demographic and skill groups use cross-country averages for the employment rates of the various skill and demographic groups. Changing the aggregate employment rates or the employment rates of age and skill groups (but by leaving the share of different skill and demographic groups unchanged as a share of working age population) produces variation in the growth effect. While these effects are far from being as large as those related to uncertainty and those related to alternative scenarios for labour share, they could well be used to reflect country specificities in final economic outcomes (Figure 9).

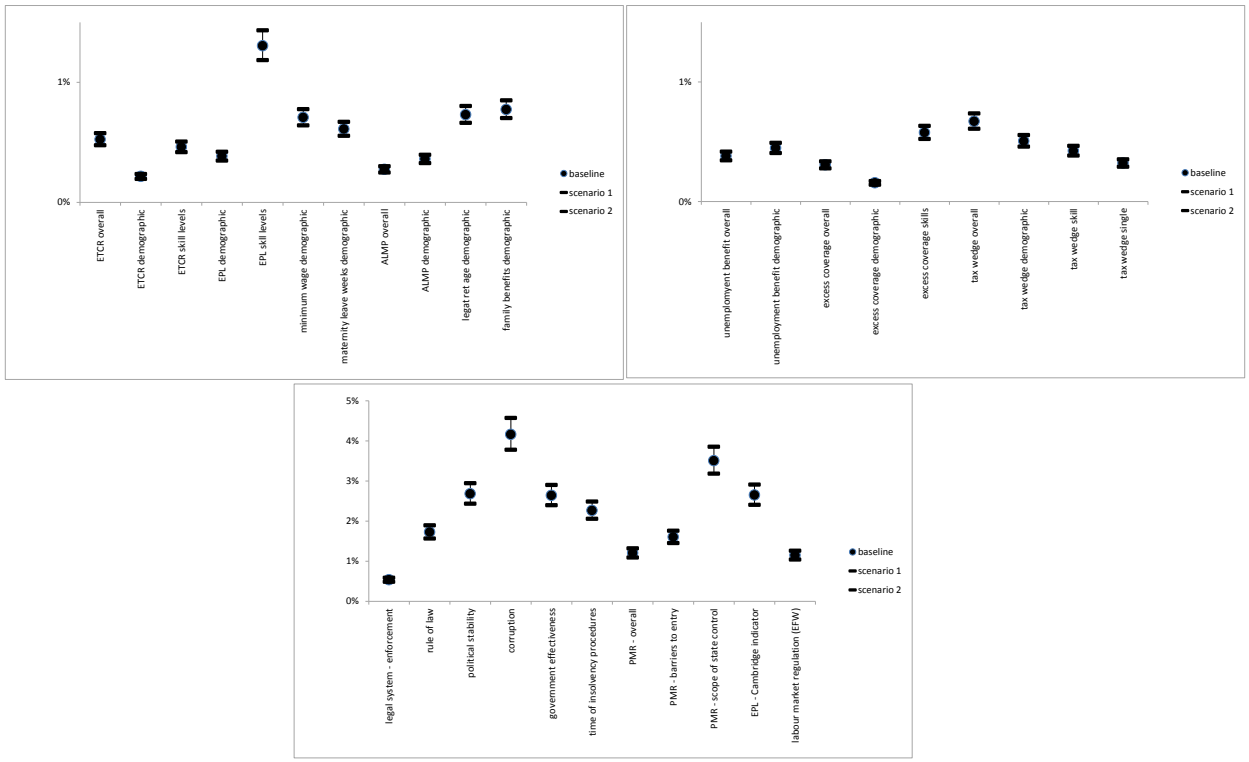
Figure 8. Long-term effects - alternative scenarios for the capital share; capital deepening



Note: Alternative scenarios use a 10 p.p. increase and decrease in factor shares. . Policy changes are defined as the average pro-reform change over a window of two consecutive years (see Égert and Gal, 2016).

Source: OECD calculations.

Figure 9. Long-term effects - Alternative scenarios for composition effects and the average employment rate, employment



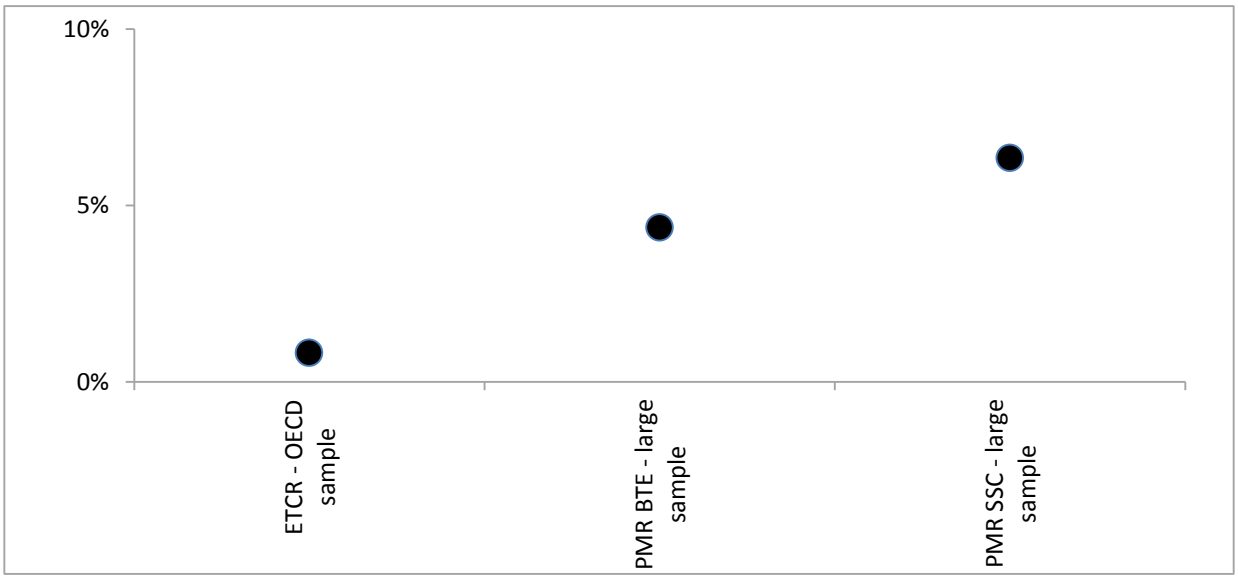
Note: Alternative scenarios use a 10 p.p. increase and decrease in the employment rate. For the two upper figures, policy changes are defined as the average pro-reform change over a window of two consecutive years (see Égert and Gal, 2016). For the lower figure, policy changes are obtained as one standard deviation of the cross-section data.
Source: OECD calculations

8.2. Differentiating between different country groups

8.2.1. OECD vs. non-OECD countries

40. A simple way of producing differentiated policy effects is to split the sample along the lines of some marked country characteristics. An obvious feature is the level of economic development, which essentially allows for splitting the large sample into advanced and less advanced countries. For instance, Product market regulations go in tandem with stronger growth effects through capital deepening for the large sample. They are indeed five times larger than the effects derived for the OECD sample (Figure 10).

Figure 10. Effect on per capita income through capital deepening, OECD vs. large sample (including OECD and non-OECD countries)



Note: Add the note here. If you do not need a note, please delete this line.
Source: OECD calculations.

8.2.2. Different groups within the OECD

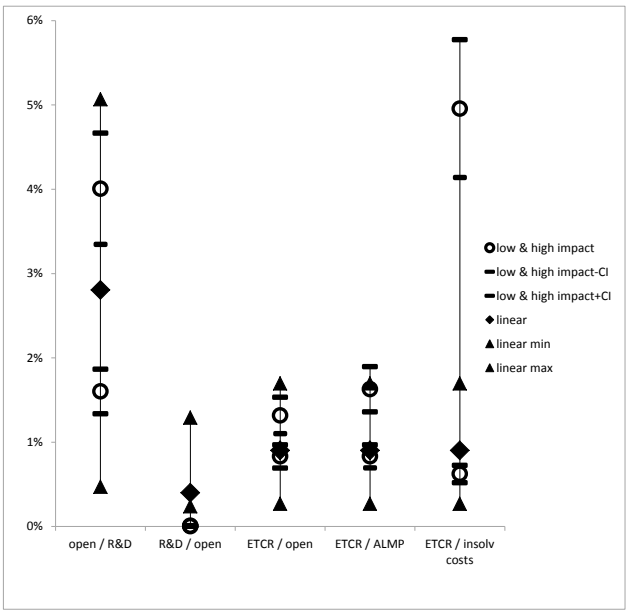
41. Within the OECD, countries could be put into core (or advanced) and catching-up economies within the OECD sample. Estimation results indicate that the effect of trade openness and R&D on growth through the MFP channel differs substantially for developed and less developed OECD countries. Greater spending on R&D is associated with stronger growth effect in core OECD countries. At the same time, trade openness appears to play a bigger role for less developed OECD countries, which can make a better use of technology diffusion than investment in R&D (see Égert, 2017b).

8.2.3. Threshold non-linear effects

42. Estimating non-linear effects, i.e. policy effects conditional on the level of other policies, is a powerful way to produce country-specific estimates depending on whether any given country is above or below the estimated threshold. Figures 11 to 14 show that such threshold effects help interpret the large uncertainties arising from the linear specifications. While in many cases the non-linear effects are located inside the large uncertainty band, they relate to a more targeted and specific part of the uncertainty band. This indeed reduces uncertainty. In other (and more rare) cases, the non-liner effects can be outside of the linear uncertainty band.

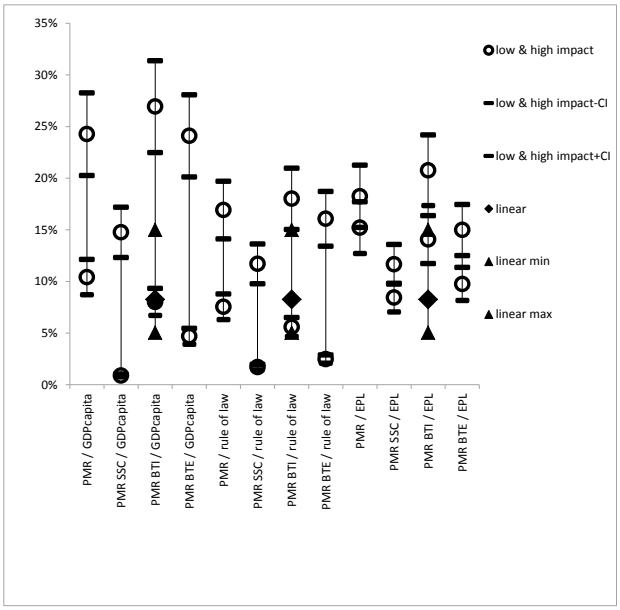
Figure 11. Non-linear long-term effects, MFP

OECD sample



Large sample

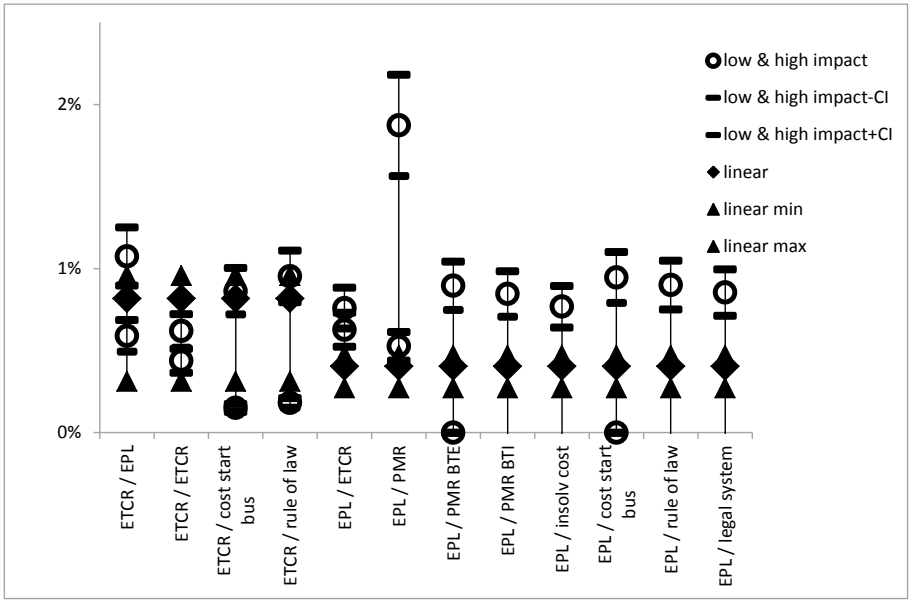
including OECD and non-OECD countries



Note: policy1/policy2 (eg open / R&D) indicates the policy impact of policy 1, conditional on the level of policy2. For the figure on the left, policy changes are defined as the average pro-reform change over a window of two consecutive years (see Égert and Gal, 2016a). For the figure on the right, policy changes are obtained as one standard deviation of the cross-section data. The policy effects are calculated using the following coefficient estimates: coeff base = preferred (mid) coefficient estimate, base-/+CI give the 90% confidence intervals; coeff low and high are the lowest and highest coefficient estimates picked from alternative model specifications. Coeff low-CI and coeff high+CI are the respective 90% confidence intervals.

Source: OECD calculations.

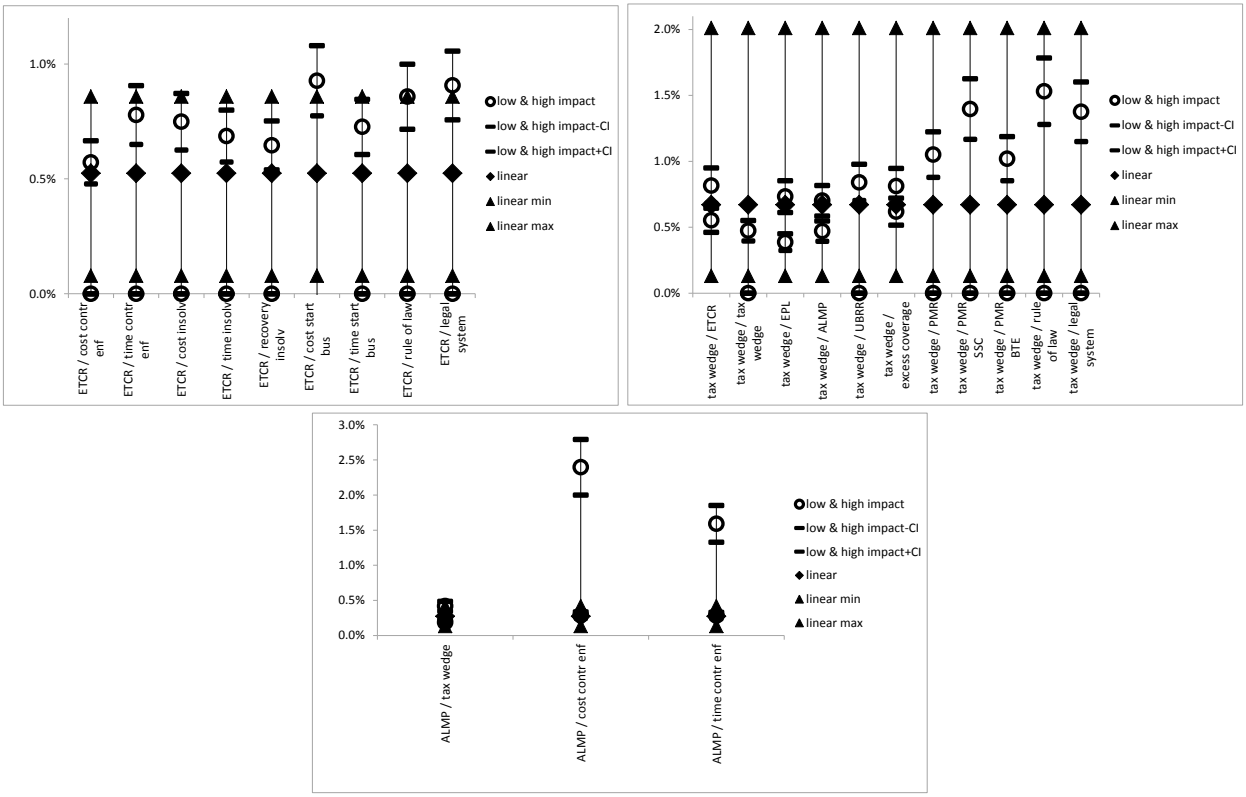
Figure 12. Non-linear long-term effects, capital deepening, OECD sample



Note: policy1/policy2 (eg ETCR / EPL) indicates the policy impact of policy 1, conditional on the level of policy2. policy changes are defined as the average pro-reform change over a window of two consecutive years (see Égert and Gal, 2016a). The policy effects are calculated using the following coefficient estimates: coeff base = preferred (mid) coefficient estimate, base-/+CI give the 90% confidence intervals; coeff low and high are the lowest and highest coefficient estimates picked from alternative model specifications. Coeff low-CI and coeff high+CI are the respective 90% confidence intervals.

Source: OECD calculations

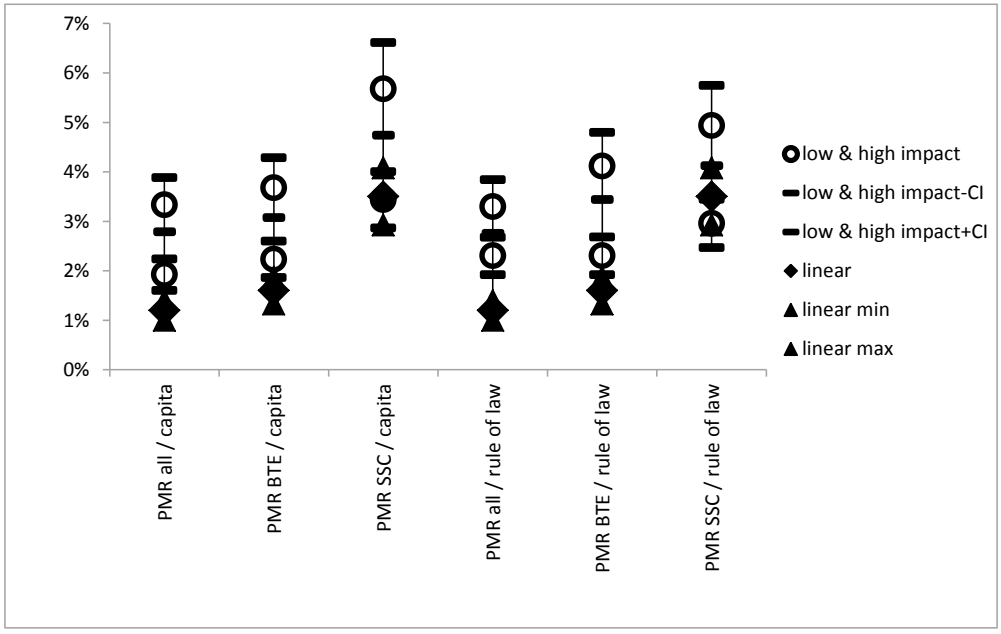
Figure 13. Non-linear long-term effects, employment, OECD sample



Note: policy1/policy2 (eg tax wedge / ETCR) indicates the policy impact of policy 1, conditional on the level of policy2. policy changes are defined as the average pro-reform change over a window of two consecutive years (see Égert and Gal, 2016a). The policy effects are calculated using the following coefficient estimates: coeff base = preferred (mid) coefficient estimate, base-/+CI give the 90% confidence intervals; coeff low and high are the lowest and highest coefficient estimates picked from alternative model specifications. Coeff low-CI and coeff high+CI are the respective 90% confidence intervals.

Source: OECD calculations

Figure 14. Non-linear long-term effects, large panel



Note: policy1/policy2 (eg PMR / rule of law) indicates the policy impact of policy 1, conditional on the level of policy2. policy changes are obtained as one standard deviation of the cross-section data. The policy effects are calculated using the following coefficient estimates: coeff base = preferred (mid) coefficient estimate, base-/+CI give the 90% confidence intervals; coeff low and high are the lowest and highest coefficient estimates picked from alternative model specifications. Coeff low-CI and coeff high+CI are the respective 90% confidence intervals.

Source: OECD calculations

Box 1. Calculating total policy impacts on per capita income

Theoretical considerations

In the new framework, similarly to previous frameworks, structural policies affect per capita income through the supply side components. The appropriate aggregation across the components is straightforward in a standard neo-classical model with a Cobb-Douglas aggregate production of the following form.

$$Y = K^{\alpha}(hL)^{1-\alpha}, \quad 0 < \alpha < 1 \qquad (1)$$

with h denoting labour-augmenting (Harrod-neutral) technological progress. Note that the empirical construction of the MFP measure that is used for the estimations relies on the formulation in equation (1). [10] However, under the assumption of constant returns to scale, equation (1) can be rewritten in the following way:

$$Y = MFP(K^{\alpha}L^{1-\alpha}) \qquad (2)$$

where there is a very close link between multi-factor productivity (MFP) and h: $MFP = h^{1-\alpha}$. Introducing per capita measures and after some rearrangements, per capita income can be expressed as a function of MFP, the capital-output ratio (K/Y) and the employment rate (L/N_{wa}):

$$\ln\left(\frac{Y}{N_{pop}}\right) = \frac{1}{1-\alpha}\ln(MFP) + \frac{\alpha}{1-\alpha}\ln\left(\frac{K}{Y}\right) + \ln\left(\frac{L}{N_{wa}}\right) + \ln\left(\frac{N_{wa}}{N_{pop}}\right) \qquad (3)$$

where N_{pop} and N_{wa} stand for total population and working age population, respectively.

The advantage of this formulation is that in a standard setting, all components are separable and independent from each other. Specifically, the capital-output ratio does not depend on either productivity or employment, neither is the employment rate influenced by productivity or capital.[11]

[10]. MFP used for the estimations is calculated as follows:
$\ln(MFP_t) = \ln(Y_t)/(1-\alpha) - \ln(L_t) - \ln(CLF_t) - \alpha/(1-\alpha)\ln(K)_t,$

where *CLF* adjusts labour input for people working but not living in the country or those working abroad for domestic companies $\alpha = 0.33$,the standard value in the literature and fixed across countries and over time for ensuring comparability in a simple manner.

[11]. Considering capital intensity, when *r* is the real interest rate, the capital-output ratio in equilibrium is given by $\frac{K}{Y} = \frac{\alpha}{r}$. In a more elaborate setting, the real interest rate can be replaced by a more elaborate user cost of capital, which includes the relative price of investment goods and corporate taxes as further determinants. In addition, excessive regulation can introduce frictions that suppress capital accumulation – a mechanism that can be captured by product and labour market regulation indicators.

As for the employment rate, both labour supply and labour demand determinants enter as policy channels in equilibrium (hence no need to include wages or productivity on top of them).

For simulating the effects of changes in policies, the above equation will be used in growth rates:

$$\Delta\ln\left(\frac{Y}{N_{pop}}\right) = \frac{1}{1-\alpha}\Delta\ln(MFP) + \frac{\alpha}{1-\alpha}\Delta\ln\left(\frac{K}{Y}\right) + \Delta\ln\left(\frac{L}{N_{wa}}\right) + \Delta\ln\left(\frac{N_{wa}}{N_p}\right) \quad (4)$$

where Δ captures differences over time, which can be interpreted as percentage changes. As mentioned above, MFP in our empirical framework uses the Harrod-neutral specification. Hence (4) can be rewritten as follows:

$$\Delta\ln\left(\frac{Y}{N_{pop}}\right) = \Delta\ln(h) + \frac{\alpha}{1-\alpha}\Delta\ln\left(\frac{K}{Y}\right) + \Delta\ln\left(\frac{L}{N_{wa}}\right) + \Delta\ln\left(\frac{N_{wa}}{N_p}\right) \quad (5)$$

Similarly to the calculation of MFP a standard value for capital elasticity is set in the simulations ($\boldsymbol{\alpha} = 0.33$). The last term capturing the share of working age population will be assumed to be unchanged over the simulation horizon. Alternatively, demographic projections by the United Nations could be used over the projection horizon (long-term scenarios project of the OECD, Johansson et al., 2013).

Practical considerations

MFP and capital deepening are measured in logarithms, while the employment rate is measured in percentage points (between 0 and 100). The simulation framework requires that the reform impacts are expressed in log-points for each supply side component, Percentage point changes in the employment rate are thus transformed into log-points by dividing the changes in employment : $\Delta\ln\left({}^{L}/_{N_{wa}}\right) = \frac{\Delta\left({}^{L}/_{N_{wa}}\right)}{{}^{L}/_{N_{wa}}}$

Another issue about aggregation is how to obtain the aggregate employment effect from the demographic and skill groups of the population. Policy effects for these groups are aggregated using the groups' weight in the working age population.

Source: Égert and Gal (2016)

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Annex A.

Table A1. Sources of coefficient estimates used for the calculation of long-term policy effects

Policies supply-side channel	**Linear effects** average time (within) effects	cross-country (between) effects		
	OECD countries	OECD countries	non-OECD countries	large sample (OECD & non-OECD)
PRODUCT MARKET REGULATION				
Product market regulation (OECD PMR indicator)				
MFP	MFP TR1 eq1	EME TC1 eq1	EME TC1 eq1	--
K/Y	INV T6B eq7	--	--	EME TB6 eq6
Employment	LM T8 eq 3	EME TC6 eq1	EME TC6 eq1	EME TB9 eq8
Time of insolvency procedures				
MFP	--	--	EME TC2 eq3	EME TB3 eq 12
Employment	--	--	--	EME TB9 eq1
LABOUR MARKET REGULATION & POLICIES				
Employment protection legislation (EPL permanent contracts)				
OECD's EPL indicator				
MFP	--	MFP TR7 eq6	--	--
K/Y	INV T6B eq7	--	--	--
Employment	LM T15 eq 2, LM T13, eq3,6,9	--	--	--
Cambridge EPL indicator				
Employment	--			EME TB9 eq3
Economic Freedom of the World EPL indicator				
Employment	--	--	--	EME TB9 eq1
Spending on active labour market policies (ALMP)				
MFP	MFP TR8 eq1	--	--	--
Employment	LM T8 eq3	--	--	--
Tax wedge				
Employment	LM T8 eq3	--	--	--
QUALITY OF INSTITUTIONS				
Rule of law				
MFP	--	MFP TR7eq6	--	EME TB4 eq1
Cost of contract enforcement (Doing business indicator)				
MFP	--	--	--	EME TB3 eq4 6
K/Y	--	--	--	EME TB7 eq5-6
R&D INVESTMENT				
MFP	MFP TR1 eq1	--	--	--
TRADE OPENNESS				
MFP	MFP TR1 eq1	--	--	--

Note: EME = Égert (2017a), MFP = Égert (2017b), INV = Égert (2017c), LM = Gal and Theising (2015), the part after MFP, INV and LM denote the number of the table (eg T6B = Table 6B) and the number of the equation in that table (eg. Eq6=equation 6)

Source: OECD.