

Chapter 3

The Quantification of the Effects of Structural Reforms in OECD Countries



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3.1 Introduction

This chapter describes and discusses a new simulation framework that quantifies the impact of structural reforms on per capita income. The overall medium- to long-term supply side impact is derived through components of the production function: multi-factor productivity, capital intensity and the employment rate. It builds on and extends the previous frameworks developed in the OECD's Economics Department, which include Bouis and Duval (2011) and Barnes et al. (2013) and the long-term scenario model elaborated in Johansson et al. (2013). In what follows, this will be referred to as the old framework.

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In developing a new empirical framework for the quantification of the medium- to long-term impact of reforms, a number of objectives have been established at the outset (OECD 2015a). First, to extend the set of policy channels included in the framework to significantly broaden the range of quantifiable reforms. Second, to update the framework to cover the post-crisis period. Third, to improve the framework's internal consistency with respect to the country and time coverage, the empirical specification and econometric method used to estimate policy impacts. Fourth, country-specific policy effects should be better taken into account. And finally: a better integration of emerging market economies.

This chapter is a first step towards addressing the first three objectives. First, relative to the old framework, the number of policy variables and channels through which they influence GDP per capita is increased. Second, the new framework is based on relationships estimated over a period including the immediate post-crisis years (1985–2011), although it ends in 2011 due to the availability of some policy indicators. Third, internal consistency is increased by a considerable extent: new estimates for the three supply-side channels are based on a similar sample of countries and time span. The sample size is almost identical for the individual supply-side channels.¹ The estimates are also based on a unified estimation framework (dynamic OLS in a panel setting).

The results presented in this chapter are based on *average* policy effects obtained on an OECD sample. Country-specific effects can be identified in a panel setting by conditioning the impact of individual policies on the stance of other policies or via policy interactions. This will allow for the incorporation of a potentially large set of additional policy areas including institutions and policy areas with limited time-series availability (e.g. subcomponents of the PMR indicator, housing market regulations or the rule of law indicator). Work on integrating EMEs into the quantification framework will also be completed in the next phase.

This chapter is structured as follows. Section 3.2 compares the main features of the old and the new frameworks. In particular, it discusses how the new framework improves on the old framework by (i) incorporating more policy channels, (ii) enhancing the internal consistency of the policy impacts, and (iii) using updated estimates for them. Section 3.3 presents in detail how these new coefficient estimates are obtained. Section 3.4 sets out the new simulation framework and shows the impact of policy changes on per capita income and its supply-side components. It differs from typical OECD studies analysing *specific* policy impacts in a number of ways. First, the simulation framework considers the impact of a large number

¹For instance, policy effects on labour market outcomes are analysed for specific policies (independently of other possibly relevant policies) on substantially different country samples. The effects of unemployment benefits, tax wedge and active labour market policies are taken from Bassanini and Duval (2006). The effect of childcare spending reported in Jaumotte (2003) is used. The first study covers 20 countries and the period 1982–2003, and uses OLS and SUR for estimation purposes. The second paper looks at 17 countries and 1985–1999. It employs 2-stage least squares to estimate policy effects. For a more detailed comparison, see Tables A1.1 and A1.2. in Égert and Gal (2016).

of policies by controlling for a wide range of other policies (including them in the regressions at the same time). Second, most projects typically look at the isolated relationship between policies on the one hand productivity, investment or labour market outcomes on the other hand. The framework is used to aggregate these effects into an overall impact on per capita income. Finally, Sect. 3.5 concludes.

3.2 A Consistent Framework to Quantify the Impact of Structural Reforms

We follow previous OECD papers by assessing the impact of structural reforms on per capita income based on a production function approach (Barnes et al. 2013; Bouis and Duval 2011; Johansson et al. 2013). In this chapter, the influence of policies on GDP is assessed through their influence on its supply side components: multi-factor productivity (MFP), capital intensity and employment. Within this framework, the relationship between policies and these components is obtained from a range of cross-country reduced-form panel regressions. The overall impact on GDP per capita is obtained by aggregating the policy effects of the various channels.²

The framework presented in this chapter seeks to improve on a number of dimensions compared to previous OECD studies. First, a considerably larger number of policy determinants are analysed for MFP and employment and policy determinants of capital deepening are introduced. Second, internal consistency is improved in three ways. To start with, supply-side channels are used in a consistent manner: 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). In addition, econometric estimates are obtained using the very same up-dated dataset (SPIDER dataset) for as many countries as possible (25 for the employment rate and above 30 for MFP and capital deepening) and estimation technique. Finally, changes in policy measures and the horizons at which their impact is measured are standardised. The last major improvement relates to the updating of the coefficient estimates. We make use of econometric estimates covering the post-crisis period (mostly until 2011–2013) for all three supply-side channels (MFP, capital deepening and the employment rate).

²Appendix 1 in Égert and Gal (2016) provides a detailed comparison of the old and new frameworks.

3.3 Empirical Estimates Used in the Simulation Framework

The baseline estimates used in the simulation framework are taken from Égert (2017a, b) and Gal and Theising (2015). They are summarised hereafter.³

3.3.1 *Multi-factor Productivity*

We calculate aggregate MFP as the residual of output once capital and labour are accounted for. Human capital is included in our measure of MFP: MFP series, which exclude human capital (output minus human and physical capital and labour) are implausible: a decline over decades in countries close to the frontier, and the USA being far from the frontier (see details in Égert 2017a).

The policy determinants of MFP are taken from Égert (2017a) and the main results are summarised in Table 3.1 (columns 1 to 3). These results suggest that a strong negative relationship can be identified between product market regulations, captured by the overall Energy, Transport and Communication Regulation (ETCR) indicator (and its subcomponents measuring the degree of barriers to entry and the extent of public ownership in the energy, transport and communication sectors), and MFP if only country but no year fixed effects are used.⁴ If both country and time fixed effects are included in the regressions, only the coefficient estimate on public ownership is found to be statistically significant, overall ETCR and barriers to entry have large standard errors for the full sample. When using a subsample, given by data available on general spending on basic research (rather than business spending on R&D funded by industry used for the large sample), the overall ETCR indicator and its subcomponents become again negative and statistically significant.

Three labour market regulation indicators are used: employment protection legislation (EPL) for permanent contracts, spending on active labour market policies

³Several sensitivity checks are carried out in Égert (2017a, b) and Gal and Theising (2015). They confirm that the results summarised hereafter are fairly robust to alternative specifications regarding time and country coverage, different controls and estimation methods.

⁴The MFP and ETCR series have common trends captured by year fixed effects. These trends are strongly correlated with each other. The correlation between the time fixed effects of MFP and the demeaned overall ETCR series is 0.72 (the series are also demeaned in the regressions including country fixed effects). When we compare the time fixed effects in the MFP and ETCR series, the correlation is 0.77. This is not surprising as time fixed effects explain about 89% of the variation of the demeaned overall ETCR series. When decomposing the overall ETCR indicator into (i) barriers to entry and (ii) public ownership, public ownership survives the inclusion of year fixed effects. This variable could potentially be used for the purpose of quantification (at the expense of covering fewer policy areas).

Table 3.1 MFP and investment: long-term coefficient estimates used in the simulations

Explanatory variables	Dependent variable				
	Multi-factor productivity			log(capital stock/output)	
	(1)	(2)	(3)	(4)	(5)
Product market regulation					
ETCR aggregate	−0.037**		−0.047**	−0.035**	−0.025**
ETCR public ownership		−0.027**			
Labour market policies					
log ALMP			0.029**		
EPL					−0.152**
Intermediate outcomes					
trade openness (size adjusted)	0.007**	0.008**	0.006**		
business exp. On R&D by industry	0.071**	0.059**	0.047**		
Elements of the user cost of capita					
log relative investment prices				−0.377**	−0.608**
long-term real interest rate				0.002	0.004*
corporate taxes/GDP				−0.024**	−0.026**
error correction term	−0.033**	−0.043**	−0.052**	−0.026**	−0.022**
Adjusted R-squared	0.952	0.959	0.964	0.919	0.947
Country/year fixed effects	Yes/No	Yes/Yes	Yes/No	Yes/Yes	Yes/Yes
No. of observations/countries	755/34	755/34	570/32	705/32	600/31
Years	1985–2011	1985–2012	1985–2013	1985–2013	1985–2013

Notes: Estimates based on using the dynamic OLS (DOLS) estimator with one lag and one lead. The MFP regressions include human capital and output gap and the capital deepening regression output gap as control variables. Standard errors are heteroscedasticity robust. ** and * denote significance at the 5% and 10% level, respectively

(ALMP) and the unemployment benefit replacement ratio. None of these labour market regulation indicators is statistically significantly related to MFP when added one by one to the baseline regression.⁵ But ALMP becomes statistically significant if used in logs. The positive sign on ALMP may indicate that more

⁵The finding that EPL is statistically not significant stands somewhat in contrast with the literature using sector- and firm-level data relying on difference-in-difference approaches. For instance, Bassanini et al. (2009) finds for a set of 16 OECD countries from 1982 to 2003 that country-level EPL is associated with lower MFP growth in sectors with higher layoff rates. Rincon-Aznar and Siebert (2012) show the negative relation to hold for manufacturing sectors but not for the services sectors. Using firm-level data for the USA, Autor et al. (2007) report mixed evidence on the negative relation between employment protection and the level of MFP: the coefficient estimates are negative but only one coefficient in two is precisely estimated. Dougherty et al.

spending on ALMP helps labour reallocation towards more productive uses by reducing skill mismatches (Adalet-McGowan and Andrews 2015). Adding year fixed effects to the regressions switches off the innovation intensity variable. In the simulations, estimates obtained using country fixed effects only will be used.

3.3.2 *Capital Deepening*

The policy determinants of capital deepening are taken from Égert (2017b). The results are summarised in Table 3.1 (columns 4 and 5). In the baseline specification, K/Y is regressed on the user cost of capital (decomposed into relative investment prices, the real interest rate (proxied by long-term government bond yields deflated by the inflation rate) and corporate taxes (measured as the corporate income tax-to-GDP ratio) and product market regulation. Labour market policies are added to the regressions in a later stage. The results show that the corporate taxes-to-GDP ratio and the relative investment price variable bear the expected negative sign and are statistically significant. But the real interest rate is found to be only weakly related to the capital stock. To be fully consistent with theory, we keep all three components of the user cost of capital in the specifications augmented by structural policy indicators.

Product market regulation, measured by the ETCR indicator, shows a fairly robust negative relationship with the capital stock series. It is robust to alternative (smaller) country samples and time coverage (excluding the crisis). Finally, the results do not change ostensibly if the regressions are carried out on a reduced common sample covering all labour market policy indicators as well (Table 3.1).

The employment protection legislation (EPL) indicator has a strong and quantitatively important negative relationship to the capital stock. Its coefficient estimate is precisely estimated for both the level and log-linear specifications. The estimated elasticities indicate that a one-step increase in EPL is associated with a decline of about 0.2% in the capital stock-to-output ratio.⁶ It should be noted that the negative

(2011) show that state-level employment regulation lowers MFP levels in Indian firms operating in more-labour intensive industries.

⁶This negative relationship is robust to alternative country coverages (for narrower samples composed of more developed OECD countries) and to the definition of the capital stock (real capital stock, capital stock/output, capital stock/workers). This result needs qualification. The effect of EPL on investment is not clear-cut in the existing body of research. The literature reports no evidence that labour market regulation has any impact of investment at the macroeconomic level and for several OECD countries (Kerdrain et al. 2010). There is mixed evidence on the relation between capital stock and labour market regulation at the firm level. There is evidence for European firms that more stringent EPL reduces investment per worker and capital per worker (Cingano et al. 2010). By contrast, for US firms, research suggests higher firing costs (wrongful discharge exceptions) are linked to higher capital stock and capital-to-labour ratios. But the effect becomes negative when state-specific trends are used. A rise in capital may be related to a correction of an

relation between the ETCR indicator and the capital stock remains statistically significant and of the same magnitude (Table 3.1).

3.3.3 *Employment Rate*

Policy determinants of the employment rate are taken from Gal and Theising (2015), who build on previous work from the OECD Reassessed Jobs Strategy (Bassanini and Duval 2006). The impact of policies on the aggregate employment rate is derived from estimation results obtained for four demographic groups (youth, prime age women and man; and the elderly). Such a breakdown makes it possible to capture more types of policy than regressions focusing on the overall employment rate or a breakdown by skill levels. Estimation results, summarised in Table 3.2, show that lower unemployment benefit replacement rates, increased spending on active labour market policies, and lower labour tax wedges tend to boost employment. These findings broadly confirm existing results but are based on an updated dataset and on a somewhat different methodology.⁷ Regarding wage-setting institutions, the excess coverage of wage agreements—i.e. the difference between the percentage of employees to whom the results of wage negotiations apply and those that are members of labour unions—its interaction with the tax wedge and the minimum-wage level tend to affect employment rates negatively. Product market regulation captured by the ETCR indicator correlates negatively with the aggregate employment rate. Finally, while the EPL indicator has no robust relationship with the aggregate employment rate (Égert and Gal 2016), it does have a heterogeneous impact across various segments of the population. This makes aggregate effects potentially dependent on the composition of the working age population by skills and demographic groups.

Indeed, some of the other policy effects also show significant and intuitive heterogeneity across segments of the population:

- Higher unemployment benefit replacement rates have the strongest negative effect on employment of the elderly and the low educated;
- ALMP spending has positive effects for each segments of the population, mostly so for the youth;

earlier downturn and that the introduction of more stringent firing regulations followed a rise of the capital-to-labour ratio (Autor et al. 2007). For Italian firms, estimation results show that the introduction of unjust-dismissal costs raises the capital-to-labour ratio in firms with less than 15 employees, compared to larger firms (Cingano et al. 2015).

⁷These results are robust to various sensitivity checks, including different estimation methodologies, control variables and a time period covering only the pre-financial crisis period (Gal and Theising 2015). Nevertheless, jack-knifing the sample, i.e. dropping one country at a time from the sample, shows some sensitivity to the country coverage.

Table 3.2 Employment rate: long-term coefficient estimates

Explanatory variables	Dependent variable: employment rate			
	Youth (1)	Prime age women (2)	Prime age men (3)	Elderly (4)
Tax-benefit and activation policies				
UE benefit replacement rate	-0.183**	-0.204**	-0.147**	-0.343**
ALMP spending on unemployed, as % of GDP/capita (HP-trend)	0.147**	0.092**	0.047**	0.063**
Tax wedge (single, no ch.)	-0.866**			
Tax wedge (couple, 2 ch.)		0.004	-0.274**	-0.260**
Wage setting institutions				
Excess coverage	0.072	-0.171**	0.025	0.105
Excess coverage * tax wedge (single, no ch.)	-3.627**			
Excess coverage * tax wedge (couple, 2 ch.)		-0.938**	0.079	0.623*
Minimum wage (%median)	-0.311**	-0.421**	0.043	-0.093
Labour and product market regulations				
EPL regular contracts	1.599	-2.746*	-0.569	1.710
ETC regulation	1.032	-1.533**	0.232	0.630
Policies primarily affecting women				
Family benefits in cash (% of GDP)		-0.967		
Family benefits in kind (% of GDP)		4.698**		
Number of weeks of maternity leave		0.265**		
Pension system—primarily affecting the elderly				
Legal age for pensions (total)				0.851**
Error correction term	-0.303**	-0.145**	-0.294**	-0.160**
Adjusted R-squared	0.978	0.960	0.907	0.977
Country/year fixed effects	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
No. of observations/countries	422/25	420/25	420/25	422/25
Years	1987–2010	1987–2010	1987–2010	1987–2010

Notes: Estimates based on using the dynamic OLS (DOLS) estimator with one lag and one lead. Heteroskedasticity and autocorrelation robust (Newey-West) standard errors are shown in parentheses. The regressions also include the output gap, government employment, the government budget balance, a measure of average educational attainment (adjusted mean years of schooling) and an indicator for the presence of minimum wages as further controls. For more details, see Gal and Theising (2015). ** and * denote significance at the 5% and 10% level, respectively

- The impact of minimum wages is stronger for the youth than for prime age men and the elderly.⁸ Its impact is even stronger for prime wage women.⁹
- Stricter employment protection legislation tends to decrease female employment rates, although this result is not robust to the exclusion of family policies. The effects of EPL on men are ambiguous. It also has opposing effects on the low educated (lowering employment) and on the highly educated (increasing employment); see Égert and Gal (2016). The explanation can be that stricter EPL may hold back less the hiring of highly qualified workers (they are more likely to provide a better match for the firm) and may impact their firing less (which may be more costly). These opposing effects across groups of the population help to explain why it is difficult to find robust aggregate effects;
- Raising the legal retirement age increases labour force participation for the elderly;
- More spending on in-kind family benefits, such as childcare and longer maternity leaves, increase employment rates of the working-age female population.

3.4 The New Simulation Framework

This section illustrates the new quantification framework. Appendix describes how policy impact on the three supply-side channels can be aggregated to total per capita income effects.

3.4.1 *Choosing the Size of Policy Changes for Illustrative Purposes*

One needs to determine the magnitude of changes in the structural policy indicators to quantify the impact of structural policies on per capita income. Ideally, in each case, one should use details on planned policy changes and translate them into the policy indicators used for the estimations. In practice, this is not always possible. Details are not always sufficient and if they are, it is not always easy to map them

⁸The magnitude of the estimated impact (-0.3 for the youth) seems consistent with studies showing elasticities of -0.1 to -0.2 (see recent surveys by Neumark 2015 and OECD 2015b). This is because we use the Kaitz index (median to minimum wage), which in our sample averages at 50% (Gal and Theising 2015). Hence a 1% point increase in it translates into a 2% point increase, on average, for the minimum wage level. Therefore, coefficients obtained when using the level of the minimum wage should be multiplied by two to make them comparable with our coefficients.

⁹Our coefficient estimates for prime-age women are larger than those reported in the literature using similar datasets (Addison and Ozturk 2012). The differences may be due to different model specification and data coverage. Therefore, care should be taken when using these estimates for quantification.

into our policy indicators. For such cases and for illustrative purposes, we define a reform measure for each policy, which is based on policy changes observed in the past. More specifically, reforms are determined as the average improvements in the policy indicators over 2-year windows. Only those consecutive years are used when which policy indicators suggested reform in both years. It is important to stress that the impact of reforms is linear: if reform intensity (the change in the policy indicator) doubles, the impact on per capita income will also double.¹⁰

3.4.2 *Obtaining Policy Effects Over Different Horizons*

Policy effects identified by the coefficient estimates are the long-run effects (Tables 3.1 and 3.2). This implies full convergence, which can take a very long time, depending on the estimated speed of adjustment parameters. For MFP and capital deepening, the estimated error correction terms are estimated in the range of -0.03 to -0.05 , and for employment, they are around -0.2 (Égert and Gal 2016). A speed of adjustment coefficient of $\rho = -0.05$ implies that 90% of the convergence occurs after about 45 years.¹¹ This long-term convergence can be speeded up if the short-term effect is large and points in the same direction. Such an initial “boost” is found for the ETCR impact on MFP, for instance (see Fig. 3.1). Policymakers are typically interested in policy impacts at shorter time horizons. Therefore, policy impacts are also calculated and presented for 5 and 10 years after the reforms took place.

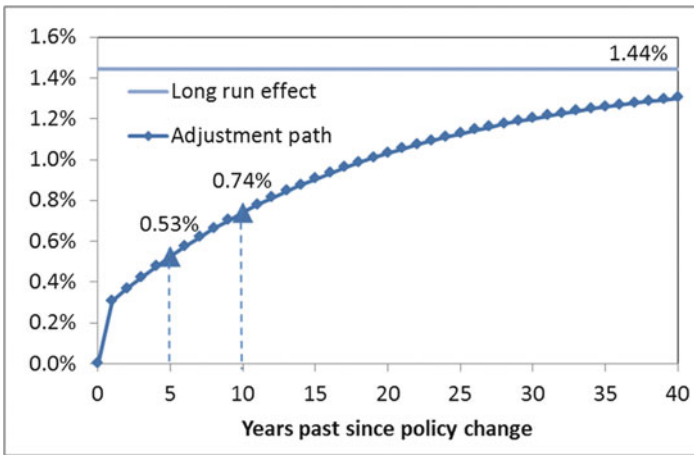
The adjustment path is calculated using the estimated error correction term and the contemporaneous, short run policy effect from the error correction model. The adjustment path uses estimates of the short-run effects and the speed of adjustment terms from Égert and Gal (2016). The overall impact will therefore depend on the adjustment path to the long-run equilibrium and the number of years considered after the policy changes. To compute policy impacts over the desired horizon, the convergence path for each policy is evaluated for each supply-side channel. These effects are then aggregated across policies and supply side components, in accordance with Eq. (3.5) in Appendix.

The policy effects are linear with respect to changing *the size* of the reform measure, but they are non-linear depending on the *time horizon* over which they are evaluated. Put differently, the impact of reforms is twice as much if the reform shock is twice as large. However, the impact 5 years after reforms occurred can be different from half of the impact predicted for 10 years after the reforms were introduced.

¹⁰Appendix 5 in Égert and Gal (2016) discusses alternative reform scenarios.

¹¹ $\ln(1 - 0.9) / \ln(1 - 0.05) \approx 45$ years. The half-life, i.e. the time over which half of the convergence to the new long-run equilibrium happens, can be calculated as $\ln(1 - 0.5) / \ln(1 - 0.05) \approx 13.5$ years.

The impact of a unit ETCR-reform on MFP unit reform: -0.31 point unit reform: 3.18 percentage points



The impact of a unit ALMP reform on the employment rate (in percentage points)

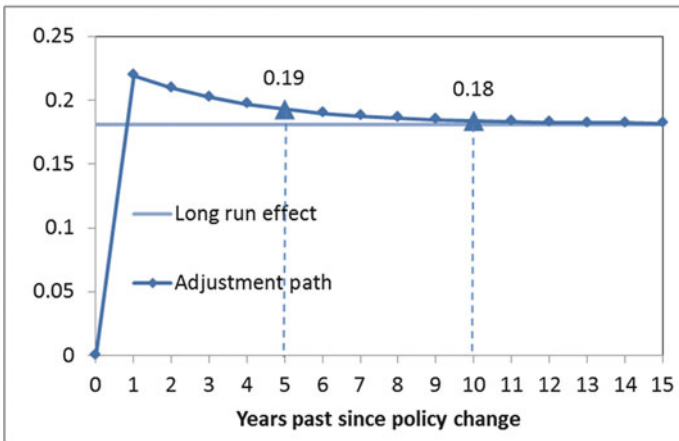


Fig. 3.1 Adjustment path towards the long-run impact: two examples. Notes: ETCR stands for Energy, Transport and Communication Regulation. The size of the reforms are measured by the average changes of the indicators to a more favourable direction, observed over two consecutive years, across all OECD countries in the sample and years (1985–2013). For each year t following the policy change, the adjustment path of the policy effect is $[1 - (1 + \rho)^t](\beta x - \gamma x) + \gamma x$, where ρ , β and γ are the estimates for the speed of adjustment, the long run and the short run impact of the policy, and x is the size of the reform shock

As described above, the shape of the adjustment path to the total long-term effect determines the short-run effect. Figure 3.1 shows these adjustment paths and the resulting non-linear impacts in terms of different horizons for two different policies. The adjustment path for a change in ETCR on MFP is slow and decelerating, while

the adjustment of a change in ALMP on the employment rate is characterised by an initial overshooting and then a gradual return to the long-run equilibrium.

3.4.3 Simulation Results

This section presents the impact of policies on per capita income levels. The overall impact mostly reflects average effects across countries, as country-specific effects play a much smaller role in the new framework at the current stage.

3.4.3.1 Average Country Effects in the New Framework

Let’s first zoom in on the *overall impact* on per capita income 5 years after the policy changes took place (Fig. 3.2 and Table 3.3. The results suggest that product market regulation, as measured by the ETCR indicator, has the largest overall direct policy impact: 0.7%. This is because ETCR influences per capita income through all three supply-side channels (productivity, capital deepening and the employment rate). The impact through MFP is 0.5. This is comparable with the impact of other policies. For instance, the impact of increased ALMP spending, a reduction in the tax wedge and in the minimum wage or in the number of maternity leave weeks, ranges from 0.36

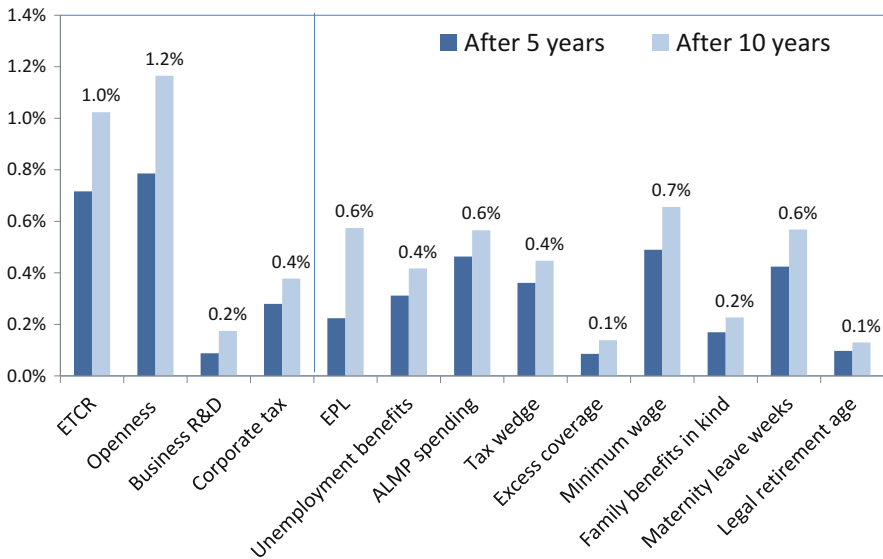


Fig. 3.2 The impact of reforms on GDP per capita 5 and 10 years after the reforms. Notes: Typically observed reforms are measured here by the average of all beneficial 2-year policy changes that were observed over two consecutive years in the sample

Table 3.3 The impact of reforms on GDP per capita and its supply side components 5 years after the reforms

Structural policy areas	Size of a typically observed	Total effect on GDP per capita in percent	Impact on supply side components		
			MFP in percent	K / Y in percent	L / N in percentage points
Product market regulation		0.72			
ETCR (0-6, 6 is strictest)	-0.31	0.72	0.53	0.07	0.10
Intermediate policy channels mainly affecting		0.87			
Openness	4.01	0.79	0.79		
R&D (business exp.)	0.10	0.09	0.09		
Investment specific policies		0.28			
Corporate tax	-0.98	0.28		0.57	
Labour market policies		2.88			
Labour market regulations		0.22			
EPL (regular contr., 0-6, 6 is strictest)	-0.30	0.22		0.24	0.07
Tax-benefit and activation policies		1.39			
Unemployment benefits	-1.42	0.31			0.21
ALMP spending	3.18	0.46	0.09		0.25
Tax wedge	-2.28	0.36			0.24
Tax wedge (single)	-1.39	0.25			0.17
Wage setting institutions		0.58			
Excess coverage	-1.89	0.09			0.06
Minimum wage	-2.48	0.49			0.32
Labour market policies for	0.69				
Family benefits in kind	0.11	0.17			0.11
Maternity leave weeks	4.83	0.42			0.28
Legal retirement age	0.57	0.10			0.06

Notes: Typically observed reforms are measured here by the average of all beneficial 2-year policy changes that were observed over two consecutive years in the sample. The total GDP/capita effect uses the employment effects from the aggregation across demographic groups, and it uses the formula in Eq. (3.5) to aggregate across supply side components

to 0.49% (see column (2) in Table 3.3). The influence of trade openness is similar in magnitude to that of ETCR. However, it requires further empirical work to pin down through which channels openness impacts MFP and thus per capita income.

Some policies have only a minor impact on per capita income levels. For instance, raising the legal retirement age, increasing business spending R&D funded by industry and cutting excess coverage add about 0.1% to per capita income when using past positive policy changes over two consecutive years (column (2) in Table 3.4). The small impact of R&D may seem puzzling. There is some evidence that less developed OECD countries may benefit more from technology diffusion and adoption through the trade channel, and that innovation intensity (more spending on R&D) may be more important for more advanced OECD countries (Égert 2017a).

The overall impact of all labour market policies is considerably larger than the overall effect of ETCR and the remaining policies (corporate taxes and R&D spending). Nevertheless, adding up the effect of all labour market policies implies that reforms are carried out simultaneously in all quantifiable policy areas, which is rather implausible in practice.

Table 3.3 can provide precious help for policy makers for the elaboration of comprehensive structural reform packages. Depending on the ease with which reforms can be implemented, policies could be picked to reach policy objectives in terms of overall impact on per capita income.

When we compare the impact of policies across *different horizons*, i.e. 5 and 10 years after policy changes and the long-run effect (Table 3.4), the following results stand out. First, for some policies, the overall long-term effects on GDP per capita can be considerably larger than the 5- to 10-year impacts. These policies include ETCR, EPL and ALMP spending. Furthermore, the total impact of other policies, mostly labour market policies transiting only via the employment rate channel, materialises at a shorter horizon. Hence, the impact at different horizons (reported in Table 3.4) is similar in magnitude.

As to the impact of policies on the separate *supply-side channels* (Fig. 3.3),¹² some results are worth highlighting. To start with, the results suggest that different policies have different impacts on the separate supply-side channels. For instance, corporate taxes have a much larger impact on investment compared to product market regulations (ETCR). The impact of legal retirement age on the employment rate is roughly 5 times smaller than those found for minimum wages, maternity leave weeks or ALMP spending (Fig. 3.4).

The impact of EPL reform on the employment rate is subject to large uncertainties. The effect is very small and negative if estimates from aggregate employment equations are used, reflecting the mechanism that in the short run, less strict EPL can induce more firings. However, when the overall impact is obtained by aggregating the impacts across separate segments of the population—either by educational

¹²In addition to the baseline results based on demographic groups, the predicted impacts for the employment rate and the core set of policies are shown for two alternative approaches: (i) results obtained for the overall employment rate; and (ii) results obtained for skill groups.

Table 3.4 The impact of reforms on GDP per capita at different horizons

Structural policy areas	Size of a typically observed reform	Total effect on GDP per capita		
		After 5 years	After 10 years	After full convergence (long run)
Product market regulation		0.72	1.02	2.09
ETCR (0-6, 6 is strictest)	-0.31	0.72	1.02	2.09
Intermediate policy channels mainly affecting productivity		0.87	1.34	2.86
Openness (perc. of GDP)	4.01	0.79	1.17	2.40
R&D (business exp.) (perc. of GDP)	0.10	0.09	0.17	0.46
Investment specific policies		0.28	0.38	1.25
Corporate tax (as perc. of GDP)	-0.98	0.28	0.38	1.25
Labour market policies		2.88	4.03	5.78
Labour market regulations		0.22	0.57	1.83
EPL (regular contr., 0-6, 6 is strictest)	-0.30	0.22	0.57	1.83
Tax-benefit and activation policies		1.39	1.74	2.10
Unemployment benefits (perc. of earnings)	-1.42	0.31	0.42	0.45
ALMP spending (per unemployed, as perc. of GDP/capita)	3.18	0.46	0.57	0.85
Tax wedge (perc.points)	-2.28	0.36	0.45	0.47
Tax wedge (single) (perc.points)	-1.39	0.25	0.31	0.32
Wage setting institutions		0.58	0.79	0.86
Excess coverage (perc.points)	-1.89	0.09	0.14	0.15
Minimum wage (perc. of median)	-2.48	0.49	0.66	0.70
Labour market policies for		0.69	0.92	0.99
Family benefits in kind (perc. of GDP)	0.11	0.17	0.23	0.24
Maternity leave weeks	4.83	0.42	0.57	0.61
Legal retirement age	0.57	0.10	0.13	0.14

Notes: Typically observed reforms are measured here by the average of all beneficial 2-year policy changes that were observed over two consecutive years in the sample. The total GDP/capita effect uses the employment effects from the aggregation across demographic groups, and it uses the formula in Eq. (3.5) to aggregate across supply side components

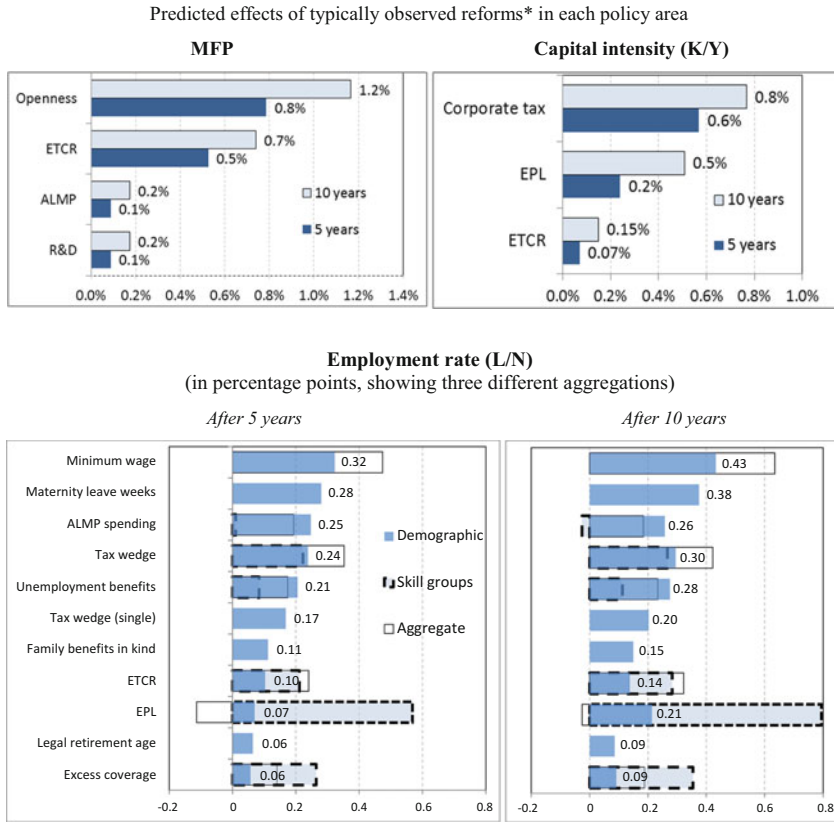


Fig. 3.3 Effects of improving structural policy areas: details by supply side components after 5 and 10 years. Notes: *Typically observed reforms are measured as the average improvements in the policy indicators over all 2 year windows that show improvements in both periods (see Table 3.4, column 2). The employment rate effects use all three aggregation approaches, and the size of the effects is indicated by numbers for the aggregation using demographic groups

attainment levels or by demographic groups—positive effects can be identified, up to half a percentage point. Uncertainties about the average employment impact of EPL have also been emphasised in earlier findings in the literature (Boeri et al. 2015).

3.4.3.2 Country-Specific Effects in the New Framework

The new simulation framework allows for country heterogeneity in three different ways. First, heterogeneous effects may result from different reform intensity. Second, heterogeneous effects may occur through the interaction of wage setting institutions. The effect of the labour tax wedge is found to depend on the level of excess coverage of wage bargaining (Gal and Theising 2015; de Serres et al. 2014).

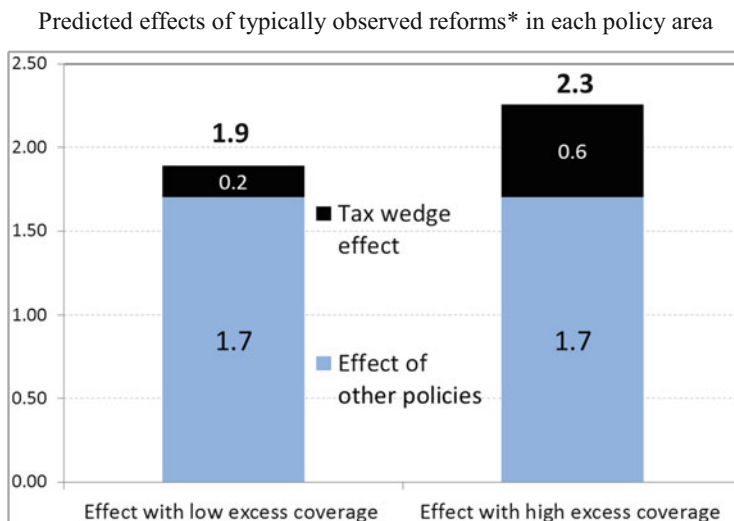


Fig. 3.4 Employment effects of tax wedge reforms in a low vs. high excess coverage country. Notes: *Typically observed reforms are measured as the average improvements in the policy indicators over all 2 year windows that show improvements in both years. The low and high excess coverage country corresponds to the 25th and 75th percentile of the excess coverage distribution in 2011 (Poland and Greece, respectively)

The payoffs from lowering the average labour tax wedge can be substantially higher for countries with higher excess coverage. The gains in the employment rate from a cut in the labour tax wedge (a reduction corresponding to the average observed over two consecutive years) are by 0.4 percentage point larger for a country with a high excess coverage than for one where it is low (Fig. 3.4).

Finally, heterogeneous effects may result from differences in the age, gender and skill composition of the population. In principle, they can be another source of country-specificity in the framework, as the labour market results show heterogeneity across these groups. However, these effects are rather small in practice. For instance, using the lowest and the highest shares of the most responsive groups to policies (i.e. youth or low educated) makes only a marginal difference (0.1–0.2 percentage point) for the final impact on aggregate employment (these results are not reported here). Hence in practice, differences in the relative size of these demographic groups, as well as in the skill composition of countries have only limited effects on per capita income. This serves as one more motivation to expand the framework with more non-linear effects and interactions between policy areas.

3.5 Conclusion

This chapter describes and discusses a new simulation framework that quantifies the impact of structural reforms on per capita income. Compared to earlier attempts, the new framework developed in this chapter broadens the range of quantifiable reforms, updates the underlying empirical relationships, covers the post-crisis period and improves the framework's internal consistency. The chapter presents the new coefficient estimates on the three main supply-side components (MFP, capital and employment). The chapter is a step in a gradual, on-going process to continuously improve and update the quantification of the effect of structural reforms on per capita income levels. Further work is needed to better account for country-specific effects and to extend the analysis to emerging market economies. Last but not least, the extent to which the macroeconomic estimates are consistent with results obtained on the basis of sector- and firm-level data will be verified in future work.

Using typical past reforms as a basis for simulation, the new framework provides a number of results for the main policy variables. First, 5 years after the reforms, product market regulation has the largest overall single policy impact. However, the combined impact of all labour market policies is considerably larger than that of product market regulation and the remaining policies combined (corporate taxes and R&D spending). Some specific policies only have a minor impact on per capita income levels. They include the legal retirement age and business spending on R&D.

Second, policy impacts can differ at different horizons. For some policies, the overall long-term effects on GDP per capita can be considerably larger than the 5- to 10-year impacts. This is particularly the case of policies that influence GDP per capita through capital deepening (product market regulation, employment protection legislation and spending on active labour market policies). The long-term impact of other policies, mostly labour market policies transiting only via the employment rate channel, materialises at shorter horizon.

Third, the new framework shows the determinants of policies through the separate supply-side channels.

Fourth, different policies have different impacts on the separate supply-side channels. For instance, corporate taxes have a much larger impact on investment than product market regulations. The impact of legal retirement age on the employment rate is roughly 5 times smaller than that found for minimum wages, maternity leave weeks or ALMP spending.

Finally, there is no robust relationship between employment protection legislation reform and the aggregate employment rate. Some policy areas (family benefits, pension age) can be assessed and included in the framework only by demographic groups. Hence as a benchmark in future quantification exercises, the effects found when aggregating across demographic groups could be used.

Appendix: 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:

$$Y = K^\alpha (hL)^{1-\alpha}, \quad 0 < \alpha < 1 \quad (3.1)$$

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 Eq. (3.1).¹³ However, under the assumption of constant returns to scale, Eq. (3.1) can be rewritten in the following way:

$$Y = MFP (K^\alpha L^{1-\alpha}) \quad (3.2)$$

where there is a very close link between multi-factor productivity (MFP) and h : $MFP = h^{1-\alpha}$. Introducing per capita measures and after\vdadjust{\pagebreak} 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}):

$$\ln\left(\frac{Y}{N_{pop}}\right) = \frac{1}{1-\alpha} \ln(MFP) + \frac{\alpha}{1-\alpha} \ln\left(\frac{K}{Y}\right) + \ln\left(\frac{L}{N_{wa}}\right) + \ln\left(\frac{N_{wa}}{N_{pop}}\right) \quad (3.3)$$

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.¹⁴

¹³MFP used for the estimations is calculated as follows:

$$\ln(MFP_t) = \ln(Y_t) / (1 - \alpha) - \ln(L_t) - \ln\left(\frac{CLF_t - \alpha / (1 - \alpha)}{\ln(K)_t}\right),$$

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.

¹⁴Considering 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 the user cost of capital, which includes the relative price of investment goods and corporate

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

$$\Delta \ln \left(\frac{Y}{N_{pop}} \right) = \frac{1}{1-\alpha} \Delta \ln(MFP) + \frac{\alpha}{1-\alpha} \Delta \ln \left(\frac{K}{Y} \right) + \Delta \ln \left(\frac{L}{N_{wa}} \right) + \Delta \ln \left(\frac{N_{wa}}{N_p} \right) \quad (3.4)$$

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 Eq. (3.4) can be rewritten as follows:

$$\Delta \ln \left(\frac{Y}{N_{pop}} \right) = \Delta \ln(h) + \frac{\alpha}{1-\alpha} \Delta \ln \left(\frac{K}{Y} \right) + \Delta \ln \left(\frac{L}{N_{wa}} \right) + \Delta \ln \left(\frac{N_{wa}}{N_p} \right) \quad (3.5)$$

Similar to the calculation of MFP a standard value for capital elasticity is set in the simulations ($\alpha = 0.33$). 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, see 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 the employment rate by the latest observed employment rate for the working age population L/N_{wa} (which was 67% in 2013, averaged across all countries in the sample):

$$\Delta \ln \left(\frac{L}{N_{wa}} \right) = \frac{\Delta \left(\frac{L}{N_{wa}} \right)}{\frac{L}{N_{wa}}}$$

Another issue about aggregation is how to obtain the aggregate employment effect from the demographic and skill groups of the population. Policy effects for

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).

these groups are aggregated using the groups' weight in the working age population. For the illustrative simulations presented in this paper, the population structure of the average OECD country is used in the latest available year.

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