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# Composition Matters: Fiscal Consolidation and Economic Growth in the Czech Republic (2010-2013)

By Matthias Burgert, Renata Hruzova, Milan Lisicky and Allen Monks

## Summary

Between 2010 and 2013, the Czech Republic undertook a significant fiscal consolidation that cut the headline government deficit by about 4.5 pps., bringing it well below the reference value in the Treaty. This consolidation was largely achieved by discretionary fiscal measures in two areas: public investment and indirect taxes. We examine whether the composition of this consolidation could have contributed to the weakness of economic growth in the Czech Republic during this period.

We compare the consolidation package of the Czech Republic with two counterfactual packages based on the fiscal consolidations undertaken by Slovakia and Poland during the same period. We estimate the size and composition of the three packages and scale them to match that of the Czech package. This allows us to assess the impact on growth that consolidation on this scale would have had under a different mix of fiscal measures. We simulate the impact of the three estimated packages on the Czech economy in the short- to medium-term using the European Commission's QUEST model, a macroeconomic model used for policy analysis.

The results of this analysis suggest that the composition of the Czech consolidation package had a larger negative impact on economic activity than the counterfactual packages. This is due to the large and persistent negative impact that reductions in public investment have on GDP in our model. While discretionary measures in other areas also have a negative impact on GDP in the short term in our model, the impact generally dissipates in the years following the consolidation. Having achieved a balanced budget (in structural terms) by the end of the consolidation period, the Czech Republic had scope to increase public investment and, indeed, such an increase occurred in 2014 and 2015. Nevertheless, these results suggest that the composition of fiscal adjustment matters for the short-term impact of consolidation on economic growth.

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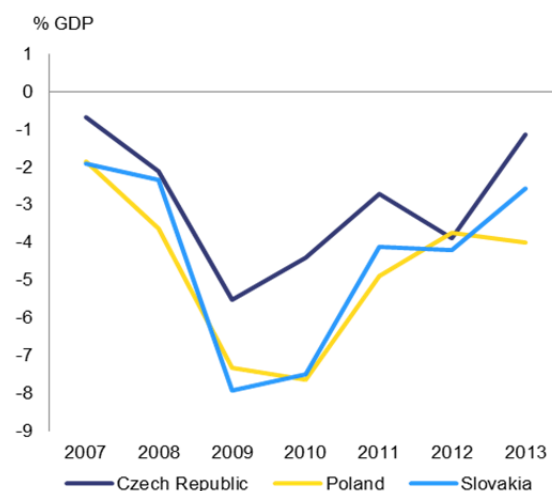
## Introduction

In this Economic Brief, we examine the growth impact of the 2010-13 fiscal consolidation undertaken by the Czech Republic. During this period, the Czech authorities undertook a substantial fiscal adjustment in the context of the excessive deficit procedure<sup>1</sup>, with the headline government deficit falling from 5.5% of GDP in 2009 to 1.2% in 2013 (Graph 1) and the structural deficit falling from 5.0% of GDP to a surplus of 0.1% (Graph 2). At the same time, the growth performance of the Czech economy was weak (Graph 3), with the country entering a two-year recession in 2012. We examine the extent to which the composition of the fiscal consolidation may have been a contributing factor to this weak growth performance.

We compare the impact of the Czech fiscal consolidation with counterfactual consolidation packages based on those implemented in Slovakia and Poland during the same period. We choose these countries due to their structural similarities, such as their similar levels of economic development, as well as the fact that they had a comparable fiscal position entering the crisis and undertook fiscal consolidation around the same time, although the Czech consolidation was frontloaded (Graphs 1 & 2).<sup>2</sup> In contrast, medium-term potential GDP growth for the Czech Republic was lower than the other two countries at the start of the consolidation period.<sup>3</sup>

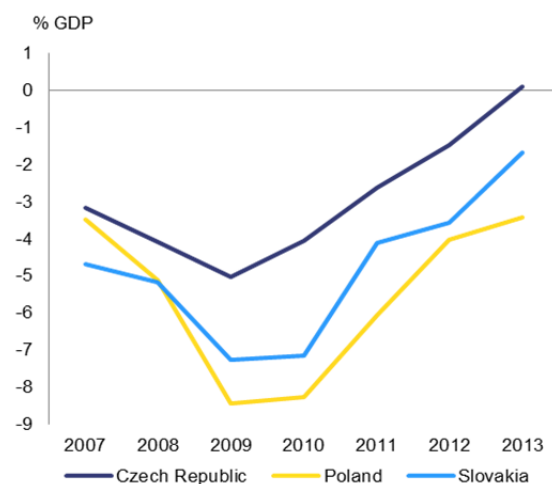
We input estimated discretionary fiscal measures for the three packages into a version of the European Commission's QUEST model that is calibrated to match certain characteristics of the Czech economy, such as the level of employment, the sectoral composition of output and bilateral trade patterns. This allows us to simulate the short- and medium-term impact of the three packages on the level of Czech economic activity. In order to do so, we re-scale the two counterfactual packages in order that they match the size of the Czech package, thus allowing us to abstract from the size of the packages and to focus on their composition. We can then determine whether differences in the composition of these consolidation strategies can help explain the weak growth performance of the Czech economy during the period of consolidation. It is important, however, to stress the model-dependent nature of this exercise, which simulates the impact of a purely fiscal shock.

Graph 1: Headline Balance of General Government



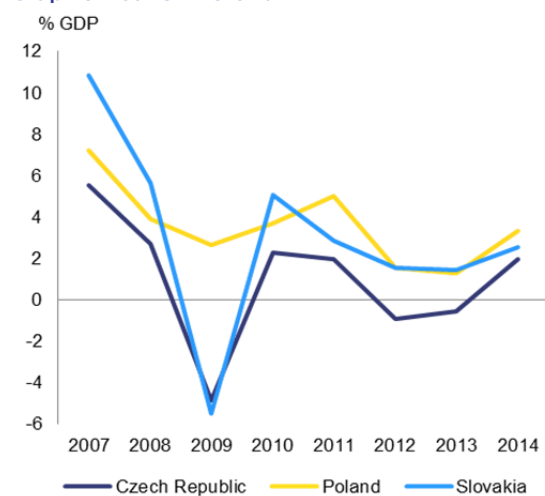
Source: AMECO

Graph 2: Structural Balance of General Government<sup>4</sup>



Source: AMECO

Graph 3: Real GDP Growth



Source: AMECO



## Composition of Fiscal Consolidation

### Measuring the Fiscal Effort

The analysis is based on estimates of discretionary fiscal measures in the various general government revenue and expenditure categories that are defined in the QUEST model.

On the revenue side, we use a combination of two approaches to estimate discretionary fiscal measures. The first approach is based on internal estimates of individual revenue measures, which we group into the main revenue categories defined in QUEST, i.e. personal income tax, corporate income tax, indirect taxes and social security contributions. The second approach estimates discretionary fiscal measures by comparing the observed change in each revenue category to a "no-reform" scenario, i.e. the theoretical change that would have prevailed had there been no discretionary policy change. This scenario is calculated using standard OECD tax elasticities with respect to their corresponding base, e.g. private consumption in the case of indirect taxes, wage bill in the case of personal income tax.<sup>5</sup> The fiscal effort in this approach is calculated as the difference between the observed change and the change calculated under the "no-reform" scenario. The final estimates of discretionary fiscal measures in each revenue category are calculated by taking a simple average of the estimates from the two approaches.

For expenditure items, we only use the method based on the "no-reform" scenario as estimates of individual expenditure measures are more difficult to obtain. Defining an appropriate "no-reform" scenario is more challenging than for the revenue side, particularly in the post-crisis period that we focus on. We use a European Commission estimate of the growth rate of nominal potential GDP for all expenditure categories, i.e. public investment, compensation of employees, social transfers and intermediate consumption. While such an assumption may be somewhat simplistic, this measure is likely to be less distorting than other options and allows for cross-country comparability.

### Composition of the Fiscal Efforts

The results of the estimated de-composition of the annual fiscal effort for the three countries are presented in Graph 4 and in Table 1 (at the end of the text). These figures are cumulated in order to show the total estimated consolidation effort in each

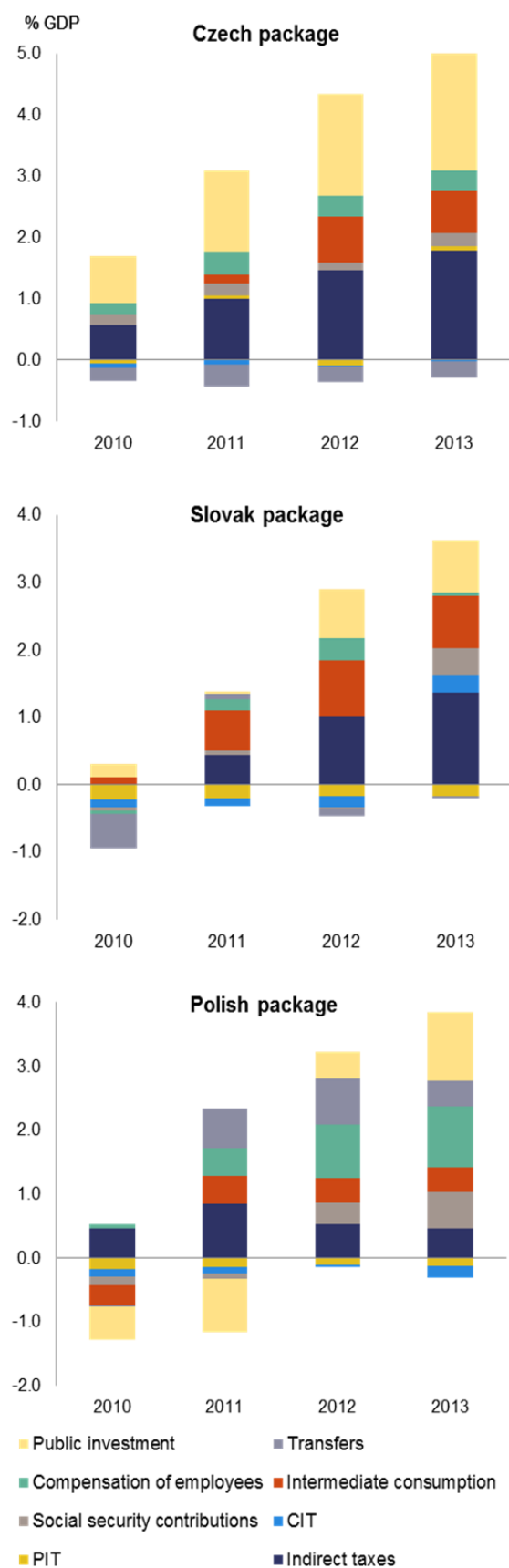
revenue and expenditure category during the consolidation period.

While the composition of the Czech consolidation package varied from one year to another, two main budgetary items drove the budgetary adjustment: indirect taxes and public investment. These developments are well-captured by our estimates of the fiscal effort. Within the category of indirect taxes, both excise duties and VAT were increased several times with an estimated cumulative fiscal impact of almost 1.8% of GDP in the period 2010-2013. This reflects the greater scope that existed at the time to increase revenues from indirect taxes compared to other revenue categories. In particular, labour taxation was already high in the Czech Republic compared to the EU average at the start of the consolidation period due to high social security contributions. VAT rates increased from 5% and 19% in 2010 to 15% and 21%, respectively, in 2013. At the same time, government investment targets were undershot during the consolidation years: the deep drop in public investment averaged more than 10% annually over the period 2010-2013.<sup>6</sup> The consolidation effort also affected other expenditure and revenue categories, albeit to a lesser degree. The main measures included lower indexation of pensions, cuts in operational expenditure of the government, a temporary freeze in public sector wages at the level of central government, an increase in the personal income tax rate and cuts in social benefits.

A comparison of the estimated consolidation packages shows a larger consolidation undertaken by the Czech Republic (4.9% of nominal GDP), compared to Poland (3.5%) and Slovakia (3.4%). Consolidation in the Czech Republic was also frontloaded, starting in 2010, whereas our estimates show Poland and Slovakia embarking on consolidation only in 2011. In the case of the estimated Polish consolidation package, the largest measures were taken in 2011 and 2012, whereas in the Slovak package the measures are spread out more evenly in the period from 2011 to 2013.

Comparing the composition of the consolidation packages, our estimates show that the Polish and Slovak packages relied on a greater mix of measures than that of the Czech Republic, which relied heavily on indirect taxes and public investment. The Polish package was quite heavily skewed towards expenditure measures (in particular in relation to compensation of employees), while the other two were more balanced between revenue and expenditure measures.

**Graph 4: Estimated Cumulated Fiscal Consolidation: Czech Republic & Counterfactual Packages (2010-13)**



Source: European Commission Calculations

The estimated discretionary measures are broadly in line with developments in the structural balances of these countries over the period (Graph 2 & Table 1), although there are some differences. It is important to note that the expenditure and revenue categories used in our model may not fully capture the consolidation effort as they do not include items such as transfers between pension pillars, government sales, and capital/current transfers. In our view, such measures are unlikely to have had a significant macroeconomic impact.

The change in the Czech structural balance (5.1 pps of GDP) is very close to the sum of discretionary fiscal measures (4.9 pps). For both Poland and Slovakia, the change in the structural balance is larger than our estimates of total discretionary measures (5.0 pps. vs. 3.5 pps. and 5.6 pps. vs. 3.4 pps., respectively). In the case of the estimated Polish package, this is mainly due to the fact that we exclude discretionary measures that gave rise to transfers from second to first pillar pension schemes (estimated to account for 1pp. of the change in the structural balance).<sup>7</sup> In the case of the Slovak package, in addition to excluding the effect of pension-related measures (0.7pps.), there are other factors that explain the difference. In particular, part of the consolidation occurred in expenditure and revenue categories that we do not examine (as explained above), such as subsidies to enterprises, current and capital transfers, and government sales. This was particularly the case in 2011, for which the difference between the fiscal effort implied by our estimate and the change in the structural balance is the largest.

## Impact of Consolidation

### Assessing the Economic Impact

We assess the impact of the three estimated fiscal consolidation packages on the Czech economy using the European Commission's QUEST model.<sup>8</sup> The version of the model used in this paper consists of three regions: the Czech Republic, the euro area and the rest of the world. All three regions are calibrated to match essential properties of national accounts data and bilateral trade linkages between the regions.

To account for uncertainty and complexity surrounding the implementation of the consolidation packages, we simulate the consolidation scenario under a stepwise credibility assumption.<sup>9</sup> More precisely, economic entities learn at the beginning of each of the first four years (2010 through 2013) about the new level of the budgetary variables. They then expect the level of these variables to remain

constant throughout each of the four years, but to be phased out gradually after the end of each year. Accordingly, at the beginning of the following year, beliefs are updated. Only at the beginning of 2014 do agents consider the reform to be permanent. A consequence of this assumption is that the benefits of future tax reductions on the consumption of intertemporally-optimizing households (the Ricardian effect of consolidation) only materialize once the budgetary adjustments become fully credible.

It is assumed that the nominal interest rate does not react to the state of the economy throughout the consolidation period. The motivation for this assumption is twofold. First, it is meant to reflect the situation after 2010 where the Czech National Bank was operating at or close to the zero lower bound. Second, this assumption allows for a clearer comparison of the nature of the consolidation packages by abstracting from potentially asymmetric monetary policy responses in the various scenarios.

### Size effect

As noted above, the estimated size of the Czech consolidation package is somewhat larger than the estimated Slovak and Polish packages. Intuitively, this should give rise to a larger impact on GDP and this is confirmed by initial results from our QUEST model (not shown). The negative impact of fiscal consolidation on growth appears to correspond to observed real GDP developments over this period, with the level of Czech real GDP falling in 2012 and 2013 before rebounding in 2014. However, it is not possible to conclude that this weak growth performance was solely due to fiscal consolidation as such a comparison would need to be made with a no-reform baseline, which is not observable and subject to other growth shocks. In our analysis, we aim to examine whether the composition of the consolidation that was undertaken could have had a more or less negative impact than alternative consolidation packages.

### Composition effect

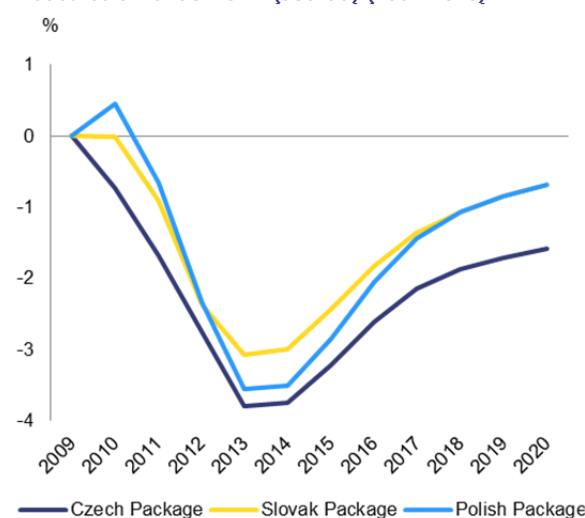
In order to focus on the composition effect of the fiscal consolidation, we scale the figures presented in Table 1 so that the total size of the estimated cumulated Slovak and Polish packages is equal to that of the Czech Republic, i.e. 4.9% of GDP. This means that we can compare consolidation packages that are of equal size but with different

compositions. This allows us to assess what the impact of the Czech consolidation could have been had a different mix of measures been used, while maintaining the overall size of the consolidation.

Graph 5 shows our results for the impact of these three consolidation packages on the level of Czech GDP up to 2020. We can see that the composition of the three packages makes a difference to the overall effect on GDP, with the Czech package having a larger impact than the other two, particularly in the case of the Slovak package. Furthermore, this difference becomes larger in the medium-term in our model, with GDP recovering more slowly under the Czech package than the other two packages.

The results presented in Graph 5 show the joint impact of the various revenue and expenditure measures included in each of the three consolidation packages. In order to more precisely identify the elements that give rise to such differing impacts on GDP in our model, we re-run our simulations separately for each of the revenue and expenditure items. The results of these simulations are shown in Graph 6.<sup>10</sup>

**Graph 5: Simulated Impact of Fiscal Consolidation Measures on Czech GDP (Scaled) (2009-2020)**



Source: ECFIN Calculations

Note: Results indicate percentage deviations from a no-reform baseline.

Our results for the Czech consolidation package show a significant impact of the reductions in public investment on GDP during the period of the fiscal consolidation. The second biggest contributor is the increase in indirect taxes, which gives rise to around a quarter of the fall in GDP by 2013. However, while the effect of the increase in indirect taxes dissipates in the medium-term in our model, the effects of lower public investment are more

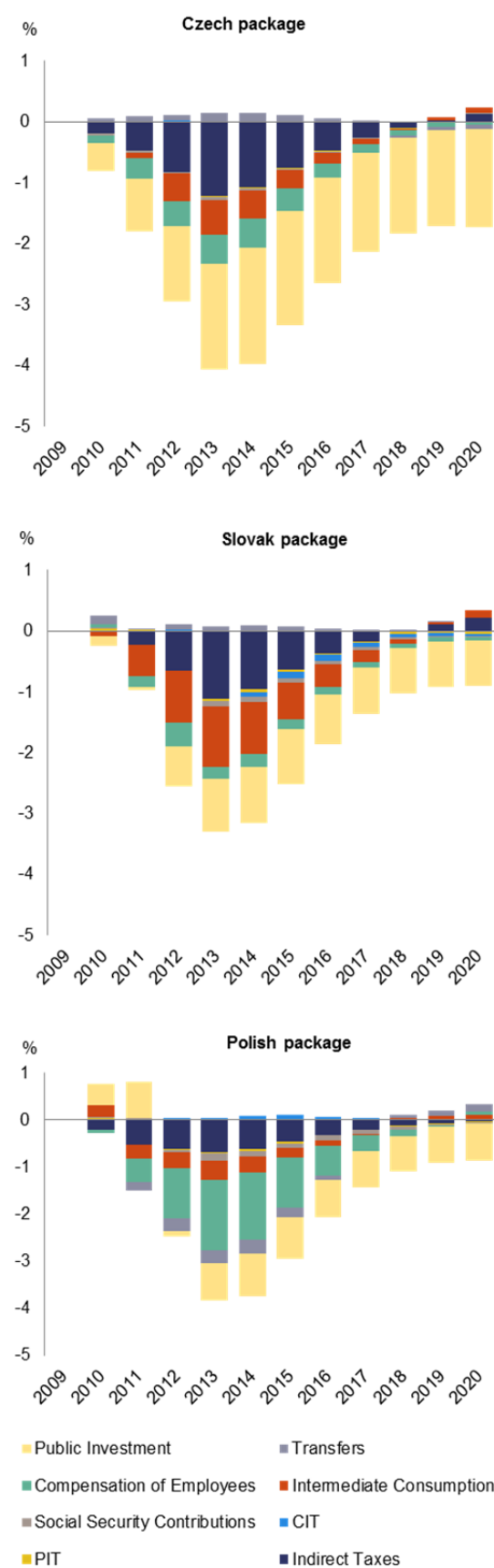


persistent. At the end of the simulation period, public investment is the only significant contributor to the decline in GDP. This is due to the impact of an increasing public investment gap on potential GDP growth in the medium term in our model. Such an impact can also be seen when the estimated Slovak and Polish consolidation packages are applied to the Czech economy. The impact of reductions in public investment does not dissipate over time in these simulations, as in the Czech case. However, the contribution of this element to the fall in GDP is lower than in the Czech case and, therefore, does not act as an impediment to growth to such a strong degree in the medium-term in our model.

Further examination of the model's results for the estimated Slovak and Polish packages points to the medium-term benefits of achieving fiscal consolidation using revenue and expenditure categories that do not have a significant medium-term impact on economic growth. For example, by 2013, there is a significant negative impact from intermediate consumption in the Slovak package and from compensation of employees in the Polish package. However, neither of these contributes to lower GDP in the medium term, with the short-term effect dissipating quite rapidly.

The QUEST simulations allow us to look at the impact of the estimated consolidation packages on other macroeconomic variables. Graph 7 shows the impact of the three packages on Czech private consumption in our model. In contrast to the GDP effects, the effects on private consumption are temporary and revert back to or above zero in the medium run, with the rebound being strongest for the Czech package. Indeed, such a temporary effect can be observed in the outcomes for the Czech Republic, with the level of real consumption stagnating during the consolidation period but subsequently rebounding quite strongly. In our model, this medium-term rebound is driven by the fact that households' permanent income increases at the end of the consolidation period in anticipation of a lower fiscal burden in the future. With regards to the short run, a cut in public investment exhibits a fairly low adverse effect on private consumption, while higher consumption taxes and lower transfer expenditures have a stronger and longer-lasting effect. This explains the differences in the medium-term profile of the three consolidation packages, with the mix of both transfer cuts and indirect tax increases in the Polish package giving rise to the weakest rebound.

**Graph 6: Simulated Impact of Individual Discretionary Measures on Czech GDP (2009-2020)**



Source: European Commission Calculations

Graph 8 shows the impact of the estimated consolidation packages on Czech unemployment. There is a notably stronger impact from the Polish package than for the other two. This is due to the high weight of measures related to compensation of employees in the Polish package. In our model, such measures are split evenly between reductions in wages and reductions in the number of workers, with the latter giving rise to an impact on unemployment. Such an assumption is in line with the experience of the Czech Republic, with savings in compensation per employee largely achieved through a reduction in public-sector workers of 2.6% between 2009 and 2013. The unemployment rate also increased during the latter half of the consolidation period, to 7.0% in 2012 from 6.7% in 2011. However, in contrast to the results of our model, the unemployment rate subsequently fell quite rapidly, reaching 6.1% in 2014 and 5.1% in 2015.

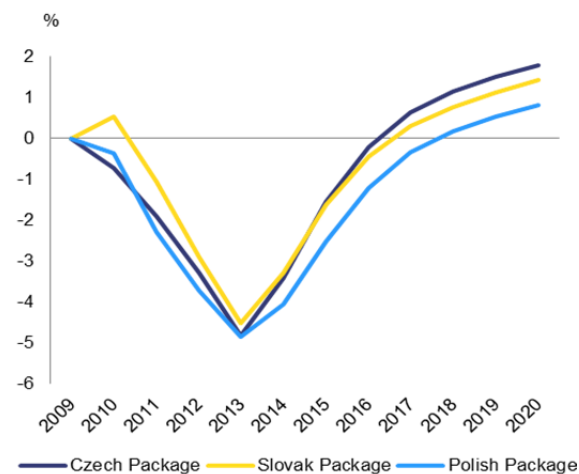
## Conclusions

In this Economic Brief, we have examined the fiscal consolidation undertaken by the Czech Republic in the period 2010–2013 in order to determine whether the composition of this consolidation could have contributed to the weak growth performance of the economy during this period. By comparing the impact of the estimated consolidation package to two counterfactual packages of the same size but different compositions, the results of our model indicate that the Czech package had a slightly more negative impact on GDP. Our results show that this was mainly due to more significant reductions in public investment in the Czech Republic during this period.

These results suggest that the composition of the fiscal consolidation contributed to the weak growth performance of the Czech Republic over this period, although it must be underlined that these results depend strongly on the underlying assumptions of our model. Furthermore, other country-specific factors also contributed to the growth slowdown in this period. In particular, growth was negatively affected by demographic trends, with the population of working age (15–64) falling by 3.1% between 2009 and 2013. Our results also suggest a lasting negative impact of the consolidation due to the heavy reliance on cuts to public investment. However, it is important to note that the Czech Republic had achieved a balanced budget (in

structural terms) by the end of the consolidation period and had scope to increase public investment. Indeed, such a rapid increase in public investment, mainly due to a temporary increase in absorption of EU structural funds, took place in 2014 and 2015.

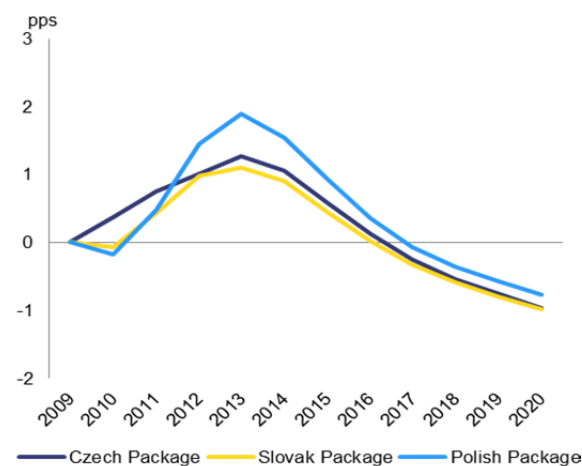
**Graph 7: Simulated Impact of Fiscal Consolidation Measures on Private Consumption Growth (Scaled) (2009–2020)**



Source: ECFIN Calculations

Note: Results indicate percentage deviations from a no-reform baseline.

**Graph 8: Simulated Impact of Fiscal Consolidation Measures on Unemployment Rate (Scaled) (2009–2020)**



Source: ECFIN Calculations

Note: Results indicate a percentage point deviation from a no-reform baseline.

**Table 1: Discretionary Measures and Change in Structural Balance in % of GDP (cumulative with 2009 as base year)**

<b>Czech Republic</b>					
<b>Revenue measures</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>Contribution</b>
Indirect taxes	0.6	1.0	1.5	1.8	37%
PIT	-0.1	0.0	-0.1	0.1	1%
CIT	-0.1	-0.1	0.0	0.0	0%
Social security contributions	0.2	0.2	0.1	0.2	4%
<b>Total revenue</b>	<b>0.6</b>	<b>1.2</b>	<b>1.5</b>	<b>2.0</b>	<b>42%</b>
<b>Expenditure measures</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	
Intermediate consumption	0.0	0.2	0.8	0.7	14%
Compensation of employees	0.2	0.4	0.3	0.3	6%
Transfers	-0.2	-0.4	-0.3	-0.3	-5%
Public investment	0.8	1.3	1.7	2.1	43%
<b>Total expenditure</b>	<b>0.7</b>	<b>1.5</b>	<b>2.5</b>	<b>2.9</b>	<b>58%</b>
<b>Total Discretionary Measures</b>	<b>1.3</b>	<b>2.7</b>	<b>4.0</b>	<b>4.9</b>	<b>100%</b>
<i>Change in structural balance</i>	1.0	2.4	3.6	5.1	
<i>Contribution from pension pillars</i>	0	0	0	0	
<b>Adjusted change in structural balance</b>	<b>1.0</b>	<b>2.4</b>	<b>3.6</b>	<b>5.1</b>	
<b>Slovakia</b>					
<b>Revenue measures</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>Contribution</b>
Indirect taxes	0.0	0.4	1.0	1.4	40%
PIT	-0.2	-0.2	-0.2	-0.2	-5%
CIT	-0.1	-0.1	-0.2	0.3	8%
Social security contributions	-0.1	0.1	0.0	0.4	12%
<b>Total revenue</b>	<b>-0.4</b>	<b>0.2</b>	<b>0.7</b>	<b>1.9</b>	<b>54%</b>
<b>Expenditure measures</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	
Intermediate consumption	0.1	0.6	0.8	0.8	23%
Compensation of employees	0.0	0.2	0.3	0.0	1%
Transfers	-0.5	0.1	-0.1	0.0	-1%
Public investment	0.2	0.0	0.7	0.8	23%
<b>Total expenditure</b>	<b>-0.3</b>	<b>0.9</b>	<b>1.8</b>	<b>1.6</b>	<b>46%</b>
<b>Total Discretionary Measures</b>	<b>-0.6</b>	<b>1.1</b>	<b>2.4</b>	<b>3.4</b>	<b>100%</b>
<i>Change in structural balance</i>	0.1	3.2	3.7	5.6	
<i>Contribution from pension pillars</i>	0	0	-0.2	-0.7	
<b>Adjusted change in structural balance</b>	<b>0.1</b>	<b>3.2</b>	<b>3.5</b>	<b>4.9</b>	
<b>Poland</b>					
<b>Revenue measures</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>Contribution</b>
Indirect taxes	0.5	0.8	0.5	0.5	13%
PIT	-0.2	-0.1	-0.1	-0.1	-3%
CIT	-0.1	-0.1	0.0	-0.2	-5%
Social security contributions	-0.1	-0.1	0.3	0.6	16%
<b>Total revenue</b>	<b>0.0</b>	<b>0.5</b>	<b>0.7</b>	<b>0.7</b>	<b>20%</b>
<b>Expenditure measures</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	
Intermediate consumption	-0.3	0.4	0.4	0.4	11%
Compensation of employees	0.1	0.4	0.8	0.9	27%
Transfers	0.0	0.6	0.7	0.4	12%
Public investment	-0.5	-0.8	0.4	1.1	30%
<b>Total expenditure</b>	<b>-0.8</b>	<b>0.7</b>	<b>2.4</b>	<b>2.8</b>	<b>80%</b>
<b>Total Discretionary Measures</b>	<b>-0.8</b>	<b>1.2</b>	<b>3.1</b>	<b>3.5</b>	<b>100%</b>
<i>Change in structural balance</i>	0.2	2.4	4.4	5.0	
<i>Contribution from pension pillars</i>	0	-0.6	-1.1	-1.0	
<b>Adjusted change in structural balance</b>	<b>0.2</b>	<b>1.7</b>	<b>3.3</b>	<b>4.0</b>	

Source: ECFIN Calculations

Note: A positive figure denotes a tightening of the fiscal stance

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<sup>1</sup> The excessive deficit procedure was launched in December 2009, when the European Council decided that an excessive deficit existed in the Czech Republic. The Czech Republic was recommended to correct the excessive deficit by 2013 ensuring an average annual fiscal effort of 1% of GDP. The procedure was abrogated in June 2014.

<sup>2</sup> While a comparison with the fiscal consolidation undertaken in Hungary during this period could also prove useful, we exclude this country for several reasons. Firstly, the fiscal position of Hungary was quite different to the three others before the crisis, with the country having been subject to an excessive debt procedure since 2004. Secondly, Hungary displayed significant macroeconomic imbalances before the crisis, primarily due to a high level of public debt and a high negative Net International Investment Position (NIIP). This meant that the impact of the crisis was not the same as for the other countries, which mainly suffered from a fall in economic growth due to significantly weaker external demand. Finally, and linked to the previous two points, the significant impact of the crisis on Hungary's external position and public finances led it to enter into an EU-IMF financial assistance programme in 2008. This programme remained in place until 2010, after the start of the period that we analyse in this paper.

<sup>3</sup> According to the European Commission's winter 2016 macroeconomic forecast, the average annual growth rate of potential GDP for the 10-year period 2007-2016 was 1.9%, 3.3% and 3.6% for the Czech Republic, Slovakia and Poland, respectively. The lower rate of potential GDP growth for the Czech Republic can be partly explained by its higher level of GDP per capital (both in nominal and purchasing power-adjusted terms) throughout this period.

<sup>4</sup> Figures for the structural balance of the general government sector are only available from 2010. The figures in the graph for 2009 refer to calculations that are based on the cyclically-adjusted net lending or borrowing requirement of the general government sector. Differences between the two series arise when the government undertakes one-off and other temporary expenditure or revenue measures. We have estimated these one-off measures and adjusted the 2009 cyclically-adjusted net lending or borrowing figures accordingly. The figures for 2007 and 2008 have not been adjusted and, therefore, correspond to the cyclically-adjusted net lending or borrowing requirement of the general government sector.

<sup>5</sup> In a limited number of cases, we have made an adjustment to the standard OECD elasticities based on the expert judgement of DG ECFIN staff members working on the relevant country desk.

<sup>6</sup> The large drop in investment during this period reflects lower transfers from the central government to regional governments and municipalities, a suspension of EU structural fund payments due to irregularities, delays in implementation of large infrastructure projects, significant changes in the public procurement law and other factors.

<sup>7</sup> During the period 2010-2013, both the Slovak and the Polish authorities decided to increase the proportion of social contributions which accrued to the pay-as-you-go (first) pension pillar (classified under ESA within the general government) instead of going to the fully-funded (second) pillar (classified outside of general government). While this is considered under ESA a discretionary measure with a fiscal impact on the general government deficit, we consider that it does not have an impact on the real economy during the period under examination since the overall social contributions rates remained unchanged. We therefore do not include these changes in our analysis.

<sup>8</sup> The QUEST model was developed by the Directorate General for Economic and Financial Affairs (DG ECFIN) for macroeconomic policy analysis and research. QUEST belongs to the class of New-Keynesian Dynamic Stochastic General Equilibrium (DSGE) models that serve as the foundation for macroeconomic policy analysis in international institutions and central banks. The model is a multi-region extension of the estimated DSGE model for the euro area (see Ratto, M., Roeger, W., and in 't Veld, J. (2009). QUEST III: "An estimated DSGE model of the euro area with fiscal and monetary policy." *Economic Modelling*, Vol. 26(1). pp. 222-233). In each of the regions it distinguishes between households, a production sector and a fiscal authority. An important feature of the model is the distinction between two types of households, which both consume and provide labour services to the production sector. One type of household – the Ricardian household – has full access to financial markets and has therefore perfect insurance against adverse income shocks. The other type – the liquidity constrained household – has no financial market access and therefore does not have the possibility to smooth consumption over time. More information on QUEST-based analysis can be found at: ([http://ec.europa.eu/economy\\_finance/research/macroecconomic\\_models\\_en.htm](http://ec.europa.eu/economy_finance/research/macroecconomic_models_en.htm)).

<sup>9</sup> For a more detailed description and an application to euro area wide consolidation efforts of the stepwise credibility approach refer to in 't Veld, J. (2013). "Fiscal consolidations and spillovers in the Euro area periphery and core," *European Economy - Economic Papers* 506, Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

<sup>10</sup> As can be observed, the sum of the individual impacts of each revenue and expenditure item in each year is mildly greater than their joint impact (as shown in Graph 5). This is due to the assumptions underlying our simulations in the QUEST model. More precisely, these differences arise due to a restriction placed on the monetary policy reaction function in our simulations. It is assumed that monetary policy operates at the zero lower bound during the period of the fiscal consolidation and for one year following the end of the consolidation. The nominal interest rate can, therefore, not react to the deflationary effect of the fiscal consolidation, thus worsening the impact of a negative fiscal shock on real GDP growth. This element of the impact of the consolidation on real GDP growth is enhanced when each revenue and expenditure category is modelled separately, compared to when they are modelled jointly. The sum of the overall impacts in the former case is therefore greater than the impact in the latter case.

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