Box 2. Potential GDP development and outlook in the medium term

The potential GDP defines the sustainable level of aggregate supply in the medium-to-long term. Usually, this indicator is used to determine the phase of the business cycle and to assess the associated inflationary pressures. When the actual real GDP (further actual GDP) is below its potential level, the existing production capacity is underutilized to satisfy the aggregate demand, and there are no causes for inflationary pressures to emerge. This situation can occur during the business cycle period, which begins with the recession phase and ends with the early recovery phase. Otherwise, when the actual GDP is above its potential level, most of the available production capacity is utilised or there is even a shortage of it, therefore producers, being unable to increase production capacity in the short-run, begin to limit the demand by raising prices. This situation is typical for the period of the business cycle which begins with the recovery phase and ends with the early recession phase. Consequently, the potential GDP is also defined as the level of economic activity, which is achieved by using the existing production capacities, but without causing inflationary pressures.

The potential GDP describes the aggregate supply side, so the level of this indicator is mainly determined by technological and organizational parameters of the production process as well as the available quantities of main production factors. Usually, the following key factors of production are distinguished: capital, labour and overall technology level. It is convenient to analyse the labour factor, measured by the total hours worked in the economy, as the result of several other structural indicators—population, participation rate, unemployment level and the average hours worked by one employed person. All these factors are expected to be important for the variation in the potential GDP annual growth rate, but the long-run trend growth rate of potential GDP is mainly determined by technological progress and population growth rates.

Certain institutional and structural changes in the economic environment may significantly affect the need for capital, labour and technology, and their availability to producers. For example, the tax system, legal regulation of labour, goods and services' markets, the patent system, accessibility to financial markets affect the optimal bundle of capital, labour and technology chosen by producers. For this reason, the changes in potential GDP growth rate also reflect the effectiveness of structural reforms.

Evaluation of potential GDP

The potential GDP is not observable. Different approaches are used for its measurement. The most common is the production function approach, which was applied to obtain the below presented potential GDP estimates for Lithuanian economy. According to this method, it is assumed that the real GDP is produced by a Cobb-Douglas production function employing the key factors of production:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha},$$

where: Y_t—aggregate supply (real GDP), A_t—the total factor productivity (technology level), K_t—the stock of capital, L_t—labour. The parameter α defines the capital share in the production.[1] The total factor productivity is calculated as the Solow residual. The time-series for capital stock are obtained by applying the perpetual inventory method (Vetlov 2003).

The labour factor is further divided into the working age population (POP_t), participation rate (PR_t), unemployment rate (u_t) and the number of hours worked by one employed person (H_t):

$$L_t = POP_t PR_t (1 - u_t) H_t.$$

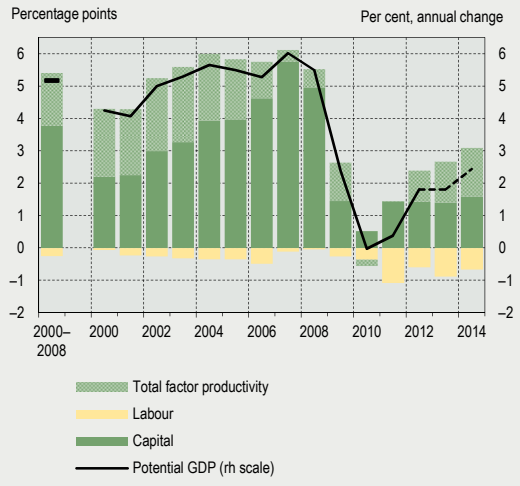
The potential GDP is estimated as a smooth component of actual GDP. This component is calculated by using the above Cobb-Douglas production function, where the potential (or natural) factor levels and their medium-term forecasts are used instead of the actual or forecasted ones. The potential level of each factor, except for the stock of capital and the working age population, is estimated using statistical, econometric methods.[2] It is assumed that the stock of capital and the working age population are already close to their potential levels, therefore their actual and predicted levels are used to estimate the potential GDP.

Development and the outlook in the medium term for Lithuania's potential GDP annual growth rate

The estimates and medium-term forecast of Lithuania's potential GDP annual growth rates are presented in Chart. A. The comparison of potential GDP annual growth rates in period 2000–2008 and 2009–2012 shows that the recent potential GDP annual growth rates are significantly lower. In 2000–2008, the average potential GDP annual growth rate was 5.2 per cent, and in 2009–2012 it was 1.1 per cent. Since 2009, the potential GDP annual growth rate varies more. It reached its smallest value in 2010, when the GDP did not change compared to the previous year. In subsequent years, the potential GDP annual growth rate increased, but not enough to reach the average estimate for the 2000–2008 period. The forecast for the medium-term potential GDP annual growth rate is also moderate. It shows that in 2013–2014 the Lithuania's potential GDP is expected to grow by an average annual rate of 2.1 per cent.

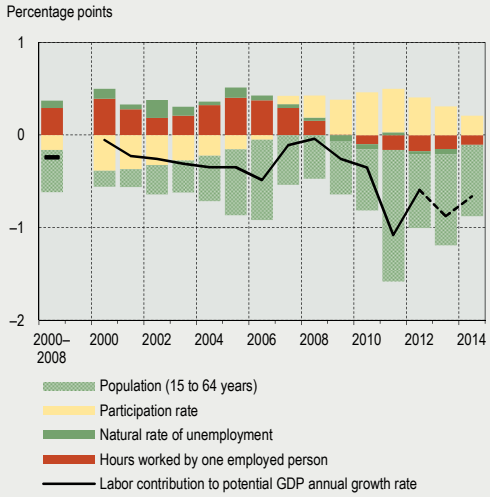
The breakdown of the potential GDP growth rate by factors indicates that its decrease in the period of 2009–2012 compared with 2000–2008 was mostly due to unfavourable development of the total factor productivity and the stock of capital. Changes in the labour growth rate in the period of 2009–2012 were also worse, but their contribution to the potential GDP annual growth rate decrease was less significant.

Chart A. Potential GDP growth and the driving factors



Sources: Statistics Lithuania and Bank of Lithuania calculations.
Note: working age population is based on the recalculated size of population by Statistics Lithuania in 2001–2012 which reflects the 2011 Population and Housing Census data.

Chart B. Decomposition of labour contribution to the potential GDP annual growth rate



Sources: Statistics Lithuania and Bank of Lithuania calculations.
Note: working age population is based on the recalculated size of population by Statistics Lithuania in 2001–2012 which reflects the 2011 Population and Housing Census data.

The average capital contribution to the potential GDP annual growth rate fell from 3.8 per cent in period 2000–2008 to 1.2 per cent in 2009–2012. This fall indicates a strong investment drop caused by the slowdown in the construction sector during the crisis, and increase in corporate bankruptcies. Moreover, since 2009 the development of investment, and hence the stock of capital, was limited due to stricter lending standards. According to the medium-term investment forecasts, stock of capital annual growth is expected to be moderate in 2013–2014. It should be close to the 2000 rate and should contribute by around 1.5 per cent to the potential GDP annual growth rate.

The average total factor productivity contribution to the potential GDP annual growth rate fell from 1.6 per cent in the period of 2000–2008 to 0.5 per cent in 2009–2012. This decrease can be attributed to ineffective investment in capital, typical for the boom period. This can be seen in Chart A: since 2006, the total factor productivity contribution to the potential GDP annual growth rate decreased significantly and the stock of capital substantially increased. The small productivity capital, which was accumulated during the boom, had a negative impact for the total factor productivity in subsequent periods. It is predicted that in 2013–2014, the total factor productivity will on average grow at about 1.4 per cent annually and will contribute to the potential GDP annual growth rate by the same amount.

The average labour contribution to potential GDP annual growth rate fell from –0.2 per cent in period 2000–2008 to –0.6 per cent in 2009–2012. Detailed decomposition of the labour contribution (see Chart B) shows that the main reason for this drop is the negative dynamics in the working-age population. Its impact on the potential GDP annual growth rate on average in 2000–2008 was –0.5 per cent, and in 2009–2012 was –0.9 per cent. It is expected that in the medium term the decrease in the working age population will negatively affect the potential GDP annual growth rate and will on average contribute by–0.9 per cent annually in 2013–2014. The working age population and the level of technology are the key determinants of the long-term potential GDP. Consequently, the smaller working-age population will contribute to a smaller sustainable GDP growth in Lithuania in the long term than it was in 2000–2008.

Output gap and its relationship to inflation

The indicator of the output gap is used to identify the phase of the business cycle and assess the inflationary pressures. It is calculated as the deviation of actual real GDP from its potential level. Such a gap shows how intensively the existing production capacity is utilised to meet the prevailing demand. The larger the actual GDP than its potential level (the gap is positive); the greater is the inflationary pressure, and vice versa.

The development of the Lithuania's output gap and its medium-term forecast are presented in Chart. D. In 2003–2009, the output gap estimate was positive with the peak in 2007. During the crisis, from the beginning of 2009, the demand (particularly the foreign demand) decreased, so the actual real GDP fell sharply and the output gap was significantly negative. The calculated estimates indicate that actual GDP is still slightly lower than its potential level. It is predicted that the negative gap will disappear in 2013.

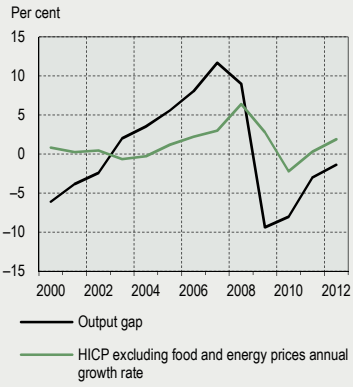
Chart C. Level of actual and potential GDP

Sources: Statistics Lithuania and Bank of Lithuania calculations.
Note: working age population is based on the recalculated size of population by Statistics Lithuania in 2001–2012 which reflects the 2011 Population and Housing Census data.

Chart D. Output gap

Sources: Statistics Lithuania and Bank of Lithuania calculations.
Note: working age population is based on the recalculated size of population by Statistics Lithuania in 2001–2012 which reflects the 2011 Population and Housing Census data.

Chart E. Comparison of the output gap and HICP excluding food and energy prices



Sources: Statistics Lithuania and Bank of Lithuania calculations.
Note: working age population is based on the recalculated size of population by Statistics Lithuania in 2001–2012 which reflects the 2011 Population and Housing Census data.

In Chart E the dynamics of output gap are compared to the dynamics of HICP excluding food and energy prices. HICP, excluding food and energy prices, is less influenced by exogenous factors (such as weather conditions, discovery of oil fields, etc.), so this index better reflects the price changes resulting from movements in supply and demand in the economy. Comparison of the output gap with the change in the aforementioned HICP index reveals that these two rates vary in a similar manner, i.e., with the increasing output gap inflation increases and when the gap decreases, inflation decreases. However, the inflation response is characterized by a lag, which is approximately equal to one year. Many countries feature such a lag, which can be explained by presence of price rigidities in the short run. Thus, the estimates of the Lithuanian output gap reflect the inflationary pressures on prices quite accurately.

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[1] The parameter is set to 0.5 according to the National accounts of Lithuania.

[2] The potential level of total factor productivity and the level of participation rate is measured as the trend component, obtained by applying the extended Hodrick-Prescott filter (Mohr 2005), and the potential level of the hours worked by one employed person is determined using the standard Hodrick-Prescott filter (Hodrick, Prescott 1980). The natural rate of unemployment is assessed using the Kalman filter.