DAINIS STIKUTS

MEASURING OUTPUT GAP IN LATVIA

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ABSTRACT

To determine whether economic progress of a country presents a threat to its macroeconomic sustainability, the difference between actual and potential output is usually used in the formulation of the economic policy. A number of methodologies, including the time series method, HP filter approach and CD function, have been used in the estimation of potential GDP. Potential production factor values were calculated for the needs of the production function. The data used in the paper lead to an inference that the economic growth depends on increases in capital stock and technological progress, both contributing to labour productivity and offsetting workforce shrinkages.

Focusing on the relationship between output gap and inflation, this paper concludes that in Latvia, in contrast to several developed countries, the correlation between output gap and inflation is extremely weak due to the size and openness of the national economy as well as labour market inelasticity. Surveys conducted to date do not produce adequate data for an accurate estimation of the impact the output gap may have on inflation. Inflation is affected by a number of factors, e.g. Latvia's openness to imports, a relatively unlimited external supply of goods for relatively fixed prices, and administratively regulated prices, but it does not depend on the output gap. Hence the excessive demand is to be associated with a rise in imports rather than an upswing in inflation. Therefore, instead of inflation rate, it is the current account that reflects the domestic demand and its development trends more accurately.

Key words: *output gap, potential output, production function, NAWRU*

JEL classification codes: *C13, E32*

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INTRODUCTION

The growth rate of the Latvian economy has been among the highest in Europe since the end of the 1990s. Latvia's real GDP rose 6.8% in 2000, 7.9% in 2001 and 6.1% in 2002, with yet an even higher GDP growth indicator (8.6%) only in 1997. It is not known what GDP growth Latvia could have reached in 1998 if the national economy had not been subject to adverse effects of the Russian financial crisis. However the decline in GDP did not last long, and the pace was picking up again a few years after this serious exogenous shock, reaching a considerably high level.

Under specific conditions, swift growth of a national economy may give rise to macroeconomic problems. Thus, for instance, the economic growth rate of more than 5% per annum is an object of concern about macroeconomic sustainability for almost all economically developed countries because in most cases such a rate indicates that the demand for domestic goods and services is rising at a higher pace than is the supply potential, contributing to additional inflationary pressure or leading to instability of the banking system (the so-called economic overheating). From another perspective, the majority of the developing countries have a potential for sustaining a high growth rate over considerably long horisons due to a substantial strengthening in the domestic supply under the impact of swiftly growing demand. This explains why the developing countries, Latvia among them, can attain a higher growth rate than the developed countries. However, the economic growth potential is not limited in these countries, and with the demand markedly exceeding the potential domestic supply, macroeconomic sustainability may be impaired.

To determine whether economic progress of a country presents a threat to its macroeconomic sustainability, the difference between actual and potential output is usually used in the formulation of the economic policy (hereinafter, the output gap). Potential output can be defined as an output level where production factors are fully (meaning most optimally) employed at the current level of technology. In the long run, potential output indicates optimal supply possibilities and allows for the assessment of the sustainable non-inflationary growth path. In the short term, the output gap reflects the balance of demand and supply and, hence, possible economic growth effects on macroeconomic stability indicators, inflation including.

A positive output gap is associated with excess demand in the economy, which may lead to inflationary pressures. A negative output gap suggests that the potential output exceeds the demand. Thus the potential output provides a key benchmark against which to assess sustainable non-inflationary growth.

Most of the studies dealing with the impact of the output gap on the national economy in industrialised countries focus on how the inflation rate reacts to the output gap. When the exchange rate is fixed, import prices are set in the national currency, the country is small and cannot affect world prices, and competition is perfect (or close

to perfect) there is a possibility that an excess domestic demand can affect imports, not prices. As the open sector goods predominate Latvia's consumption basket and its global trade share is small, it is quite likely that the output gap and the growth in imports would be closely related also in Latvia.

Papers devoted to the estimation of potential output and the effects of the output gap on inflation in the US and West European countries abound in number. By contrast, the impact of the output gap on inflation and other macroeconomic factors in developing countries of Eastern Europe has been little researched despite its importance. The current paper focuses on the estimation of Latvia's potential output basing on statistical methods and the production function approach, and assesses the eventual impact of the output gap on macroeconomic indicators.

I. POTENTIAL OUTPUT ESTIMATION METHODOLOGY

Potential output as unobservable variable cannot be estimated directly. It can, however, be estimated by several statistical and theoretical methods. Statistical methods eliminate cyclical fluctuations from the actual output time series. The statistical methods include the time trend approach and the Hodrick-Prescott or the HP filter approach. To apply statistical methods, no other additional variables than actual output are needed. This explains why statistical methods are so widespread. On the other hand, statistical methods have several drawbacks, low estimation and forecasting efficiency among them, particularly when made over longer horisons. The application of these methods requires relatively extensive time series. The most essential drawback of this approach, however, is that substantial changes in the economic structure due to which the level of potential output may change by leaps and therefore be inconsistent with the forecast, are not taken into account. This drawback is particularly noteworthy for studies about Latvia and similar developing countries, as with the advance of market economy in the early 1990s a great number of changes in the economic structure took place, and the level of Latvia's potential output has, undoubtedly, changed alongside with them.

Due to the drawbacks of simple statistical methods, the analysis of the production function is used as an alternative for measuring potential output. The most widely applied structural method is the estimation of the production function in the form of the Cobb-Douglas function (hereinafter, the CD function); the estimation can be conducted also on a wider scope assuming that substitution elasticity of the production factors is constant. Potential output thus estimated will not present a smooth curve because changes in the economic structure are taken into account. Nevertheless, this method strongly rests on statistical measurements and, with considerably short time series typical for Latvia, may be biased. The following section deals with some statistical and production function methods.

Statistical Methods

Time trend

The simplest method to measure potential output is the linear trend:

$$y_t = const + \beta t + \varepsilon_t \qquad [1].$$

This method is based on the assumption that GDP can be split into two components: the deterministic trend and the cyclical component. Potential GDP is reflected by a constant and a trend component ($const + \beta t$), while the error ε_t of the equation is the estimation of the output gap. This method rules out any shocks that may influence a potential GDP deviation; yet it does not take into account changes in the economic structure and, hence, does not envisage movements in the pace of the potential GDP

growth due to them. Over a shorter horison, however, this method can yield satisfactory results because the effects of changes in the economic structure emerge only over a longer period.

The HP filter

The HP filter approach is a simple and widely used method by which the long-term tendency of a needed variable is obtained using only observable actual data. The tendency is obtained by minimising fluctuations of actual data around the trend, i.e. by minimising the following function:

$$\sum\left(\ln y_t - \ln y_t^*\right)^2 + \lambda\sum\left[\left(\ln y_{t+1}^* - \ln y_t^*\right) - \left(\ln y_t^* - \ln y_{t-1}^*\right)\right]^2 \qquad [2],$$

where y^* is the trend of the variable y or its long-term tendency. The coefficient λ in function [2] regulates how smooth is the long-term GDP tendency (which can be interpreted as potential output in this case). A low λ value forms a trend that follows closely the movements in actual GDP, while a high λ value reduces sensibility of the trend to short-term fluctuations. If the value of λ is very high, the long-term tendency obtained by the HP filter is similar to the linear trend.

The λ value for the HP filter can often be selected freely depending on the desirable smoothness of the final trend. It is common practice to select the λ value equal to 1 600, if the HP filter is used for quarterly data, and from 100 to 10 for annual data. When the obtained trends with different λ values are compared, one can see that higher λ values increase the difference between the actual and smoothed time series.

The HP filter approach has two positive features. First, the obtained trend is influenced by shocks. Second, it is simple to measure, hence also to reproduce. On the other hand, the method also has a number of drawbacks. The HP filter produces a good result only when data on a stable economic environment not affected by strong shocks are used. In this case, the HP filter and econometric methods have an advantage over a simple linear trend. However, numerous different shocks do affect the growth in developing countries, and substantial and accelerated changes in actual output do not necessarily signal either expansion or contraction of potential output. In this context, reliance on the HP filter approach alone may lead to erroneous assumptions. In addition, sources often subject to criticism such elements of the HP filter as freedom to select the λ value and biases at the ends of the time series that may influence the economic policymakers' decisions. Irrespective of the given drawbacks, the HP filter approach is widely employed because of its simplicity.

The Production Function

The above methods of output gap estimation distinguish between the trend component of actual data and the deviation from the trend (the cyclical component). These

methods do not use information provided by production factors such as capital stock, workforce and technological development. They do not measure the influence of structural shocks on potential output and hence the output gap estimation may sometimes be biased. In order to avoid it, the estimation of the public production function is used as an alternative output gap estimation approach. The production function may take various forms, yet the most widely used is the CD function specification.

The CD function may be written as follows:

$$Y_t = A_t\left(K_t\right)^{\alpha}\left(L_t\right)^{1-\alpha} \quad [3],$$

where Y_t is GDP at constant prices,
$A_t = Ae^{\beta t + \varepsilon_{y_t}}$ characterises the total factor productivity (TFP),
K_t is capital stock at constant prices,
L_t is the demand for labour or the number of the employed,
α is the elasticity of production factors (with production expanding, production efficiency remains unchanged).

The CD function has the following properties: production volume is directly proportionate to the volume of employed factors, elasticities of factor intensity are positive and their sum is one.

Via linearisation, this function can be written in the following way:

$$\ln\frac{Y_t}{L_t} = \ln\left(A_t\right) + \alpha\ln\left(\frac{K_t}{L_t}\right) \quad [4].$$

This reduces the number of coefficients to be estimated and eliminates the multicolinearity problem of explanatory variables.

The logarithm of the total factor productivity $tfp_t = \ln\left(A_t\right)$ is:

$$tfp_t = y_t - \left[\alpha k_t + (1-\alpha)l_t\right] = a + \beta t + \varepsilon_{y_t} \quad [5],$$

where the technology parameter β determines the increase of the efficiency trend and ε_{y_t} is the estimation error – a stochastic process. Equation [5] shows that the aggregate output y_t can be expressed as the sum of two factors – explained and unexplained. The explained part is given in square brackets, while the unexplained part is the variable tfp_t. The unexplained part is known as the "Solow residual".(9)

Potential output is derived by inserting potential capital stock into the equation, using labour (input) and retaining the technology development trend. The function is as follows:

$$Y_t^{pot} = A_t^{pot} \left(K_t^{pot}\right)^{\alpha} \left(L_t^{pot}\right)^{1-\alpha} \quad [6],$$

where *pot* denotes the potential value.

The next step is to measure the potential value of production factors. The actual value of capital stock is used as a substitution for its potential value, as capital stock cannot fluctuate substantially, and it is usually assumed that the capital stock available is always used at its potential. Thus we arrive at:

$$K_t^{pot} = K_t \quad [7].$$

Potential labour input is estimated using the NAWRU (non-accelerating wage-inflation rate of unemployment) concept.(1) There is also another approach – the NAIRU (non-accelerating inflation rate of unemployment) (10), but R. Torres has showed that in the NAWRU approach there is a better consistency between the labour market and the goods market.(11)

The NAWRU is such an unemployment rate at which wage inflation (or increase) is constant. Studies show (4) that the equilibrium unemployment rate changes over time, i.e. it is not a constant, but generally follows the actual unemployment rate (due to hysteresis and labour market inelasticity). To measure a NAWRU varying in time, this study uses J. Elmeskov's method (3). It is based on a simple identity, which interconnects changes in unemployment with those in wage inflation:

$$u_t - u_t^{\mathrm{NAWRU}} = \lambda \Delta^2 w_t \,,\ \lambda < 0 \quad [8],$$

where u_t is the actual unemployment rate,
u_t^{NAWRU} is the unemployment rate, which has no effect on wage inflation,
w_t is the average gross wage in the national economy.

This identity postulates how the labour market pressure works, i.e. if actual unemployment is below the NAWRU level, it affects the growth of wages and salaries. It is assumed that changes in the NAWRU occur slowly and gradually over time, i.e. $\Delta u_t^{\mathrm{NAWRU}} \approx 0$. Differentiation of both sides of the previous equation leads to equation for λ:

$$\lambda = \frac{\Delta u_t}{\Delta^3 w_t} \,,\ \Delta^3 w_t \neq 0 \quad [9].$$

When inserting the latter into equation [8], we obtain:

$$u_t^{\mathrm{NAWRU}} = u_t - \frac{\Delta u_t}{\Delta^3 w_t} \Delta^2 w_t \quad [10].$$

Thus the NAWRU is equal to the actual unemployment rate, which is adjusted by

unemployment rate changes and wage inflation relationship. The NAWRU calculated in this way is not smooth enough and the HP filter is applied to increase its smoothness. Consequently, potential employment is calculated as follows:

$$L_t^{pot} = L_t^S(1 - u_t^N) \qquad [11],$$

where L_t^S is the HP filtered labour supply,
u_t^N is the smoothed NAWRU unemployment rate.

The total factor productivity tpf_t is partly estimated by the production function as ε_t and the potential level is determined by the HP filter to obtain a smooth time series. In such a way, the potential total factor productivity, moving alongside with its trend, is obtained.

The CD function has drawbacks as well. First, it is a very simplified reflection of the reality. For instance, the CD function measurements assume that there is perfect competition in the factor market, i.e. factors are homogeneous. In other words, labour force or capital in mechanical engineering is the same as in the banking sector or agriculture and can be easily transferred from one sector to another. Second, the data employed may give a biased estimation. The application of more accurate data is restricted by irregular availability of data (e.g. data in respect of utilisation of capital are not accessible with adequately high frequency to be used in econometric studies). Third, natural or optimal factor utilisation capacity is difficult to define. Potential output cannot be defined as the maximum utilisation capacity of factors. Capital stock that has become obsolete due to technological advances must be gradually replaced and the labour trained in operating new technologies. Moreover, when defining potential output as the maximum possible output, situations where the actual output is above the potential output do not exist. This indicates that utilisation of capital stock to its full capacity is impossible. Finally, the Solow residual is a substantial component of the production function, which is calculated as estimation residual and as such is economically unexplained and freely interpretable.

Irrespective of its drawbacks, the CD function is still one of the methods, which is widely used to estimate the potential output.

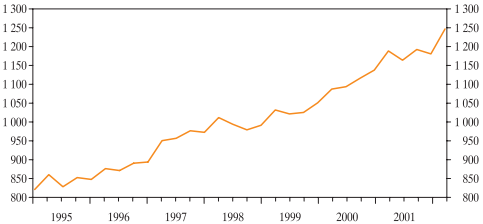
II. DATA USED IN LATVIA'S POTENTIAL OUTPUT ESTIMATION

In order to avoid seasonal effects, all time series used in the research have been seasonally adjusted.

Statistical methods used in the estimation of Latvia's potential output employ quarterly GDP data starting with the year 1995 (see Chart 1). The selection of data has been determined by several factors. First, in the initial years of the economic reform process, i.e. in the early 1990s, Latvia's national economy experienced structural shocks (growing inflation, loss of traditional export markets, changes in terms of trade etc.), the intensity and scope of which prevented the potential GDP estimation for the given period (ended 1995) from attaining a statistically satisfactory level. In addition, after 1995 Latvia's national economy experienced cyclical development phases characterised by upward and downward trends associated with both instability of external demand (e.g. under the impact of Russia's financial crisis) and internal shocks (e.g. the 1995 banking crisis).

Chart 1

GDP
(at constant prices of 1995; in millions of lats)



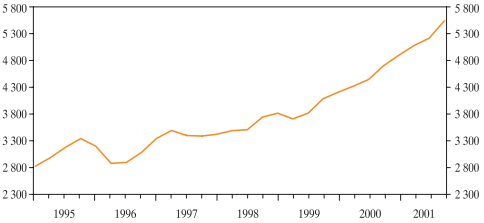
Quarterly data of the capital stock at constant prices is not published. The Central Statistical Bureau of Latvia (hereinafter, the CSB) disseminates only annual capital data at current prices. Similarly, capital stock depreciation and revaluation data are also published only on an annual basis. By contrast, information on investment in capital formation and the related deflator is provided on a quarterly basis. On the basis of these data, it is possible to construct the quarterly capital stock so that changes in capital stock reflect the investment dynamics, and the sum total of quarterly indicators is equal to the annual indicator. Fixed capital calculated for Latvia in this manner is reflected in Chart 2.

Capital growth as reflected in Chart 2 indicates that to a large extent the economic advance is determined by strengthening of the economy's potential. A decline in capital stock was observed only after the banking crisis of 1995, with a slightly less pronounced downslide under the impact of the Russian financial crisis in 1999. With respect to these developments it can be stated that the changes in the economic structure gave rise to alterations in total potential output.

Data on labour or the number of people in employment is provided by the CSB on a

Chart 2

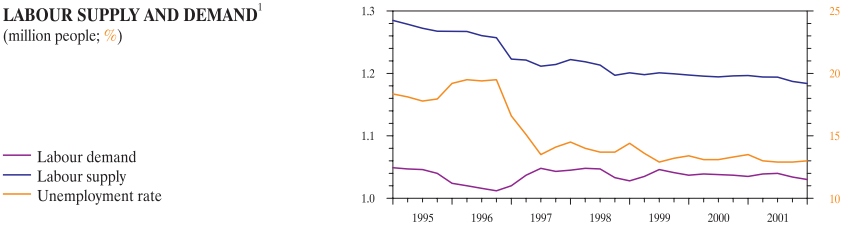
CAPITAL STOCK
(at constant prices of 1995; in millions of lats)



quarterly basis. The number of those employed in the national economy is an indicator of the demand for labour force (see Chart 3), while the labour supply corresponds to the number of economically active population. The difference between the two figures is the number of the unemployed or job seekers, i.e. those economically active people who currently do not work and are not temporarily absent from work, are actively seeking a job and are immediately available for work if they find it. In contrast to official national unemployment, according to which the unemployed is a person who is looking for work, is registered with the State Employment Service and applies to it at least once a month, the indicator calculated for the needs of this paper covers all inhabitants of working age irrespective of their registration with the State Employment Service.

Chart 3

LABOUR SUPPLY AND DEMAND[1]
(million people; %)



As is seen from Chart 3, since 1995 a constant decline in labour supply due to the shrinking number of economically active people (because of demographic reasons and migration) has been observed. The demand for workforce in the last decade, on the other hand, has been influenced by a number of factors.

In the given period, the first notable decline in labour demand was attributable to the banking crisis of 1995. It was the largest decline (3.5% from the first quarter of 1995 to the fourth quarter of 1996) that caused also a notable rise in unemployment due to almost unchanged labour supply.

The second substantial decrease in labour demand was related to the Russian finan-

[1] The CSB has recalculated employment statistics in accordance with the revised methodology; statistical data has been published only since 2002.

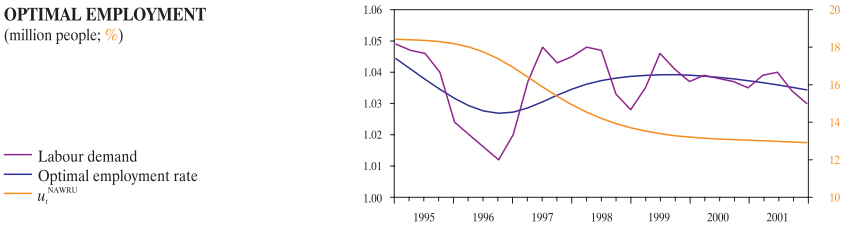
cial crisis (1.9% from the fourth quarter of 1998 to the first quarter of 1999). Many enterprises had to narrow production and this led to contracting labour demand. This time, however, the unemployment rate did not rise in proportion to the fall in the output growth rate, which was an indication of producers' unwillingness to dismiss "redundant" workforce completely as they were convinced that the incurred economic hardships were temporary, and, with production soon recovering, hiring of labour would be related to extra costs.

The third major drop in the demand for labour was associated with the global economic slowdown reinforced by events in the US on September 11, 2001. Despite deterioration of the external economic environment, Latvia's unemployment rate remained unchanged due to shrinking labour supply. Overall, the unemployment rate has been gradually declining in Latvia since 1998. However, Chart 3 shows that in contrast to growth tendencies of capital stock the labour demand has not increased substantially since 1995. This implies that resources leading to a sustainable and robust growth in Latvia currently are not used to their fullest potential; Latvia's economic development relies basically on an upswing in labour productivity driven by technological advances, and a more intensive utilisation of capital stock rather than employing additional workforce.

This observation is confirmed by Chart 4 which reflects the optimal and the potential output levels derived from equations [10] and [11]. The Chart clearly shows movements in employment during crisis periods. In 1995, insolvency of some banks had an essential effect on the natural employment rate by reducing growth potential of the Latvian economy. By contrast, effects of the Russian financial crisis on the optimal employment rate of Latvia were not observed, and the rise in the unemployment rate caused by this crisis was moderate and short-lived.

Chart 4

OPTIMAL EMPLOYMENT
(million people; %)



Since 2000, labour demand in Latvia has been close to optimal (i.e. close to the current level of labour supply, attainment of which does not pose a risk of additional wage inflation). The optimal level can be pushed up by measures that stimulate economically active population to join the labour market. Increasing participation rates would ensure a more rapid economic growth without impairing macroeconomic sustainability.

III. LATVIA'S POTENTIAL GROSS DOMESTIC PRODUCT

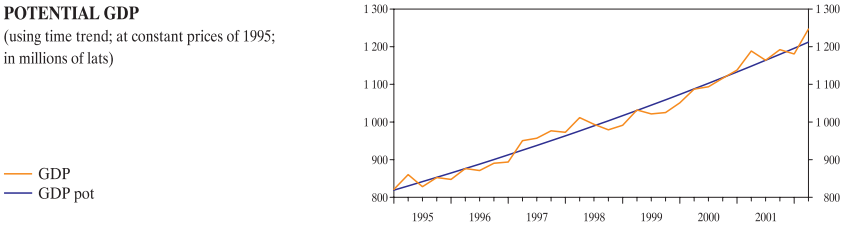
This Chapter presents the results of potential GDP and output gap calculations obtained by using all three methods described above. First, the output gap is calculated by using the time trend. The following result is obtained from regressing logarithmical GDP against the constant and the deterministic trend:

$$\ln(GDP_t) = 6.600 + 0.014 \cdot t$$
$$t\text{-statistic} \quad (802.5) \quad (39.6)$$
$$R^2 = 0.982 \quad DW = 0.632$$

At a glance, this equation seems convincing if only the degree of the explained variation (R^2) and the significance of t-statistic are estimated. The equation implies that the optimal GDP growth for Latvia would be 5.8% per annum, which, in fact, was the average GDP growth between 1995 and 2002 (see Chart 5). At the same time, the result points to the drawbacks of this method. First, the equation leads to an assumption that the potential GDP growth is likely to remain unchanged over a longer horison. This is not true to the fact because under a growing general level of GDP (hence also the base against which the future growth rate is measured) the growth rate should decline. Second, in the linear estimation the output gap is autocorrelated (i.e. it is dependent upon its own value in the previous period), and it is demonstrated by a relatively low DW (Durbin–Watson) statistic. However, this DW statistic value can be anticipated because the output gap is closely related to the economic cycle. Third, any deviation of the GDP value from the linear trend is taken as a deviance from the optimal output irrespective of specific circumstances incurred in each particular period.

Chart 5

POTENTIAL GDP
(using time trend; at constant prices of 1995; in millions of lats)

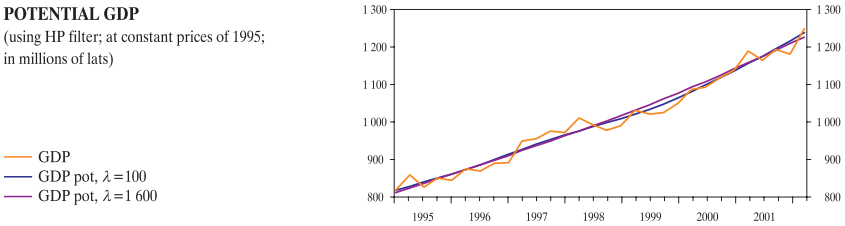


In the estimation of potential GDP by the HP filter approach, two λ values – 100 and 1 600 were used (see Chart 6). The value 1 600 was selected because it is usually used for quarterly data. The time series thus obtained is comparatively smooth. By contrast, the value 100 was selected to add variability to potential GDP, as it could be more in accord with Latvia's situation.

Chart 6 reports greater differences for the period from 1997 to 2000. If λ = 1 600, it is assumed that the national economy did not undergo substantial structural changes,

Chart 6

POTENTIAL GDP
(using HP filter; at constant prices of 1995; in millions of lats)



hence potential GDP grew smoothly (a 5.5% rise on average) and was within the range of 5.4% and 5.8%. If, by contrast, $\lambda = 100$, it is assumed that the changes in the economic structure affected the potential output and rendered it more volatile. Hence it is closer to actual GDP, increased by 5.6% on average, and was within the range of 4.7% and 6.5%. In both cases potential output did not grow in a linear way but incorporated the actual output growth dynamics. This method does not elucidate why the potential output changes over time and leaves the reasons for such changes unidentified. It is an essential drawback of this method.

To measure Latvia's potential output, it is necessary to estimate labour demand and capital stock elasticity. The estimation of Latvia's production function from 1995 to 2002 using equation [3] produced the following result:

$$\ln(\mathrm{GDP}_t) = 3.598 + t^{0.116} + 0.225 \cdot \ln(K_t) + 0.775 \cdot \ln(L_t) + \varepsilon_t$$

t-statistic (11.578) (11.553) (18.170)

$R^2 = 0.978$ DW = 0.976,

where GDP is at constant prices;
L_t is the number of employed;
K_t is the accumulated capital stock;
t is the time trend.

The coefficients estimated and their statistical significance should be assessed as satisfactory. The equation explains almost the entire variability of GDP. The value of the DW statistic indicates autocorrelation in the residual and the absence of a valid explanatory factor. This factor is a dynamic component of the production function that contains information about a deviation from the long-term trend. The result should be assessed as good because potential output is to be viewed from a long-term perspective.

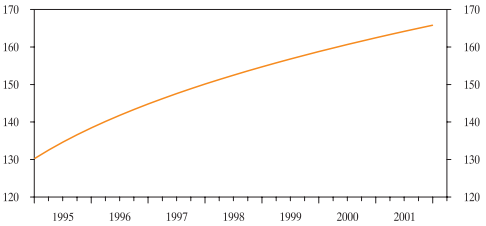
Labour demand elasticity derived from the equation is 0.775, and the value of capital stock elasticity is 0.225. These values agree with estimations produced by research on other countries. For instance, the majority of research papers indicate that the value of labour elasticity for developed countries is around 2/3, while that of capital is 1/3 (labour elasticity estimates in the US are within the range of 0.59 and 0.87, and from

0.57 to 0.59 in Germany) (2; 1). Recent studies show that in Estonia labour elasticity is around 0.67 (7). On these grounds, the estimation of labour and capital elasticity of Latvia's production function can be assumed as credible.

Technological progress measured with equation [5] for the period from 1995 to 2002 ensured the average economic growth of around 0.8% on a quarterly basis or 3.6% annually (see Chart 7).

Chart 7

TECHNOLOGICAL LEVEL



Substituting potential estimates for actual data and the technological variable for the estimated residual variable, the potential output can be calculated. Latvia's potential and actual GDP calculated in this manner can be seen in Chart 8. Potential GDP has increased by 5.5% per annum on average, with the growth rate fluctuating within the range of 3.7% and 7.3% at times. In this case, changes in actual GDP are much closer to the level of potential GDP, and movements in the latter are explained by changes in the production factor capacity utilisation. Actual GDP fell behind potential GDP only during the Latvian banking crisis (from the third quarter of 1995 to the first quarter of 1996) and after the Russian financial crisis (from the fourth quarter of 1998 to the first quarter of 2000). By contrast, actual GDP was above the level of optimal GDP from the second quarter of 1997 to the third quarter of 1998.

Chart 8

ACTUAL AND POTENTIAL GDP
(using CD function; at constant prices of 1995; in millions of lats)

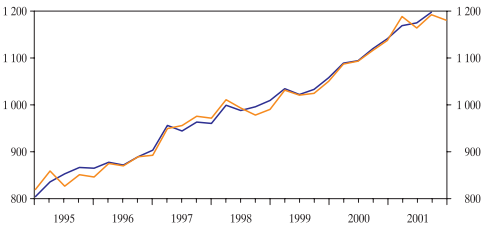


Chart 9 summarises all output gap values estimated in this paper. Two full cycles can be distinguished in the period starting in 1995. The duration of the first cycle (i.e. from a current highest point to the next highest point) is about 3 years. The second cycle lasts 3–3.5 years. The end of the time series does not permit a more accurate

determination of the last cycle because the concluding determinant of the cycle has not set in – the output gap is negative over a longer time period.

Analysing output gaps that have been calculated using the three different methods, a number of common traits can be discerned. In the period between mid-1997 and the third quarter of 1998 (i.e. within about one-year period before the Russian financial crisis), the economic growth was remarkably swift, and all output gap indicators evidenced that the growth rate of the national economy exceeded its potential long-term growth rate (a positive output gap is an evidence). Later (up to the second quarter of 2000), however, under the impact of the Russian financial crisis the restructuring of Latvian export markets took place and production resources available were not used to their fullest potential, giving rise to a lower-than-potential production level.

Chart 9

OUTPUT GAP

(%)

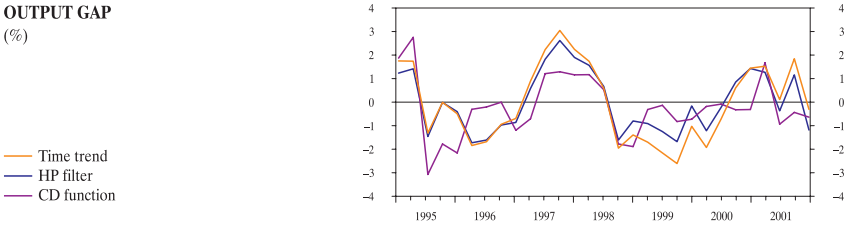


Chart 9 displays also some differences depending on the method used in the estimation of the output gap. First, in comparison with simpler output gap estimation methods, the CD function produces an output gap that indicates a larger actual output difference from the potential level after the banking crisis of 1995. Second, the CD function evidences that in the period of swift economic development the potential output of Latvia grew at a faster pace and, therefore, the actual GDP excess over potential GDP was smaller than could be predicted if a statistical method alone was used. Third, the CD function indicates that since mid-2000 the economic development has been in line with the growth in country's potential GDP, hence the output gap is quite narrow and does not present any threat to Latvia's macroeconomic sustainability. Overall assessment of the output gap indicates that when measured by the CD function it implies less pronounced cyclical fluctuations than does the output gap measured by simple statistical methods. Moreover, as all data available are used in the output gap estimation by the CD function, there are solid grounds for an assumption that the output gap thus estimated reflects the growth in the Latvian economy more accurately.

IV. ECONOMIC EFFECTS OF EXCESS DEMAND

In the developed countries, the output gap is basically in the focus of monetary policymakers because of its alleged inflationary pressure. Interrelation between the output gap and inflation is derived from the Philips curve theory. Originally this theory explained correlation between nominal wages and unemployment in the United Kingdom. Unemployment was a proxy for excess labour demand (the lower the level of unemployment, the higher the labour demand). A low unemployment rate, in its turn, indicated an excess demand and pressure for higher wages.

The original Philips curve was modified over time. To make it more useful for policymakers, the Philips curve was transformed from a wage change into a price change equation, thus assuming that prices were set by a constant mark-up to labour unit cost. The slope of the price-change Philips curve enables policymakers to determine what unemployment level corresponds with any target rate of inflation. Later the definition of excess demand was re-specified determining that excess demand was the difference between natural and actual unemployment. Adoption of unemployment gap in the Philips curve implied that economic fluctuations result from both the demand and the supply shocks.

Natural unemployment is defined as the rate that prevails, when expectations are fully realised and incorporated into wages and prices, and the inflation rate remains unchanged. Natural rate of unemployment and potential output are conceptually similar (7). Thus the output gap can be used in the Philips curve as an indicator of excess demand. Now the Philips curve defines inflation pressures arising from excess demand.

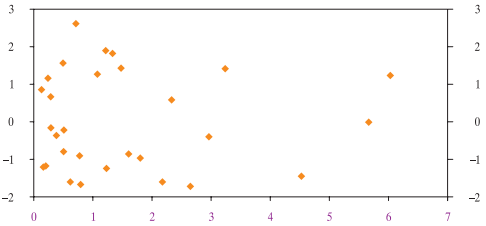
Both theory and practice indicate that the output gap and inflation in the developed countries are positively correlated. The majority of countries relying on direct inflation targeting as their monetary policy strategy use the output gap as one of the important determinants of inflationary pressures. A sustained positive output gap is indicative of demand pressures and a signal to the monetary authority that tightening may be required.

However, when conducting analysis of output gap and inflation movements, a close correlation between the two indicators is difficult to detect. Chart 10 shows the most typical picture of their interconnection. In Latvia, at least between 1995 and 2002, there was no sufficiently close and positive interconnection between the output gap and inflation. This can be attributed to specific features of the national economy. Price movements in Latvia are substantially affected by several factors, such as prices converging towards those of the EU, a gradual rise in administratively regulated prices and the weight of import prices in the consumer basket. None of the above factors is directly dependent upon the size of the output gap.

These inferences are also supported by formal analysis. As reflected in Table 1 (with

Chart 10

OUTPUT GAP AND INFLATION
(quarter-on-quarter changes; %)



t-values in brackets), the use of the HP filter approach to distinguish a long-term trend from short-term fluctuations and incorporation of several inflation-driving variables (e.g. import prices and administratively regulated prices) in the regression analysing price movements produce identical results: in none of the case studies the output gap (irrespective of the estimation method applied) gives adequate information in respect of inflationary expectations.

Table 1

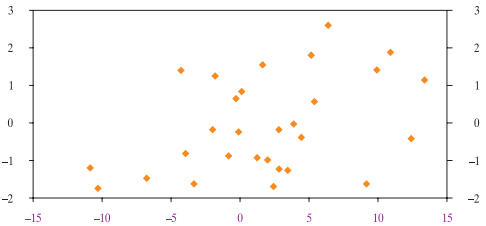
ESTIMATES OF OUTPUT GAP AND ELASTICITY OF CONSUMER PRICE INDEX (CPI) (1995–2002)

Output gap	CPI changes against previous period		Year-on-year CPI changes	
	HP filter	Additional variables	HP filter	Additional variables
Time trend	0.201 (1.287)	0.063 (0.276)	–0.009 (–0.034)	0.109 (0.596)
CD function	0.185 (0.959)	0.101 (0.589)	–0.127 (–0.387)	0.154 (0.930)

Latvia is a small open economy where consumption and investment are largely reflected in import volumes. A small economy implies that under perfect competition and a fixed exchange rate a rise in domestic demand does not have a substantial effect upon the price level. Provided the domestic demand is growing rapidly in Latvia and its output gap retains a positive value, a short-term lack of domestic supply is offset by external supply or imports (as in (5)). That is why in Latvia, as in the majority of small open countries, the interrelation between the output gap and imports of goods and services (see Chart 11) is much closer than the interrelation between the output gap and inflation.

Chart 11

OUTPUT GAP AND IMPORTS
(quarter-on-quarter changes; %)



To determine relationship between the output gap and imports for Latvia the following regressions have been performed:

$$\Delta \ln(\text{imports}_t - \text{import\_trend}) = \alpha + \beta \text{GAP}_t + \varepsilon_t \quad [12]$$

and

$$\Delta \ln(\text{imports}_t) = \alpha_0 + \alpha_1(\ln(\text{imports}_{t-1}) + \alpha_2 \ln(\text{GDP}_t) + \alpha_3) + \beta' \text{GAP}_t + \varepsilon_t \quad [13].$$

The results of the regressions are showed in Table 2 (with *t*-values in brackets). As is seen from the Table, variability of the output gap explains less than a third of import variability, whereas elasticities of the output gap against imports (β and β') are close to 1. It implies that if the demand increases above the optimal level by 1%, imports increase by about 1%, i.e. a rise in the domestic demand above the level of the domestic supply is almost fully reflected by a rise in imports.

Table 2

ESTIMATES OF OUTPUT GAP AND ELASTICITY OF IMPORTS (1995–2002)

		Production function	HP filter (λ = 100)	Time trend
Regression [12]	β	1.165 (3.511)	1.087 (3.320)	0.844 (3.218)
	R^2	0.359	0.315	0.301
Regression [13]	β'	1.295 (4.464)	1.158 (3.823)	0.928 (3.869)
	R^2	0.672	0.612	0.616

These results lead to a conclusion that for the Latvian economy it is the current account rather than inflation indicators that gives a more comprehensive picture of the development trends in the domestic demand. Thus, for instance, an over expansionary economic policy resulting in a swift rise in the domestic demand without an accompanying adequate rise in the domestic supply is more likely to have an adverse effect on the current account than the inflation rate, as is the situation in the majority of developed countries.

CONCLUSIONS

The study has dealt with a number of methodologies used in the estimation of potential GDP: the time series method, the HP filter approach and the CD function. Potential values of production factors were calculated for the needs of the production function. The data used in the paper lead to an inference that the economic growth is dependent on increases in capital stock and technological progress which both contribute to labour productivity and offset shrinkage of workforce.

Output gaps measured by the three methods share a number of traits. In the period from mid-1997 to the third quarter of 1998, the output gap was positive, i.e. the economic growth of the country went beyond the potential growth rate. By contrast, output was below the potential level between the fourth quarter of 1998 and the second quarter of 2000. On the whole, the output gap estimation by the CD function indicates a lower cyclical variance in comparison with the simpler statistical methods.

Focusing on the relationship between the output gap and inflation, this paper concludes that in Latvia in contrast to several developed countries, the correlation between the output gap and inflation is extremely weak due to the size and openness of the national economy as well as labour market inelasticity. Surveys conducted to date do not produce adequate data for an accurate estimation of the output gap impact on inflation. Inflation is affected by such factors as Latvia's openness to imports, a relatively unlimited external supply of goods for relatively fixed prices, and administratively regulated prices, and does not depend on the output gap. Therefore excessive demand is more pronouncedly correlated with a rise in imports, not inflation. On these grounds, it is the status of the current account, and not the inflation rate, that more accurately reflects the domestic demand and its development trends.

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