Potential output estimation for Moldova: a production function approach

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Berlin/Chişinău, December 2021
Executive Summary

- This technical note summarizes the contents of a workshop held on 20 – 21 October 2021 titled “GET workshop on an economic model for the potential output estimation for Moldova”
- It outlines and compares various methods for measuring the potential output and thus output gap of an economy using the example of Moldova
- Estimating the output gap is a difficult task, since the potential output is not directly observable and its high political relevance for evaluating structural reforms makes it crucial to calculate it as transparently as possible
- Based on the comparison, the production function approach is identified as the most suitable method for Moldova and described in more detail
- Examples of results obtained for the potential output estimation using the production function approach for Moldova are discussed to illustrate the application options
1. The potential output

- The potential output and its related output gap are the key indicators to determine the cyclical stance of the economy.
- Furthermore, it has become the essential instrument to evaluate structural reforms in economies around the globe.
- The potential output is an indicator for the aggregate production capacity, at which the economy utilizes all available factors sustainably and without creating additional inflationary pressure.
- With the potential output concept, several macroeconomic policy areas can be addressed:
  - Fiscal policy (e.g. structural deficit position, cyclical stabilization policy)
  - Monetary policy (e.g. interest rate policy)
  - Economic situation (e.g. determinants of the business cycle)
Definition: Potential output is the aggregate production capacity
• at which the economy utilizes all available factors sustainably
• without creating additional inflationary pressures

The main problem is: It is not directly observable!
• In pure statistical terms: trend output
• In pure theoretical terms: flexible output
• The truth is somewhere in the middle depending also on the question to answer
• For example, for monetary policy, the inflationary pressure aspect is more important than for fiscal policy
While in economic research it is always desirable to find the best estimation methodology no matter how complex it is, in applied economic research and economic policy there are some trade-offs to be considered in forming the most transparent and comparable methodology, which include:

**Comparability vs. uniformness**
- Country-to-country comparison is desirable,
- but countries have structural differences

**Applicability vs. complexity**
- Everyone should be able to replicate it,
- but it should also meet modern scientific standards

**Stability vs. rigidity**
- Robust results (year-to-year) are desirable,
- but large shocks and changes should have significant effects

1.2 Trade-offs when measuring the potential output
In the following, different methodologies for measuring the potential output of an economy are examined and compared:

- HP filter
- Unobserved component model
- SVAR model
- DSGE model
- Production function approach
2.1 HP filtering

- Hodrick-Prescott (HP) filter is a specialized filter for trend and business cycle estimation and works as a smoothing parameter
- It disentangles an observed time series into a trend component and a cyclical component
- When using the HP filter, one must consider several advantages and drawbacks:
  + Easily applicable
  + Most-commonly used
  - End-of-sample problem
  - Choice of the smoothing parameter, since it includes a judgmental task with a chance of biasedness
- In fact, it is a pure statistical filtering tool with no economic concept behind it
- However, it is useful to get a first impression of the trend and cycle of an economic variable
2.2 Unobserved component model

- The unobserved component model is based on the Phillips curve concept
- The inflation-output gap relation can be used to estimate the trend output
- It is a structural time series model and is in a class of flexible models
- It decomposes the response series into latent components such as trend, cycle and seasonal effect
- However, it cannot be used if there is no significant relationship between inflation and output
- There are several reasons for a potential weak inflation-output gap relation (flat Phillips curve):
  - High migration, demographic change
  - Openness of the economy
  - Inflation and wage expectations (i.e. high uncertainty)
  - Labour union behaviour (i.e. high unpredictability)
  - Monetary policy at the zero lower bound
2.3 Structural vector autoregressive regression (SVAR)

- The structural vector autoregressive regression (SVAR) disentangles demand and supply shocks
- SVAR models are relatively easy to estimate and have good forecasting capabilities
- Supply shocks drive actual and potential output in the same direction
- Cumulated demand shock series can be interpreted as output gap
- The application of the SVAR can be problematic in case of:
  - Price and wage rigidities,
  - Financial frictions (i.e. the "stickiness" involved in transactions including time, effort and money)
  - Other business cycle shocks with similar but different patterns
  - Supply shocks also drive a wedge between potential and actual output
2.4 Dynamic stochastic general equilibrium model

- Macroeconomic method that is often employed by monetary and fiscal authorities for policy analysis
- Used to explain historical time-series data, as well as for future forecasting purposes
- Once the model can match the reality, it is possible to simulate different scenarios (e.g. effect of specific tax cuts)
- Advantages are the sophisticated forecasting predictability and the possibility to consider and explain the channels through which the business cycle is affected
- However, it is everything but easily applicable and it takes years to train people to become experts
- In addition, large amounts of data and long time series are needed for good forecasting results
- Thus, it is often not possible to replicate results in a transparent way
2.5 Production function approach

• The production function (PF) methodology is based on the neoclassical production function, where potential GDP is defined as a function of potential labour volume, capital stock and trend total factor productivity.

• Its main advantage is that it is a simplistic approach while the method is also able to consider the structure of the economy.

• It is often better applicable than more scientific methods and it is easier to calculate different scenarios, e.g. for structural reforms.

• This makes it easier for economic policy makers to consider different scenarios based on expected future trend changes.

• Another relative advantage of the PF approach is its comparability with output gap estimations from other countries.

• Not only the EU Commission but also the IMF, OECD and other institutions use the production function approach to compare the business cycle and for fiscal surveillance with a comparable and transparent methodology.
2.6 Comparison between alternative methods

Comparison of Moldova’s potential output between alternative methods

% of GDP, yoy

Source: Own calculations

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2.6 Comparison between alternative methods

- When comparing the output gap for Moldova across different methods, the suitability of each method for the country can be illustrated.
- SVAR and DSGE models underestimate the size of the output gaps, especially in the financial crisis → they interpret the financial crisis as a monetary policy shock.
- Estimates for the UC model and the PF approach closely resemble the pure HP filtering.
- However, in 2016 we see that the HP filter yields a high positive output gap, while all other indicators do not.
- A big advantage of the PF approach is the implied economic intuition with a well proven economic concept and statistical methodology.
2.7 Conclusion

• In general, the production function approach has a nice balance between the trade-offs
• It can be made more precise by integrating other scientific methods (Kalman filter instead of HP filter)
• Especially for economic policy analysis it has an advantage, because the results are better comparable than other “methods”
• Once this tool is well established, the variety of computations can be enhanced to focus on specific business cycle issues or economic concepts, as the price-output or unemployment-wage relationship
• However, in the literature of potential output estimation there is still some room for extensions
3. Production function approach

- The European Commission, the IMF and the OECD estimate potential output via a production function approach, where potential GDP is defined as a function of potential labour volume, capital stock and a trend for total factor productivity.

Production function: \[ Y = TFP \cdot K^\alpha \cdot L^{1-\alpha} \]

- TFP is defined as total factor productivity and is calculated recursively.
- K is the capital stock in the economy.
- L is labour input and is classified into four subcomponents (see next slide).
- The HP filter is used to detrend labour volume and TFP.
- However, capital should not be detrended as the full utilization of the existing capital stock in the economy should be considered.

Implicit assumption:
- There are no structural breaks in capital and total labour volume series.
3.1 Extension

In case there is more detailed data on employment (and capital) available:

- Potential employment can be separated into the working-age population (POP), labour force participation rate (pq), employment rate (1-ur) and hours

\[ Y = TFP \cdot K^\alpha \cdot (POP \cdot pq \cdot (1 - ur) \cdot Hours)^{1-\alpha} \]

- The advantage of exploiting more detailed data is that demographic change can be included in the analysis, i.e. structural shifts in the labour market, e.g.
  - Labour force participation decisions
  - Unemployment rate

- In the following, the potential output is estimated with the standard EU methodology using data from the National Bureau of Statistics and Penn World Data
4. Potential output results for Moldova

- The diagram below displays the actual GDP growth and the potential GDP growth for Moldova using the production function methodology.
- It shows that the COVID-19 pandemic in 2020 hit the economy even harder than the financial crisis in 2009.

**Actual GDP growth and potential growth for Moldova**

*Source: Own calculations*
In addition, the output gap can be calculated, that is the percentage deviation of actual to potential output.

The COVID-19 pandemic has led to a recession in 2020 with large unused capacities – Moldova’s production was close to 7% below its potential.

Even in the aftermath of the crisis, it is estimated that in 2021 and 2022 capacities will still be underutilized - thus, structural reforms are essential to boost productivity and put the economy on a sustainable growth path.

Source: Own calculations

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4.2 Contribution of growth components

- It can be noted that capital and TFP had positive growth effects in every year.
- Labour volume contribution has become positive since 2013 (except for 2018 – 2020) and increases further until 2025.

**Contributions of production factors to potential output for Moldova**

Source: Own calculations
4.3 Demographic effects

- When analyzing employment in more detail, the shrinking population reduces potential growth.
- However, increasing working hours and participation rate as well as reducing unemployment rates overcompensated the demographic effects.

**Contributions of the factors of the volume of work to potential output**

Source: Own calculations
4.4 Conclusion

- The production function approach can estimate the potential output, the output gap as well as the contribution of the different components
- The output gap was close to 7% in 2020 due to COVID-19 and the drought
- Even in the aftermath of the crisis, it is estimated that in 2021 and 2022 capacities will still be underutilized
- One of the future key aspects in Moldavan economic policy will be the demographic shift → extended PF approach
- Despite gaining more relevance in the next years, labour input still has a relatively low contribution to potential output
- Thus, labour policy should focus on education and training (e.g. government programs or employer-led apprenticeships) to improve the contribution
About the German Economic Team

Financed by the Federal Ministry for Economic Affairs and Climate Action, the German Economic Team (GET) advises the governments of Ukraine, Belarus, Moldova, Kosovo, Armenia, Georgia and Uzbekistan on economic policy matters. Berlin Economics has been commissioned with the implementation of the consultancy.

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