ANALYSIS OF THE GERMANY GDP DEVELOPMENT AND ITS IMPACT ON FISCAL POLICY

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Abstract

This paper focuses on the usage of mathematical tools within a broader macroeconomic application. The prime objective of the paper is to predict a short-term development of the most important macroeconomic variable, GDP, and to analyse its influence on the state's fiscal policy. As the future GDP development prediction tool serves time series analysis method, namely moving averages. Results are afterwards being used in the macroeconomic IS-LM model to identify changes on the goods and money market, respectively. The final outcome reflects fiscal policy behaviour based on changes caused by GDP development and policy recommendations for obtaining desired objectives. For the sake of the paper, all the above stated steps are being applied for data reflecting Germany's GDP, as for the best-performing Euro zone economy. The results show that an established trend in growth will be even more significant.

Key words: GDP, Fiscal policy, IS-LM Model, Moving averages

JEL Code: E62, H39, C53

Introduction

Nowadays there is a much bigger pressure on state governments regarding fiscal policy measures as ever before. Mainly a level of attained GDP is on a daily basis being discussed. Considering GDP levels, most of important decisions are based on a perception of this indicator. The main objective of this paper is to analyse factors affecting state fiscal policy, namely GDP, the most important macroeconomic variable, concretely, to analyse GDP development in selected Euro zone country, Germany. The goal is to try to project a future development based on a right fit model and ultimately to draw macroeconomic consequences of such a projected development in the short run. The next particular objective is to find an appropriate model for forecasting a future GDP development and consequently to perform such a short-run forecast based on the model. Finally, the last particular objective is to

interpret obtained results using the macroeconomic IS-LM Model and to identify possible consequences resulting from the fiscal policy strategy. Last but not least, some recommendations based on the IS-LM Model as well as the overall macroeconomic situation today shall be provided.

1 IS-LM model

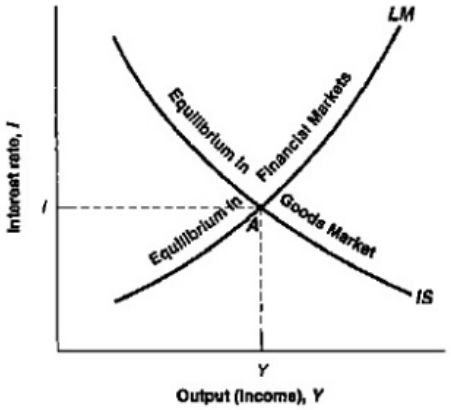
The IS-LM model provides a framework (Dixon, Gerrard, 2000) to understand how output – GDP and interest rate are defined and interconnected in the short run. The fundamental part of the IS-LM model is a determination of equilibrium in the financial markets and the goods markets as well as characterizing the implications while achieving such equilibrium. The IS-LM model is based on the General Theory written by John Maynard Keynes and its understanding of two-sided economy. There are two major factors which define the IS-LM approach:

1. Output is an endogenous variable which is demand-determined.
2. The rate of interest is an endogenous variable, and affects both the demand for goods (investment and possibly consumption) and the demand for money (Dixon, Gerrard, 2000).

The IS curve displays (Blanchard, 2003) the interplay between the output level – GDP and the interest rate which corresponds with equilibrium in the goods market. The LM curve displays the interplay between the output level – GDP and the interest rate which respond to equilibrium in the financial market.

Any point on the downward-sloping IS curve corresponds to equilibrium in the goods market. Any point on the upward-sloping LM curve corresponds to equilibrium in financial markets. Only at point A are both equilibrium conditions satisfied. (Blanchard, 2003)

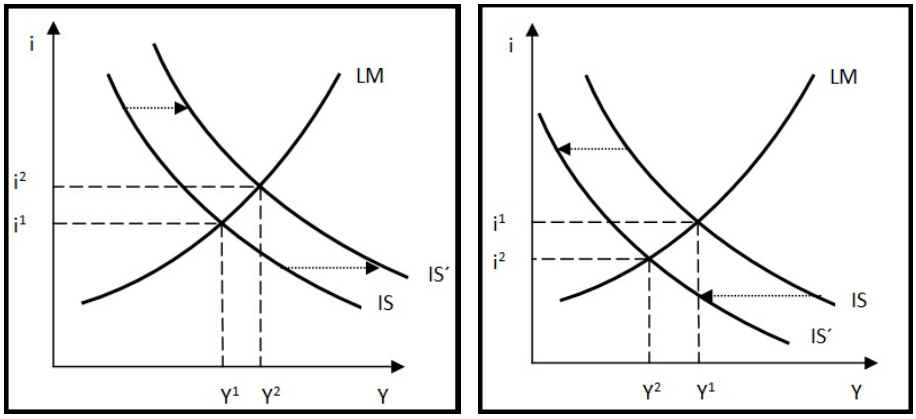
Fig. 1: The IS-LM model



Source: Blanchard (2003)

In other words (Blanchard, 2003), the point *A* represents, at the corresponding level of interest rate, *i* and output, *Y*, total equilibrium, meaning the point of equilibrium in both markets, namely goods and financial markets. The IS-LM model shows what consequences have changes in all the variables included in the IS and the LM relation such as taxes, government spending, money supply on the level of output – GDP – income and the level of interest rate in the short run.

Fig. 2: Fiscal expansion **Fiscal contraction**



Source: Self-created graph of the fiscal expansion/contraction.

In the case of the fiscal expansion, (Blanchard, 2003) the government either decreases the level of taxes, *T* or increases the level of government spending, *G* and thus shifting the IS curve to the right:

- A decrease in taxes, *T* leads to an increase in disposable income, hence increasing consumption and ultimately output – GDP.
- An increase in government spending, *G* directly leads to an increase in output – GDP.

Results of the fiscal expansion (Blanchard, 2003) is higher level of output – GDP and/or higher level of interest rate.

In the case of fiscal contraction (consolidation), (Blanchard, 2003) the government either increases the level of taxes, *T* or decreases the level of government spending, *G* and thus shifting the IS curve to the left.

- An increase in taxes, *T* leads to a decrease in disposable income, hence decreasing consumption and ultimately output – GDP.
- A decrease in government spending, *G* directly leads to a decrease in output – GDP.

Results of the fiscal contraction (consolidation) (Blanchard, 2003) is lower level of output – GDP and lower level of interest rate.

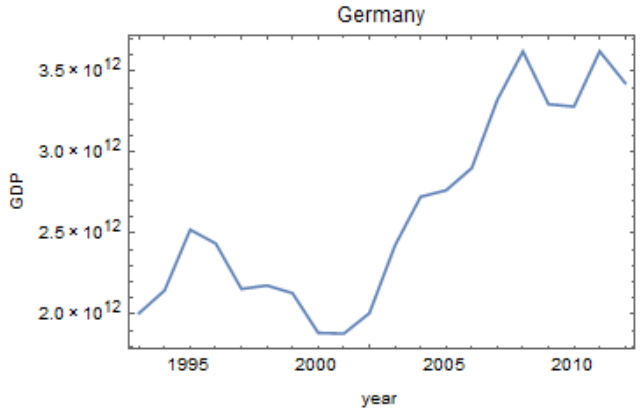
2 GDP development Germany

Germany's GDP (Trading Economics, 2014) reached the all-time high of $3.625x1012 in 2011 and recorded really fast resurrection after the crisis. Germany's GDP accounts to 5.48% of the world economy and as Germany is the largest economy in the Euro zone and the fourth largest in the world, many other countries are heavily dependent on Germany's performance.

German economic driver is without any doubts the export. Mainly the export of high-added value goods boosted the German economy in the last decades. Moreover, the German economy profits from a highly-developed infrastructure, qualified labour and big capital stock as well.

Our analysed sample period is from 1993 to 2012. Data was obtained using Wolfram Alpha engine with access from Wolfram Mathematica software. Figure 3 shows GDP development during analysed period.

Fig. 3: GDP development in Germany in USD



Source: Self-created graph using Wolfram Mathematica

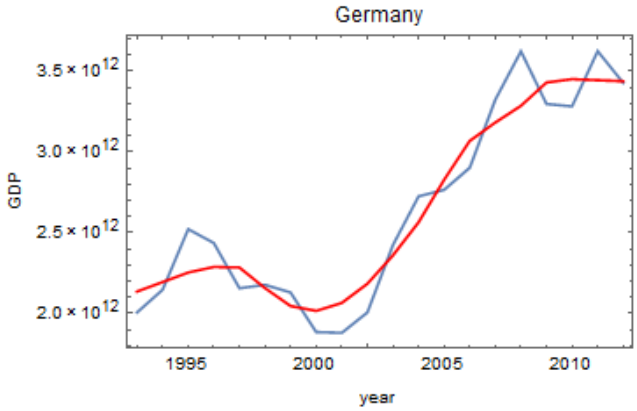
In order to smooth out fluctuation in Germany's GDP development and thus to define a long-term trend, moving averages method will serve as a time series analysis tool to do so (Cipra, 1986). But not only defining a long-term trend, smoothing the trend also provides a basis for a subsequent short-term prediction.

Let's start with moving averages with a linear trend to recognize to what extent it can be used as a reliable and accurate method. To find it out, we use our program code written in Wolfram Mathematica software.

The Fig.4 gives a better view of how this data is smoothed. The blue line on the Fig.4 are actual values of Germany's GDP. The red line represents the linear trend of averaged smoothed values. As can be seen, the smoothed red line captures the actual trend quite precisely. However, there is too big a distance between the actual and smoothed values,

especially at the beginning and at the end of the time span. Due to this reason, a prediction based on this linear trend would not be that accurate. It is therefore necessary to use moving averages with a quadratic trend, in order to obtain more precise prediction.

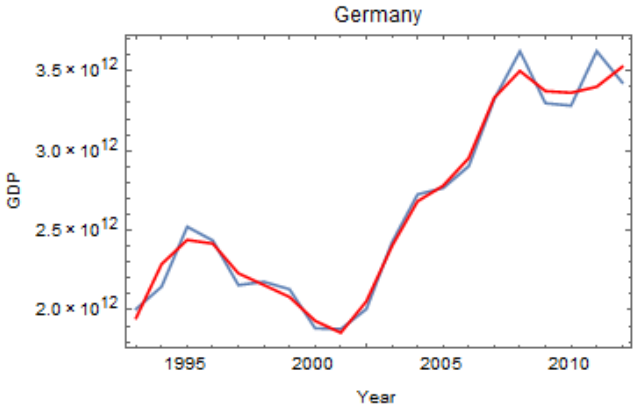
Fig. 4: Smoothed data for German GDP – moving averages with a linear trend



Source: Self-created graph using Wolfram Mathematica

On Fig. 5, the red line captures the actual trend obviously more rigorously and it is very close to the actual values represented with blue line throughout the whole time span. Thus it can serve as a reliable basis for future short-term predictions.

Fig. 5: Smoothed data for German GDP – moving averages with a quadratic trend



Source: Self-created graph using Wolfram Mathematica

In order to make projections as accurate as possible, we forecast the GDP development using moving averages with the quadratic trend for the next 2 time periods, meaning for the next 2 years. As long as the latest available data we use dates back to 2012, the forecasts will be for the years 2013 and 2014, respectively (see Fig. 6).

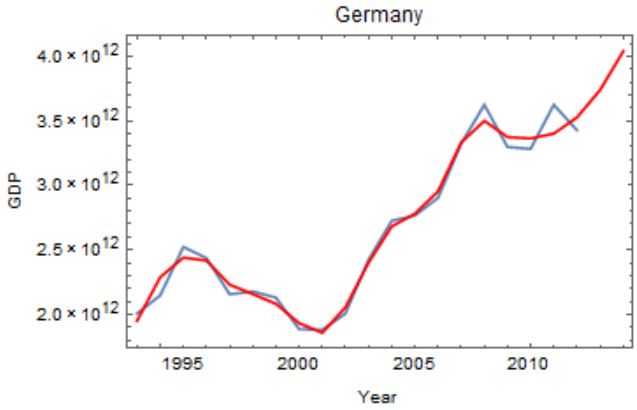
Our model gives predicted values of the German GDP for the next 2 years:

In 2013, Germany's GDP value amounts to 3,739.6 billion USD.

In 2014, Germany's GDP value amounts to 4,040.6 billion USD.

On the Fig. 6 it can be identified that Germany's GDP will rise quite significantly, as the moving averages method predicts. The forecast reflects an overall rising trend throughout the whole time span and also the latest values that already have a growing tendency. Based on this graph, it seems that Germany's GDP will copy the trend it had in the time span from the year 2002 until the year of the crisis, 2009. That would mean that Germany has already recovered from the crisis and has overcome the deepest recession and is now getting back into a period of economic growth.

Fig. 6: GDP development forecast for German data based on moving averages with a quadratic trend



Source: Self-made input to Wolfram Mathematica

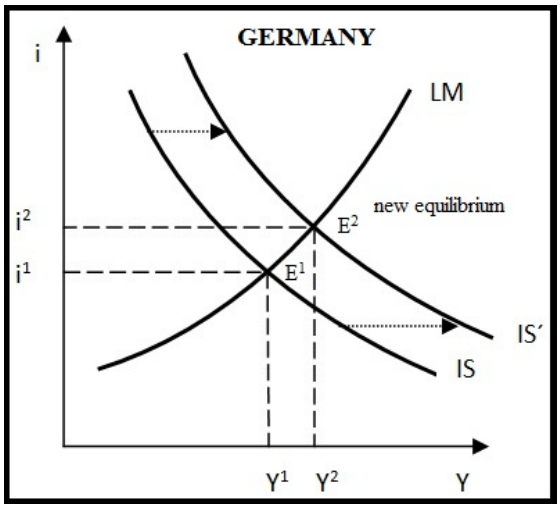
3 IS-LM application

Considering the forecast obtained by quadratic moving averages method, Germany's GDP should be rising quite significantly within the next two time periods, namely 2013 and 2014, copying the trend from the growth period in the beginning of the millennium. This means that Germany's output, Y should be higher in the next two consecutive periods. Growing output indicates certain fiscal policy measures, in this case assuming fiscal expansion. That causes a change in the equilibrium on both goods and money markets which can be illustrated as in Fig. 7.

The Fig. 7 illustrates the fiscal expansion happening in Germany based on the GDP development predictions. As we can see, the IS curve shifts to the right, symbolizing fiscal expansion conditioned by expected higher output, Y^2. Hence a new equilibrium, E^2 is reached.

This new equilibrium intersects the LM curve a little bit higher which indicates a higher interest rate, i^2.

Fig. 7: Fiscal expansion in Germany



Source: Self-created graph of the fiscal expansion in Germany.

Here, the interest rate dilemma emerges. In this particular case for Germany the future change of output triggers, according to the IS-LM model a change in the interest rate. However, interest rates should be the same within the whole Euro zone as long as ECB takes control over monetary policy of all Euro zone members. The latest monetary policy measure taken by ECB represents a target fixed rate of main refinancing operations to be 0.25% per annum. This interest rate is valid for all Euro zone members. Thus a policy mix is no longer possible within the Euro zone, i.e. combination of fiscal and monetary policy by each state separately. However, through individual transmission mechanisms of each member state, deposit interest rates differ from state to state. More concretely, as of December 2013, the deposit interest rate in Germany reaches maximally 1.00%. This means that except monetary policy remains just fiscal policy as a tool for small fine-tuning measures in interest rates. Considering the forecasts, the interest rate in Germany should slightly increase its value. Is Germany willing to sacrifice the interest rate increase for attaining higher output and thus higher economic growth?

In order to provide certain recommendations, paradoxically, what would be in favour of an interest rate change in Germany is exactly opposite. Germany is strictly against any inflation. In terms of overall economic output though, the growth of GDP is desirable.

It seems that Germany is already on a good way to boosting its economy as it was before the crisis. The higher GDP growth however leads to a higher interest rate according to

the IS-LM model. How the fiscal policy should be performed depends on specific goals of Germany's government:

1. Hold interest rates steady

In this case, to prevent an interest rate increase, the overall output should not rise as significantly as the forecast shows. Thus measures of fiscal policy expansion should be a little bit reduced or very slight measures of fiscal contraction either by:

- Decrease in government spending, G
- Increase in taxes, T

But only to a certain degree to still maintain the growth, not turning it to a strong fiscal contraction. By doing so, Germany will maintain its economic growth but with little or no change in interest rate.

2. Boost growth even more

According to the forecast, Germany's GDP is expected to grow significantly. But if there is still not sufficient growth, the following fiscal policy measures can boost the economy even more, concretely performing a stronger fiscal expansion:

- Increase in government spending, G
- Decrease in taxes, T

This would trigger even higher overall output but the price to pay for it would be significantly a higher interest rate which could ultimately lead to a lower investment, and thus to a lower growth in the long-term. It would work in the short-term to stimulate an even higher growth but based on Germany's long-lasting attitude against any increase in interest rate this scenario is rather unlikely.

Conclusion

The current situation of German economy and its GDP development of past 20 years have been shown in this paper. It served as a basis for all the computations within this paper.

The last part of the paper represents the whole practical part and application of knowledge towards the objective of the paper. The following steps have been done in order to meet the main objective of this paper, i.e. to analyse factors that can influence a state's fiscal policy together with particular objectives, meaning providing recommendations for fiscal policy measures based on the GDP projections. Thus, the forecasted values of GDP have been used as an input for curve shifts within the IS-LM Model. Hence, fiscal expansion has been recognized and illustrated. After analysing macroeconomic consequences of such a GDP

development, certain recommendations on possible fiscal policy measures depending on government's goals have been provided.

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