Impacts of academic research on GDP growth

Executive summary

1. As it is shown in the economic growth literature, the return of resources invested in research is expected to contribute to the higher growth rate of potential income of the economy. This paper examines this relation in case of Hungary based on data from the period 2000-2011. We used county level data (NUTS3) obtained from KSH (Hungarian Central Statistical Office) and Eurostat in panel structure.

2. Three sources of GDP growth are the increase in labor, in the capital stock and technology development. The main source of long-run economic growth is the development of technology, which is measured by the increase in total-factor productivity (TFP). This factor lays behind one part of the GDP growth in Hungary between 2000 and 2006; the other part could be explained by the increase in capital stock. In the period 2006-2011, in those mostly declining years, TFP decreased in line with the GDP.

3. Research and development (R&D) and expansion of human capital are the main reasons for technological development. In Hungary the expansion of tertiary education is currently the prime source of increase in human capital. The rate of graduates among workers rose from 11% to 18% in the last decade and its further increase is one key to economic growth in the near future. Therefore we focus on "education channel": an enlargement in number of graduates leads to an increase in their ratio among workers. This leads to an improvement in TFP and indirectly fosters GDP growth. (However this channel will reach its boundaries in not that long run.)

4. "Research channel" is the other important field. It implies that new engineering and technical knowledge is created as a consequence of R&D activities resulting in a more efficient production and an increase in GDP. This knowledge is measured by the accumulated number of patents.

5. As our model implies, TFP is mostly explained by the employment of graduates and by the level of technological knowledge. Our regression on county level panel data shows that the first factor explains approximately 50% of TFP, while the second element explains another 5-10%.

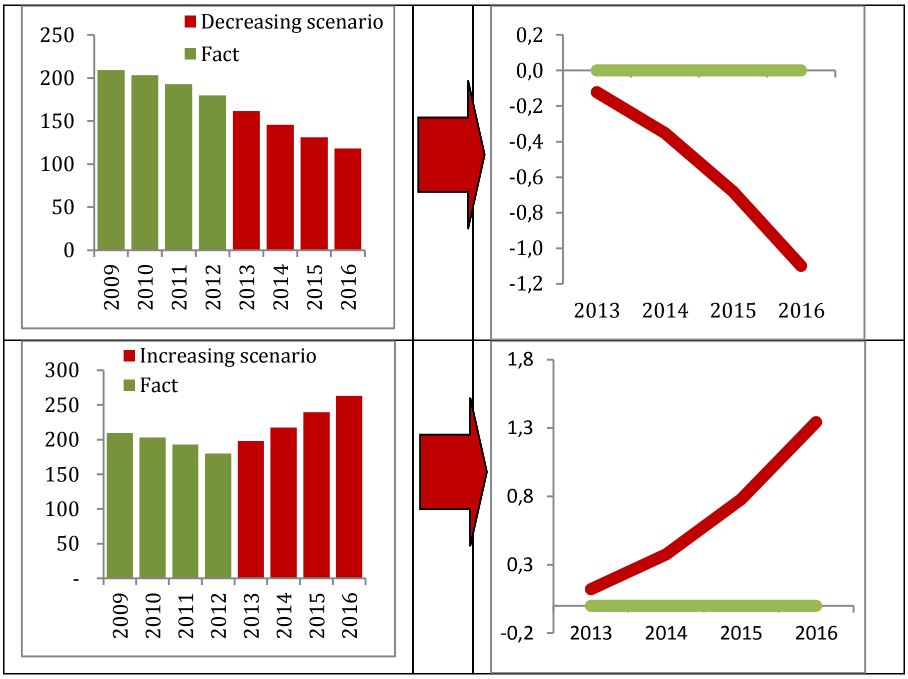
6. R&D activities are conducted by three different institutions: higher education institutions (universities, HEIs), research institutes (mainly state owned and financed), and private companies. The contribution of research institutes to the amount of new patents is significant, as our regression estimates show, 1% rise of researchers employed in research institutes leads to an increase of 0.24% in the number of patents. The effect of private companies' research activity on the number of new patents is even larger, it is 0.57%. However, in case of the third type of institutes, research executed by universities does not influence significantly the number of new patents directly. However, we highlighted that university research has a significant effect on private companies' R&D activities, therefore they do

influence the volume of new patents indirectly. In more concrete terms, 1% increase of university researchers attracts 0.36% more company R&D activities, thus higher education R&D resources influences indirectly the amount of patents.

7. The universities' effect on corporate R&D's location is related to their research profile. The nearer the profile of university researchers is to the research profile of corporate R&D, the greater the settlement effect. University research influences the location of corporate research especially in those counties (outside the capital, Budapest), where universities are more specified. As our model suggests, universities with broader research profile attract relatively less corporate R&D.

8. Our model-based forecast shows the effect of an increase (or decrease) in the resources of higher education and research institutions on the economy's growth potential. As for the education channel, in the base scenario we assumed that the current (2012) level of financial support of higher education will not change until the end of 2016. We compared two scenarios: in the first case, we expect a 4-year-long expansion with a 10% annual rise in the resources, while in the other case we suppose 10% annual decrease. Since in our model the increase in employment of graduates leads to higher GDP, we suppose that increasing the amount of sources spent to the universities leads to a rise in the number of students. Thus the ratio of graduates among the working-age population will be higher that infers an increase of graduates among workers. Ultimately, this mechanism entails GDP growth through the rise of TFP. In total, we expect in case of expansion a 1.5% higher, while in the other case, 1% lower GDP in 2016 compared to the unchanged conditions of 2012.

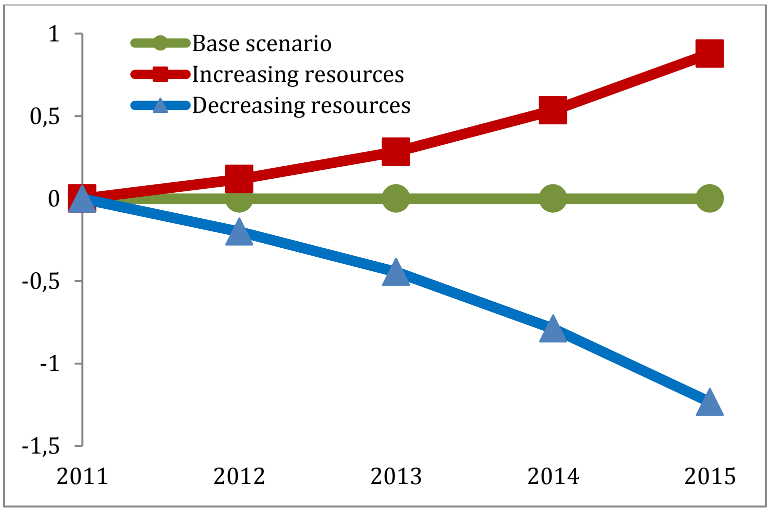
The potential effect of national resources spent on higher education (education channel, %)



9. We also prepared two scenarios for the "research channel". The benchmark path was the constant level of resources from 2011 to 2015. In the first scenario we assumed that financial support paid to universities and research institutes increases 10.7% a year effectuating in an approximate increase of 50% during the four years. In the other scenario we assumed a

similar 10.7% decrease in financial support which accumulates to a decrease of 36% in total financial support.

The potential effect of national resources spent on R&D sector (universities and research institutes, %)



10. In the study we assumed that an increase or decrease in the amount of resources leads to proportional changes in the number of researchers employed in universities and research institutes. Definitely this is fiction, the scope for expanding researches are much more limited. However it is still possible to interpret these scenarios as raising the resources leads to more efficient R&D activities. In our model raising funds spent on scientific research increases the level of technological knowledge so the economy's income potential will enlarge. In our scenario the expansion of resources in the sector of higher education and research institutes improves the GDP by 1%. Withdrawal of funds results a greater decline.

11. Our model captures complex connections by illustrating the main links. More detailed exploration of the relationship between higher education, research institutes and companies requires more investigation. One possible direction of a further study is the correction by the quality of educational and research activities. Currently quality did not appear in our examination. In another study we found that the efficiency of R&D in Hungary is lower than in any other European countries. Not only the number of patents, but also their value is an important factor, therefore we have to take into consideration that patents are only part of the whole R&D activity. Investigation of further indicators is recommended.

12. Moreover, as for education, we should take into account the differences in the market value of graduate degree depending on the subject and institute that issued it. We also need to investigate the migration processes that results from the greater mobility in higher education. One relevant prediction of our model is that the source of economic growth is not the education in itself, but the employment of graduates. As long as one can get his/her degree abroad and come home to work, the Hungarian higher education does not influence greatly the economic growth. On the other hand, a potential decrease in the level of education has a negative impact on corporate R&D because of the local spill-over effect. We cannot overemphasize the importance of problem.