Box 3

# Why has Iceland's growth potential slowed?

In the past decade, growth in both output and productivity has gradually lost pace in Iceland and other advanced economies, and there are signs that productivity growth will remain slow in the industrialised world. This Box focuses on these trends and explores why a similar pattern can be expected in Iceland. The rate of output growth that can be maintained with normal resource utilisation has therefore been revised downwards from 2¾% to 2¼% in the Bank's baseline forecast.

**What is potential output?**

An economy's potential output is the level of production (measured in terms of GDP) that can be achieved with "normal" utilisation of the available resources, or factors of production (such as labour and capital). If resource utilisation exceeds this normal level, excess demand develops and an output gap opens up. Excess demand pushes prices of these factors upwards and ultimately leads to higher inflation. If resources are not fully utilised, however, a slack develops in the economy and prices of these factors rise less, or may even fall.[1]

Growth in potential output indicates the pace at which the economy can grow without putting undue strain on its factors of production. As a result, estimating the economy's potential output and determining whether there is an output gap or slack plays a key role in the Bank's assessment of underlying inflationary pressures and monetary policy formation at any given time.

**What determines an economy's potential output?**

Potential output generally increases over time because, as the working-age population grows, there are more people at work, making it possible to produce more. Potential output also rises over time in line with growth in productivity, which reflects how much production can increase for a given amount of inputs.[2] This can be shown by defining labour

1 Potential output cannot be measured directly in the way that, for instance, GDP can be; therefore, it must be estimated using economic models. In estimating Iceland's potential output, the Central Bank considers a number of indicators and uses various statistical methods to arrive at its final estimate (see, for example, Box IV-1 in *Monetary Bulletin* 2011/4 and Box 3 in *Monetary Bulletin* 2018/2).

2 Fluctuations in the resource utilisation ratio can also cause fluctuations in potential output. For instance, it is estimated to have declined in the wake of the financial crisis just over a decade ago, when workers emigrated from Iceland, manufacturing equipment was sold out of the country, and equilibrium unemployment rose. For further discussion, see Box IV-1 in *Monetary Bulletin* 2011/2.

productivity as GDP per hour worked – i.e., $Q = Y/N$ where $Q$ is labour productivity, $Y$ is GDP, and $N$ is total hours worked, or labour volume (i.e., the number of working persons multiplied by their average working hours). If small letters denote logarithms and Δ the annual change, the economy's potential output growth rate $\Delta y$, can be expressed as the sum of productivity growth, $\Delta q$ and growth in labour volume, $\Delta n$:

$$(1)\ \Delta y = \Delta q + \Delta n$$

It can be seen from Equation (1) that a key driver of long-term GDP growth – and therefore of overall living standards – is productivity growth. In order to understand more fully what determines productivity growth, it is possible to use a simple production function such as the Cobb-Douglas production function in the Bank's macroeconomic model. According to the Cobb-Douglas function, the inputs – labour volume ($N$) and capital ($K$) – are used in fixed proportions ($\beta$ and $1-\beta$) to create the economy's total output ($Y$):

$$(2)\ Y = AN^{\beta} K^{1-\beta}$$

In addition, it is possible to boost output by enhancing the efficiency of the production, which is expressed in terms of total factor productivity ($A$).[3]

Using the production function, it is easy to see that productivity growth is determined by two factors: growth in total factor productivity, $\Delta a$, and growth in the capital stock per hour worked, $\Delta(k - n)$, or what is often referred to as capital deepening:

$$(3)\ \Delta q = \Delta a + (1-\beta)\Delta(k-n)$$

It is therefore possible to increase labour productivity by investing in tangible assets (factories, tools, and equipment) that boost the performance of the labour force, and by utilising currently available labour and equipment more effectively. This can be done, for instance, through research and development, which leads to technological advances and streamlining of production. The same happens as the labour force's expertise and specialisation increase. Better infrastructure also fosters increased production capacity, whether it takes the form of road systems, broadband connections, or healthcare and education systems. All of these factors bolster the knowledge, flexibility, and production capacity of the labour force and reduce the cost of transport and trade.

3 Total factor productivity is not measured directly but instead is calculated as a residual using the production function, $A = Y/(N^{\beta} K^{1-\beta})$, and is often called the Solow residual.

Finally, increased competition can provide incentives for innovation and technological advances. The same applies to cross-border trade, which fosters more efficient resource utilisation and provides an important channel for the worldwide flow of new technologies and expertise.

**GDP growth has slowed alongside reduced productivity growth**

Chart 1 shows how GDP growth in Iceland has gradually lost pace in the last four decades. Early in this period, twenty-year average GDP growth was about 5% per year, but by the end of the twentieth century it had fallen to just under 3%. In the twenty-first century, economic activity has been volatile, with strong upswings in the mid-2000s and mid-2010s followed by deep recessions, the first in the wake of the financial crisis and the second in the wake of the COVID-19 pandemic. Twenty-year average GDP growth has therefore declined still further and now measures about 2½% per year.

At the same time, trend population growth has been relatively stable at roughly 1% per year, apart from temporary pick-ups during the two aforementioned economic upswings when labour immigration increased. GDP growth per capita has therefore developed broadly in line with overall GDP growth, declining from 2% per year around the turn of the century to 1¼% in the past twenty years.

Chart 1 therefore suggests that long-term average GDP growth has slowed. This also accords with growth in potential output as estimated using the Bank's macroeconomic model. As Chart 2 indicates, average yearly growth in potential output has fallen from 3% over the period from 1991-2010 to 2.6% in the past ten years. The shift in productivity growth is even more pronounced: during the former period, labour productivity grew by an average of 1.8% per year, while in the last ten years, productivity growth has fallen by half to only 1%.

**Comparable trends in other advanced economies**

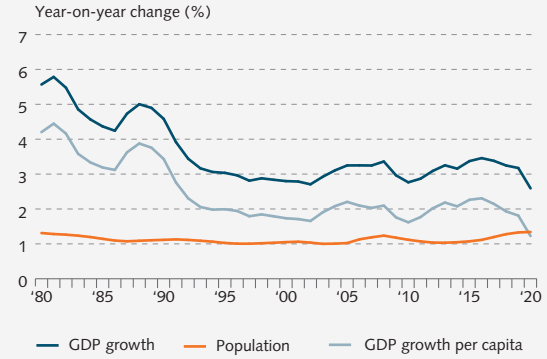
This aligns with the trend in other advanced economies (Chart 3).[4] Long-term average productivity growth was over 3% per year until the late 1980s but then gradually fell to about 2% by the end of the century. It remained there until the mid-2000s but has declined even further since then, to about 1% per year by the end of the 2010s.

Average productivity growth has therefore been about half as strong in the past decade as it was in the two decades beforehand (Chart 4), both in Iceland and in other advanced

4 The countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, South Korea, Sweden, Switzerland, the UK, and the US.

Chart 1

GDP growth and population growth, long-term trend 1980-2020[1]

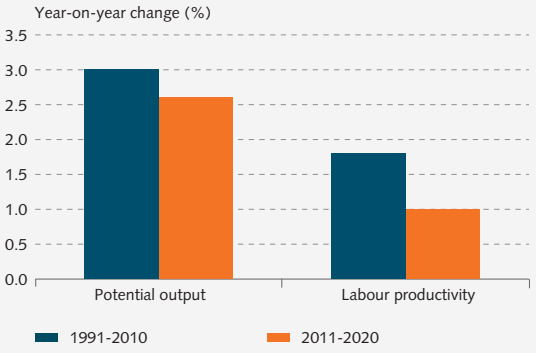



1. 20-year moving average of GDP growth and population growth. Population based on annual averages.

*Source:* Statistics Iceland.

Chart 2

Potential output and labour productivity[1]

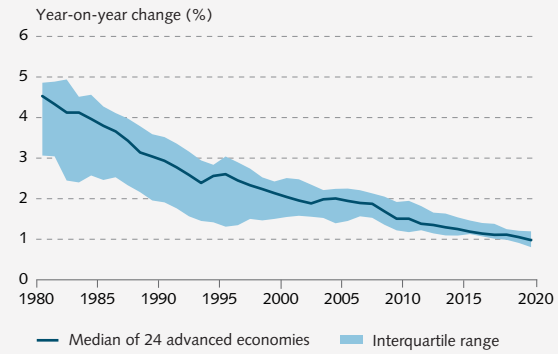



1. Labour productivity measured as GDP per hour worked.

*Sources:* Statistics Iceland, Central Bank of Iceland.

Chart 3

Labour productivity in advanced economies 1980-2020[1]




1. 20-year moving average of annual growth in GDP per hour worked. For most countries, data are obtained from Penn World Tables (PWT) until 1970 and from the OECD thereafter (PWT data are only available from 1971 for Luxembourg and New Zealand, and from 1982 for Israel; and OECD data are only available from 1996 for Austria, from 1984 for Greece, and from 1982 for Israel).

*Sources:* OECD, Penn World Tables, vol. 10.0 (Feenstra et al., 2015).

economies (in terms of both the group average and the five top-performing countries). Average GDP growth has fallen even more, as reduced productivity growth is compounded by slower growth in the working-age population. This is less applicable to Iceland, which reflects both a relatively young population and robust immigration in recent years.

**Why has productivity growth slowed down in advanced economies?**

As Equation (3) shows, there are two factors that could explain the general slowdown in productivity growth among developed countries. On the one hand, it is possible that growth in total factor productivity has declined; i.e., companies have not been able to improve their utilisation of labour and capital at the same pace as before. On the other hand, it could be that growth in the capital stock per hour worked has slowed; i.e., investment in equipment and new technology has lost pace.

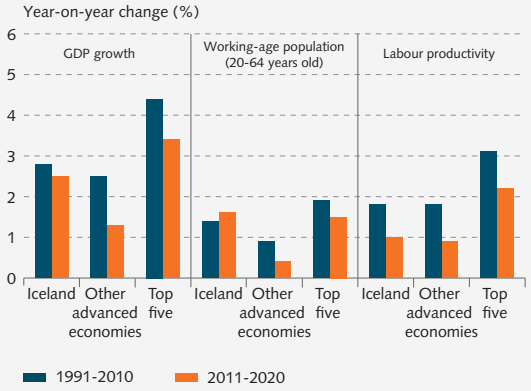
Chart 5 shows that growth in total factor productivity has slowed somewhat in advanced economies: in the past ten years, the growth rate has been around 0.3% per year, as compared with an average of 0.8% per year in the two decades beforehand. The same is true of the five top-performing countries. This reversal in total factor productivity growth is considered to have begun in the mid-2000s, owing in part to a slowdown in technological advances among companies and countries at the technological frontier, and a slowdown in the diffusion of technology to those not at the frontier (for further discussion, see, for instance, Fernald, 2014, and International Monetary Fund, 2018).

As Chart 5 illustrates, the pace of capital deepening has also slowed. In the past ten years, the growth rate has been a full 2 percentage points lower than in the two decades beforehand, both in terms of the advanced economies' average and in terms of the five top performers. A major factor here is the slow pace at which investment recovered after the financial crisis just over a decade ago, with impaired corporate balance sheets, high corporate and government debt levels in many advanced economies, and weak demand undermining investment capacity and appetite. This can be seen in Chart 6, which shows that over the past ten years, investment in advanced economies has been weaker than in the previous two decades by an average of just over 1 percentage point of GDP.

Although labour productivity growth has slowed in Iceland as it has in other advanced economies, the composition of Iceland's slowdown is different. Growth in total factor productivity has not given way – instead, it has continued to measure just over 1% per year – but the growth rate of

Chart 4

GDP growth, population growth, and labour productivity[1]

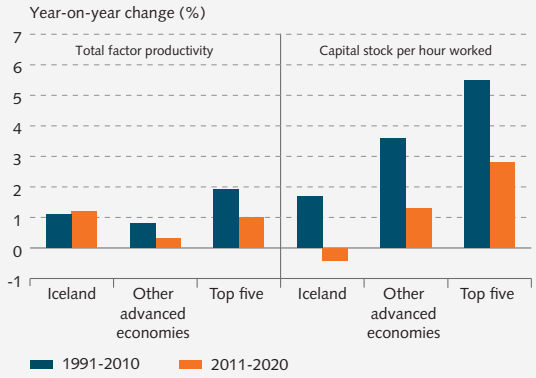



1. Comparison of average growth in Iceland, in 24 other advanced economies, and in the five advanced economies with the strongest growth during the period in question. Labour productivity measured as GDP per hour worked.

*Sources:* OECD, Statistics Iceland, Central Bank of Iceland.

Chart 5

Total factor productivity and capital stock per hour worked[1]




1. Comparison of average growth in Iceland, in 24 other advanced economies, and in the five advanced economies with the strongest growth during the period in question. Total factor productivity is estimated using the production function in the Bank's macroeconomic model.

*Sources:* OECD, Statistics Iceland, Central Bank of Iceland.

Chart 6

Gross capital formation[1]


1. Comparison of investment spending in Iceland with the average of 24 other advanced economies and the average of the five advanced economies with the largest share during the period in question.

*Sources:* OECD, Statistics Iceland.

capital per hour worked has turned negative by an average of 0.4% per year in the past ten years, whereas in 1991-2010 it was positive by nearly 2% per year. Investment has also been weaker in Iceland in the past ten years (Chart 6). This is compounded by the fact that the post-crisis upswing was based to a large degree on rapid growth in tourism, a relatively labour-intensive and non-capital-intensive sector. As a result, the labour force has grown significantly and the capital stock per hour worked has contracted.

**Global productivity growth likely to remain weak in coming years**

Although weaker growth in potential output among advanced economies can be attributed in part to legacy effects of the financial crisis more than a decade ago, there are other causes as well, as the slowdown had already begun when the crisis struck. The causes are not solely cyclical, either; in fact, it appears that the trend can also be traced to structural factors with a long-term impact. For instance, growth in the working-age population will probably continue to lose pace in advanced economies, and in some countries the working-age population has already begun to shrink. Furthermore, it is possible that the scarring effects of the COVID-19 pandemic on advanced economies' potential output will be felt for some time to come. Previous experience of economic crises gives cause to assume that the impact on unemployment and labour participation could prove long-lasting, and corporate insolvencies and financial distress could cause the effects of the pandemic on business investment and development to persist as well (see also Box 4). The impact could be even greater than in previous crises if there is a permanent contraction among contact-intensive companies and sectors; on the other hand, the problem may spread less readily to other sectors than it would among manufacturers in dense global value chains (see International Monetary Fund, 2021).

Therefore, most studies indicate that potential output among advanced economies will grow somewhat lower than at the turn of the century. The findings of Celic *et al.* (2020) indicate, for instance, that potential output growth among advanced economies has declined by ½ a percentage point to an average of 1½% per year (see also Reifschneider *et al.*, 2015, and International Monetary Fund, 2021).[5]

5 Although the impact of the still-ongoing digital revolution cannot be seen clearly in productivity figures, it could imply the hope of stronger productivity growth once digitisation has been better incorporated into businesses' activities.

**There is no obvious reason why Iceland should be different: for one thing, innovation is not stronger here than in other advanced economies …**

It is difficult to envision a vastly different scenario for Iceland. With weaker investment, for instance, one of the main drivers of productivity growth has lost momentum, and investment spending is now proportionally lower than in other advanced economies (Chart 6). Nor does a comparison of spending on research and development (R&D) give cause to assume that productivity growth will develop more favourably in Iceland than in other advanced economies (Chart 7). Although the ratio of R&D spending to GDP in Iceland is close to the advanced economies' average, it has not risen in the past decade, as it has elsewhere; furthermore, Iceland's R&D spending ratio is considerably below that in the five countries that spend the most.

R&D spending is not a flawless metric of innovation and development, however, as it only measures the amount of money spent on R&D, not the innovations derived from it. Another common way to view the scope of innovation and development is to examine the number of patent applications filed, as this should reflect the frequency of new discoveries that foster innovation and increased productivity. But even by this metric, there is little to indicate that productivity growth in Iceland stands apart from the global trend described above (Chart 8).

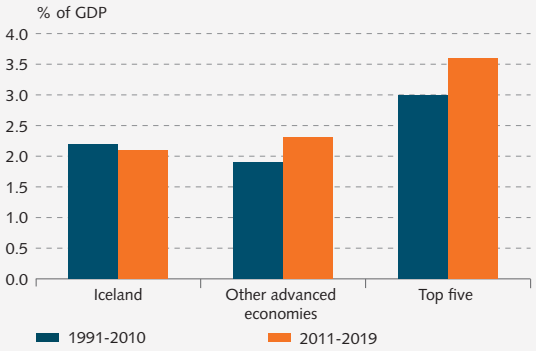
**… Iceland is not more open to international trade and foreign investment …**

It is possible to boost productivity by importing knowledge from abroad in the form of new technology or new management and manufacturing techniques. Research shows that the flow of global expertise and equipment takes place primarily through world trade and foreign investment in domestic businesses (see, for instance, Keller, 2010). In addition, increased activity along global value chains has become an ever more important channel for the flow of expertise across borders, as large international companies are often at the technological frontier, and the knowledge they possess is diffused to domestic participants in the value chain (see, for example, International Monetary Fund, 2018).

It cannot be seen that Iceland has an advantage over other advance economies in this regard, either (Chart 9): the scope of international trade in Iceland is marginally below the advanced economies' average, and well below that in the five top performers. There is less inward foreign direct investment (FDI) in Iceland than in other advanced economies, as FDI faces more barriers in Iceland than are generally

Chart 7

Research and development spending[1]

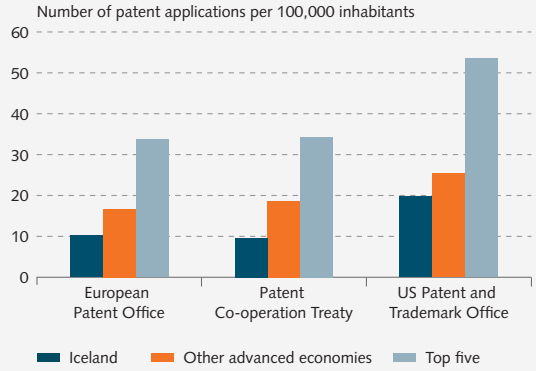



1. Comparison of research and development spending in Iceland with the average of 24 other advanced economies and the average of the five advanced economies with the largest share during the period in question.

*Sources:* OECD, Statistics Iceland.

Chart 8

Number of patent applications 2017[1]

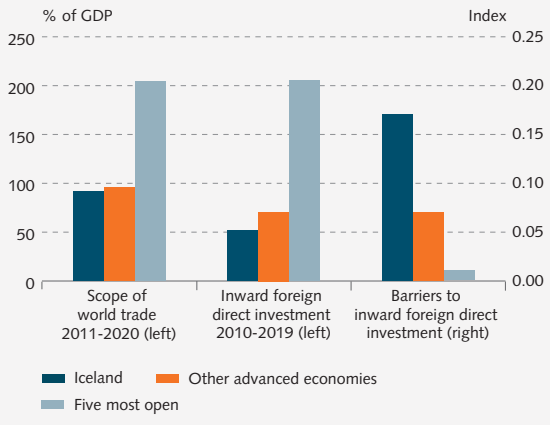



1. Number of patent applications with the European Patent Office (EPO), and the US Patent and Trademark Office (USPTO) and according to the international patent system under the Patent Cooperation Treaty (PCT).

*Source:* OECD.

Chart 9

Scope of world trade and foreign investment[1]




1. Scope of world trade calculated as the ratio of exports and imports to GDP. Barriers to inward foreign direct investment obtained using the OECD's FDI Restrictiveness Index for 2019. The index value rises as restrictiveness increases and is subject to a maximum value of 1. VANTAR.

*Sources:* OECD, Statistics Iceland.

found elsewhere.[6] As a result, the openness of the Icelandic economy to trade and foreign direct investment does not appear to give cause to expect productivity to develop differently here than in other advanced economies.

**… and barriers to competition are generally greater in Iceland than in other advanced economies**

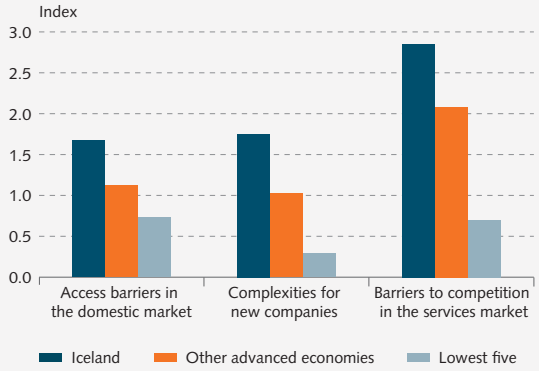
Stronger competition and ready access for new market participants can also be important catalysts of innovation and development. Under such circumstances, incumbent market participants should have a stronger incentive to invest in innovation so as to maintain their competitive advantage. Furthermore, easy market access for new companies can be an important channel for bringing new knowledge into the market and spreading it across borders (see, for example, International Monetary Fund, 2018). Accordingly, countries with few barriers to access and a relatively accommodating structure for business start-ups should be able to maintain stronger productivity growth through their own innovations or through inflows of new expertise from abroad. Iceland does not fare particularly well in this respect. There are relatively more barriers to competition and market access in Iceland than in other advanced economies (Chart 10). For instance, it is more complicated to start a business in Iceland than is typically the case in other advanced economies, and there are more barriers in the service sector. Again, these measures do not suggest that productivity growth in Iceland will be more favourable than is expected in other advanced economies.

**Summary**

Productivity growth has slowed in all major advanced economies in recent decades, and the factors that cause this are likely to remain in play over the next several years. Iceland has not been excluded from these developments, with annual labour productivity growth 1 percentage point lower over the past ten years compared to the previous two decades. As a consequence, the economy's potential growth rate – i.e., the GDP growth rate that can be sustained with normal resource utilisation – has probably declined. It is now estimated at 2¼%, or ½ a percentage point below the previous level of 2¾%. ■

Chart 10

Regulatory burden in domestic markets[1]




1. Indices ranging from 0-6 (higher values indicate broader restrictions). Comparison of Iceland, the average of 24 other advanced economies, and the five advanced economies with the least restrictive barriers and regulatory framework. Measurements for 2018.

*Source:* OECD.

6 Furthermore, Icelandic companies' participation in global value chains appears limited, which is not surprising given the strong correlation between global value chain participation and the scope of inward FDI (see, for example, International Monetary Fund, 2018).

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