

# SPEECH



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SVERIGES RIKSBANK  
SE-103 37 Stockholm  
(Brunkebergstorg 11)

Tel +46 8 787 00 00  
Fax +46 8 21 05 31  
registratorn@riksbank.se  
www.riksbank.se

## The effects of digitalisation on the economy\*

Thank you for the invitation to come here and speak at Entreprenörskapsforum. I cannot imagine a better place to talk about digitalisation and its potential effects on the economy.

One example of technological advances and the effects of digitalisation is right here – in our mobile phones. Four out of five Swedes in the age range 16-85 had access to the internet via a mobile phone in 2018.<sup>1</sup> It is difficult to imagine, but today's smart phones actually have greater processing power than the computers that enabled the Apollo moon landing in 1969!<sup>2</sup> Smart phones also give us access to inconceivable amounts of information and entertainment that did not even exist in 1969. The answer to a question is only a few clicks away.

As a consumer it is easy to see the value of these technological advances, although we do not in our daily lives use the capacity for anything comparable to the giant leap for mankind the moon landing entailed...

The new technology provides us with entertainment, but not only that. It also affects our working lives and the economy in general. Rapid developments in technology gradually lead to higher productivity and increase our welfare, but they are also a source of concern for many people. Will my job still exist in the future, or will it be done by a robot or an algorithm? How can my company compete in these days of rapid technological advances?

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<sup>1</sup> Refers to Statistics Sweden's figures on private individuals' access to and use of IT. 82% of all Swedes in the age range 16-85 years had access to the internet via a mobile phone in 2018. [http://www.statistikdata-basen.scb.se/pxweb/sv/ssd/START\\_LE\\_LE0108\\_LE0108D/LE0108T14/?rxid=8f4a0041-1be9-4ed3-b6fb-182251a2b5cd](http://www.statistikdata-basen.scb.se/pxweb/sv/ssd/START_LE_LE0108_LE0108D/LE0108T14/?rxid=8f4a0041-1be9-4ed3-b6fb-182251a2b5cd)

<sup>2</sup> <https://www.zmescience.com/research/technology/smartphone-power-compared-to-apollo-432/>

My speech today will not provide all the answers. Instead, I intend to discuss my thoughts on how digitalisation can affect various parts of the economy and what role it plays for monetary policy. Can the Riksbank attain its target of 2 per cent even in a world of digitalisation? Is it still desirable to aim for this target? My reply to both of these questions is yes, but I will return to that later.

## Focus on digitalisation – where are we now?

What is digitalisation and how does it differ from the concepts of automation and technological advances? Jesper Roine, professor at the Stockholm School of Economics has divided them up in a useful manner.<sup>3</sup>

- Automation – a machine doing the work of a person.
- Digitalisation – converting information to a digital form.
- Technological advances – broader concept that covers the other two but also other things.

The concepts are of course related. Digitalisation can enable automation and is an example of technological advances. In this speech I focus on digitalisation, but will also touch on the automation that follows on from digitalisation. I wish to include in the concept of digitalisation here machine learning, artificial intelligence, 3D printers and the use of cloud services and Big Data. A common collective name often used for several of these technologies is Industry 4.0 or the Fourth Industrial Revolution.

## Will productivity increase?

How far have we come with regard to the digitalisation of the business sector? One hears an awful lot about technological developments in the media and in business journals. From what is written one might easily gain the impression that we can do more and faster. But official data on productivity does not confirm this. The fact that statistics and reality sometimes appear to be disconnected from one another is nothing new. In 1987 economist Robert Solow wrote “you can see the computer age everywhere but in the productivity statistics”, when describing the emergence of information and communication technology (ICT) and the relatively low productivity growth in the United States in the 1980s.

If we look at Sweden, productivity growth in the business sector has been very weak since 2006, a year or so before the global financial crisis occurred. We have often had to revise down our productivity forecasts as a result of the surprisingly weak development. Productivity has also shown weak development in other developed countries recently, which indicates that it is the result of a joint trend.

There are many possible explanations for the decline. Some economists, such as Robert Gordon, say we are in a period of very low productivity growth that will be the new normal for a rather long time. According to this point of view, a large share of the fruits of digitalisation have already been harvested. As early as 2005, for instance, several economies had adapted their business methods and models

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<sup>3</sup> Roine (2016).

to the internet. The conclusion of this point of view is, put simply, that more recent innovations have not been as significant as those during earlier industrial revolutions.<sup>4</sup>

Others, such as Andrew McAfee and Erik Brynjolfsson at MIT, say that the effects of digitalisation have passed under the radar and that we will see major productivity increases in the future when the new technologies are used more broadly in the business sector.<sup>5</sup> Economic historian Joel Mokyr also points out that the productive potential in new technologies will lead to strong pressure for change in the economy.<sup>6</sup>

As you can hear, there are very differing views on the subject and the assessment of future productivity growth is a question we are constantly struggling with.

### **We are in the “installation phase”**

Personally, I think that that model from Bart van Ark (2016) is useful when considering the different views. This distinguishes between an “installation phase” and a “deployment phase” for new technology.

The first phase involves exploring new markets and growth is limited to a couple of companies. During the second phase the markets are consolidated and there is broad growth in the economy. One can imagine that Brynjolfsson and McAfee consider we are in the first phase, while Gordon thinks we have already passed the second phase.

My assessment is that we are probably somewhere in the installation phase with regard to digitalisation. I base this on some, few, companies having seen their market power increase in recent years.<sup>7</sup> These companies are often known as “superstars” and have high profit margins and have experienced high return on invested capital. They are often multinational corporations that sell products and services all over the world. At the same time, it appears as though smaller companies have fared less well. The difference in productivity between superstars and ordinary companies has also increased.<sup>8</sup>

When we talk to companies in our Business Survey, they largely confirm this picture. The companies that have long been subjected to international competition on global markets have a greater tendency to regard digitalisation as an opportunity than the consumer-related companies with most of their operations in Sweden.

### **Change is a necessary condition for a prosperous society...**

Regardless of what stage of technological development we are at, it is clear that technological advances revolutionise lives and entire societies. The internal combustion engine transformed transportation in society. Electricity gave us light,

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<sup>4</sup> Cowen (2011).

<sup>5</sup> Brynjolfsson and McAfee (2011).

<sup>6</sup> <https://voxeu.org/article/technological-progress-thing-past>

<sup>7</sup> See, for instance, De Loecker and Eekhout (2017, 2018).

<sup>8</sup> OECD (2015).

heat and energy. Digitalisation, and above all the internet, has given us almost direct access to enormous amounts of information.

Each new innovation replaces other products or changes their areas of use. Our behaviour changes and we make new demands of companies and decision-makers.

In some branches the changes have been particularly marked over the past decade. One example is traditional media. More people are reading the news online or on Twitter instead of printed newspapers or listening to podcasts instead of the radio and watching YouTube instead of TV. The financial sector has also experienced a major revolution. Fewer and fewer transactions are made with cash and banking services that were previously provided at bank offices have moved online. Swish payments are now as common as cash payments.<sup>9</sup> In a few years' time, it may be the case that the use of cash is at such a low level that the general public no longer has access to any form of central bank money that can be used to make payments in ordinary shops. This would be a step into the unknown, and is something I have mentioned on earlier occasions when I discussed the potential introduction of an e-krona.<sup>10</sup>

Change and “creative destruction” are positive in the long run.<sup>11</sup> It is important to point this out, even if it seems obvious. In 1850, almost four in five people in Sweden worked in the agricultural sector. It was hard work, done under difficult conditions and entailed long working days. Just over 100 years later, less than one in five people in Sweden were working in agriculture. Many had instead sought their fortunes in the growing industrial sector, which reached an employment peak in the mid-1960s. Gradually, jobs in the industrial sector were then replaced by jobs in the service industries, including the public sector. This process has continued during the 1990s and 2000s and in 2018 more than 50 per cent of all private sector employees in Sweden were working in service industries. At the same time, GDP per capita has shown rapid trend growth from 1850 until now.

Productivity growth means we have time and money over to invest in other things than work and output. Ultimately, it increases our welfare, makes our workplaces better and improves our health. A somewhat hackneyed but nevertheless descriptive quote from Nobel Prize winner Paul Krugman is “Productivity isn’t everything, but, in the long run, it is almost everything”.<sup>12</sup>

### ...but also creates distinct challenges

Despite changes and productivity improvements in the long run lying behind almost all of the growth in welfare, there are of course important challenges in the short run. Behind every statistic there are people and families. Owning horse-drawn coaches when the internal combustion engine was commercialised or being a seamstress when Spinning-Jenny came into operation was probably quite tough. Similarly, there can be major upheavals in our lives if driverless trucks push

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<sup>9</sup> Sveriges Riksbank (2018a).

<sup>10</sup> Skingsley (2018).

<sup>11</sup> The concept of creative destruction was coined by Joseph Schumpeter in 1942.

<sup>12</sup> Krugman (1997).

out lorry drivers or software and algorithms take over administrative tasks. Or, to take changes in my own job as members of the Executive Board of the Riksbank, when a combination of algorithms, machine learning and Big Data become better than human analysts at making forecasts, or even designing well-balanced monetary policy.

Such changeovers can create gaps between different sections of the population. Those with the right skills to make use of the technological developments will find it easy to get jobs and can see their salaries rise because of higher productivity. In economist speak this is called being a complement to technology. Routine and less complicated work tasks can be replaced by automatic processes, which leads to lower demand for these jobs and thus lower wages. Such jobs are substitutes for technology. Then there are also jobs which are not tangibly affected by technological developments. These are jobs with a high service content and many human elements. Psychologists, preschool teachers, health and medical care specialists and hairdressers are the examples usually put forward as difficult to replace with automatic processes and AI.

I am fairly convinced that we in Sweden can use today's technology as complement to the strengths we already have. Smart automated solutions give us more time and resources to invest in other important issues. They also give us new tools to manage new challenges. What is obvious is that we cannot stand still in terms of competence. We must embrace life-long learning as a motto.

Otherwise there is a risk of further differences between those who have skills that benefit from the new technology and those who are replaced. How long these differences prevail will depend on how quickly people with outdated skills can adopt new skills, change their way of thinking and benefit from the new conditions. But, as I said, this isn't really anything new. As we saw earlier, the agricultural society was replaced by an industrial society that has been replaced by a services society. The number of jobs has not declined and GDP per capita shows a rising trend. But we need to also see the human fates beneath the statistical surface. The fact that welfare is increasing on a general level does not mean that the changes are being made without any frictions at individual level.

## The effects of technological advances may be different from before

An important difference between the current technological developments and the previous revolutions is that the new economy requires increasing elements of purely human traits. Muscle power was needed in both agriculture and the manufacturing industry. Both sectors had many routine and relatively simple work tasks. But in the new economy creativity, inventiveness and the "human touch" are considered important. These are abilities that often require adaptation to the situation, they are difficult to teach and therefore difficult to copy, even with new technology. The new skills we need to acquire make high demands of our educational systems and of skills development in companies and in the public sector. And if technological advances continue at a rapid pace, we must all be ready to update our knowledge.

The effects of digitalisation can also be much greater than the effects of earlier industrial revolutions. Online robots and AI have the potential to replace large sectors of the human workforce. Some analysts think that the whole labour market will change fundamentally, and that this will be fairly soon.<sup>13</sup> In such a situation, it will not only be groups of employees with different skills that will be polarized. Here I am not even talking about the most dystopic forecast for the future – of an almost omniscient artificial intelligence with its own agenda that takes over the world. Instead I mean a changeover to where many tasks and jobs are no longer done by people. Such a development will create tension between those who own capital in the form of equity and funds and those who do not. This is because the capital owners will receive the productivity gains generated by the machines.

### Digitalisation can lead to concentrated product markets.

There are other problems with digitalisation for market economies. We see already now social networks like Twitter, Facebook and Instagram dominate their respective markets. Few people use search engines other than Google. These companies are not only dominant in their respective fields; they also determine who may market themselves or express themselves on their platforms. In this way, they govern how other companies reach out to prospective customers.

Of course, size and influence need not necessarily be negative from a competition perspective. The problems arise when new companies experience difficulty starting up their operations and are forced to deal with various entry barriers to be able to “challenge”<sup>14</sup> the established players on the market in question. Both economies of scale and network effects can function as entry barriers, however. Starting up a new Facebook would be difficult and require major investments, but it is not impossible.<sup>15</sup>

A further problem that can arise from digitalisation is that companies can use the different price comparison sites to observe one another’s pricing. One often claims that these platforms are really good for consumers trying to find the lowest prices, but they also make it easier for companies to monitor one another’s prices and coordinate their prices with one another.<sup>16</sup> This can be a problem from the point of view of competition.

### Challenges can be tackled

The short-term challenges I have described should not be underestimated. They are real problems that affect real people. And problems experienced now are not helped by knowing that humanity will benefit in the long run. But what is the best

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<sup>13</sup> Stefan Fölster replicated a study by Frey and Osborne (2013) using Swedish data and found that more than 50 per cent of all jobs could be replaced by digital and automated technology in the coming 20 years. A study by the OECD shows instead that around 35 per cent of Swedish professions have a high or significant risk of automation.

<sup>14</sup> Baumol et al (1982).

<sup>15</sup> Facebook was far from the first social network. In Sweden there were similar platforms such as Skunk, Lunarstorm, MySpace and other local variations such as Apberget <https://www.svd.se/lunarstorm-tillbaka--men-vad-hande-med-skunk#sida-2> long before this. However, none of these platforms succeeded in becoming as large or maintaining popularity for as long as Facebook.

<sup>16</sup> The European Commission found in a branch study that a majority of companies monitor their competitors’ prices. Two thirds use software to automatically adjust their prices when other companies adjust theirs.

way of dealing with these problems? I think there are three areas that are particularly important. However, I say this in the knowledge that they are far beyond the Riksbank's sphere of influence. Others hold the tools and the responsibility for them.

- I would say that opportunities for education and life-long skills development are entirely decisive here. Even highly-educated professional groups, who have previously had a low level of unemployment, will need further development many times during their professional lives. Quite simply, we need to embrace a life-long learning to be able to meet and benefit from technological advances.
- Taxation and income transfer systems are primary tools to change the gaps in society that follow on from digitalisation.
- New technology also brings new actors and some of these have become very large. Markets characterised by high entrance barriers, synergies and network effects can easily be concentrated in the hands of a few dominant actors. The competition authorities in different countries must therefore have cross-border cooperation to monitor and when necessary regulate various markets and in this way safeguard the interests of the general public.

## Effects of digitalisation – a conceptual framework for monetary policy

So far I have focused on the potential effects of digitalisation and what problems they can entail. I have also taken up various areas where I think we need to meet and make use of the technological advances. But we also need to investigate what effects digitalisation has had on the Swedish economy and to ask ourselves what monetary policy should do. This is often a question that is not so easy to answer, as structural transformations and their effects can be difficult to identify, despite often affecting the economy over long periods of time.

For a general description of how digitalisation can affect inflation, one can use a model that we presented in our Monetary Policy Report in February 2015.<sup>17</sup> It provides a general view of the channels through which inflation can be influenced when a change such as digitalisation occurs.

Firstly, digitalisation affects companies' output capacity via automation, which reduces their cost pressures in total. Secondly, consumers can more easily find information through price comparison sites or e-commerce platforms. This can increase competition and reduce the companies' mark-ups when costs increase.<sup>18</sup> Thirdly, the consumer price index (CPI) is directly affected by lower costs for information and communication technology.

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<sup>17</sup> See Monetary Policy Report, February 2015.

<sup>18</sup> Apel et al (2014).

## Productivity and the labour market

Let's begin with companies' production capacity and the consequences for the labour market. In the manufacturing industry digitalisation appears to have to increased productivity, but this is not the case in the service industries. The development in employment appears to have been poorer in professions where digitalisation has been stronger. The labour market appears to have become more polarized as a larger number are either employed in high salary or low salary professions.<sup>19</sup>

Companies responding to our own Business Survey often confirm that digitalisation leads to a competence shift in the labour force. They see a substantial need to recruit specialists with, for instance, digital competence and they have less need to recruit general staff.<sup>20</sup>

In consumer-related sectors companies believe to a greater extent that digitalisation will lead to fewer employees within a few years, while the responses from manufacturing companies are more neutral. The explanation is often that the manufacturing industry has already made major changeovers and that digital technology is already a complement to large groups of employees. In the retail trade there are larger groups of cashiers, stocks workers and shop assistants who can be replaced by automated solutions.

## Consumer behaviour

Digitalisation also affects us as consumers. The use of internet and online shopping have increased in Sweden and are at a high level compared with other European countries. We now have access to more information than before and can compare prices of various products and various sellers very quickly.

Previously, if you wanted to buy a new pair of shoes you had to go into several shops to compare prices. First you needed to have an idea of where to find a specific model of shoe, say a pair of Converse all-stars in size 39, and then you needed to travel round to find the best price. Now you can quite simply visit a price comparison site online and enter the name of the model and get price information, stocks status and suggested sales points that are online. This has reduced the search costs enormously.<sup>21</sup>

## Companies' pricing

At the same time, e-commerce is changing the playing field for many trading companies and changing their pricing. Why should customers pay more for something in a shop when they can buy it cheaper online?

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<sup>19</sup> Heyman et al (2016).

<sup>20</sup> Sveriges Riksbank (2018c).

<sup>21</sup> The Swedish Competition Authority commissioned researchers Niklas Rudholm and Charlie Lindgren to analyse how price transparency through price comparison sites affects prices and price spread between companies. They used information from the comparison site Prisjakt to compare how prices of games differ between various online traders. They saw that the development of prices for a particular product was highly correlated among the largest companies. This indicates a reduction in price spread.

The studies comparing pricing in shops and pricing online for the same company point to the differences between the two sales channels being less than one might believe.<sup>22</sup> Nevertheless, there are differences. Within e-commerce prices are changed more often, the cost increases are passed on to consumer prices faster and the margins tend to be somewhat lower<sup>23,24</sup>.

In Sweden, e-commerce now accounts for almost 9 per cent of all turnover in the retail trade, according to the Retail and Wholesale Research Institute (HUI). But there are substantial differences between different branches. In the music and film branch the majority of income is from online sales, while e-commerce is much less common in other branches.<sup>25</sup> Despite increasing in significance, digitalised goods have not affected CPIF inflation more than before.

When we talk to companies about how the use of digital technology will affect their future prices, there is a clear difference between consumer-related companies and business to business companies. In the consumer-related companies, sales prices are expected to fall somewhat, while the others consider that the new technology will make it possible to raise prices as it will strengthen the companies' positions on international markets.

## Digitalisation and an inflation target

So how shall we take digitalisation into consideration in our monetary policy and our forecasts? Well, to a great extent it is a question of qualitative assessments of what effects are reasonable. But that sounds simpler than it really is. As I said before, structural changes can affect the economy over a long period of time. Even afterwards it is difficult to know how much a specific factor has affected the labour market or inflation, for instance.

We have seen in our own evaluations that lower price mark-ups as a result of, for instance, digitalisation, may have contributed to holding back inflation, particularly during the period 2014-2015. At the same time, the most important reason for the low inflation during this period appears to have been low domestic cost pressures.<sup>26</sup> And as resource utilisation has increased, inflation has also risen towards the target. It is evidently possible to attain a quantified inflation target.

When I follow the debate on monetary policy in Sweden, the argument keeps cropping up that the two-per cent target for inflation will be impossible to attain as the economy becomes increasingly digitalised. However, one should also look at events in other developed countries with similar targets. Because of course Sweden is not alone in being affected by digitalisation. There does not seem to be any clear relationship in these other countries between for instance the spread of e-commerce and inflation.

However it is possible that the lack of simple correlations in data hides some causal relationship. Better indicators of the spread of digitalisation may give other

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<sup>22</sup> Cavallo (2017).

<sup>23</sup> Cavallo (2018).

<sup>24</sup> Gorodnichenko and Talavera (2017).

<sup>25</sup> Swedish Trade Federation (2018).

<sup>26</sup> Sveriges Riksbank (2018b).

results. My point is therefore that it is up to the critics to present proof of why more digitalisation would necessarily mean that inflation was held below the target for a long period of time. In the longer run inflation is determined by the monetary policy that is conducted on average and its effects on inflation expectations. A better explanation for the differences in inflation rates between countries around the world is therefore that they conduct different monetary policies.

Having a credible benchmark for price setting and wage formation facilitates long-term planning for both individuals and companies. The inflation target is needed in particular when the world is changing rapidly as a result of major upheavals such as digitalisation. The alternative would be a less stable development and poorer opportunities for good economic growth.

### Clear game rules for a smoothly-functioning economy

Let me summarise my thoughts: My assessment is that digitalisation contributes to a new way of producing, pricing and demanding goods and services. By maintaining a stable rate of inflation close to our target, monetary policy helps this changeover. To do so, we need to understand the development of economic activity, as well as the effects of structural changes in the economy.

What we know is that labour markets change. They become more polarized, which makes it more important for people to update their skills to the new circumstances. The game plan for companies is changing. E-commerce can for example mean that companies' prices change more often and become more sensitive to shocks. Increased consumer power and greater competition slow down prices and thereby margins for the companies.

The changes are necessary to increase our welfare, even if they create problems for some people in the short term. To manage these challenges, we should jointly strengthen the opportunities for education and skills development, even out some of the gaps arising during the upheavals and safeguard the interests of the general public by strengthening competition on the new markets.

In a changing world we need to have clear game rules to ensure the economy functions smoothly. Reliable price stability, in terms of purchasing power, is one such game rule. It makes it easier for individuals and companies to plan for the future, it improves price setting and wage formation and thus contributes to more stable economic activity. So, attaining our inflation target of two per cent will help to accomplish the changeover following on from digitalisation.

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