MAY 2019

Monthly Report

The Digital Revolution: Don't Panic – But Stay Alert

Robot Adoption in the EU-CEE and the Rest of the EU

Negative Natural Interest Rates and Secular Stagnation: Much Ado About Nothing?

The Vienna Institute for International Economic Studies
Wiener Institut für Internationale Wirtschaftsvergleiche

The Digital Revolution: Don’t Panic – But Stay Alert

Robot Adoption in the EU-CEE and the Rest of the EU

Negative Natural Interest Rates and Secular Stagnation: Much Ado About Nothing?

ALEXANDRA BYKOVA
LEON PODKAMINER
OLIVER REITER
ROBERT STEHRER

CONTENTS

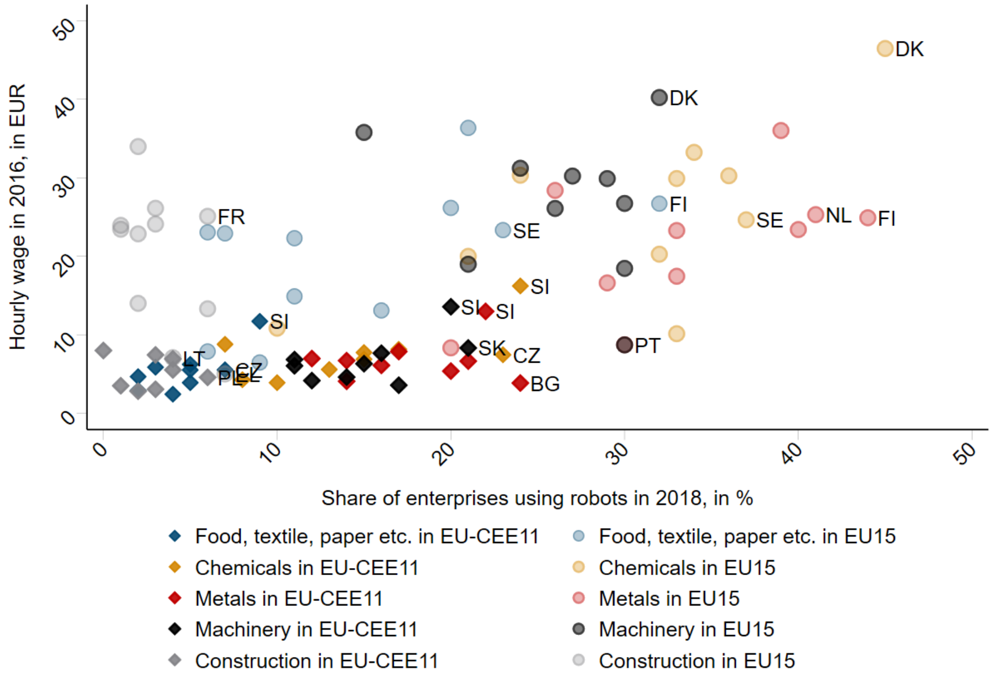
Chart of the month: Automation in manufacturing and construction in the EU

BY ALEXANDRA BYKOVA

The adoption of new technologies such as industrial robots and more sophisticated cyber-physical systems of industry 4.0[1] is happening everywhere. However, the speed of diffusion is uneven across countries and industries.

Along with robot density, the share of enterprises using robots can also be used to capture the degree of automation in a particular sector or country. This indicator includes not only the use of industrial robots (those performing mostly routine and clearly structured tasks), but also of service robots. The latter have a certain degree of autonomy and are dedicated to interaction with people, objects and devices.[2]

Comparison of EU countries by level of automation and labour costs for selected industries



Notes: Each diamond/circle corresponds to a particular country-industry. The country labels indicate the top two countries within each sub-region in terms of degree of automation for each group of industries. Hourly wage is calculated based on annual national accounts data. Dataset excludes Latvia, Luxembourg, Ireland, and country-industry combinations where data are not available.
Source: Eurostat, own calculations.

1 'Cyber-Physical Systems (CPS) are integrations of computation, networking, and physical processes.' https://ptolemy.berkeley.edu/projects/cps/

2 For a more detailed definition see International Federation of Robots (IFR) (2018) and ISO 8373:2012. Service robots are used for warehouse management systems, transportation, cleaning or waste disposal tasks, assembly works, surveillance, security or inspection, robotic store clerk tasks, construction works, and damage repair.

In the EU28 on average only 8% of all enterprises with more than 10 employees (excluding the financial sector) used industrial and service robots in 2018. However, the chart below illustrates a wide dispersion in the degree of automation across countries (diamonds for EU members in Central and Eastern Europe – EU-CEE11 and circles for EU15) and industries (differentiated by colour). Top two countries within each sub-region in terms of degree of automation for each group of industries are labelled.

List of industries according to NACE Rev. 2 classification

Description	NACE Rev. 2 codes
Food, textiles, paper etc.	Manufacture of products based on: food, beverages, tobacco, textile, leather, wood, pulp and paper; publishing and printing (C10-C18)
Chemicals	Manufacture of petroleum, chemical, pharmaceutical, rubber, plastic products and of other non-metallic mineral products (C19-C23)
Metals	Manufacture of basic metals and fabricated metal products, except machinery and equipment (C24-C25)
Machinery	Manufacture of computers, electric and optical products, electrical equipment, machinery and equipment n.e.c., motor vehicles, other transport equipment, furniture, other manufacturing, repair and installation of machinery and equipment (C26-C33)
Construction	Construction (F)

A positive correlation between the degree of automation and the labour costs is clearly traceable for almost all industries except construction. Besides, in the chemical industry and metals production, automation is more widespread than in other sectors. The diamonds that represent EU-CEE11 are primarily located in the left part of the chart, suggesting that these countries are 'followers' in robot adoption. In EU-CEE11, the largest share of enterprises using robots in food, textiles, wood and paper and chemicals is observed in Slovenia. Bulgaria is ahead of other EU-CEE countries in metals manufacturing, Slovakia in machinery production, and Poland in construction. Among EU15 countries, the front-runners in automation are Denmark, Sweden and Finland.

The gap in automation levels between the EU15 and EU-CEE11 varies across industries. For food, textile, wood and paper, chemicals and metals production, more than 20 percentage points separate the top countries in each of the sub-regions, which is consistent with wage level gaps. For machinery, the difference is narrower (11 percentage points), primarily reflecting the closer integration of EU-CEE11 countries with Western Europe in car production. Finally, in construction the degree of automation is rather low in both sub-regions, despite the pronounced wage gap, which is probably due to technical feasibility constraints of automation in this industry (Artuc et al., 2018).

Tight labour markets and demographic decline in EU-CEE11 countries are putting upward pressure on wages and signal further labour supply shortages in the future. Further catching up in automation may be a response by firms to these challenges (wiiw, 2019). IFR (2018) anticipates that the stock of industrial robots in EU-CEE countries will grow by 22% per year in the next three years, compared to only 5% for Germany. Given the historically observed positive correlation of automation with FDI (EBRD, 2018), one can expect further substantial FDI inflows into these countries.

REFERENCES

Artuc, E., P.S.R. Bastos and B. Rijkers (2018), Robots, Tasks and Trade, *Policy Research Working Paper*, No. WPS 8674, World Bank Group, Washington DC.

EBRD (2018), *Work in Transition. Transition Report 2018-2019.*

International Federation of Robots (IFR) (2018), *World Robotics 2018 Industrial Robots*.

wiiw (2019), Moving Into the Slow Lane, *wiiw Forecast Report. Economic Analysis and Outlook for Central, East and Southeast Europe*, Spring 2019, Vienna, March.

Opinion Corner*: The digital revolution: Don't panic – but stay alert

BY ROBERT STEHRER

The impact of new technologies on the labour market will be challenging. But this has to be seen in a broader perspective, beyond the sheer number of jobs expected to be destroyed.

More than 30 years ago Bob Solow stated: 'You can see the computer age everywhere but in productivity statistics'.[1] Since then it is widely acknowledged that, despite the rise of information and communication technologies, labour productivity growth has not surged at all or – even worse – is at a historically low level over the last decades. The reasons for this 'productivity paradox' are widely debated.

An analogous argument might be made concerning employment. Despite the widespread fears that information and communication technologies could destroy a lot of jobs and even lead to the 'end of work' (see e.g. Rifikin, 1995), employment levels generally increased in the long run (either measured in number of persons employed or employment and activity rates).

WILL ROBOTS TAKE OUR JOBS?

In economic history these debates have a long tradition, starting with David Ricardo's famous chapter 31 'On Machinery' in the third edition of his *Principles* (Ricardo, 1821) and followed by various debates on 'technological unemployment', inter alia by J.M. Keynes, Sir John Hicks, Wassily Leontief, and many others.

Today, a similar debate exists, with a focus on 'digitalisation' and disruptive technologies related to important new trends such as the Internet of things, Big Data, virtual and augmented reality, 3-D printing, blockchain technologies, artificial intelligence, robotics, nanotechnology, and biotechnology.

A number of studies point towards the substantial potential employment impacts and calculate the number of 'jobs at risk of automation'. For example, a recent OECD study (OECD, 2019a) states that some 14% of jobs are at high risk of automation, and 32% of jobs could be radically transformed (though these numbers greatly vary across countries).

There are, however, several important caveats to such numbers. First, in most studies in this area, the speed and time dimension of job destruction (and workers' displacement) are not mentioned or rather

---

* Disclaimer: The views expressed in the Opinion Corner section of the Monthly Report are exclusively those of the authors and do not necessarily represent the official view of wiiw.

1 R. Solow (1987), 'We'd better watch out', *The New York Times Book Review*, 12 July, p. 36.

vague.[2] In reality, the diffusion of new technologies may proceed at a slower pace than generally assumed, and at different speeds across industries and countries (see e.g. Vinoski, 2017). The process therefore might be considered to be less disruptive for the labour market than the sheer numbers cited above suggest.

Second, while acknowledging the potentially disruptive impacts on future jobs and skill needs, and the potential for societal transformations in general, one also has to take into account the job-creating potential in producing these new technologies and the instalment of new capital.

Third, in most of the literature it seems to be argued that these new technologies are (almost perfect) substitutes of labour. However, in reality it might be that they are rather substitutes for older types of capital (e.g. robots replace older production lines rather than workers). This implies that the impact on employment levels is limited.

Fourth, in some countries – particularly Central and Eastern European countries – labour shortages are arising due to demographic reasons. In such a situation, automation and digitalisation could help to sustain labour productivity and value added growth (see Stehrer and Leitner, 2019; Leitner et al., 2019).

NET EMPLOYMENT IMPACT LIMITED, BUT SOCIAL TRANSFORMATIONS COULD BE SIGNIFICANT

The empirical literature so far points towards a small positive impact of robot adoption on labour productivity growth, with the effect on employment being unclear (but in general small). However, research in this area is still limited by difficulties in measuring the various aspects of the 'digital economy' (see IMF, 2018 and OECD, 2019b); therefore it might be too early for conclusive results.

The social impacts, though, could well be quite significant. The effects of new technologies on many aspects of personal and social life (e.g. discussed under headers like 'smart home', 'smart health', etc.) and economic matters and work (Industry 4.0, autonomous driving, etc.) could be important – see e.g. Tegmark (2017) and Brynjolfsson and McAfee (2014).

The policy debate around the impact of new technologies on the labour market should therefore focus on issues such as new skills requirements, challenges for the education system (including life-long learning and adult training), the impact on work relationships, working standards and employment protection, inequality, security issues and personal rights, and other social changes. The issues will certainly pose challenges to both policy-makers and civil society in the coming years (see e.g. Servoz, 2019). Finally, the potential of the new technologies to address other important challenges like population ageing and climate change also needs to be highlighted in the debate.

---

[2] 'According to our estimate, 47% of total US employment is in the high risk category, meaning that associated occupations are potentially automatable *over some unspecified years*, perhaps a decade or two.' (Frey and Osborne, 2017, p. 265, emphasis added.)

REFERENCES

Brynjolfsson, E. and A. McAfee (2014), *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W.W. Norton & Company, New York.

Frey, C.B. and M. Osborn (2017), 'The future of employment: How susceptible are jobs to computerisation?', *Technological Forecasting and Social Change*, 114, pp. 254-280.

IMF (2018), Measuring the digital economy, *IMF Staff Working Paper*.

Leitner, S., R. Stehrer and R. Grieveson (2019), EU Faces a Tough Demographic Reckoning, *wiiw Policy Notes and Reports*, No. 30.

OECD (2019a), *The Future of Work*, Paris.

OECD (2019b), *Measuring the Digital Transformation: A Roadmap for the Future*, Paris.

Ricardo, D. (1821), *On the Principles of Political Economy and Taxation*, 3rd edition, John Murray, London.

Rifikin, J. (1995), *The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-Market Era*, G.P. Putnam's Sons, New York.

Servoz, M. (2019), 'AI. The Future of Work? Work of the Future! On how artificial intelligence, robotics and automation are transforming jobs and the economy in Europe', Report for the European Commission.

Stehrer, R. and S.M. Leitner (2019), Demographic Challenges for Labour Supply and Growth, *wiiw Research Report*, No. 439.

Tegmark, M. (2017), *Life 3.0: Being Human in the Age of Artificial Intelligence,* Alfred A. Knopf, New York.

Vinoski, J. (2018), 'Will A Robot Take My Manufacturing Job? Yes, No, And Maybe', https://www.forbes.com/sites/jimvinoski/2018/09/03/will-a-robot-take-my-manufacturing-job-yes-no-and-maybe/#692c3317123f

Robot adoption in the EU-CEE and the rest of the EU

BY OLIVER REITER

Economists debate whether the introduction of robots in the production process has the potential to severely disrupt the labour market by inducing massive lay-offs of workers. This article reviews current research on the potential impact of robots on the labour market as well as presents summary statistics on the adoption of robots in the EU.

CONSEQUENCES OF ROBOTISATION STILL UNCLEAR

Estimates of the number of jobs being at risk of robotisation vary by a wide margin. For instance, in a widely discussed paper Frey and Osborne (2017) warn that up to 47% of all current jobs in the United States might be 'computerisable'. Other researchers paint a much more conservative picture. Arntz, Gregory and Zierahn (2016) decompose each job into the tasks it contains and evaluate the 'automatibility' of each task. They estimate that only up to 9% of jobs are currently automatable. Nedelkoska and Quintini (2018) expand the country and occupational title coverage of Arntz, Gregory and Zierahn (2016) and come to the conclusion that around 14% of jobs are in risk of being automatised. Both Arntz, Gregory and Zierahn (2016) and Nedelkoska and Quintini (2018), however, stress that this risk is unevenly distributed and that low-skilled jobs face a higher risk of being automated.

Similarly, the literature has come to very different estimates of the effects of the adoption of robots on the labour market. On the one hand, it may lead to a destruction of jobs in one part of the economy. This destruction can lead to grave repercussions, such as in the case of the introduction of weaving machines in the early 19th century which destroyed many jobs in the weaving industry and led to widespread, even violent, protests (see Stöllinger, 2018). However, it may create jobs in another part of the economy as well. These general equilibrium effects are important to consider, as they can heavily influence the direction of the overall effect of the introduction of robots on employment.

Autor and Salomons (2018) are among the researchers that study these general equilibrium effects. Rather than relying on a specific type of technological progress, they use total factor productivity (TFP) and analyse the different channels through which increases in TFP affect the labour market. They identify three such channels: own-industry effects (direct effect), between-industry cross-country effects and final demand effects. They do find that the direct effect of an increase in TFP in an industry sector decreases employment in that sector. However, when adding the two indirect effects (between-industry and final demand effects), the overall outcome of an increase in TFP becomes positive.

There is however also research that paints a less rosy picture. Graetz and Michaels (2018) use data on the adoption of robots in industries and analyse its effect on labour productivity growth, employment, total factor productivity and output prices. Their results indicate that increased adoption of robots leads to higher labour productivity and total factor productivity growth and lower output prices. While robot adoption seems to have no effect on total employment, it does negatively affect the employment situation of low-skilled workers. Similar results can be found in a recent report by the EBRD (see EBRD, 2018) for the transition economies of Central, East and Southeast Europe: The overall effect of robotisation on the labour market may be small, but low-skilled workers are disproportionally more affected by robots.

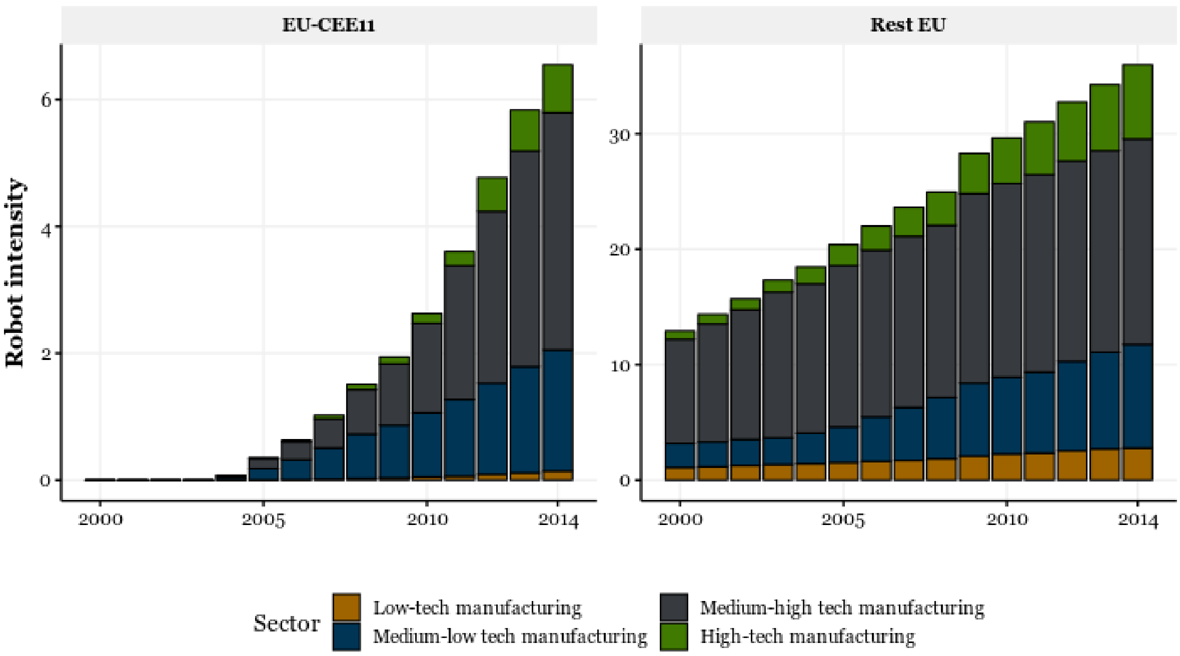
Even more alarming are the findings by Acemoglu and Restrepo (2017) who studied the impact of robotisation on the US labour market. They found that the adoption of robots leads to large and robust declines in employment and wages.

In summary, recent research shows that the adoption of robots in the production process *does* have the potential to disrupt the labour market. Even though the overall employment effect may be small, the decline in demand for low-skilled jobs could lead to serious economic and social upheavals.

TRENDS IN ROBOT ADOPTION

The data below stem from the International Federation of Robots, which collects data on the stocks and flows (i.e. new acquisitions) of industrial robots (see International Federation of Robots (IFR), 2018). 'Industrial robots' are defined as an 'automatically controlled, reprogrammable multipurpose manipulator programmable in three or more axes'[1]. This data source is combined with the World Input-Output Database (WIOD) and the Socio-Economic Accounts (SEA) (Timmer et al., 2015).

Figure 1 / Number of robots per million of hours worked, by sector



Source: IFR data, author's calculation.

[1] See International Federation of Robots (IFR) (2018), p. 29.

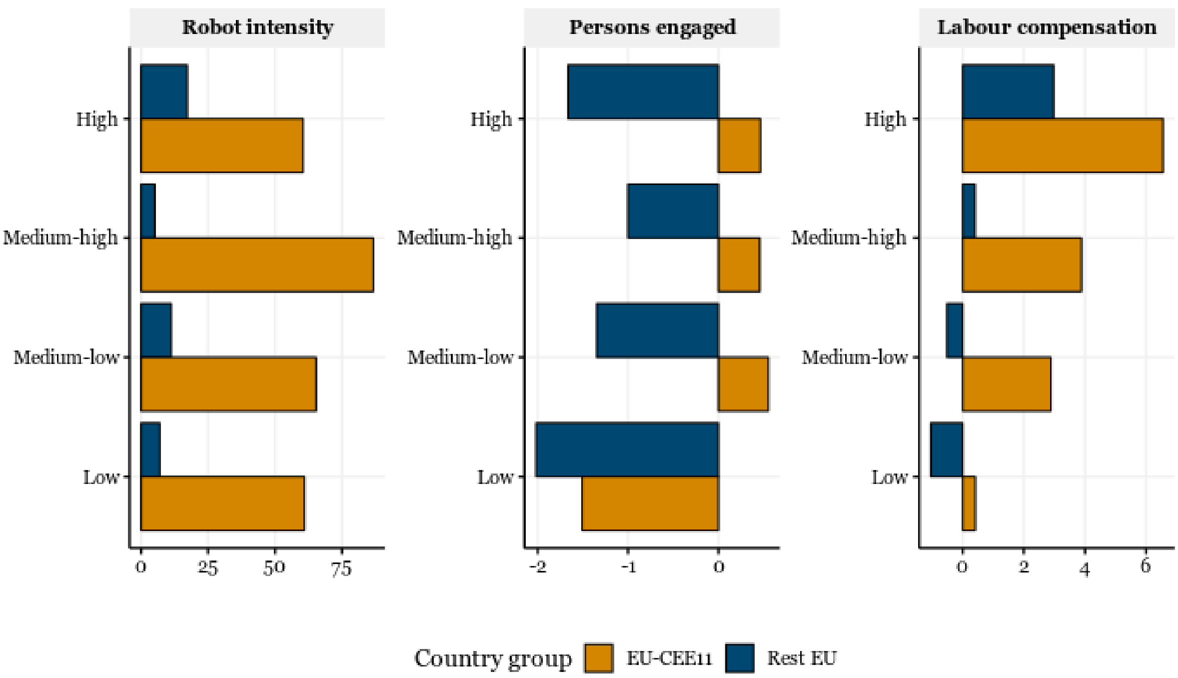
Figure 1 gives an overview of the robot intensity (defined as the number of robots per million hours worked) in EU-CEE11 countries and the rest of the EU.[2] It shows the robot density only in manufacturing; the average share of the other sectors (agriculture, mining and services) in the total number of robots is just 2%. Note that the y axis is different for the two panels: Even though the adoption of robots increased substantially in the EU-CEE11, it is still only at around 17% of the level in the rest of the EU.

The sectoral distribution of robots is similar in both country groups. We can see that the majority of robots are used in the high-technology sectors (medium-high- and high-technology sectors in Figure 1). The medium-high-tech sector contains industries such as manufacturing of chemicals, electrical equipment and automobiles, whereas the high-tech sector is made up only of pharmaceutical products and manufacture of computers. In the low- and medium-low-tech manufacturing industries (which contain the manufacture of food, textiles, furniture, plastics and metals), robots are not used as often as in the higher-tech manufacturing sectors.

Figure 2 presents a comparison of the growth rates of robot intensity for the two country groups. We can see that in the EU-CEE11 countries, robot intensity grew much faster than in the rest of the EU (starting from a much lower level). However, while in the EU-CEE11 it was the medium-tech manufacturing sectors which were the faster growing ones, in the rest of the EU it was the high-tech and medium-low-tech sectors that increased their robots usage the most.

Figure 2 / Robot intensity, employment and labour compensation, 2000-2014

Average yearly growth rates in percent



Source: IFR data and WIOD data, author's calculation.

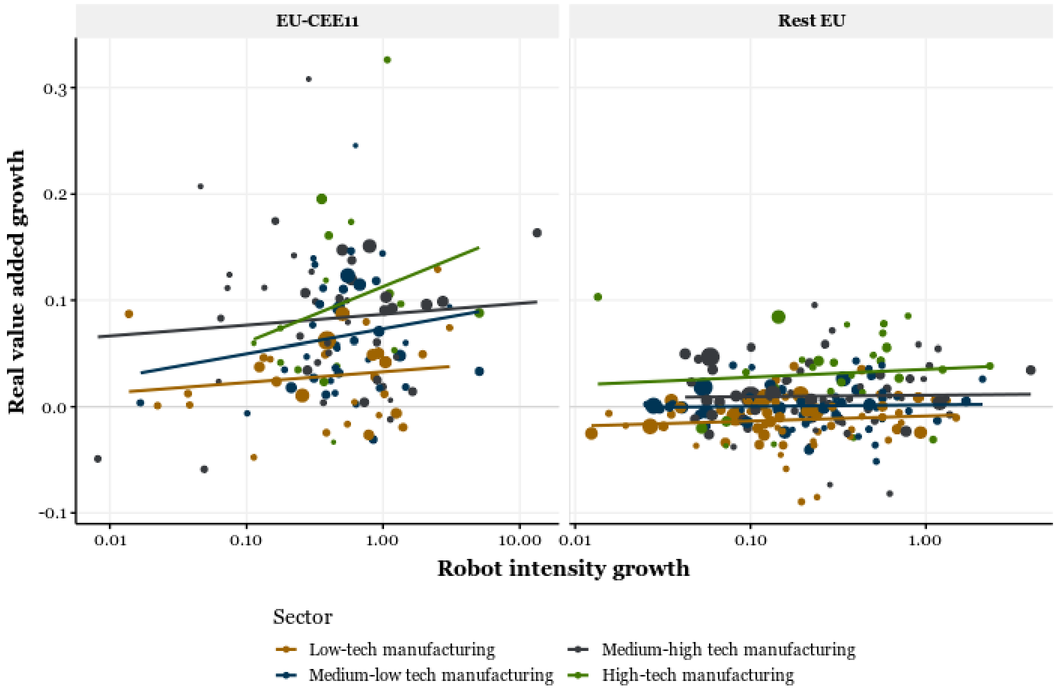
[2] The industry list is provided in the appendix.

Figure 2 also shows growth rates for two other interesting labour market indicators: employment and real wage growth. It is a well-known fact that employment in manufacturing has been declining in most advanced economies, so the figures presented in Figure 2 come as no surprise. For the EU-CEE11, however, there has been positive employment growth in manufacturing, except for the low-tech sector.

In the rest of the EU, salaries in the low- and medium-low-tech industries have been declining over the whole time period, while they were slowly growing in the medium-high-tech sector and strongly growing in the high-tech sector. The ranking of the growth rates has been the same for the EU-CEE11 countries, however, the low- and medium-low-tech industries did experience positive labour compensation growth rates.

Figure 3 complements Figure 2 by juxtaposing the average growth rates of robot intensity and real value added over the period 2000 to 2014 for each country-industry. The size of the point corresponds to hours worked in that industry and the line shows the result of a linear regression for each industry.

Figure 3 / Real value added growth and robot intensification

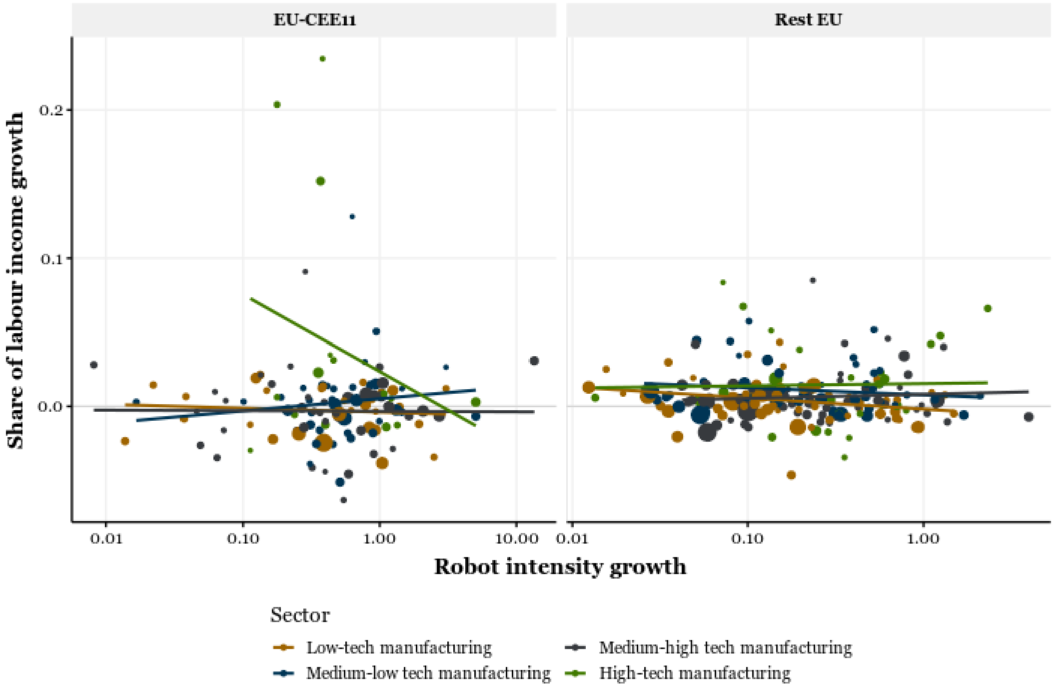


Source: IFR data and WIOD data, author's calculation.

The figure shows that higher growth of robot intensity is not universally associated with higher real value added growth. In fact, we only find a positive association in the high-tech sector in the EU-CEE11 countries. In other sectors and in the rest of the EU, robot intensity growth seems to have no effect on real value added growth.

We see a similar situation when we look at Figure 4 where robot intensity growth and the development of the share of labour income are compared. Again, it is the high-tech sector in the EU-CEE11 countries that stands out as the only sector which shows a stark negative relationship between the two variables.

Figure 4 / Share of labour income development and robot intensification



Source: IFR data and WIOD data, author's calculation.

Even though we see a lot of country-sectors whose share of labour income decreased over the observed time span (i.e. points that lie below the horizontal zero line), we are unable to find a clear connection to the adoption of robots.

CONCLUSION

The findings of the literature on the issue of robot adoption and its effect on the labour market have been highly contradictory. While according to some authors a great number of jobs are potentially automatable, other researchers find only small negative effects on employment and even positive effects on wages.

In the EU, robots are mainly employed in the medium-high- and high-tech manufacturing sectors. However, the highest growth in robot intensity – at least in Western Europe – has been observed in high-tech manufacturing. This is also the sector where labour compensation increased the most. At the same time, employment declined in all manufacturing sectors in Western Europe, especially in low-tech manufacturing (while it increased in most manufacturing industries in the EU-CEE11). In general, we cannot find a conclusive correlation between the growth rate of robot intensity and the growth of real value added or the share of labour income.

REFERENCES

Acemoglu, D. and P. Restrepo (2017), 'Robots and Jobs: Evidence from US Labor Markets', *NBER Working Paper* 23285.

Arntz, M., T. Gregory and U. Zierahn (2016), 'The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis', *OECD Social, Employment and Migration Working Papers* 189.

Autor, D. and A. Salomons (2018), 'Is Automation Labor Share-Displacing? Productivity Growth, Employment, and the Labor Share', *Brookings Papers on Economic Activity* 2018(1), pp. 1-87.

EBRD (2018), 'Work in Transition', *Transition Report 2018-2019*.

Frey, C.B. and M.A. Osborne (2017), 'The Future of Employment: How Susceptible Are Jobs to Computerisation?', *Technological Forecasting and Social Change* 114, pp. 254-280.

Graetz, G. and G. Michaels (2018), 'Robots at Work', *Review of Economics and Statistics* 100(5), pp. 753-768.

International Federation of Robots (IFR) (2018), 'World Robotics 2018 Industrial Robots'.

Nedelkoska, L. and G. Quintini (2018), 'Automation, Skills Use and Training', *OECD Social, Employment and Migration Working Papers* 202.

Stöllinger, R. (2018), 'The Luddite Rebellion: Past and Present', *wiiw Monthly Report* 11, pp. 6-11.

Timmer, M.P., E. Dietzenbacher, B. Los, R. Stehrer and G.J. De Vries (2015), 'An Illustrated User Guide to the World Input–Output Database: The Case of Global Automotive Production', *Review of International Economics* 23(3), pp. 575-605.

APPENDIX: INDUSTRY GROUPS

Industry group	Industries
Low-tech manufacturing	Manufacture of food products; beverages and tobacco products
	Manufacture of textiles, wearing apparel, leather and related products
	Manufacture of wood, paper, printing and reproduction
	Manufacture of furniture; other manufacturing
Medium-low-tech manufacturing	Manufacture of rubber and plastic products
	Manufacture of other non-metallic mineral products
	Manufacture of basic metals
	Manufacture of fabricated metal products, except machinery and equipment
Medium-high-tech manufacturing	Manufacture of coke and refined petroleum products; chemicals and chemical products
	Manufacture of electrical equipment
	Manufacture of machinery and equipment n.e.c.
	Manufacture of motor vehicles, trailers and semi-trailers
	Manufacture of other transport equipment
High-tech manufacturing	Manufacture of basic pharmaceutical products and pharmaceutical preparations
	Manufacture of computer, electronic and optical products

Negative natural interest rates and secular stagnation: Much ado about nothing?

BY LEON PODKAMINER

This note is critical of the concept of a natural interest rate and doubts the relevance of claims about the 'natural' interest rates becoming negative recently.

> *'There is a certain rate of interest on loans which is neutral in respect to commodity prices, and tends neither to raise nor to lower them. This is necessarily the same as the rate of interest which would be determined by supply and demand if no use were made of money and all lending were effected in the form of real capital goods …'*
>
> *Knut Wicksell, 1936 (1898), p. 102*

SECULAR STAGNATION AND THE NEGATIVE NATURAL RATES OF INTEREST

Like other key variables of mainstream macroeconomics (potential output and output gap) the 'natural' (or 'neutral') interest rate is unobservable – and thus not subject to measurement.[1] (Actually, the key mainstream 'unobservable variables' are intimately related to one another.)

Despite its ghostly appearance, the natural interest rate (commonly denoted as r*) plays quite a prominent role in the mainstream monetary theories – and, apparently, also for the practice of monetary policy making. The size of r* is often claimed to be an essential benchmark for monetary policy – and the research departments at central banks busy themselves with attempts at 'guesstimating' its numerical values.

Not long ago the concept of the natural interest rate has been invoked while attempting to rationalise anaemic recovery ('secular stagnation') following the 2009 Great Recession. Specifically, it is claimed that r* must have turned negative (see e.g. Summers, 2014; ECB, 2018) thus activating the 'zero lower bound' and thus becoming directly responsible for 'secular stagnation'.

The reasons why r* should have at last become negative (following its presumed long-term decline) have not been convincingly explained while its 'estimates' are more than problematic.[2] In particular, it is not satisfactory to suggest that falling/negative r* follows, one way or another, from '*a significant shift in the natural balance between savings and investment*' (see e.g. Summers, 2014, p. 69).

---

1 NAIRU, another notorious unobservable, belongs to an older version of the mainstream. In the state of the art macro (epitomised by the DSGE models) there is no place for unemployment at all (but only for a free utility-maximising choice between work and leisure).

2 The leading 'estimation methodology' (Laubach and Williams, 2003) assumes that r* must stand in a certain relation to the output gap. A logical circularity of this approach would seem quite obvious. The output gap is not only unobservable itself, but also conceptually dependent on r* (see the IS formula below).

ARE 'EXCESSIVE' SAVINGS RESPONSIBLE FOR FALLING (NEGATIVE) R*?

The sums of money invested by any firm augmenting its stock of fixed assets may depend on (or even be determined by) the stock of money savings *accumulated* by that firm (or by its willing lenders) in the past, or even during the investment period. It is however an elementary mistake to suppose that the magnitude of *aggregate* national investment in a given period is determined by the aggregate of sums of money (or some other financial assets) saved *during* that period, or before it.

Rudimentary macroeconomics identifies savings with investment (for simplicity here we are ignoring the foreign balance, a GDP component). At the *macro* level savings and investments are two sides of the same coin. No imbalance between the two items is then possible. With investment identically equal to saving, the interest rate (natural or any other) cannot be determined by their equality. In practice it is possible to draw conclusions from the imbalances between saving and investment only when the term 'saving' is somehow misinterpreted.

Observe that at the macro level causality runs (logically but not temporarily) from current investments to current savings – with the latter mirroring the former instantaneously.[3] The suggestion that investments may be too low because so are savings is thus doubly absurd, because it suggests a possibility of imbalance between the two and presumes the causality running from savings to investment. The same qualification applies to the idea of the 'global savings glut' – income unspent (and yet non-invested) aimlessly 'vagabonding' around the globe.

THE NATURAL INTEREST RATE IN THE BASIC DSGE MODEL

The existence of potentially harmful effects of negative r* could be squared with the following form of the Investment-Saving (IS) function featuring in the basic version of the New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model[4]:

$$y_t = E_t y_{t+1} – \sigma(i_t – E_t \pi_{t+1} – r_t^*) + \text{'shock'}$$

where: y is the output gap, t indexes time, E is the (rational) expectation (of output gap, inflation) by the 'representative agent', σ is a parameter (0<σ<1) related to the representative agent's preference for consumption, i is the central bank's nominal policy interest rate, π is the inflation rate, r* is the natural interest rate and 'shock' is yet another unobservable (in addition to the output gap and the 'expected' items on the right-hand side of the IS equation). It is worth observing that the term $E_t y_{t+1}$ must be interpreted as the 'representative agent' (rational) expectation of the future output gap. Thus such an 'agent' is endowed not only with a rational foresight, but also with the way of assessing an *unobservable* item.

---

3 Most Central European countries emerged from WWII without any financial, or monetary, 'savings' whatsoever. And yet very high investments (reconstruction and industrialisation) started right away in most of them. Those investments turned out to represent national savings.

4 See e.g. Galí (2008, p. 49), or Woodford (2003, p. 243). Woodford invokes Wicksell's characterisation of r* while Galí does not. Of course it is a misnomer to name the DSGE equation relating the output gap to the interest rate **The Investment-Saving** schedule (or function). The model ignores investment spending. All output produced is consumed momentarily (thus there are no savings). Galí (2008) develops a succession of DSGE models – none of them allows for investment in fixed assets.

The term ($i_t – E_t\pi_{t+1}$) should represent the central bank's interest rate (in real terms). Under stable (and predictable) inflation $E_t\pi_{t+1}$ can be approximated by current observed inflation: π_t. Even if i_t is small (as it usually is under low inflation or deflation) a negative r_t* would result in the whole term ($i_t – \pi_t – r_t$*) being positive. Thus this term's impact on y_t may only be negative. If that negative impact is sufficiently large (in absolute terms) it could make much of the right-hand side of the IS formula ($E_ty_{t+1} – \sigma(i_t – E_t\pi_{t+1} – r_t^*)$) negative as well. Absent positive shocks, a perpetually negative output gap (y_t <0) would emerge under such conditions.

Arithmetically, the term ($i_t – \pi_t – r_t$*) could here be negative (and thus its impact on y positive) only with a sufficiently negative nominal policy rate (i_t). Because (as seems quite obvious) the nominal policy interest rates cannot be pushed too much below zero (the 'zero lower bound bites') this is not considered a realistic option for ending a permanently negative output gap (or 'secular stagnation'). What remains – if one accepts this version of the IS story – is to 'stay patient' – wait for some positive 'shocks' (perhaps in the form of a fiscal impulse, or the emergence of some asset bubbles), or some inexplicable (exogenous) changes in expectations.

A DIGRESSION: ISN'T THE NATURAL INTEREST RATE AN ECONOMIC UNICORN?

Judging the magnitude of an unobservable variable, such as the natural interest rate, by reference to another unobservable variable (or collection of such variables) is obviously not a very sane approach. Moreover, it may create the impression that such a variable – even if unobservable – does actually exist. But in fact such a variable may be pure fiction, a kind of economic unicorn – i.e. an item with mutually excluding characteristics. Wicksell's original claim that '***There is** a certain rate of interest on loans which is neutral in respect to commodity prices, and tends neither to raise nor to lower them'* presumes the existence of such an equilibrium rate. But what guarantees its existence (and/or its stability and uniqueness)?

The rather curious aspect of the natural interest rate concept is its reference to inflation ('*raising or falling commodity prices*') under 'counterfactual' conditions: absence of money, frictions, shocks and other nuisance factors. But, under the absence of money, the price level remains indeterminate – and so is inflation. At best (under a unique barter-exchange general equilibrium) only the *relative* prices are determinate and can rise or fall – but only vs. one another.

Wicksell's logical error (making reference to inflation in a moneyless economy) has not been corrected by the Neo-Wicksellians. Actually, Woodford (2003, pp. 62-4) dodges the problem. On the one hand it is claimed that the 'price level in a cashless economy is in principle determinate'. But then money is introduced through the back door – in the form of 'central bank liability which may or may not have any physical existence'.[5]

That the DSGE models lack realism (e.g. by ruling out involuntary unemployment or introducing a 'representative agent' amalgamating workers with their employers) and are failing miserably as

[5] Arguably, Wicksell might have assumed that all prices were relative – with gold being the (then) obvious (and immutable) numeraire. Perhaps it was unimaginable to express prices of any commodity (rising or falling) in relation to anything else but gold – without clearly realising the fact that gold was then money after all – as well as yet another commodity.

forecasting tools does not seem to trouble their proponents. But at least they should try to get rid of self-contradictory concepts and ambiguous definitions behind their key variables.

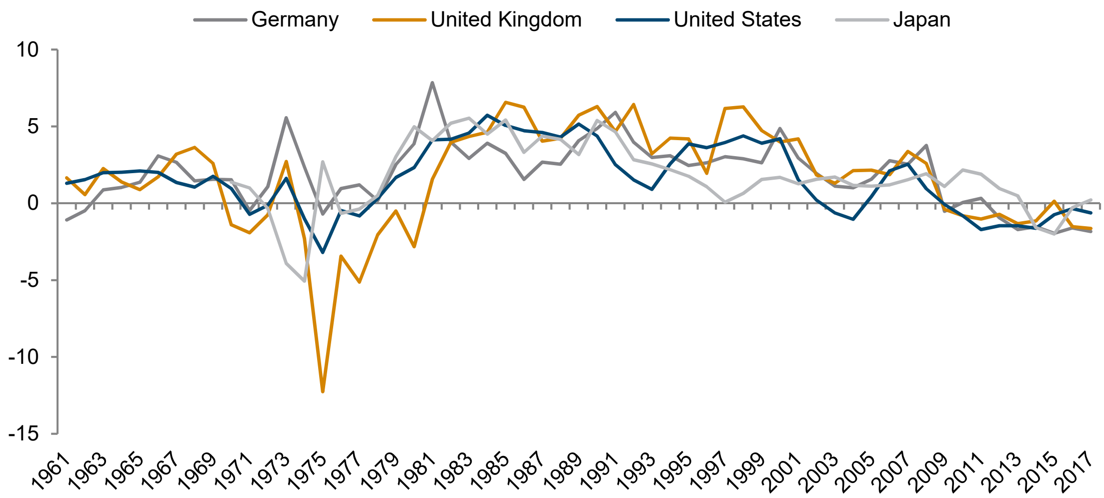
REAL SHORT-TERM INTEREST RATES HAVE FOLLOWED DECLINING TRENDS

Perhaps it may be more acceptable to try to gauge the trends in the natural interest rates (assuming they exist, though not necessarily reflecting the conditions obtaining under 'counterfactual conditions') by direct reference to the observed tendencies with respect to observed inflation and real interest rates.

Inflation, at least in the leading industrial countries, has been downwards trending since at least the early 1990s. This is an aspect of the 'great moderation' which ended in 2009 and was then followed, as far as price levels go, by deflationary tendencies.

Under generally low and fairly stable inflation prevailing since 2009, real interest rates (long since following declining trends) have eventually turned negative – see Figure 1 showing short-term interest rates in major industrial countries since 1961. This seems to support the conviction that the 'natural' interest rates must have followed similarly declining trajectories and ended up in the negative territory. Of course this conviction is not literally consistent with Wicksell's original (or Woodford's newer) definition which required that the economy in question is not only perfectly competitive, but also moneyless. Neither condition is satisfied by the really existing industrial (and almost all other) countries.[6]

Figure 1 / Real short-term interest rates in %, 1961-2017



Note: 'Real short-term interest rate' (AMECO item ISRV) is, essentially, the nominal 3-month money market rate divided by the GDP price deflator.
Source: AMECO.

6 The *models* of perfectly competitive and moneyless (barter) economies (e.g. in the Walrasian tradition) can work excellently. But could one really imagine a moneyless (barter-based) developed market economy to function competitively – or at all?

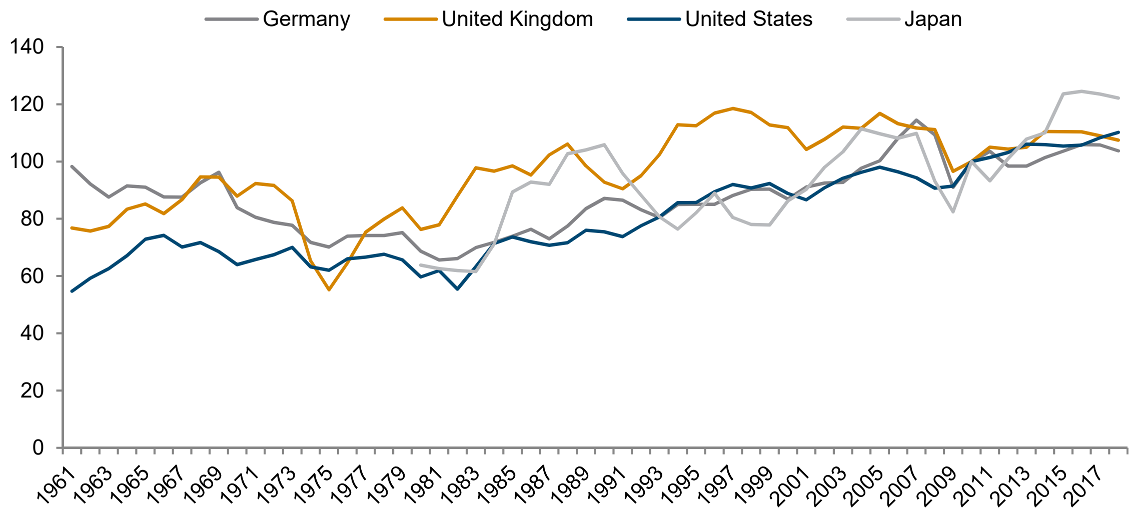
THE NATURAL INTEREST RATES RADICALLY DIVORCED FROM CAPITAL PROFITABILITY?

> *'… It comes to much the same thing to describe it [the natural interest rate] as the current value of the natural rate of interest on capital.'*
>
> *Wicksell, 1936 (1898), p. 102.*

Under Wicksell's alternative characterisation of the natural interest rate (as the rate of return on capital[7]) the factual developments observed since the late 1970s through early 2000s, and then again since 2009, could suggest that the natural interest rate has been *increasing* (see Figure 2).

As can be seen, two apparently equivalent definitions of the natural interest rate suggest qualitatively divergent interpretations of the factual developments. The first suggests that the natural interest rate may have been falling while the second that it may have been rising. The conclusion to be drawn from this is that one does not really know. The natural interest rate may have become negative recently – but it is equally legitimate to claim that it has become pretty large – and positive. Perhaps the most important conclusion would be that its eventual sign and size may not matter at all.

Figure 2 / Net returns on net capital stock in %, 1961- 2018 (2010=100)



Note: 'Net returns on net capital stock' (AMECO item APNDK) is the ratio of net domestic income less employees compensation over net capital stock (at current prices).
Source: AMECO.

[7] Again, let us gloss over the issue of existence/uniqueness of the *natural rate of interest on capital* and of its measurability under 'counterfactual' conditions (absence of money etc.).

THE IRRELEVANCE OF INTEREST RATES (NATURAL OR OTHERWISE)

It is not a problem to 'derive' a simpler 'approximate' formula for IS. Actually such an IS form *not* featuring r* comes first while developing the canonical log-linearised New Keynesian DSGE model (see e.g. Galí, 2008, p. 46). To arrive at the form featuring r*, some semantic effort is required to redefine the variables and parameters of the resulting benchmark DSGE model[8].

The ease with which one can manipulate, in the DSGE models, the attributes of the mythical 'representative worker-employer' (or of the monetary authority, 'firms', 'technology', 'shocks', etc.) is as disquieting as the arbitrariness in 'calibrating' the models' parameters. It may seem advisable to consider as irrelevant and *unfortunately useless '*most state of the art academic monetary economics' (Buiter, 2009). The same applies not only to the concept of a natural micro-founded interest rate but also to the old (Hicks') idea of a negatively-sloping IS schedule. Of course this is not to claim that the IS must be positively-sloping (though this eventuality cannot be ruled out in some circumstances[9]). Instead, it would seem legitimate to take it for granted that the impacts of moderately[10] changing interest rates on output tend to be rather unsystematic, dependent also on the real developments, and actually too difficult to model. In any case, in the real world the effects of moderate interest rate variations seem to be of the second order of importance – in contrast to fiscal and other aggregate demand-side impulses which the current mainstream tends to treat as 'exogenous shocks'.

Understanding the 'secular stagnation' may require the study of real forces behind the historically evolving global consumption and investment trajectories. One of these forces was the overall economic paradigm change of the late 1970s and early 1980s – the rise of neoliberalism as the ruling principle behind economic and social policy making (see e.g. Podkaminer, 2015; Palley, 2018).

It is perhaps not a sheer coincidence that the rise of neoliberalism as the basis of the policy practice coincided with the emergence of the micro-founded 'equilibrium' macroeconomics which has since been obligingly refuting the ('old') Keynesian ideas on which the practical economic policies during the golden era of capitalism (1950-1970) had been founded.

REFERENCES

Buiter, W.H. (2009), The unfortunate uselessness of most 'state of the art' academic monetary economics, *VoxEU*, March.

ECB (2018), The natural rate of interest: estimates, drivers, and challenges to monetary policy, *ECB Occasional Paper Series,* No 217.

Galí, J. (2008), *Monetary Policy, Inflation and the Business Cycle. An Introduction to the New Keynesian Framework*, Princeton University Press.

Laubach, T. and J.C. Williams C. (2003), 'Measuring the Natural Rate of Interest', *The Review of Economics and Statistics*, 85(4), 1063-1070.

8 The benchmark 3-equation DSGE model has – in addition to an IS formula – the equations for the 'new' Phillips curve and the Taylor Rule.

9 See e.g. Podkaminer (1997).

10 Because the DSGE models work with local (log-linearised) approximations around the presumed steady state trajectories, they cannot say anything about the effects of larger changes, or shocks, to the variables or parameters considered.

Palley, T.I. (2018), 'Three globalizations, not two: rethinking the history and economics of trade and globalization, *European Journal of Economics and Economic Policies: Intervention*, 15(2), 174-192.

Podkaminer, L. (1997), 'Upward-Sloping Aggregate Demand Functions, Downward-Sloping Aggregate Supply Functions', *Journal of Post Keynesian Economics,* 20(2), 301-308.

Podkaminer, L. (2015), 'The euro area's secular stagnation and what can be done about it. A post-Keynesian perspective', *Real World Economics Review*, 70, 2-16.

Summers, L.H. (2014), 'U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound', *Business Economics*, 49(2), 65-73.

Wicksell, K. (1936 (1898)), *Interest and Prices. A Study of the Causes Regulating the Value of Money*, translated by R. Kahn (1962 reprint, A. Kelley, New York).

Woodford, M. (2003), *Interest and Prices. Foundations of a Theory of Monetary Policy*, Princeton University Press.

Monthly and quarterly statistics for Central, East and Southeast Europe

The monthly and quarterly statistics cover **22 countries** of the CESEE region. The graphical form of presenting statistical data is intended to facilitate the **analysis of short-term macroeconomic developments**. The set of indicators captures trends in the real and monetary sectors of the economy, in the labour market, as well as in the financial and external sectors.

Baseline data and a variety of other monthly and quarterly statistics, **country-specific** definitions of indicators and **methodological information** on particular time series are **available in the wiiw Monthly Database** under: https://data.wiiw.ac.at/monthly-database.html. Users regularly interested in a certain set of indicators may create a personalised query which can then be quickly downloaded for updates each month.

Conventional signs and abbreviations used

%	per cent
ER	exchange rate
GDP	Gross Domestic Product
HICP	Harmonized Index of Consumer Prices (for new EU Member States)
LFS	Labour Force Survey
NPISHs	Non-profit institutions serving households
p.a.	per annum
PPI	Producer Price Index
reg.	registered

The following national currencies are used:

ALL	Albanian lek	HRK	Croatian kuna	RON	Romanian leu
BAM	Bosnian convertible mark	HUF	Hungarian forint	RSD	Serbian dinar
BGN	Bulgarian lev	KZT	Kazakh tenge	RUB	Russian rouble
BYN	Belarusian rouble	MKD	Macedonian denar	TRY	Turkish lira
CZK	Czech koruna	PLN	Polish zloty	UAH	Ukrainian hryvnia

EUR euro – national currency for Montenegro, Kosovo and for the euro-area countries Estonia (from January 2011, euro-fixed before), Latvia (from January 2014, euro-fixed before), Lithuania (from January 2015, euro-fixed before), Slovakia (from January 2009, euro-fixed before) and Slovenia (from January 2007, euro-fixed before).

Sources of statistical data: Eurostat, National Statistical Offices, Central Banks and Public Employment Services; wiiw estimates.

Online database access

wiiw Annual Database

wiiw Monthly Database

wiiw FDI Database

The wiiw databases are accessible via a simple web interface, with only one password needed to access all databases (and all wiiw publications).

You may access the databases here: https://data.wiiw.ac.at.

If you have not yet registered, you can do so here: https://wiiw.ac.at/register.html.

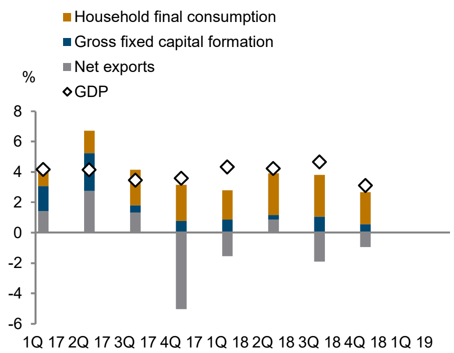
Service package available

We offer an additional service package that allows you to access all databases – a Premium Membership, at a price of € 2,300 (instead of € 2,000 as for the Basic Membership). Your usual package will, of course, remain available as well.

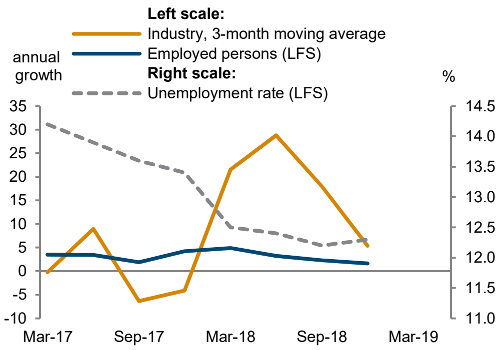
For more information on database access for Members and on Membership conditions, please contact Ms. Barbara Pill (pill@wiiw.ac.at), phone: (+43-1) 533 66 10.

Albania

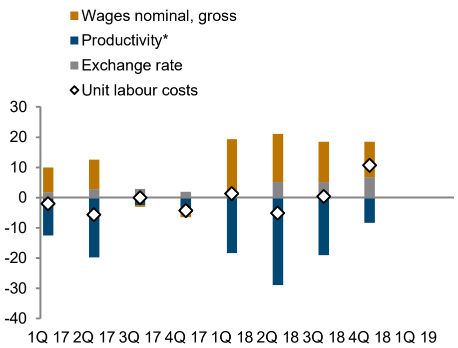
Real GDP growth and contributions
year-on-year



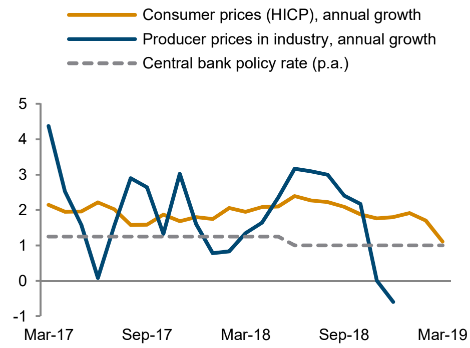
Real sector development
in %



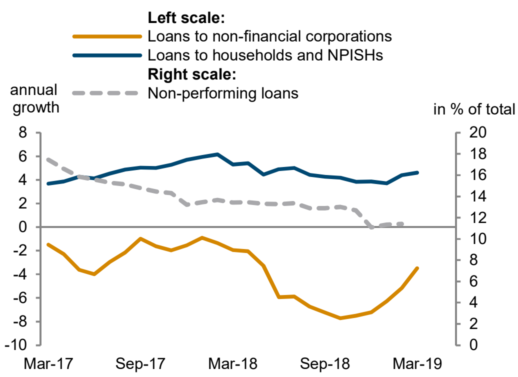
Unit labour costs in industry
annual growth rate in %



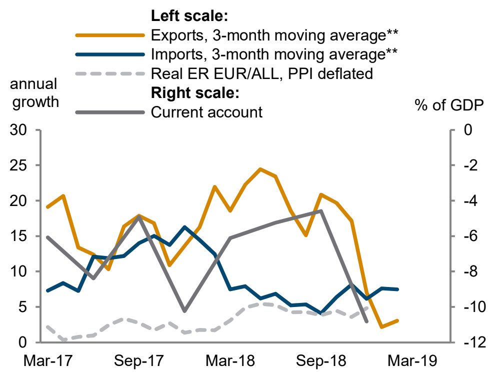
Inflation and policy rate
in %



Financial indicators
in %



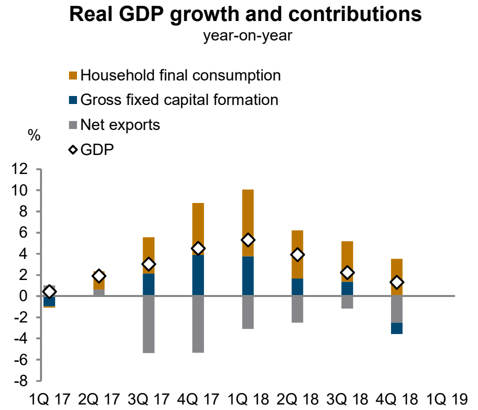
External sector development
in %

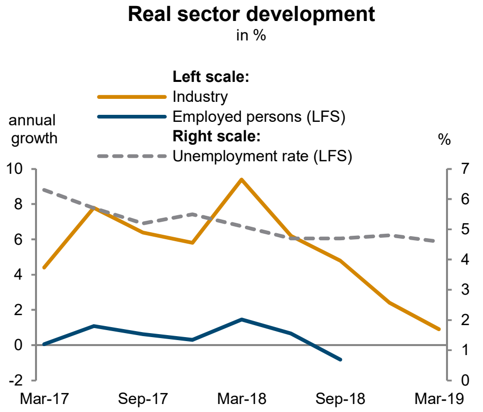


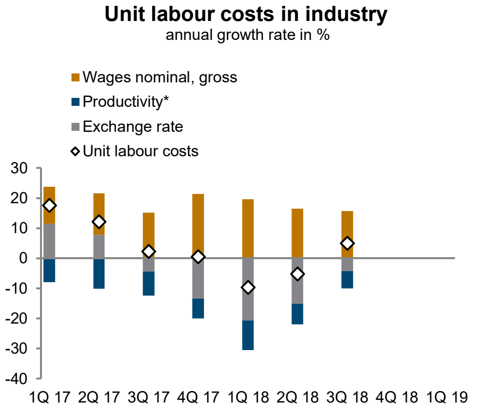
*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

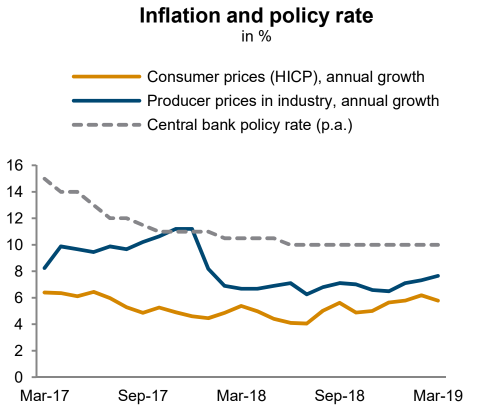
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

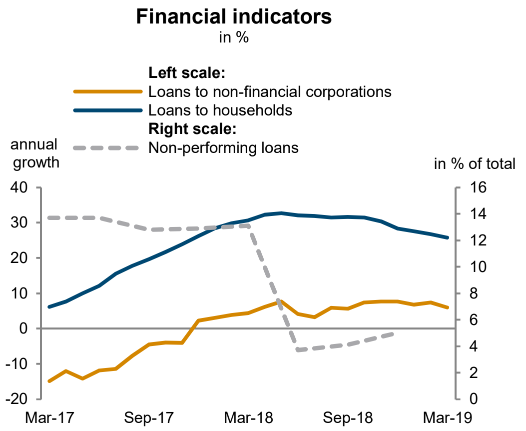
Belarus

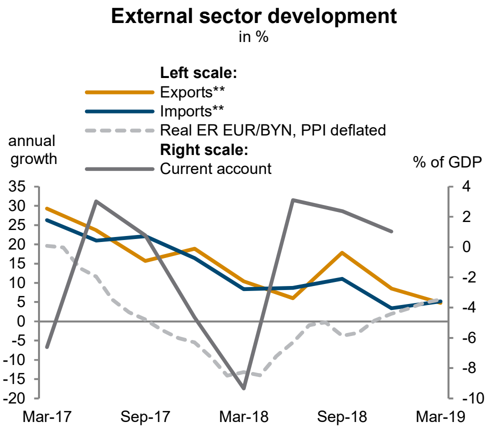










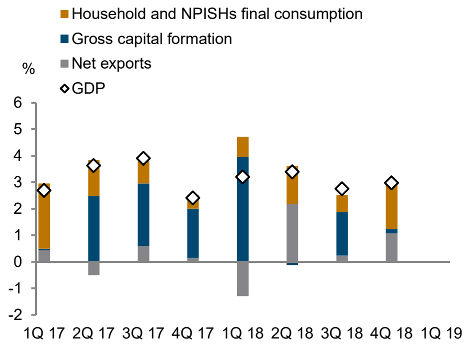


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

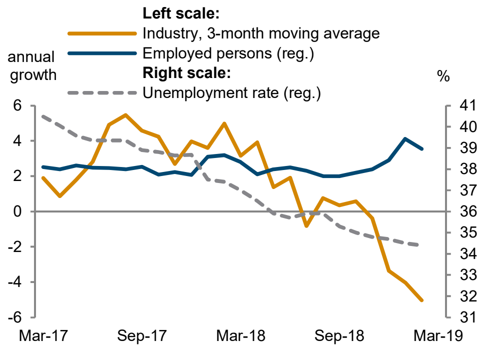
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Bosnia and Herzegovina

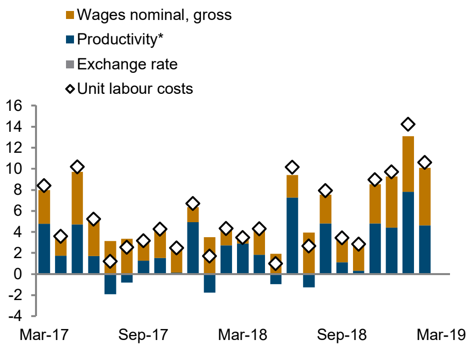
Real GDP growth and contributions
year-on-year



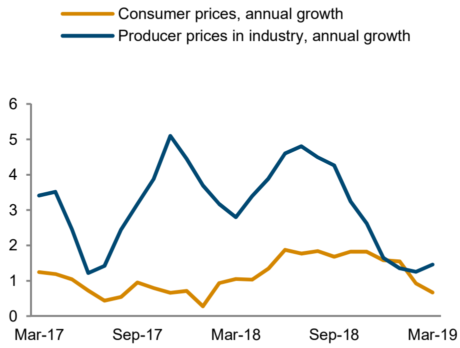
Real sector development
in %



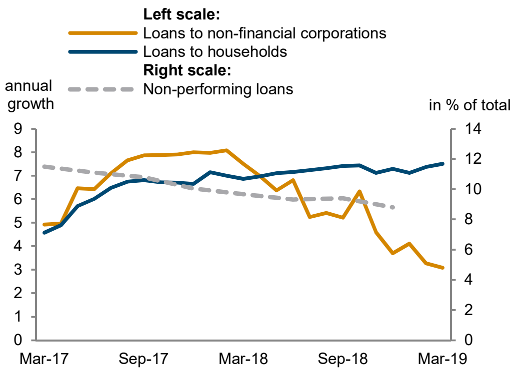
Unit labour costs in industry
annual growth rate in %



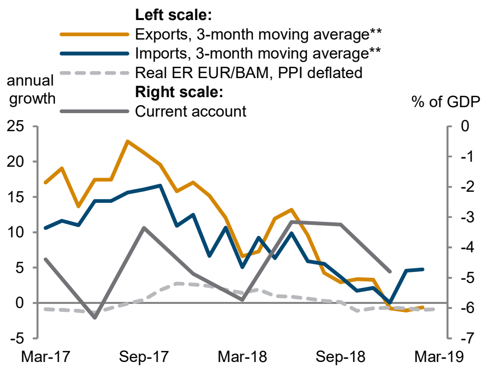
Inflation
in %



Financial indicators
in %



External sector development
in %

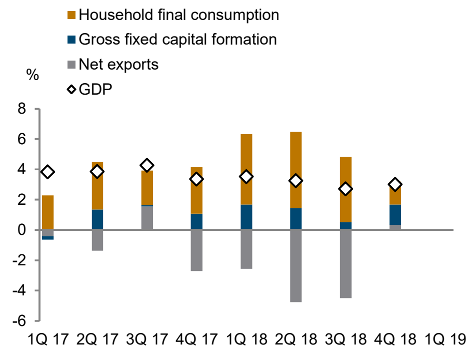


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

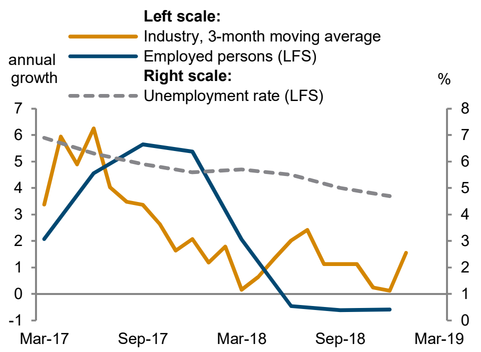
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Bulgaria

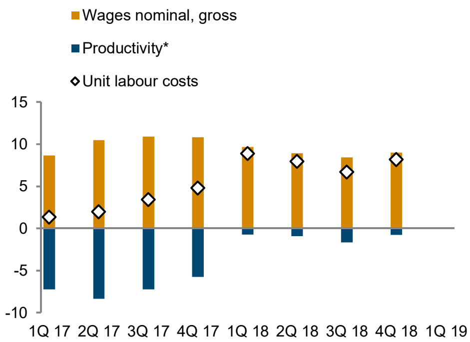
Real GDP growth and contributions
year-on-year



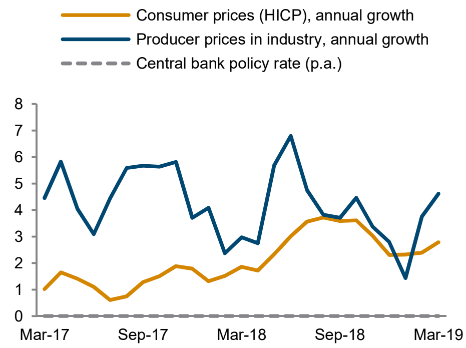
Real sector development
in %



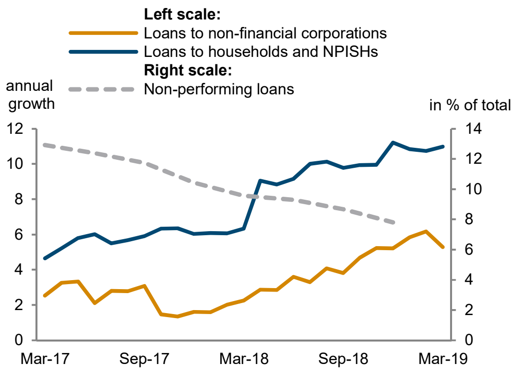
Unit labour costs in industry
annual growth rate in %



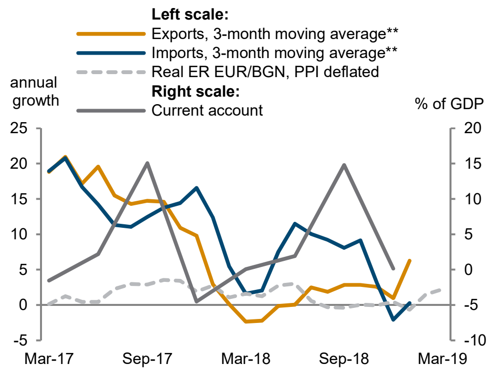
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %

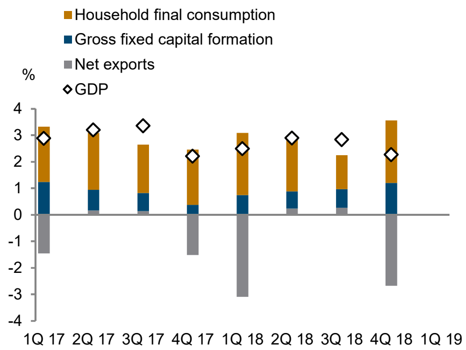


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

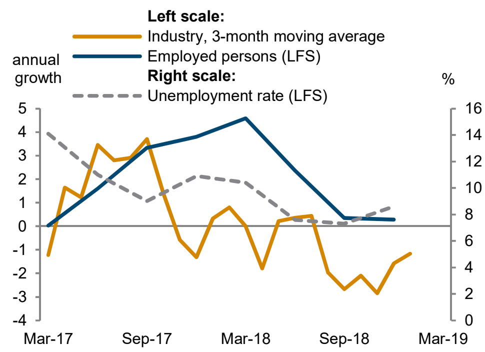
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Croatia

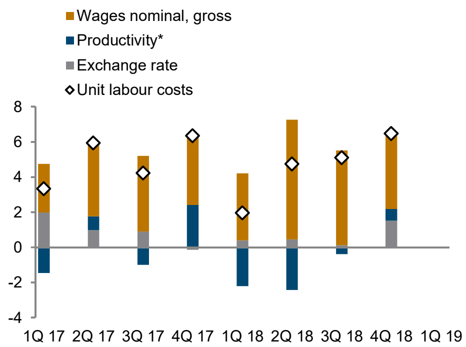
Real GDP growth and contributions
year-on-year



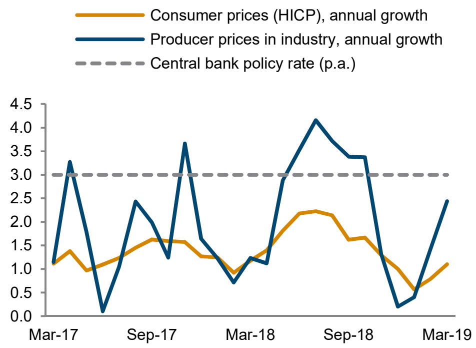
Real sector development
in %



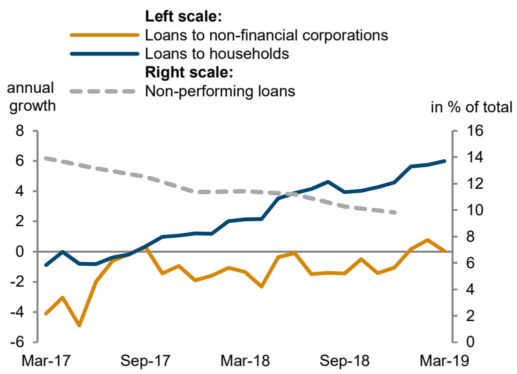
Unit labour costs in industry
annual growth rate in %



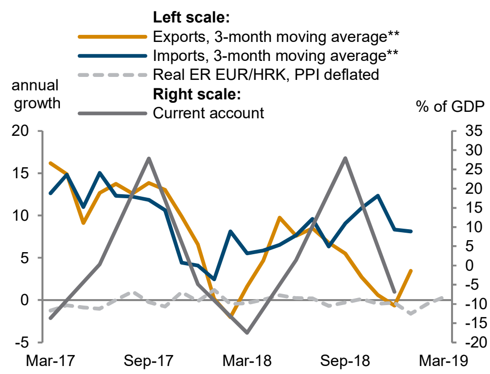
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %

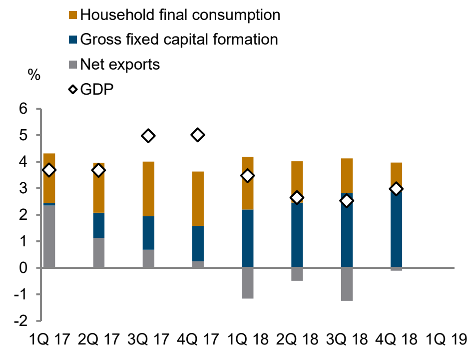


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

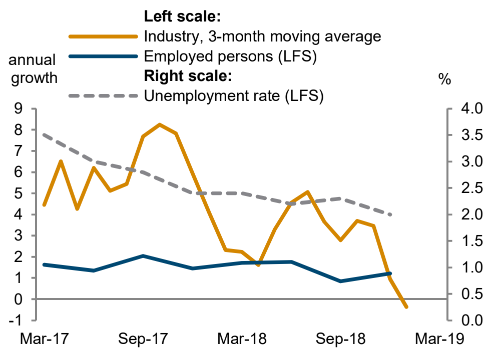
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Czech Republic

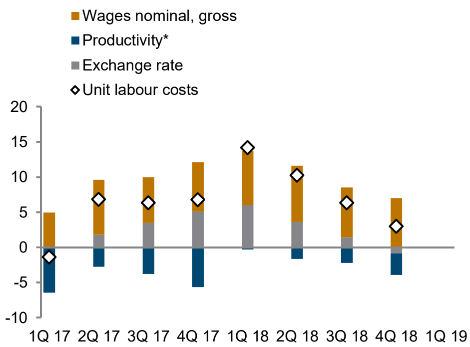
Real GDP growth and contributions
year-on-year



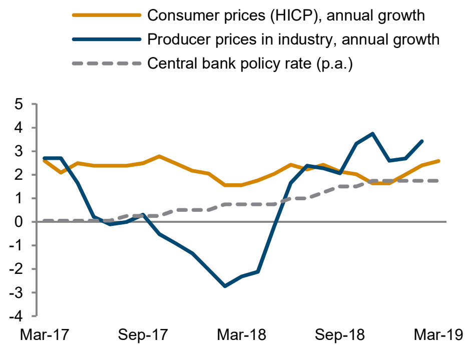
Real sector development
in %



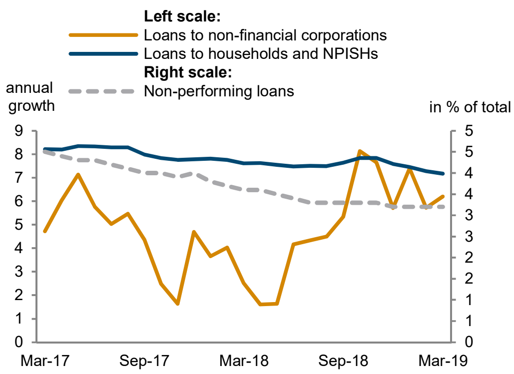
Unit labour costs in industry
annual growth rate in %



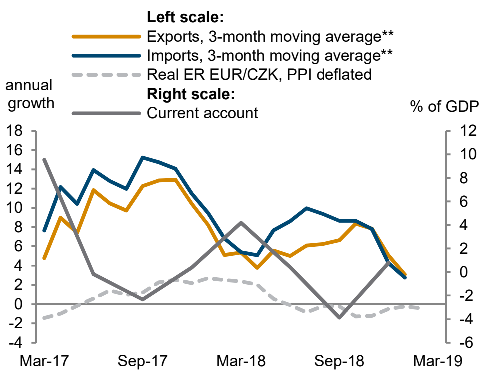
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %

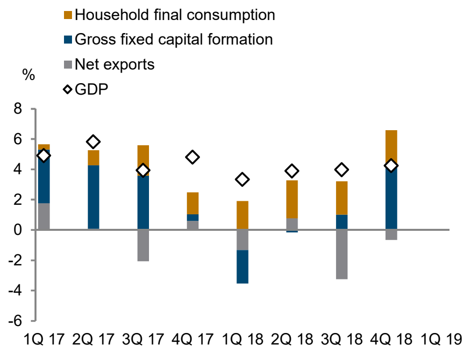


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

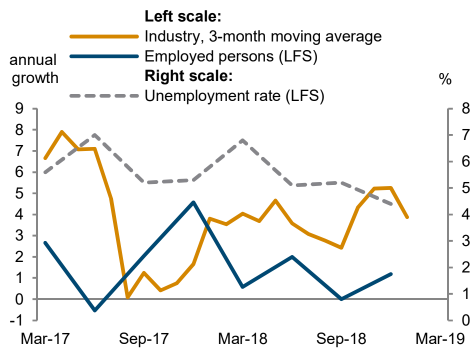
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Estonia

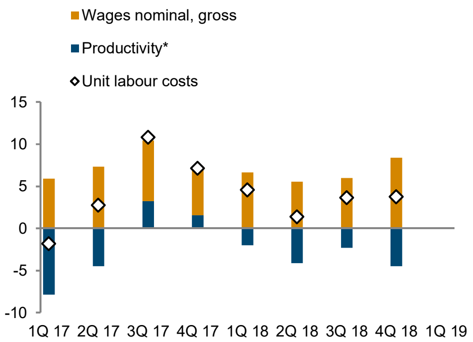
Real GDP growth and contributions
year-on-year



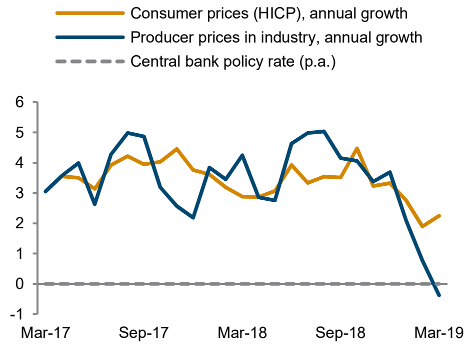
Real sector development
in %



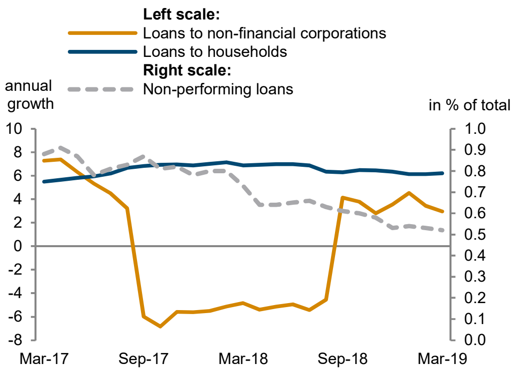
Unit labour costs in industry
annual growth rate in %



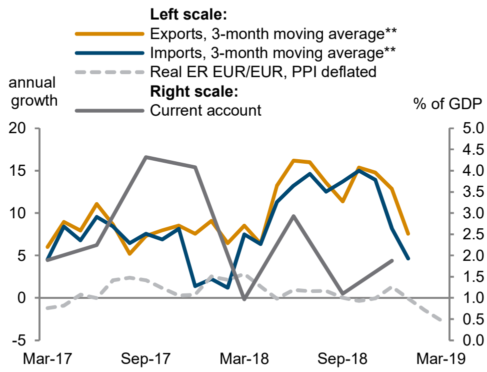
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %

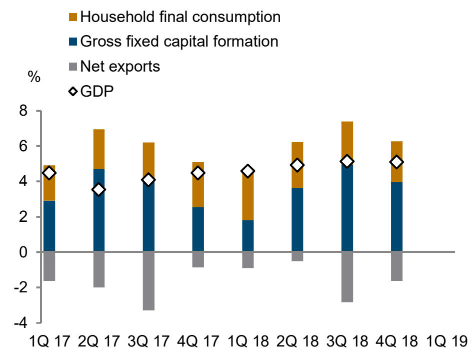


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

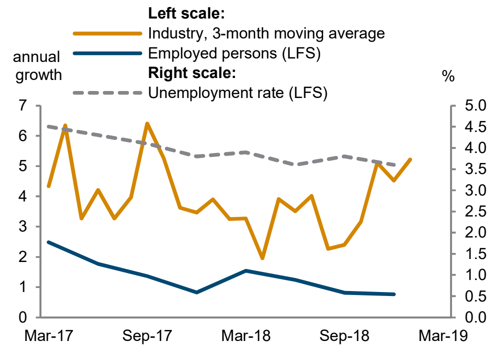
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under: https://data.wiiw.ac.at/monthly-database.html

Hungary

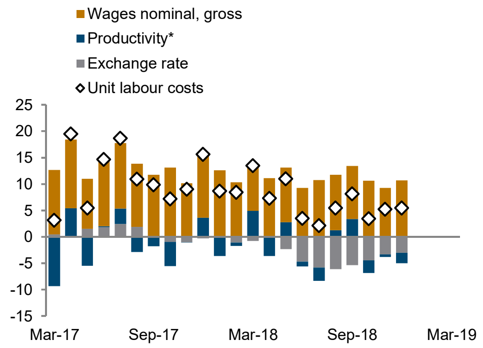
Real GDP growth and contributions
year-on-year



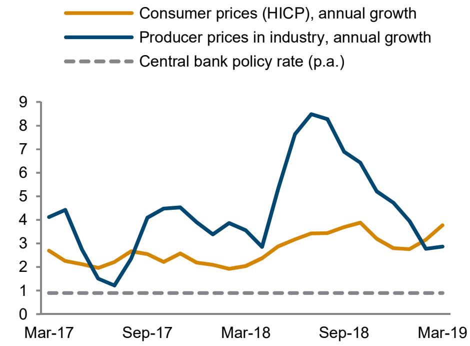
Real sector development
in %



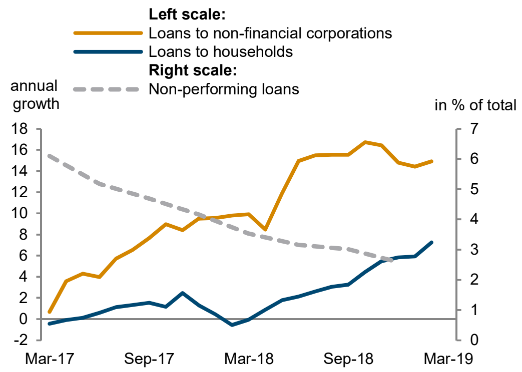
Unit labour costs in industry
annual growth rate in %



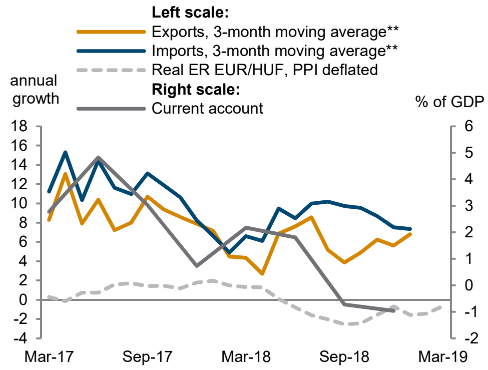
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %

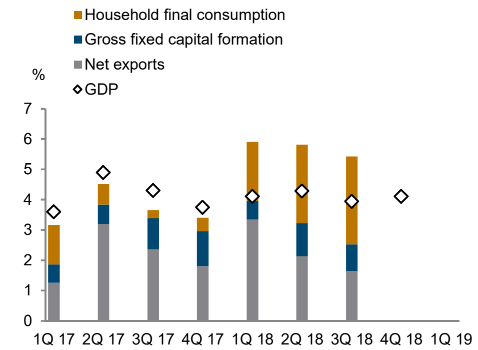


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

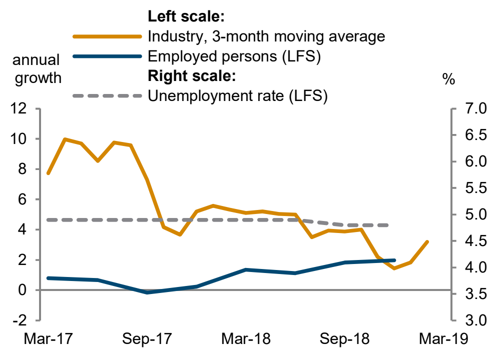
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Kazakhstan

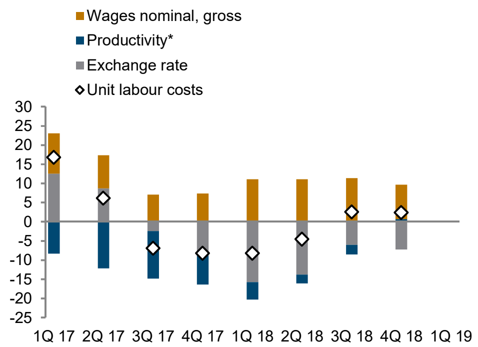
Real GDP growth and contributions
year-on-year



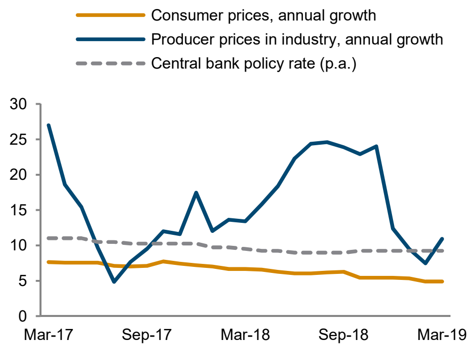
Real sector development
in %



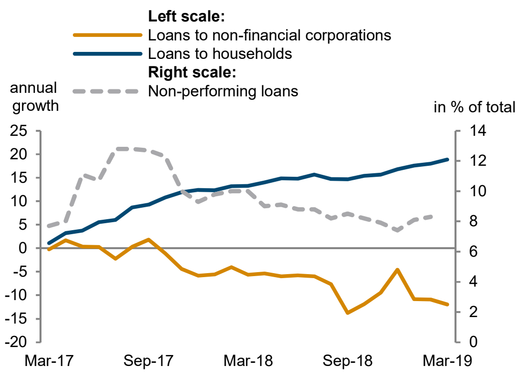
Unit labour costs in industry
annual growth rate in %



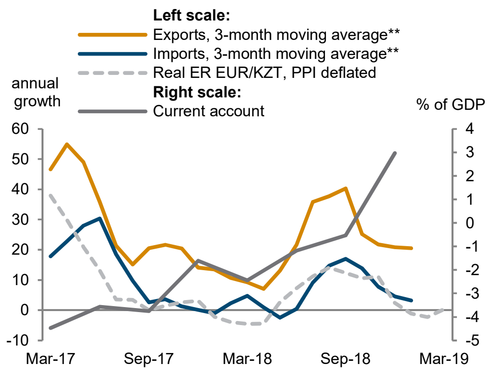
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %

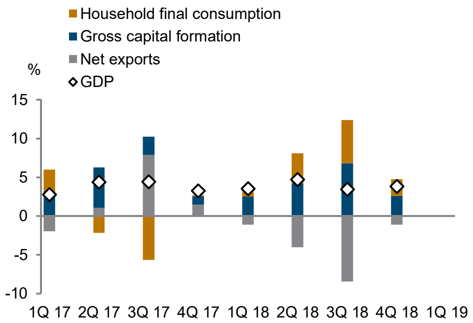


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

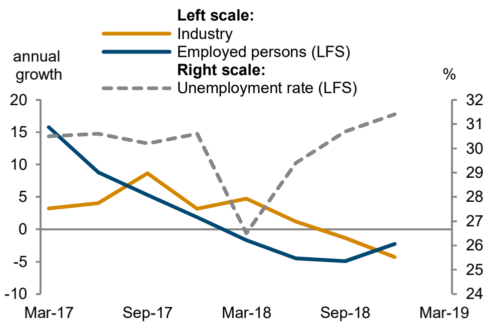
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Kosovo

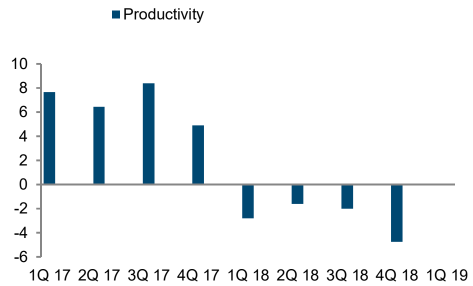
Real GDP growth and contributions
year-on-year



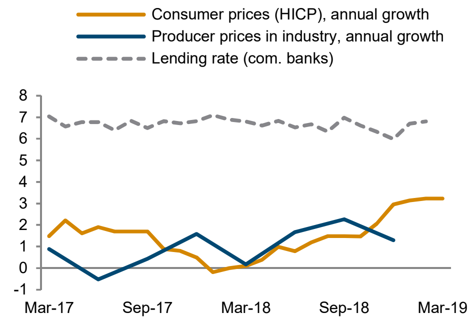
Real sector development
in %



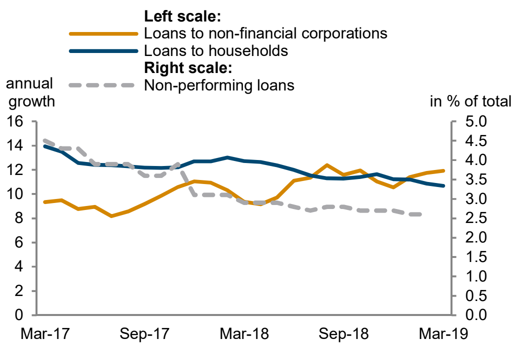
Productivity in industry
annual growth rate in %



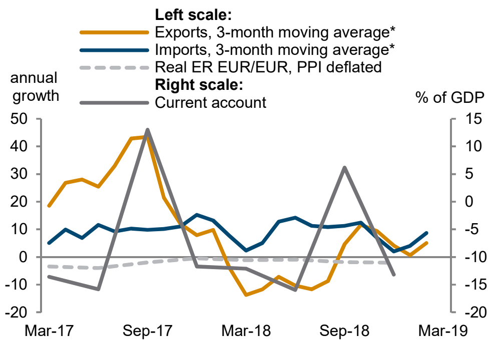
Inflation and lending rate
in %



Financial indicators
in %



External sector development
in %

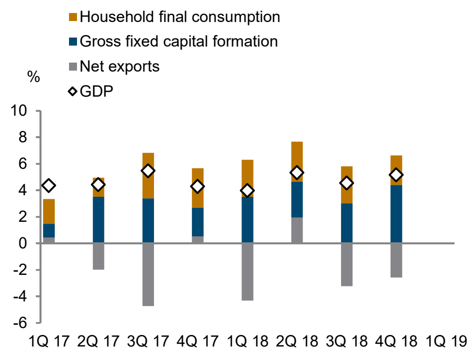


*EUR based.

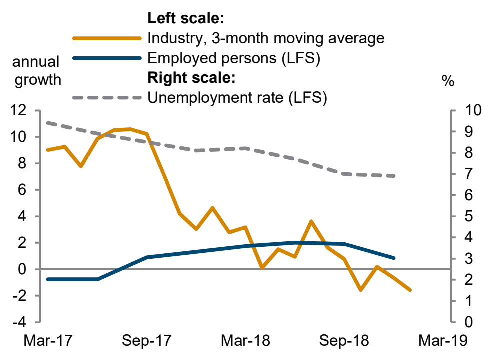
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Latvia

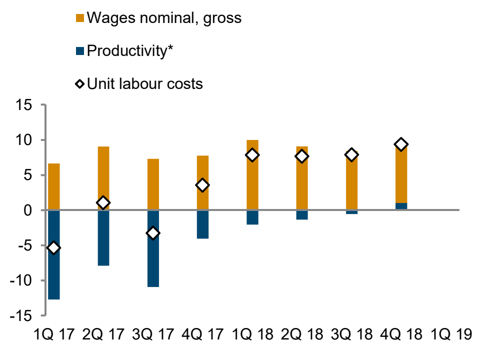
Real GDP growth and contributions
year-on-year



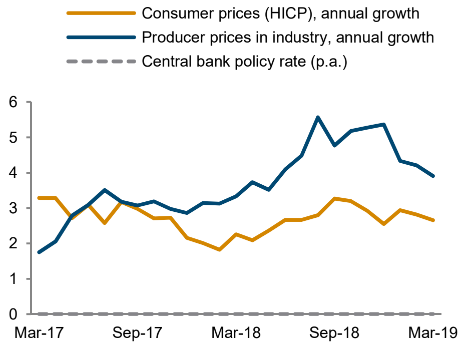
Real sector development
in %



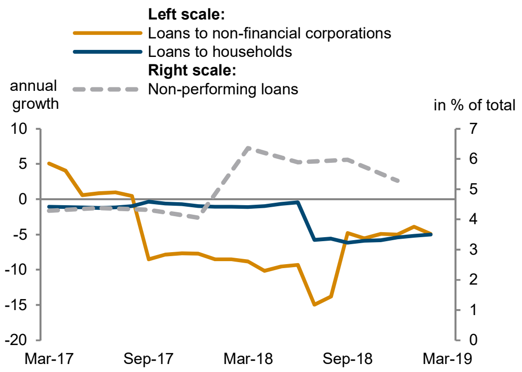
Unit labour costs in industry
annual growth rate in %



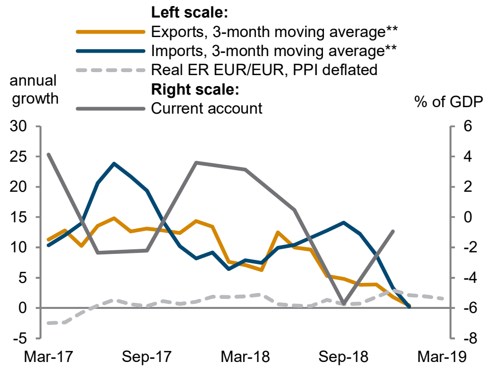
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %

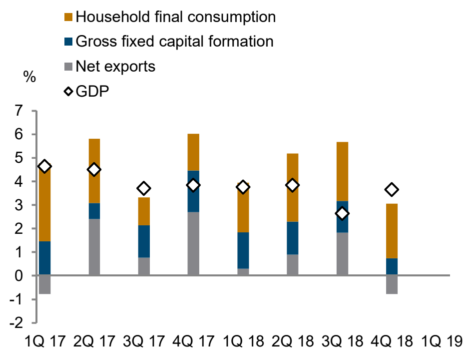


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

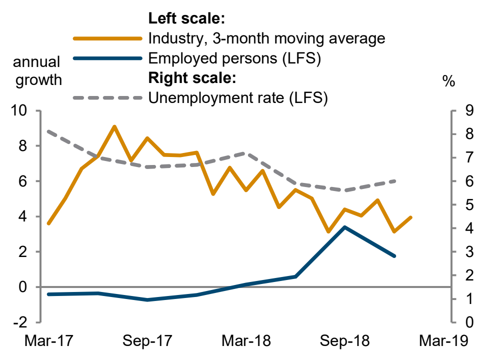
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Lithuania

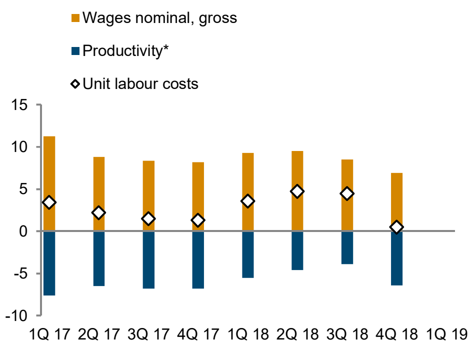
Real GDP growth and contributions
year-on-year



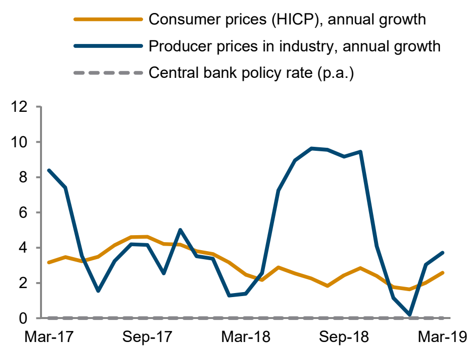
Real sector development
in %



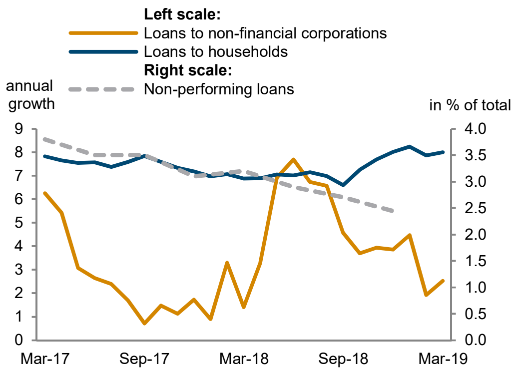
Unit labour costs in industry
annual growth rate in %



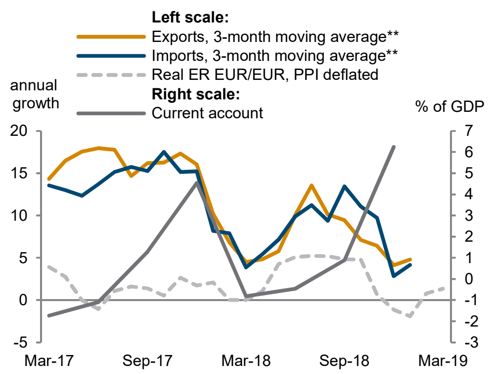
Inflation and policy rate
in %



Financial indicators
in %



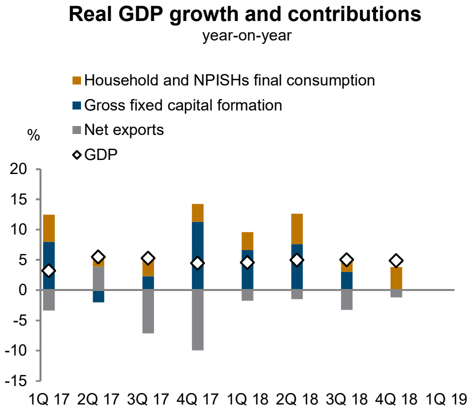
External sector development
in %

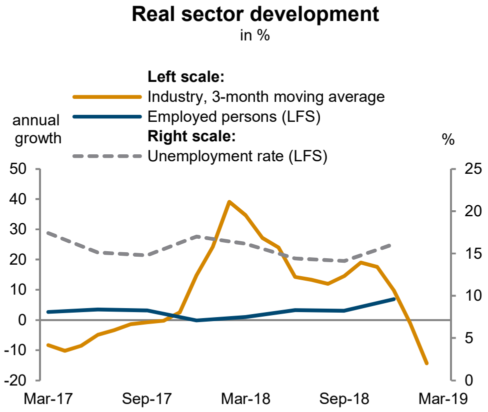


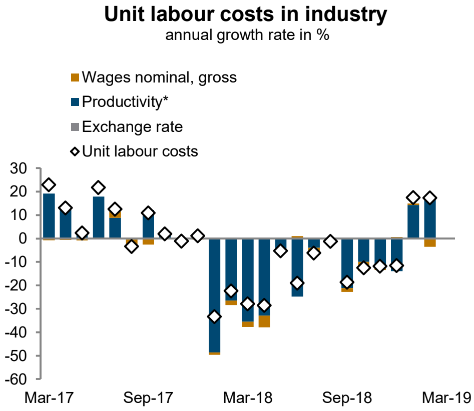
*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

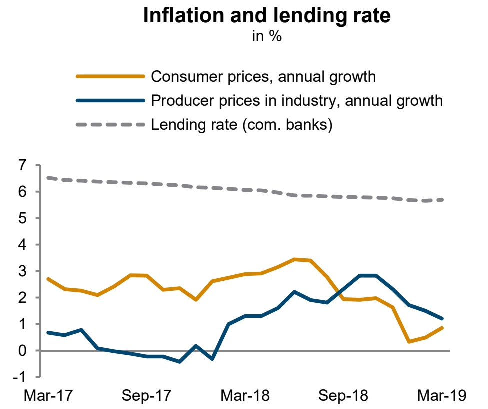
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under: https://data.wiiw.ac.at/monthly-database.html

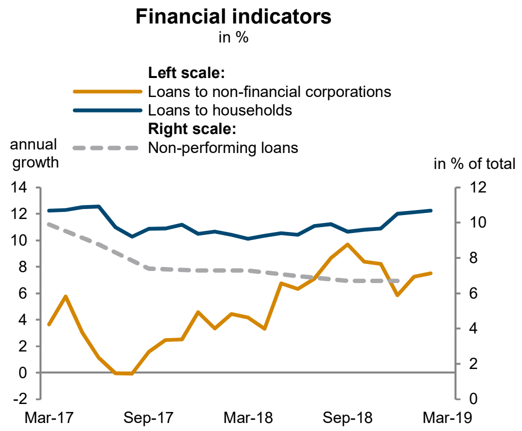
Montenegro

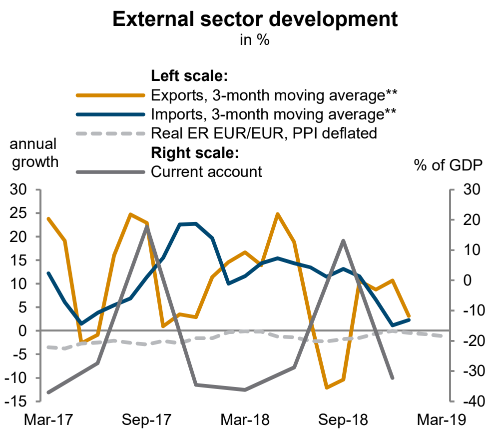








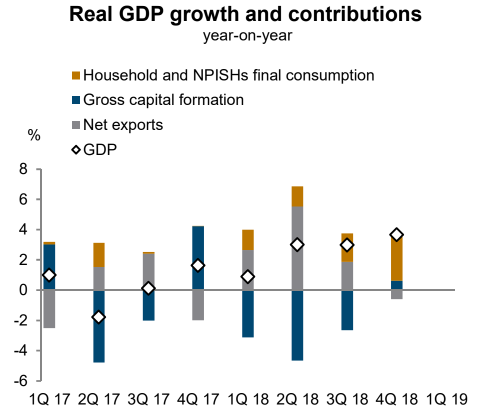


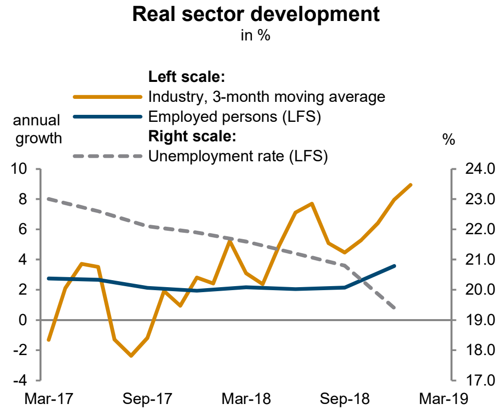


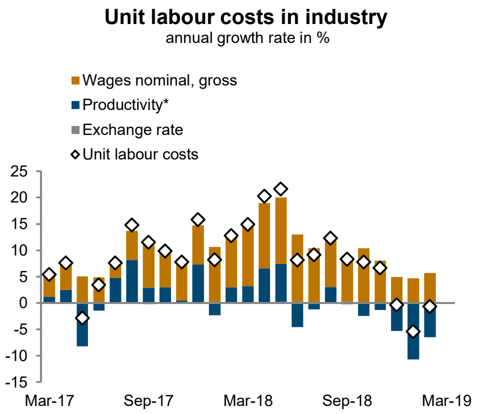
*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

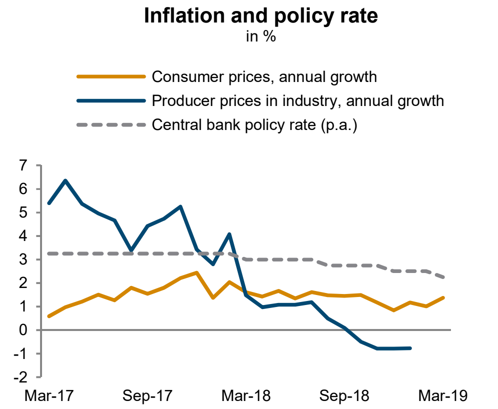
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

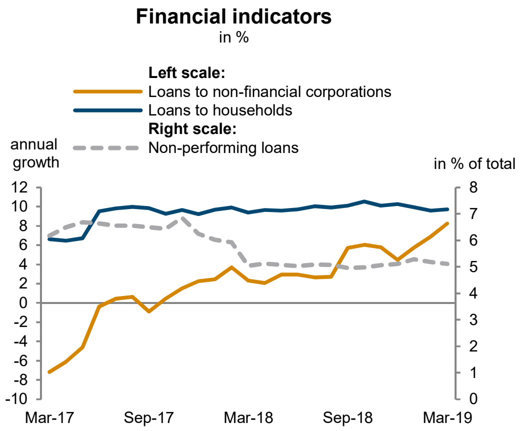
North Macedonia

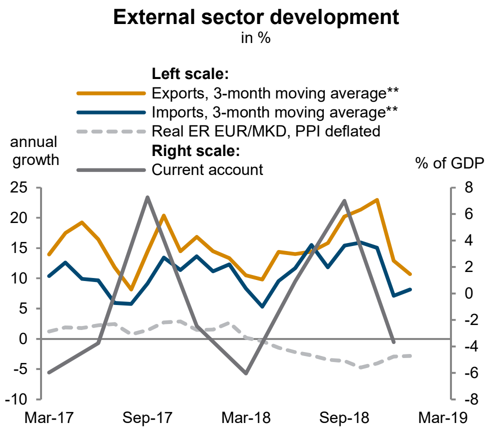








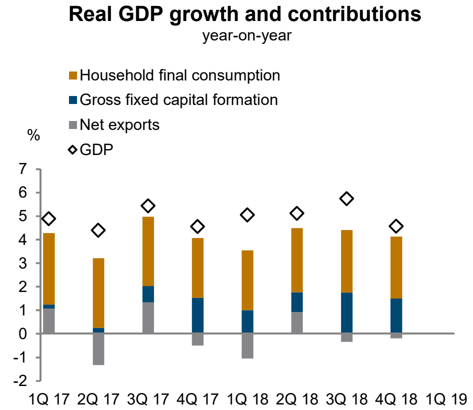


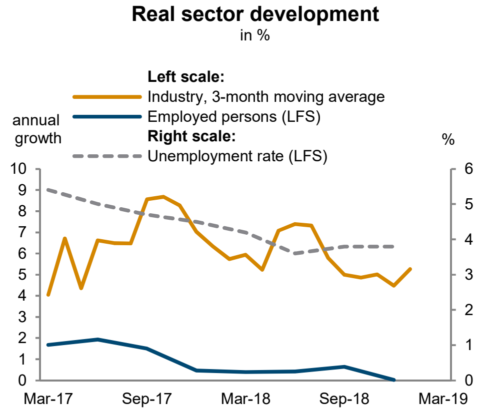


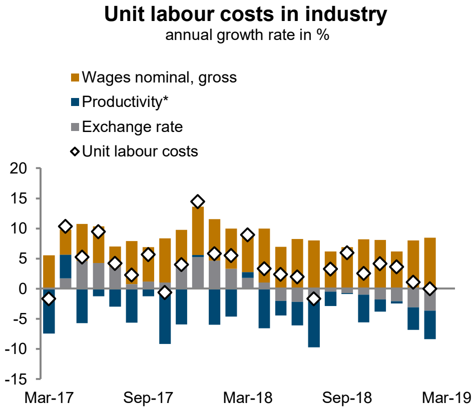
*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

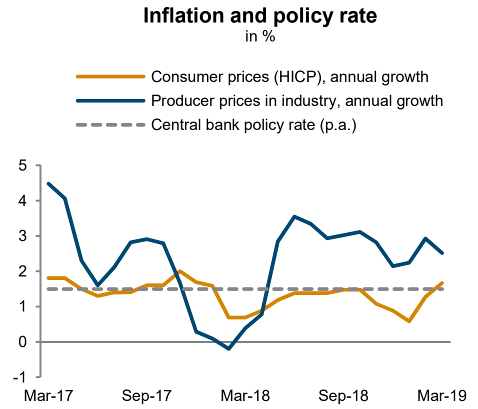
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

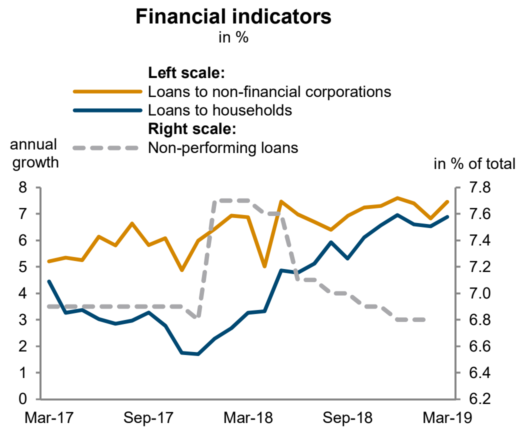
Poland

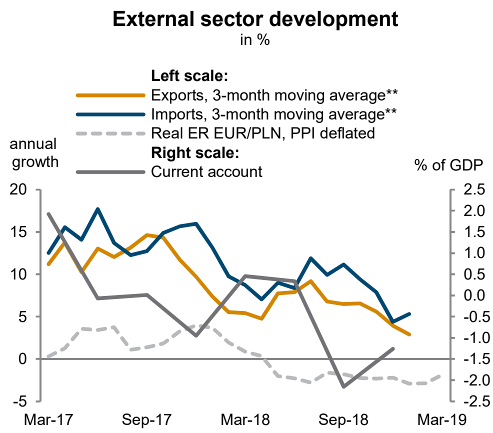










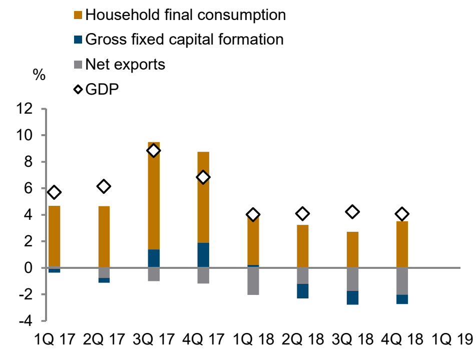


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

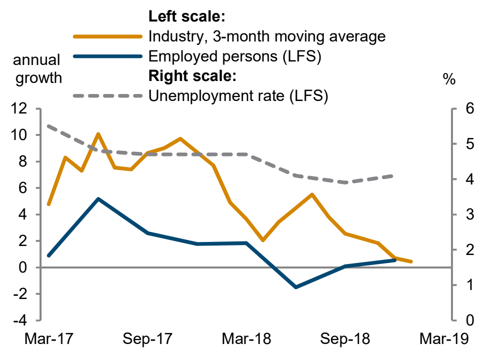
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Romania

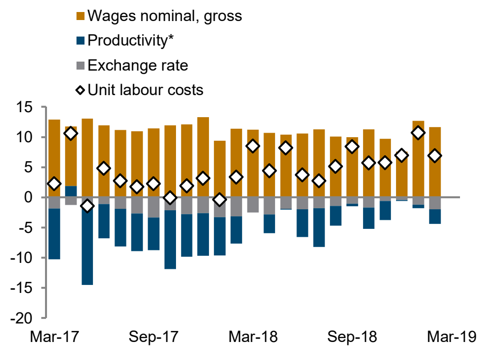
Real GDP growth and contributions
year-on-year



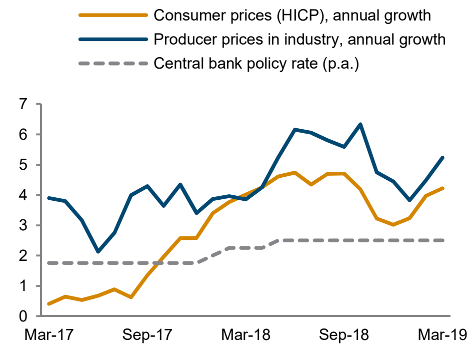
Real sector development
in %



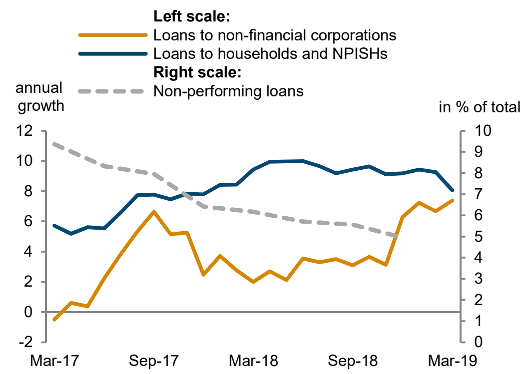
Unit labour costs in industry
annual growth rate in %



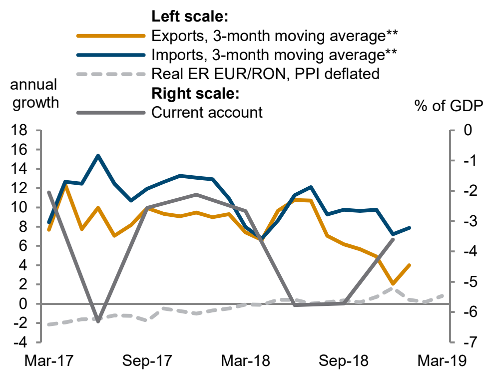
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %

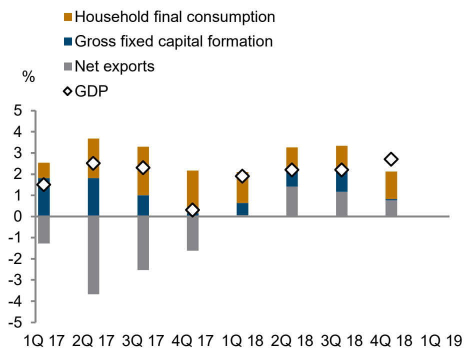


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

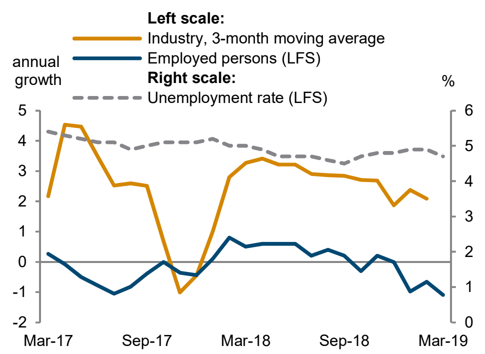
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Russia

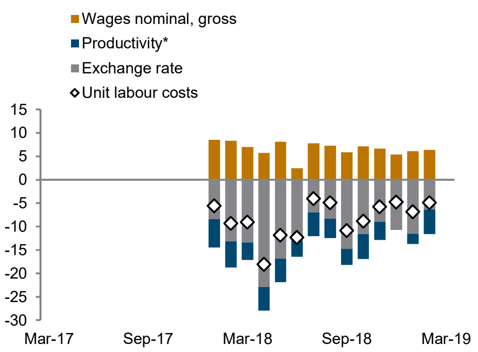
Real GDP growth and contributions
year-on-year



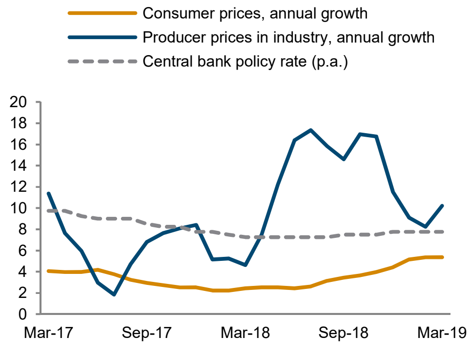
Real sector development
in %



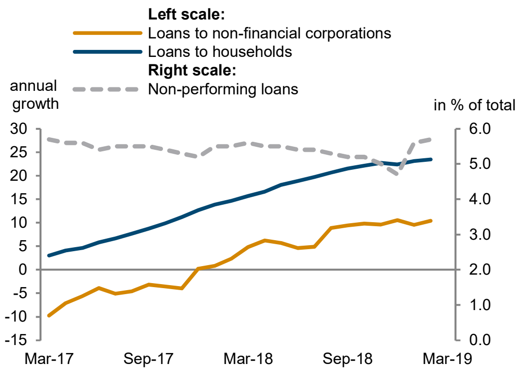
Unit labour costs in industry
annual growth rate in %



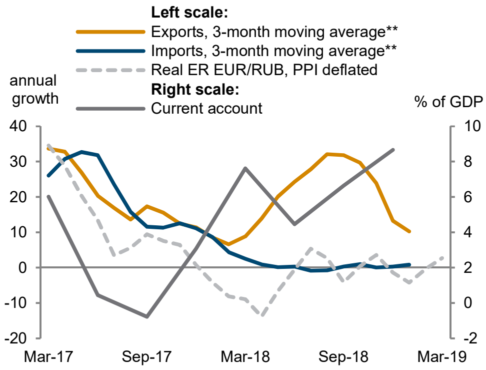
Inflation and policy rate
in %



Financial indicators
in %



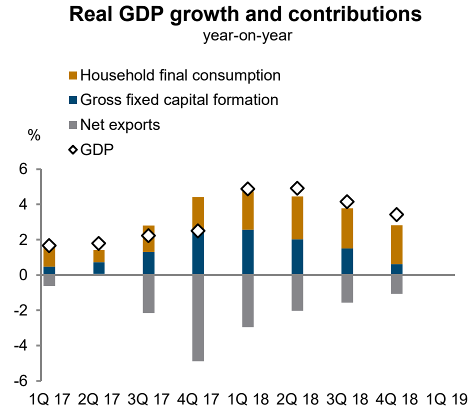
External sector development
in %

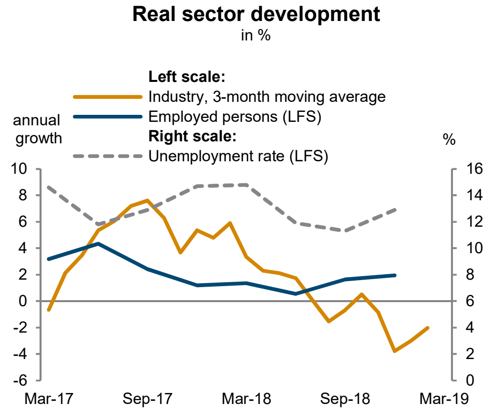


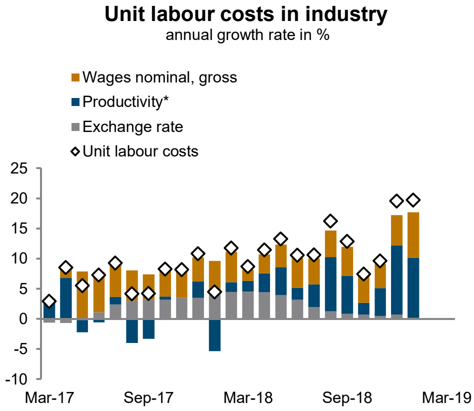
*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

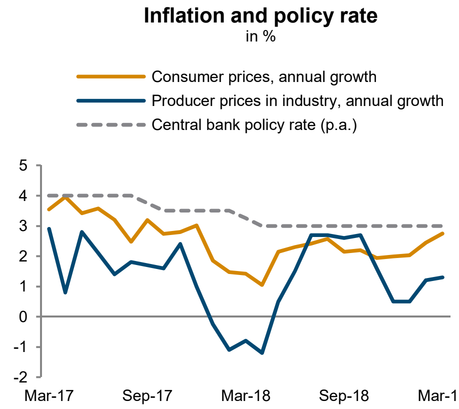
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

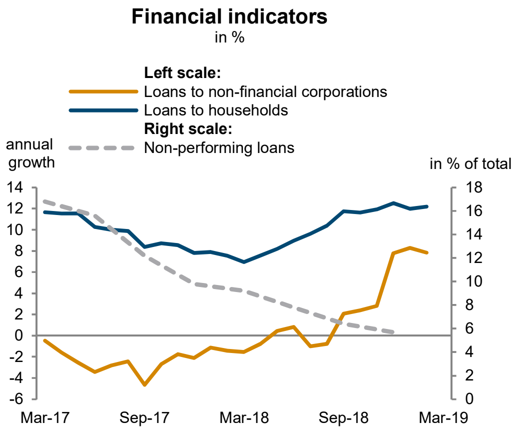
Serbia

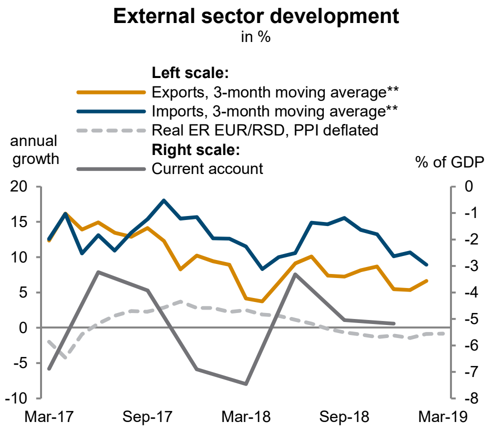










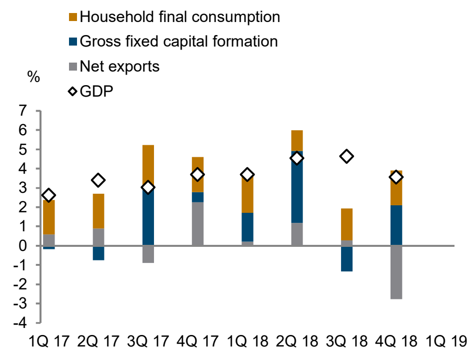


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

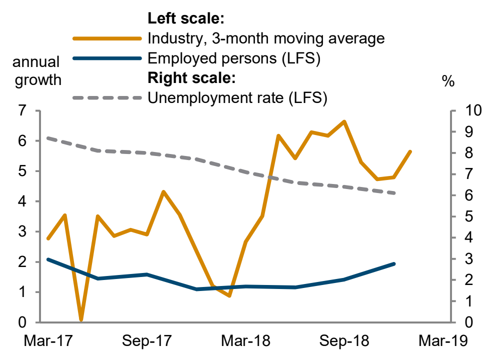
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Slovakia

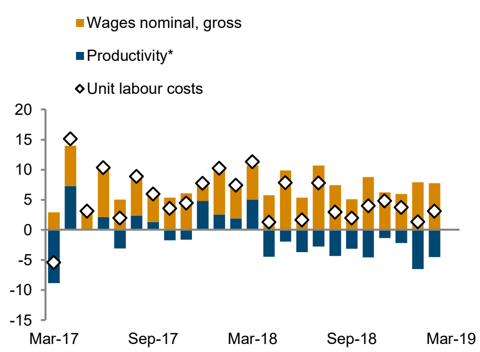
Real GDP growth and contributions
year-on-year



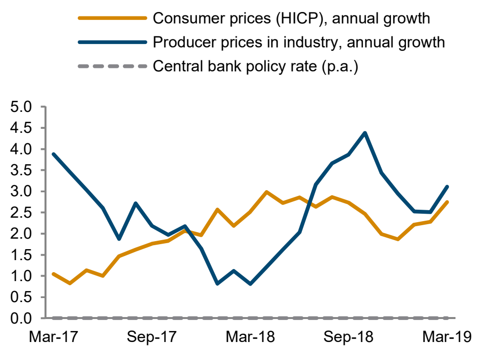
Real sector development
in %



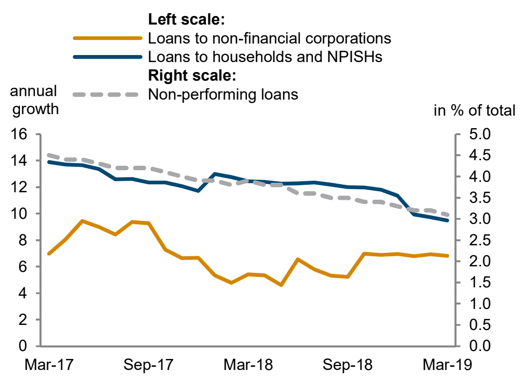
Unit labour costs in industry
annual growth rate in %



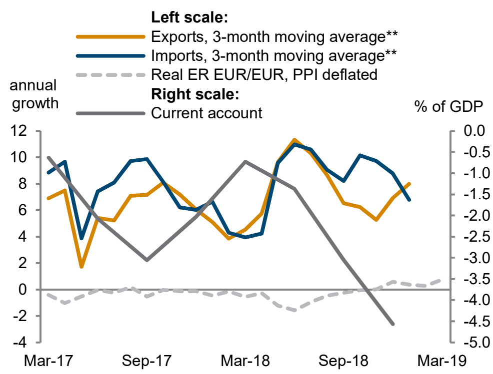
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %

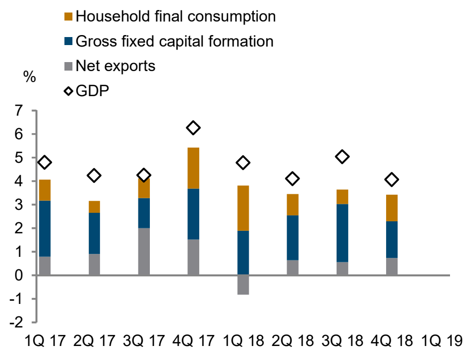


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

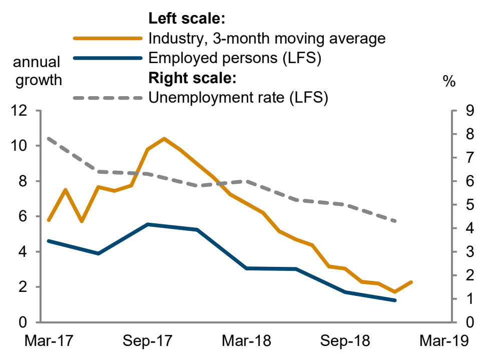
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

Slovenia

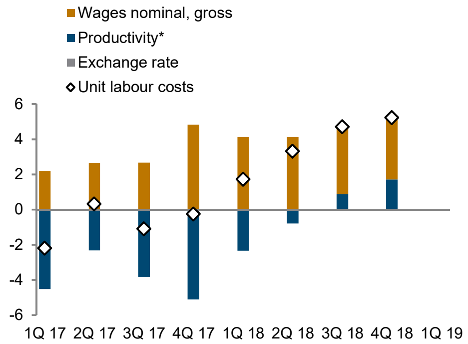
Real GDP growth and contributions
year-on-year



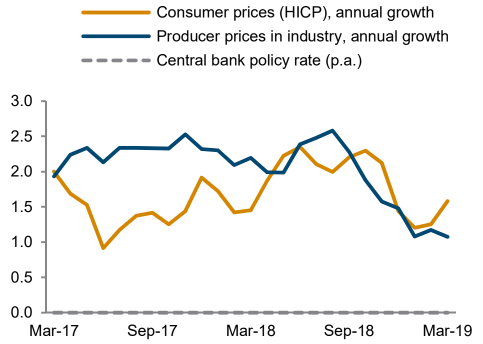
Real sector development
in %



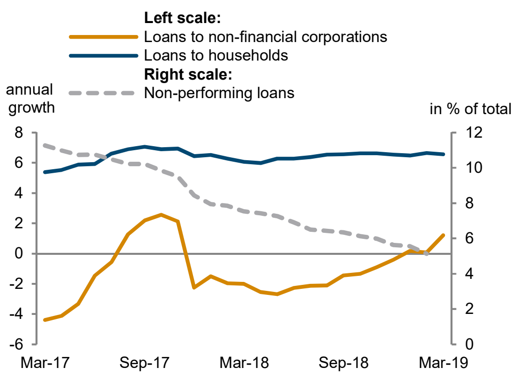
Unit labour costs in industry
annual growth rate in %



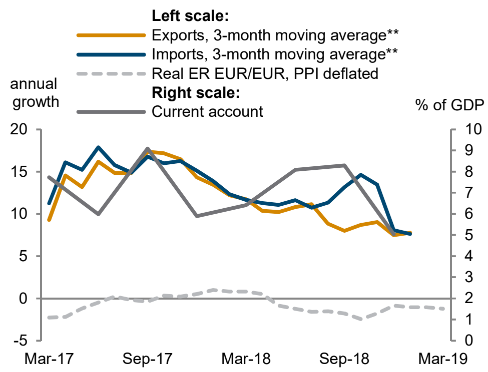
Inflation and policy rate
in %



Financial indicators
in %



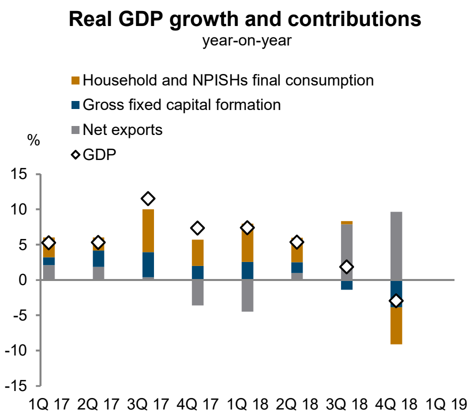
External sector development
in %

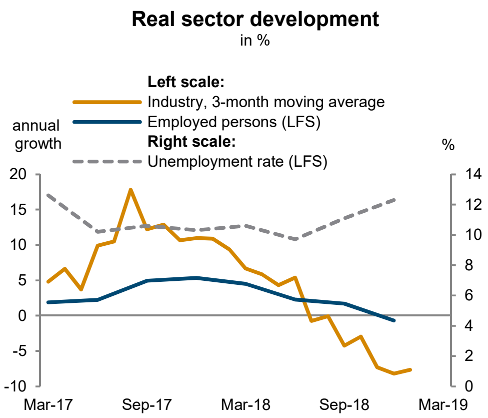


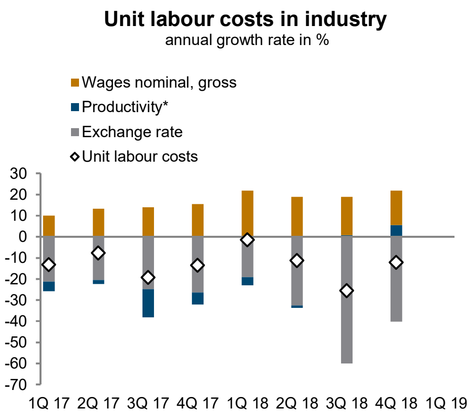
*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

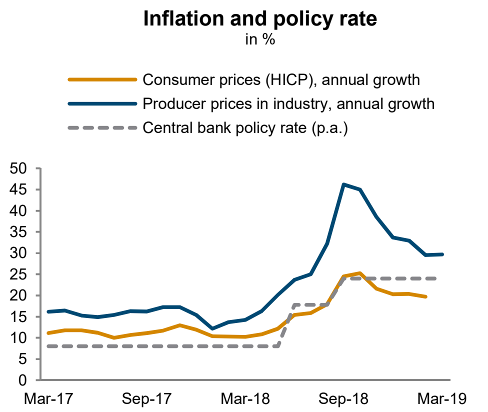
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
https://data.wiiw.ac.at/monthly-database.html

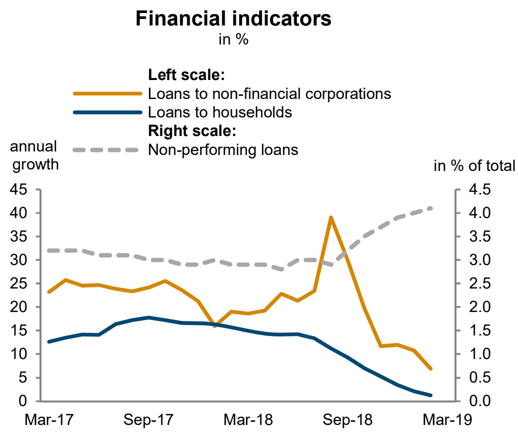
Turkey

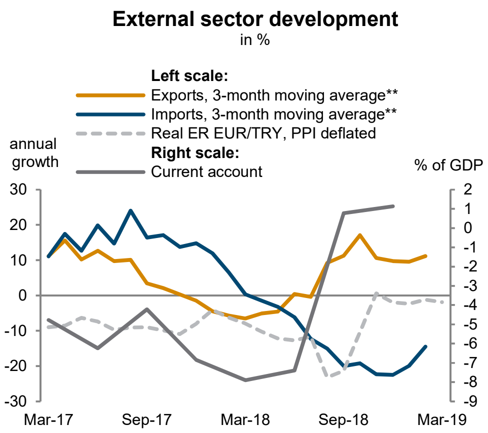










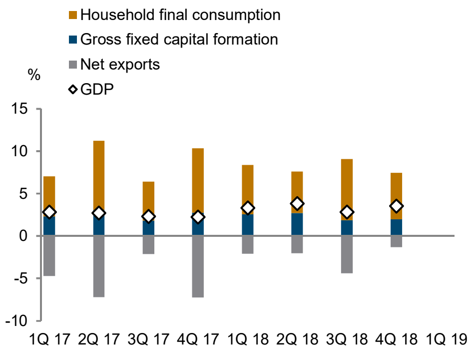


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

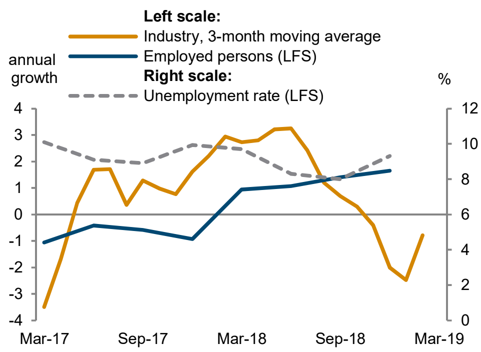
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under: https://data.wiiw.ac.at/monthly-database.html

Ukraine

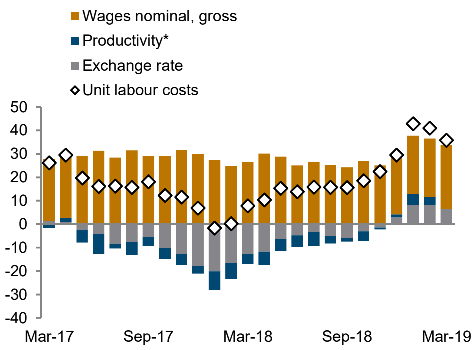
Real GDP growth and contributions
year-on-year



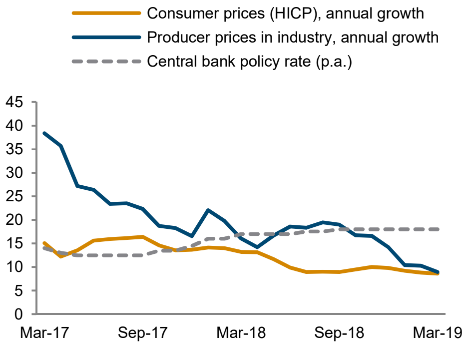
Real sector development
in %



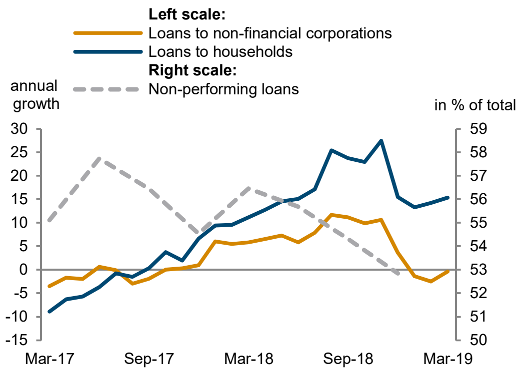
Unit labour costs in industry
annual growth rate in %



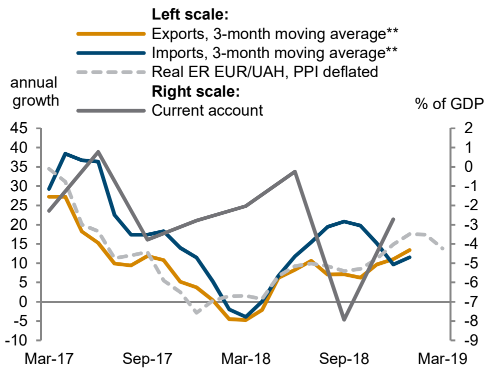
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %



*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
**EUR based.

Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under: https://data.wiiw.ac.at/monthly-database.html

Index of subjects – May 2018 to May 2019

(continued on the next page)

multi-country articles and statistical overviews

The *wiiw Monthly Report* summarises wiiw's major research topics and provides current statistics and analyses exclusively to subscribers to the wiiw Service Package. This information is for the subscribers' internal use only and may not be quoted except with the respective author's permission and express authorisation. Unless otherwise indicated, all authors are members of the Vienna Institute's research staff or research associates of wiiw.

Economics editors: Vasily Astrov, Richard Grieveson

IMPRESSUM

Herausgeber, Verleger, Eigentümer und Hersteller:
Verein „Wiener Institut für Internationale Wirtschaftsvergleiche“ (wiiw),
Wien 6, Rahlgasse 3

ZVR-Zahl: 329995655

Postanschrift: A 1060 Wien, Rahlgasse 3, Tel: [+431] 533 66 10, Telefax: [+431] 533 66 10 50
Internet Homepage: www.wiiw.ac.at

Offenlegung nach § 25 Mediengesetz: Medieninhaber (Verleger): Verein "Wiener Institut für Internationale Wirtschaftsvergleiche", A 1060 Wien, Rahlgasse 3. Vereinszweck: Analyse der wirtschaftlichen Entwicklung der zentral- und osteuropäischen Länder sowie anderer Transformationswirtschaften sowohl mittels empirischer als auch theoretischer Studien und ihre Veröffentlichung; Erbringung von Beratungsleistungen für Regierungs- und Verwaltungsstellen, Firmen und Institutionen.

wiiw.ac.at