

Monthly Report

The Role of Capital Regions in CESEE

**Economic Policy in Europe must not Turn Overly Restrictive
in Response to Inflation**

EU Economic Policy: Is Ukraine Going to put a Spoke in it?

Digital Endowments and Comparative Advantage



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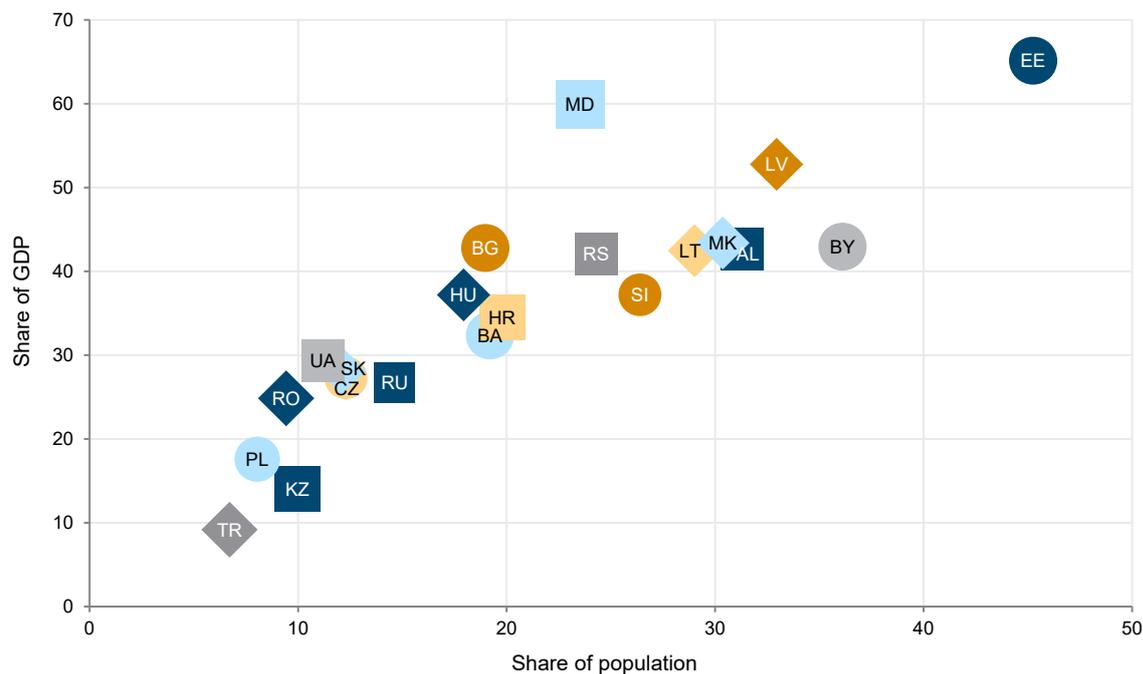
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Chart of the Month: The role of capital regions in CESEE

BY AMBRE MAUCORPS

Figure 1 / Share of capital region in a country's GDP and population in 2019, %



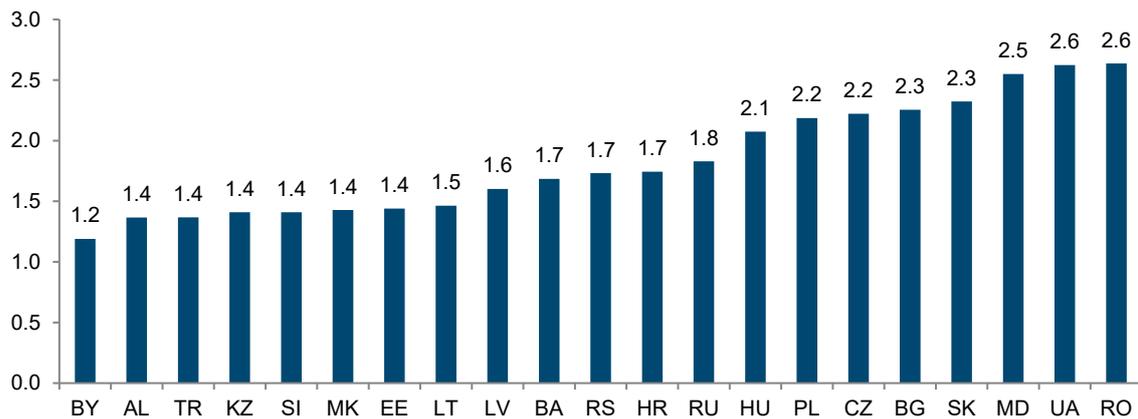
Notes: Data for Russia as of 2020. No data at the level of the capital region available for Kosovo or Montenegro. Data sources: Eurostat (for EU-CEE, Albania, North Macedonia, Serbia and Turkey – NUTS-3 level data; for Poland – NUTS-2 level data); Sarajevo Canton, *Zavod za planiranje razvoja Kantona Sarajevo* (for Bosnia and Herzegovina); Bureau of National Statistics, Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (for Kazakhstan); State Statistics Service of Ukraine, *Yearbook 2019* and *Yearbook 2020* (for Ukraine); official statistics of Belarus (for Belarus); Rosstat (for Russia); National Bureau of Statistics of the Republic of Moldova (for Moldova). Author's computations and visualisation.

Figure 1 shows the proportion of each country's population that lives in the capital region and the proportion of that country's GDP produced in the capital region pre-COVID-19. The capital region is here defined as the capital city, combined with the administrative region directly surrounding it (e.g. Kyiv city + Kyiv Oblast for Ukraine). In all the countries shown, the proportion of GDP concentrated in the capital region is greater than the share of the population. This is only to be expected, since capital regions typically attract clusters of higher value-added economic activity.

However, the ratio of the share of GDP to the share of population (i.e. the slope of the imaginary line running from the origin to the respective country point) varies widely across the CESEE countries. For instance, the capital regions of Serbia and Moldova both account for about 24% of total population, but they produce 42% and 60%, respectively, of GDP. That is, the proportion of GDP emanating from the

capital region of Moldova is 2.5 times greater than the share of the national population living there. For Serbia, it is 'only' 1.7 times greater.

Figure 2 / Ratio of the share of GDP to the share of population concentrated in capital regions, 2019



Notes: Data for Russia as of 2020. No data at the level of the capital region available for Kosovo or Montenegro.
Source: own calculations, based on data in Figure 1.

As Figure 2 shows, the ratio is very high in some EU-CEE countries, as well as in Moldova and Ukraine. In other words, the capital regions account for a disproportionate share of those countries' economic value added, relative to the population. This could result in major challenges for social, economic and territorial cohesion. Thus, public policies to foster economic growth in the peripheral urban agglomerations and the hinterland (such as EU Cohesion Policy) are particularly important to ensure the more harmonious, balanced development of those countries.

Opinion Corner^{*}: Economic policy in Europe must not turn overly restrictive in response to inflation

BY PHILIPP HEIMBERGER

There are limits to what the ECB can do in response to the supply-side shock to energy and food prices. What is needed is a holistic anti-inflationary strategy, including fiscal and regulation policies.

The central bank of the United States, the Fed, has already started to raise key interest rates in response to higher inflation. The European Central Bank (ECB) has just announced an end to net purchases of government bonds under its quantitative easing programme; it will then take the first steps to raise interest rates as well. At the same time, fiscal policy makers such as the German finance minister, Christian Lindner, are arguing for lower government spending to dampen inflation. In the context of the current economic downswing due to the consequences of the war in Ukraine, a restrictive policy mix could further slow the economy, thereby deepening social and political problems.

The rise in inflation in the US has so far covered a wide swathe of goods and services. Over recent months, core inflation in the US – which excludes volatile energy and food prices – has consistently turned out at least 2.5 percentage points higher than in the euro area. In Europe, inflation is driven primarily by energy and food prices, largely stemming from the geopolitical and economic consequences of the events in Ukraine. Oil, natural gas and food prices have risen, and disruptions to supply chains have exerted further upward pressure on prices.

LIMITS TO MONETARY POLICY EFFECTIVENESS

In terms of effectiveness, there are limits on what the ECB can do in response to a supply-side shock to energy and food prices. In any event, the central bank cannot directly control commodity prices. On the other hand, raising the key interest rate could – if overdone – cause broad-based collateral damage in an economy affected by war-related supply disruptions. Changes in key interest rates affect the economy through their impact on financial conditions and aggregate demand. An interest-rate hike makes borrowing more expensive: companies reduce their investments and consumers spend less. Expansion in the economy and employment then slows, leading to a reduction in wage growth and inflation. The lag can, however, be up to 18 months. Hiking interest rates is thus a blunt instrument in its timing, as well as its targeting.

One might hope that a rise in key interest rates will allow the euro to appreciate vis-à-vis the US dollar and other currencies, so that imports of energy and other commodities become cheaper. However, the importance of the exchange-rate channel remains uncertain. The energy price shock is already massive, but it may intensify further if there is a European decision in favour of an embargo on Russian gas imports,

^{*} 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.

or if Russia decides to halt energy exports to Europe altogether (it is already restricting them). Given the severity of the energy price shock, an appreciation of the euro by a couple of percentage points in the wake of a hike in key interest rates may not have the desired impact in terms of dampening domestic energy prices. At the same time, an appreciation of the exchange rate could reduce foreign demand for euro area exports, thereby further denting economic growth in a highly uncertain environment.

Moreover, there is so far no sign of the wage-price spiral feared by many. The ECB's wage tracker for the euro area forecasts 3% wage growth in 2022 and 2.5% in 2023. If we assume typical productivity growth of 1%, that wage growth would be consistent with the ECB's price stability target of 2%. In any case, there are no massive wage pressures that would lend support to an abrupt restrictive turn in monetary policy. A wage-price spiral is currently not a major concern, given the weakening economic environment in the euro area. Wage growth has recently been running at much lower than headline inflation rates, which implies substantial real wage losses for employees.

WILL FISCAL POLICY COMPENSATE FOR HIGHER INFLATION?

Given these real wage losses, there is greater pressure on fiscal policy to protect and compensate households. The recent rise in energy and food prices has already prompted European governments to put in place various measures at the national level (such as transfers to vulnerable households or reduced taxes).

However, as the war in Ukraine drags on and commodity prices remain elevated, more fiscal action will be needed. The European Commission has recently proposed that the EU's fiscal rules should remain deactivated in 2023. This should give European governments additional scope to deploy fiscal policy measures. However, there remains the question of whether countries whose public finances are already strained due to the impact of the pandemic will find themselves in a position to take all the fiscal action that is needed to mitigate the inflation shock.

German Finance Minister Christian Lindner and other politicians have already called on European governments to reprioritise a move towards lower government spending and a reduction in public debt levels. Fiscally hawkish policy makers are not convinced of the need for a prolonged deactivation of the EU's fiscal rules in 2023, and they do not want to support any reform of the rules framework that would give greater flexibility to countries that face high public debt levels. If the hawkish position were to prevail in fiscal policy making in EU countries, it would turn out to be more difficult to run fiscal deficits to stabilise the European economy in the context of the war next door. A turn towards fiscal austerity would be a serious policy mistake, as recent experience during the euro-area crisis of 2011-2013 suggests: it would reduce economic growth and employment, which would eventually also jeopardise public debt sustainability.

STRIKING THE RIGHT BALANCE OF ECONOMIC POLICY MEASURES

Against the backdrop of the still-recent euro-area crisis, particular caution is also called for when considering tighter monetary policy. Interest rates on government bonds in Italy and certain other euro area countries have already risen vis-à-vis Germany over recent months. But with significant key interest-rate hikes, risk spreads could abruptly rise further, and a contagious panic could once again set in on the bond markets. To avoid euro-area fragmentation, the ECB will again have to step in. And to

forestall a self-defeating outcome that could destabilise large parts of the euro area, the ECB will need to find a way to credibly signal its continued readiness to backstop government bond markets in the context of the current gradual approach towards discontinuing large-scale bond purchases and raising key interest rates.

The most effective anti-inflation measures are currently not within the remit of central banks. They lie in ending the Ukraine war, getting a global grip on the pandemic and solving the supply-chain problems. Governments have an important role to play in fighting inflation, such as by monitoring supply chains and by strengthening competition policies to counter price-fixing and profit-price spirals involving companies with large market power. Regulation policies can also help reduce speculative activities in the energy and food markets – activities that contribute to higher and more volatile prices. So long as the war and the pandemic continue to drive up prices, further compensatory measures by governments will be needed – especially for low-income households, which are particularly hard hit by price rises.

EU economic policy: Is Ukraine going to put a spoke in it?

BY BERNHARD MOSHAMMER

With the ongoing war in Ukraine, there is a wide range of new challenges for EU policy makers: support for refugees, reconstruction of Ukraine, reducing energy dependence on Russia, and the need for greater defence spending. However, given the high inflation, there is a risk of repeating the mistakes of the economic and financial crisis of 2008/2009 and engaging in excessive austerity. The EU Recovery and Resilience Facility will certainly help stabilise the economy, but will it be – can it be – enough?

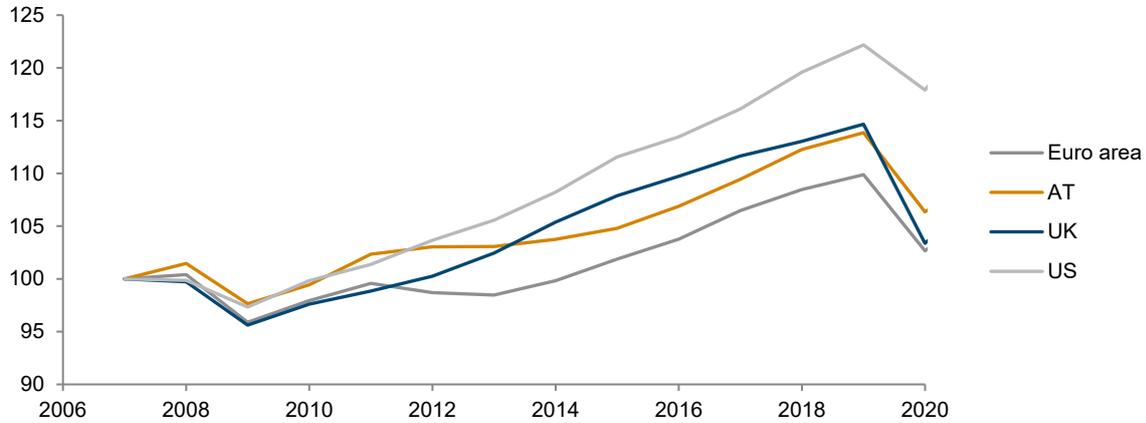
Compared to Europe's reaction to the financial and economic crisis of 2008/2009, its response to the COVID-19 pandemic has been far more resolute. This might be attributed to the lessons learned from the mistakes made during the 2008/2009 crisis; but it should also be seen in the light of the expected temporary nature of the impact of the pandemic on the economy. With the pandemic situation improving and the economy recovering, the Organisation for Economic Co-operation and Development (OECD), for instance, called in its December 2021 outlook for 'gradual moves to rebalance policy' (OECD, 2021). Now that Russia is waging war on Ukraine, the European economy is faced with a new external shock, the magnitude of which is still uncertain. Since government debts are now higher than prior to the COVID-19 outbreak and inflation is surging, the risk of repeating the mistakes of 2008/2009 is greater. This article provides an overview of the policy measures taken in the EU during the 2008/2009 crisis, the policy response to the COVID-19 pandemic and the fresh challenges arising from the war in Ukraine.

ECONOMIC POLICY DURING THE 2008/2009 ECONOMIC AND FINANCIAL CRISIS

In the wake of the economic and financial crisis of 2008/2009, the euro area witnessed a much more sluggish economic recovery than the UK or the US – in terms of both the GDP and unemployment figures – particularly between 2010 and 2014 (Figure 1). This can be attributed to several policy errors. First, the Federal Reserve of the US and the Bank of England pursued a far more accommodative policy than the European Central Bank (ECB) between 2008 and 2014 (Mody, 2018). Secondly, the ECB failed to act as a lender of last resort for euro area members until summer 2012, which led to considerable instability on the financial markets. Thirdly, the comparatively high interest rates on government bonds further reduced the fiscal leeway for tackling the crisis in already hard-hit euro area states (De Grauwe and Ji, 2013).

Furthermore, as from 2011 a series of tough measures designed to help with the fiscal consolidation of government budgets was introduced on the euro area periphery, in Greece, Portugal, Ireland and Spain. This shift toward fiscal restraint had repercussions for growth and employment, resulting in the 'double-dip' recession of Q3 2011 (Heimberger, 2017).

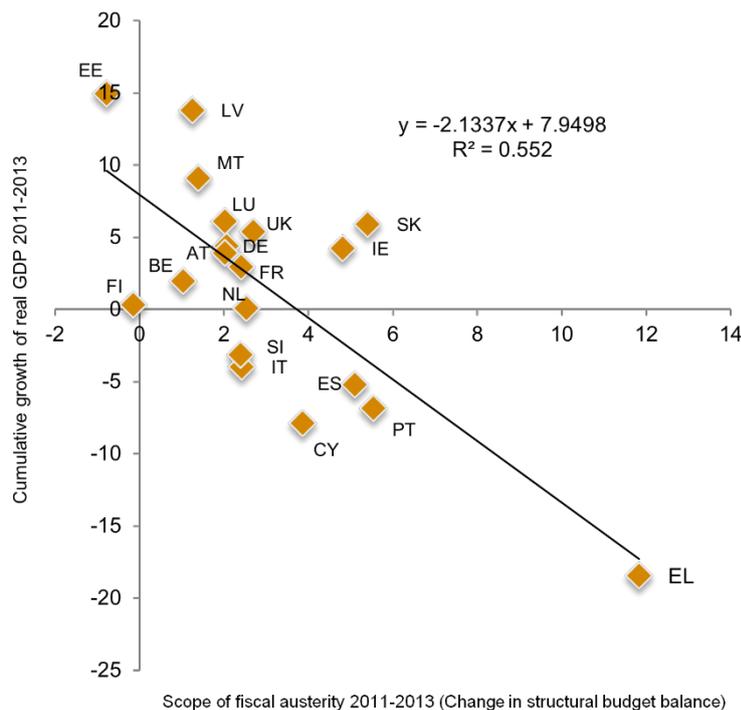
Figure 1 / Real GDP (2007=100)



Source: European Commission (AMECO); own calculations.

Indeed, one can observe a negative relationship between fiscal consolidation and economic growth between 2011 and 2013 (Figure 2). On the horizontal axis, the scope of fiscal austerity is illustrated by plotting the change in the structural budget balance. The vertical axis shows cumulative real economic growth. The negative slope of the regression illustrates the close relationship between the depth of the crisis and the extent of fiscal austerity, with the fiscal multiplier amounting to 2.1 on average. In other words, fiscal consolidation of 1 percentage point (pp) of GDP reduced cumulative economic growth on average by roughly 2.1 pp between 2011 and 2013.

Figure 2 / Fiscal austerity and economic growth



Source: European Commission (AMECO), own calculations.

Public investment was one of the main victims of austerity, although the extent to which it suffered varied across the countries. According to a survey of municipalities by the European Investment Bank (EIB), the majority stated that they had not invested enough in infrastructure even prior to the COVID-19 pandemic, particularly with regard to climate change and digitalisation (EIB, 2021).

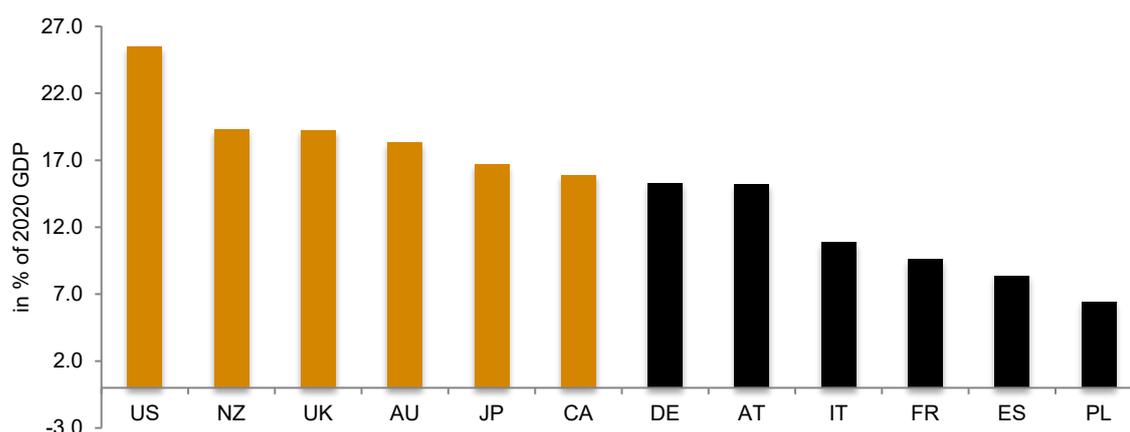
In general, the ECB's monetary policy during and after the crisis of 2008/2009 did not take adequate account of the exceptional circumstances. The ECB failed to take decisive steps to tackle the decline in economic activity caused by the fiscal austerity measures. This indecisiveness was reflected in the bank's 2011 policy rate increase and its hesitance to undertake quantitative easing until the beginning of 2015.

ECONOMIC POLICY IN LIGHT OF THE COVID-19 PANDEMIC

During the early phase of the pandemic, in particular, a 'whatever it takes' approach was the leitmotiv in fiscal and monetary policy. The ECB pursued a laxer monetary policy than in 2008/2009, leaving its policy rate at zero and intensifying its secondary market bond purchases to stabilise the financial markets, thus maintaining favourable conditions for government borrowing (Tooze, 2021).

The European Commission activated the 'general escape clause' as early as March 2020, and has prolonged it on several occasions since then, the last time at the Eurogroup meeting in May. This has given member states financial leeway, and they have made use of it (Figure 3). It is possible that not all the elements of the packages have proved equally effective, but overall a more hesitant approach would have worsened the situation for both private households and businesses (Chudik et al., 2021).

Figure 3 / Additional government spending and tax revenue forgone in response to the COVID-19 pandemic

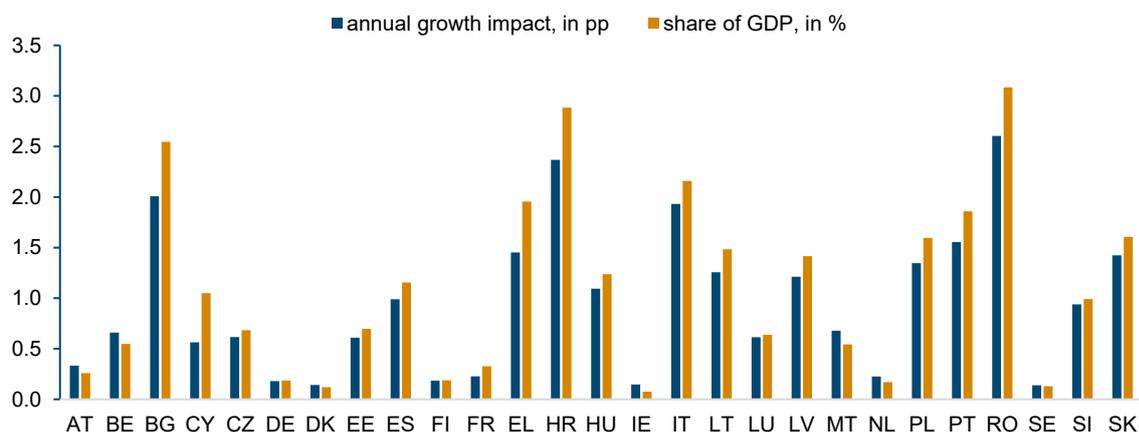


Source: IMF Fiscal Monitor, October 2021.

A totally unprecedented policy response in the EU has been the Next Generation EU (NGEU) fiscal package, with the Recovery and Resilience Facility (RRF) at its heart. The RRF – which consists of EUR 338bn in grants and a EUR 385.5bn loan component – is expected to help economic recovery – even in the wake of the fresh economic shock caused by the war in Ukraine. According to wiiw estimates

(carried out prior to the war), the annual growth contribution of the RRF package over a five-year period may exceed 2 pp in Romania and Croatia.¹

Figure 4 / Share of RRF transfers in GDP and estimated growth impact of RRF spending



Source: Bruegel (2021); wiiw MC IOD.

At the time of writing, all but two of the recovery plans (Hungary and the Netherlands) have been approved. The Dutch government finally presented its recovery plan in March 2022, but has not yet submitted it to the Commission. As for Hungary, the ongoing rule-of-law dispute between the government and the EU means that its plan is still awaiting approval by the Commission. A similar dispute with Poland has recently been resolved and the Polish recovery plan has been approved by the Commission. This is quite significant, as the Polish share of the RRF's grant component amounts to 7% of the total.

FURTHER ECONOMIC POLICY CHALLENGES

The ongoing war in Ukraine has exacerbated some of the existing challenges for the EU budget and for economic policy more generally.

First, there is the issue of Ukrainian refugees. As of 9 June, more than 3m Ukrainians were under temporary protection schemes in the EU, according to the UN High Commissioner for Refugees.² While Ukrainian refugees have been granted swift access to the EU labour market, there are some important points to note. The distribution of Ukrainian refugees in the EU is uneven: more than a million are registered in Poland alone. Moreover, 39% of refugees are estimated to be under the age of 18.³ And finally, with Ukraine's travel restrictions for males aged 18-60, women are overrepresented within the working-age group that is set to join the European labour market; however, the labour force participation rate of Ukrainian women is relatively low – in 2018, it was approximately 6 pp below the EU average (State Statistics Service of Ukraine, 2019). One key reason why women are not economically active is

¹ The estimated effect may be lower now, given the high inflation and a delay in RRF disbursements.

² It should be noted that this sum is based on the latest available to UNHCR. The date for the most recent figures ranges from 27 April (France) to 9 June (Hungary, Poland, Romania).

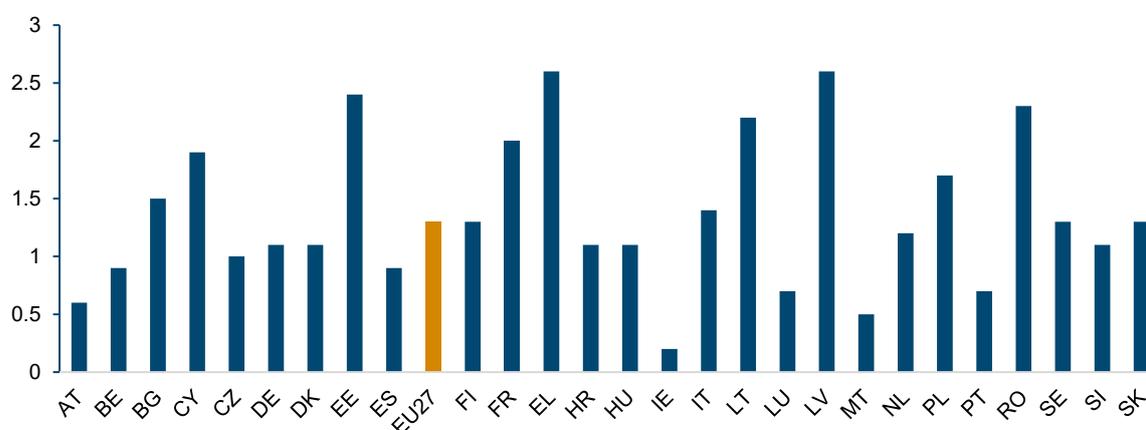
³ Mancino, D. (2022), 'Refugee flows from Ukraine', 31.05.2022, <https://data.europa.eu/en/datastories/refugee-flows-ukraine>

their household and care duties (ibid.). In the Austrian context, WIFO (2022) assumes that only two fifths of the Ukrainian refugees of working age will become economically active by the end of 2023. Hence, continued support for Ukrainian refugees will remain necessary, and their uneven distribution across member states needs to be considered.

Second, the actual cost of reconstructing Ukraine remains unclear. According to Kyiv School of Economics (KSE) estimates, as of 8 June the material value of the infrastructure either directly damaged or destroyed stood at USD 103.9bn.⁴ Overall economic losses from the war are much higher: KSE estimates range from USD 564bn to USD 600bn, while the EIB puts Ukraine's overall need for financial assistance at up to EUR 1 trillion.⁵ By way of comparison, Havlik et al. (2020) estimated the cost of reconstructing Donbas at USD 21.7bn.

Third, EU member states – albeit to varying degrees – continue to rely on Russian energy supplies. This resulted in a month of negotiations between the European Commission and EU member states over cutting Russian energy imports. A ban on Russian oil imports was only agreed in the sixth sanctions package, at the price of carve-outs for member states like Czechia and Hungary. On the issue of gas, no agreement at all has been reached. And Austria, for instance, only expects to end its dependence on Russian gas by 2027.

Figure 5 / Defence spending of EU member states in 2020, as share of GDP



Source: Eurostat.

Fourth, defence spending has already risen and is expected to increase further. The most noteworthy case is Germany's EUR 100bn special fund for upgrading its military. In 2020, defence spending in the EU averaged 1.3% of GDP (Figure 5), while NATO has a non-binding target of 2%. If those member states spending below 2% were to raise their defence spending to this level, that would mean an increase in EU member states' defence spending of approximately EUR 290bn (at 2021 prices).

⁴ <https://kse.ua/about-the-school/news/direct-damage-caused-to-ukraine-s-infrastructure-during-the-war-is-103-9-bln-due-to-the-last-estimates/>

⁵ <https://www.bloomberg.com/news/articles/2022-06-21/ukraine-reconstruction-may-cost-1-1-trillion-eib-head-says#xj4y7vzkg>

The growth projections for the EU as a whole and for the euro area have been revised downward, while public debt as a share of GDP is expected to decline more slowly than expected. In the European Commission's spring projection (published in May), the 2022 growth forecast was revised downwards from the 2021 autumn forecast by 1.6 pp, and for 2023 by 0.2 pp. The more recent (June) forecast of the ECB also revised its projections for 2022 and 2023 downward, by 0.9 pp and 0.7 pp, respectively. According to the ECB, general government gross debt is now projected to be 1 pp higher than it estimated in its spring forecast: 93% of GDP for 2022 (up from 92%) and 90.6% of GDP for 2023 (up from 89.6%).

Overall, the direct and indirect economic impact of the war outlined above raises the question of an appropriate policy response, bearing in mind the mistakes made during the 2008/2009 economic and financial crisis, with its focus on fiscal austerity. Beyond debt reduction through inflation (which the ECB admits to only hesitantly), there are two policy options (discussed below).

FRESH NEW RESOURCES TO MEET THE NEW CHALLENGES?

With regard to the costs of Ukraine's reconstruction, one theoretical option would be to confiscate frozen Russian assets and divert them to those ends. It is hard to arrive at a complete estimate of the volume of Russian assets frozen worldwide, but the Russian Central Bank's foreign reserves that are frozen are put at around USD 300bn. The US president and high-ranking EU representatives have called for legislation allowing the confiscation of Russian assets to rebuild Ukraine. Such a step would set a precedent, however, and it is not yet clear if the EU, the US and their partners would be willing to take it – and if so, how far they would be prepared to go. Furthermore, the legal challenges could take years, meaning that the resources would only become available at a later stage.

The war and its economic impact have also furthered the discussion on new EU debt creation. France and Italy are among those countries that have been very vocal on the subject of new Eurobonds. The European Commission estimates that the green and digital transition will require public and private investment of EUR 650bn a year.⁶ Reacting to the European Commission's idea of raising revenue by selling off emission allowances, the European Greens have suggested a EUR 1trillion EU Energy Transition Facility – modelled on the RRF – to finance the green transition. The EUR 200bn yet to be accessed from the RRF's loan component should give some scope for short-term manoeuvring. However, this should not stand in the way of a more long-term contingency plan: after all, structural imbalances still exist in the euro area. The legislative process to raise the new resources for the RRF is ongoing.⁷ Among future resources, the Carbon Border Adjustment Mechanism (CBAM) could become the first on which agreement is reached, since the European Parliament has recently agreed on its position for inter-institutional negotiations with the Council and the European Commission. The so-called 'trilogues' could start in the near future.

Overall, a debate on Eurobonds or a prospective new recovery fund is equally important as making progress towards agreement on the EU's own resources for the RRF funds.

⁶ Politico (2022), 'Brussels playbook', 11.03.2022, <https://www.politico.eu/newsletter/brussels-playbook/versailles-latest-fog-of-war-economy-schroder-putin/>

⁷ For a more detailed evaluation of new own resources, see Schratzenstaller et al. (2022).

CONCLUSION

The swift EU-wide policy response to the COVID-19 pandemic originally suggested that lessons had been learned from the 2008/2009 economic and financial crisis. For 2022, there was initially the hope of a gradual return to 'normal', with economic recovery picking up, support programmes being phased out and a gradual return to fiscal consolidation.

However, Russia's war against Ukraine has presented EU policy makers with a wide range of fresh challenges: support for Ukrainian refugees, the reconstruction of Ukraine, how to reduce energy dependence on Russia, and the need for more defence spending. Particularly in light of the high level of inflation and the legal challenges surrounding the possible use of frozen Russian assets, the risk that the mistakes of 2008/2009 will be repeated has increased. In this context, the start of a discussion on Eurobonds or a new RRF is very encouraging. Moreover, the loan component of the RRF that has not yet been accessed offers fiscal space that was not available during the 2008/2009 crisis. Consequently, the debate on future Eurobonds must continue, while equal attention should be given to raising the resources for the EU's RRF, given that there are already proposals on the table.

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Digital endowments and comparative advantage

BY DARIO GUARASCIO AND ROMAN STÖLLINGER

Countries' endowments with digital tasks and ICT capital will shape the digital transformation and determine comparative advantage in the digital era. By calculating endowment-based comparative advantage for 25 EU countries, we find that the underlying theory of comparative advantage (the Heckscher-Ohlin-Vanek theorem) holds. However, the EU's leaders in terms of innovation are not necessarily those countries with an abundance of digital tasks and ICT capital; this may be due to the lack of digital leadership across the EU.

INTRODUCTION

The digital transformation ranks high on the political agenda of the European Union. In March 2021, the European Commission presented a 'Digital Compass', designed to guide Europe through its digital transformation until 2030 (European Commission, 2021). The Compass for the digital era centres on digital skills, the digital transformation of companies, secure and sustainable digital infrastructure, and digital public services. This interest in the digital transformation reflects a belief that digitalisation provides a foundation for technological leadership and international competitiveness.

In recent work (Guarascio and Stöllinger, forthcoming) we make use of a key concept from trade theory – namely, endowments-based comparative advantage – and link it to digitalisation of the economy. According to the Heckscher-Ohlin model, factor endowments determine countries' comparative advantage and, with it, global trade patterns. In particular, a country that enjoys a relative abundance of a certain factor of production (say, capital) tends to export capital-intensive goods, resulting in a positive net 'factor content of trade' (FCT). In such a case, the country is said to hold a comparative advantage in capital.

The availability of international input-output (IO) data has revived empirical work on the Heckscher-Ohlin theory, and in particular its so-called 'factor content' version, most commonly referred to as the Heckscher-Ohlin-Vanek (HOV) theorem, developed by Vanek (1968). This is because international IO data allows for differences in technologies across countries and for the existence of trade in intermediates. These two features make it possible to calculate the factor contents of trade in a theory-consistent manner (Trefler and Zhu, 2010). Incorporating differences in technologies via country-specific input-output data and country-specific factor productivities results in a much better fit of the HOV theorem (Hakura, 2001; Stehrer, 2014; Trefler and Zhu, 2010). The question is whether 'digital' and 'ICT' endowments – or more precisely, digital tasks performed by workers and ICT capital – are still shaping comparative advantage in the era of digitalisation. Moreover, testing the validity of the HOV theorem for digital endowments provides insights into the distribution of comparative advantage across EU member states, which policy makers may wish to consider.

UNDERSTANDING FACTOR-CONTENT BASED COMPARATIVE ADVANTAGE

The HOV predicts that countries with abundant endowments in a certain factor of production will be net exporters of that factor, in this case digital tasks and ICT capital. The approach in our current work is to derive the digital task content of labour inputs from highly granular, occupation-specific data, in combination with a specific survey of the digital tasks performed by workers in different occupations in Italy (for details, see Guarascio and Stöllinger, forthcoming). This detailed information at the level of occupations is then aggregated to the country-industry level. Given the degree of detail of the occupations, it is reasonable to assume that the digital task content of an Italian occupation is comparable to that of the digital task content of the same occupation in other European countries.

A simple example, taking only two occupations from the dataset on the Italian economy,¹ will illustrate the logic underlying factor endowments with digital tasks. The examples are *Database and network professionals (ISCO 252)* and *Machinery mechanics and repairers (ISCO 723)* (Table 1). There are 30,860 database and network professionals who spend more than half of their time on digital tasks (52.5%). This implies that the labour services supplied by this occupation performed a total of 16,190 digital tasks in 2012. The same logic applies to machinery mechanics and repairers, who are far more numerous (329,617 persons) but have negligible digital task content (0.04). As a result, the number of digital tasks contributed by this occupation was only 125. The remaining labour services constitute non-digital tasks. Summing the digital tasks across all occupations in the same way yields a factor endowment of 714,205 for Italy and an average digital task content of 2.88% (see also Cirillo et al., 2021).

Table 1 / Digital tasks intensity at the occupation level and factor endowment with digital tasks, 2012

Occupation	Employment	Digital tasks content	Factor endowment for digital tasks
Database and network professionals (ISCO 252)	30,860	52.46	16,190
...
...
Machinery mechanics and repairers (ISCO 723)	329,617	0.04	125
Total employment	24,764,800	2.88	714,205

Note: Codes refer to the ISCO 08 classification of occupations. For the illustrative example, one occupation with a very high digital task index and one with a low index were chosen.

Source: European LFS, Survey on Italian Occupations, WIOD Release 2016.

The information on ICT capital is derived from the EU KLEMS Release 2019 database and Eurostat. Following Adarov and Stehrer (2019), ICT capital includes computer hardware, telecoms equipment and computer software and databases. Both digital tasks and ICT capital have their counterparts in non-digital tasks and non-ICT capital, which add up to total employment and total capital stocks, respectively. Hence, there are four endowments for which the HOV theorem is tested.

Technically, the HOV test consists of comparing the *measured* factor content of trade of a country (F^c) with the *predicted* FCT (\tilde{F}^c) of that country. The former uses input-output techniques to calculate the direct and indirect factor requirements (A) that are necessary to produce a country's imports and exports (T^c). The FCT can be negative or positive, with the latter signalling comparative advantage in the factor

¹ The full dataset comprises 130 occupations across 56 industries in 25 EU countries.

under consideration. The predicted FCT, by contrast, is the difference between a country's actual factor endowment with a specific factor (V^c) (say digital tasks) and its share in world endowment with that factor (V^W), given its share in global income (s^c). Then, if the fit of the HOV theorem is perfect, the measured FCT would be equal to the predicted FCT:

$$\underbrace{A \cdot T^c}_{\text{Measured factor content of trade}} \equiv F^c = \underbrace{\tilde{F}^c}_{\text{Predicted factor content of trade}} \equiv V^c - s^c \cdot (V^W),$$

DOES THE HECKSCHER-OHLIN-VANEK THEORY HOLD?

Table 2 summarises the combined results of the test, where each country is assigned to an innovation performance group, as defined by the European Innovation Scoreboard (EIS).²

Table 2 / Measured and predicted factor content of trade of EU countries, 2012

Group	Country	Measured factor content of trade				Predicted factor content of trade			
		Digital tasks	ICT capital	Non-digital tasks	Non-ICT capital	Digital tasks	ICT capital	Non-digital tasks	Non-ICT capital
Innovation leaders	DK	-10,517	-3,836	-365,356	-6,722	-14,375	-12,389	-1,161,644	92,743
	FI	-6,441	-1,472	-199,722	-18,920	-3,425	-5,934	-824,957	18,201
	LU	-12,790	-2,730	-254,851	-20,991	-1,266	296	-194,185	-12,127
	NL	12,921	2,428	91,464	111,784	11,424	8,433	-1,007,196	174,149
	SE	-15,955	4,217	-468,010	-1,833	-29,925	21,371	-2,091,753	28,361
Strong innovators	AT	-16,977	2,482	-500,571	11,359	-24,615	14,576	-1,031,520	246,473
	BE	-14,270	-1,174	-339,087	5,741	-45,596	-3,563	-1,821,048	-40,750
	DE	25,181	-11,124	-423,238	139,174	68,762	-70,988	-761,165	1,087,300
	EE	69	-86	22,549	-1,699	7,756	169	273,155	-5,940
	FR	-44,703	2,042	-1,353,694	-164,916	-270,608	-5,175	-9,073,471	161,547
	UK	8,540	19,635	-863,490	-193,487	51,607	135,635	-6,241,266	-1,987,927
	IE	-11,630	-3,797	-304,532	-18,462	-3,308	-3,499	-576,661	-26,428
PT	-4,600	-928	68,514	-19,924	-985	-3,337	1,543,988	-11,811	
Moderate innovators	CZ	23,016	1,160	713,410	53,405	84,726	575	2,338,556	200,395
	ES	-4,613	-1,099	277,888	42,970	-107,575	-17,986	168,691	-30,264
	EL	-8,981	-1,583	-282,997	-36,447	-17,576	-5,460	567,135	-152,643
	HU	13,128	6	595,728	33,590	61,939	-350	2,417,586	129,918
	IT	7,220	-2,164	-195,718	85,601	-95,331	-35,840	-2,551,968	693,251
	LT	-696	1	43,234	-3,785	9,281	739	699,382	-11,777
	LV	871	-258	41,313	1,673	12,714	-756	466,854	-7,487
	PL	37,885	-1,640	2,156,025	-45,678	164,220	-13,981	8,745,802	-646,135
	SK	7,400	584	202,153	48,187	25,516	-584	968,598	97,917
	SI	1,440	-242	69,694	4,630	7,232	-725	330,570	16,457
*)	BG	5,487	-575	464,413	-2,905	45,015	-2,398	2,663,425	2,807
	RO	9,015	154	804,878	-2,344	64,394	1,173	6,153,092	-16,230

Note: *) Bulgaria and Romania are 'modest innovators'. Digital tasks and non-digital tasks add up to total labour endowment. ICT capital and non-ICT capital add up to total capital endowment. Malta, Cyprus and Croatia missing due to data constraints.

Source: Survey on Italian Occupations, EU KLEMS, Eurostat, WIOD Release 2016. Authors' own work.

² See: https://ec.europa.eu/commission/presscorner/detail/en/QANDA_20_1150

Focusing on the results for the measured FCT, it is easy to see that the innovation leaders in the EU do not necessarily have positive net exports of digital tasks and ICT capital. In fact, it turns out that within this group only the Netherlands is a net exporter of both digital tasks and ICT capital. All other countries in the leader group are net importers of digital tasks, and – with the exception of Sweden – also have a negative factor content of trade in ICT capital.

The results are also mixed across the other innovation performance groups, with no clearly discernible patterns. This is somewhat surprising, but it says nothing about the appropriateness of the HOV theorem. However, this evidence may lend some additional support to theoretical positions that underline the importance of ‘out-of-equilibrium’ explanatory factors (see, among others, Dosi et al., 1990; 2015; Guarascio et al., 2017). This means going beyond production functions to consider factors such as country- and industry-specific capabilities or institutional heterogeneities that are likely to explain real-world specialisation and trade patterns in more detail than the Heckscher-Ohlin model, with its simplifying assumptions. On the other hand, this evidence may also reflect the differentiated pattern of specialisation in digital tasks and ICT capital. Germany and Italy, for example, which have a relatively low share of ICT capital in their overall capital stock, are net importers of ICT capital, but net exporters of digital tasks. Exactly the opposite is true of France, which, like Germany, belongs in the strong innovator group. By contrast, Czechia and Romania emerge as net exporters of digital tasks. It cannot be ruled out that this reflects to some extent Treffer’s (1995) ‘endowment paradox’, which is related to differences in factor productivities across countries. This paradox refers to the phenomenon that most factors tend to be scarce in ‘rich’ countries (owing to their comparatively high factor productivities), while ‘poor’ countries are found to have an abundance of most factors (owing to their comparatively low factor productivities), so that the latter tend to have positive measured factor contents of trade. Despite the fact that the calculation of the measured FCT took account of differences in technology in both direct factor input requirements and the input-output structure, it could possibly be that some traces of this ‘endowment paradox’ are still in the data. Moreover, as the data on digital tasks and ICT capital are defined at a very granular level, measurement error may also be an issue. This is all the more likely, as the employment and capital data had to be aligned with the corresponding values in the WIOD database.

There is, however, an alternative economic explanation for the rather unsystematic distribution of digital comparative advantage across EU member states: a lack of clear digital leadership within the EU (see, for example, Adarov et al., 2021). This concern about digital leadership – or the lack thereof – is not entirely new, and can be regarded as the latest version of the EU’s eternal concern about losing the technology race against the US (as the permanent economic rival) and other emerging economic superpowers of the time, currently China (Landesmann and Stöllinger, 2020). If one accepts the common notion that EU member states struggle to keep up with the ‘digital frontier’, then the mixed pattern of the comparative advantage in digital tasks and ICT capital may be attributable to this weakness. As this paper is confined to EU countries, this assertion remains only a hypothesis for the time being.³

Despite these surprising patterns across countries, Table 3 shows that the fit between the measured and the predicted FCT – that is, the actual HOV test – is relatively high. Overall, in 83% of cases, the measured and the predicted FCT have the same sign, which can be interpreted as strong (if not overwhelming) support for the HOV theorem (Table 3).

³ In future work, similar analyses of the factor contents of trade for the US and the EU will be undertaken; this could then provide empirical evidence for or against this hypothesis.

Table 3 / Sign tests of the HOV theorem for individual factors, 2012

	All factors	Digital tasks	Non-digital tasks	ICT capital	Non-ICT capital
Sign test	0.83	0.92	0.92	0.80	0.68
Slope coefficient	0.1867	0.2168	0.1920	0.1581	0.1273
t-statistics	(14.28)	(6.27)	(10.80)	(5.12)	(4.54)
R-squared	0.6753	0.6310	0.8352	0.5328	0.4730
No. of observations	100	25	25	25	25

Note: Sign and rank tests follow the methodology of Treffer (1995), as provided at: <http://www.robertcfeenstra.com/graduate-text.html>. This includes the weighting of factor endowments.

Source: Survey on Italian Occupations, EU KLEMS, Eurostat, WIOD Release 2016. Authors' own work.

When running the tests separately for each of the four factors, we find that our scores for both types of labour services come close to the results in Treffer and Zhu (2010), which include only labour. By comparison, the fit of the HOV theorem for ICT capital and non-ICT capital is inferior, which mirrors the pattern found in Stehrer (2014).

CONCLUSIONS

The digital transformation and its impact on countries' comparative advantage raises the question of whether factor endowments still play a role in the 'digital era'. Based on an analysis of digital and non-digital tasks, and of ICT and non-ICT capital within a HOV framework for 25 EU countries, the answer to this question is a resounding yes. A surprising finding, though, is that the EU's innovation leaders are not necessarily those that enjoy an abundance of digital tasks and ICT capital. Rather, what emerges is a mixed picture, with both innovation leaders and modest innovators holding a comparative advantage in digital tasks or ICT capital. We believe this to be a very important finding. A working hypothesis could be that this mixed pattern is due to a lack of digital leadership in any of the EU member states (and hence the EU as a whole). This would have severe implications for the future economic development of the EU; but at this stage it remains only a hypothesis.

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Conventional signs and abbreviations used

%	per cent
ER	exchange rate
GDP	Gross Domestic Product
HICP	Harmonised 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
y-o-y	year on year

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

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

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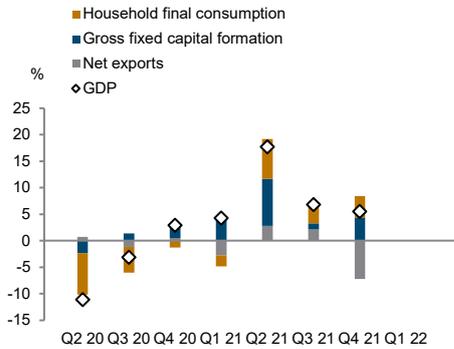
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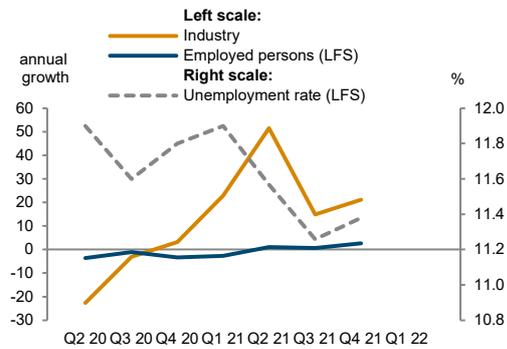
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Albania

Real GDP growth and contributions
y-o-y



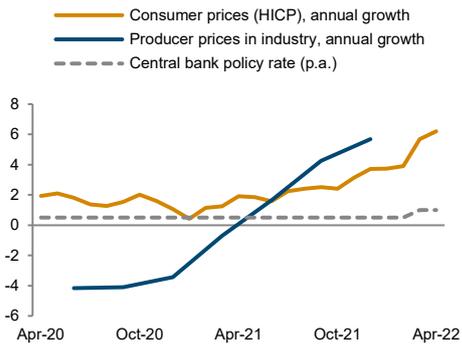
Real sector development
in %



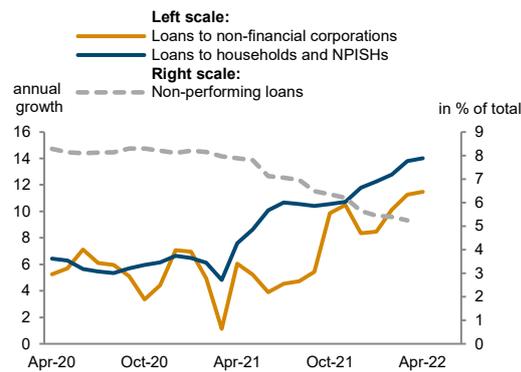
Unit labour costs in industry
annual growth rate in %



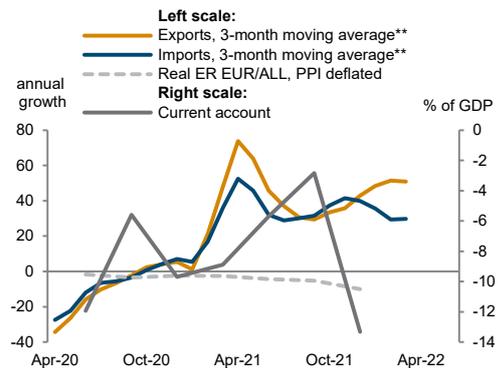
Inflation and policy rate
in %



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.

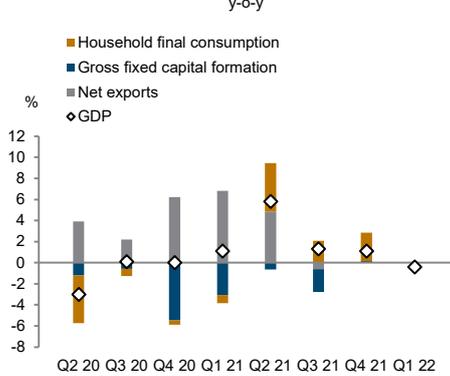
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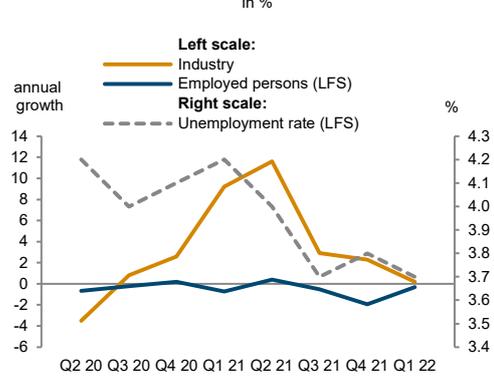
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Belarus

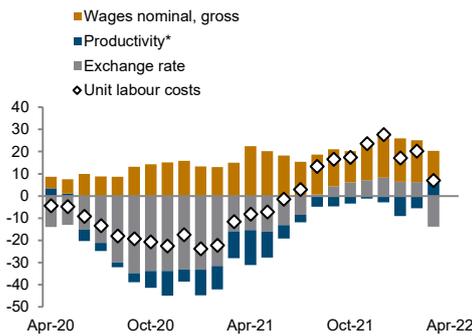
Real GDP growth and contributions



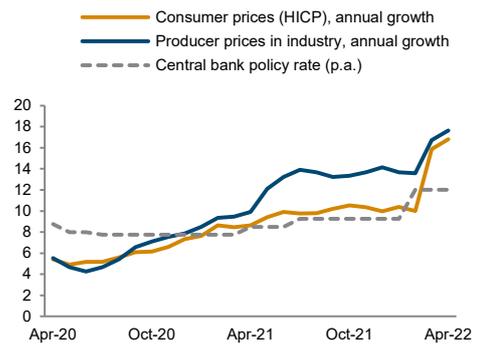
Real sector development



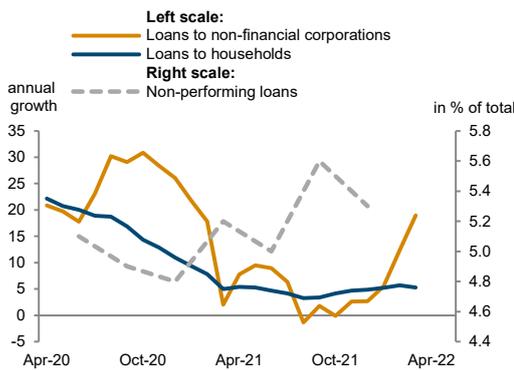
Unit labour costs in industry



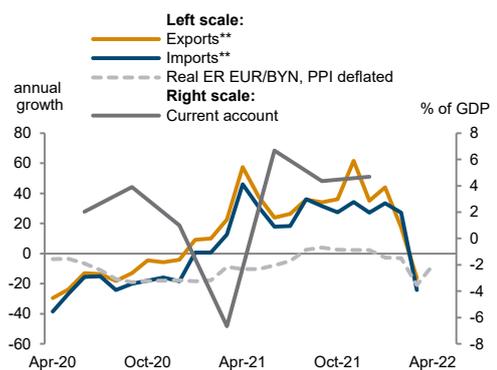
Inflation and policy rate



Financial indicators



External sector development

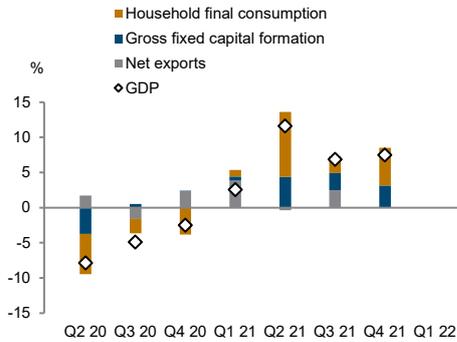


*Positive values of the productivity component on the graph reflect decline in productivity and vice versa.
 **EUR based.

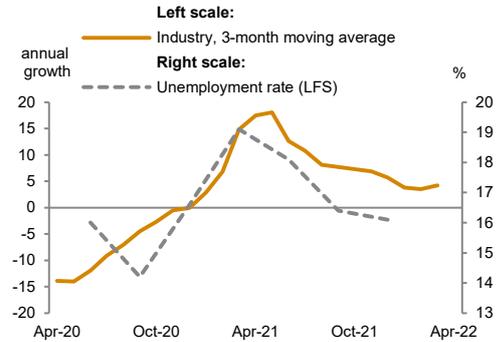
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Bosnia and Herzegovina

Real GDP growth and contributions
y-o-y



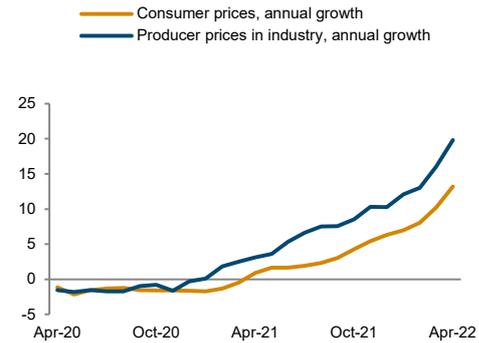
Real sector development
in %



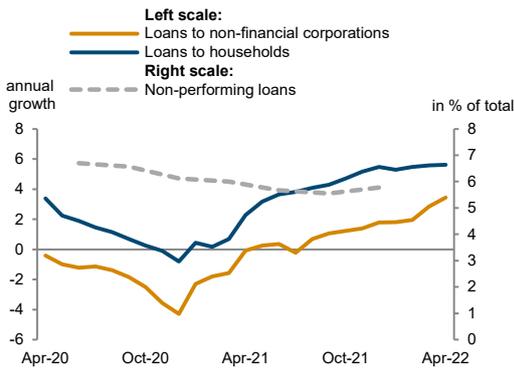
Unit labour costs in industry
annual growth rate in %



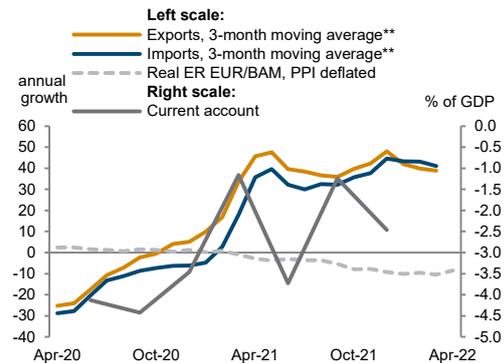
Inflation
in %



Financial indicators
in %



External sector development
in %



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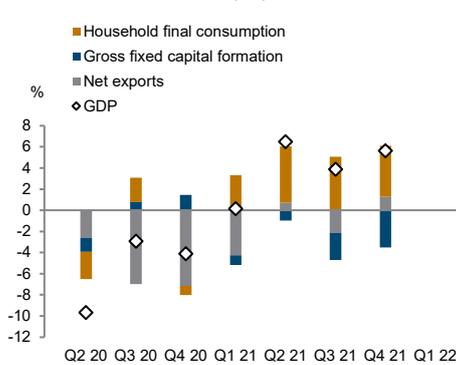
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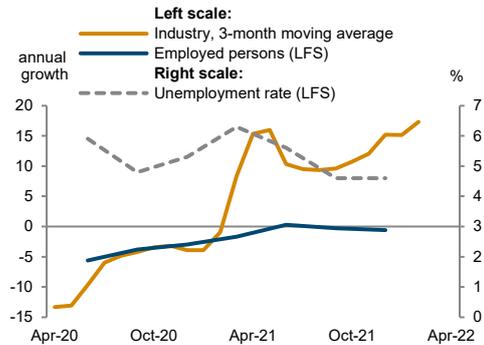
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Bulgaria

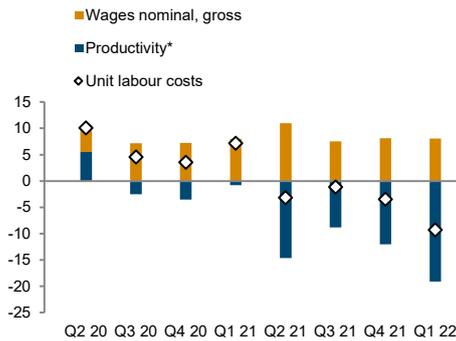
Real GDP growth and contributions



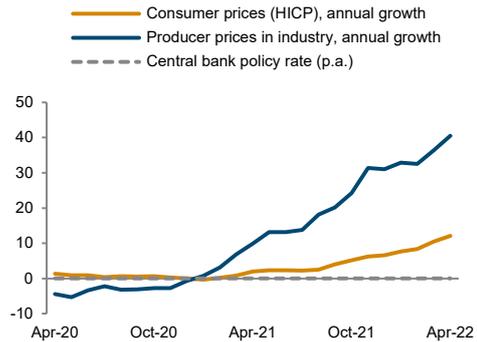
Real sector development



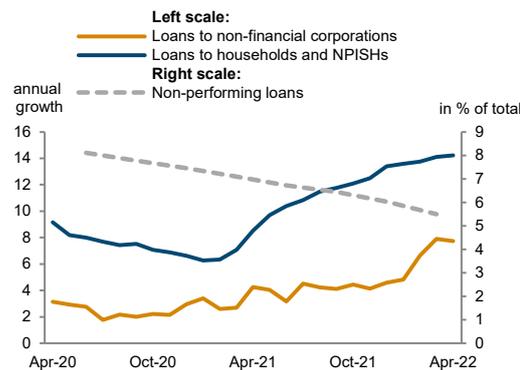
Unit labour costs in industry



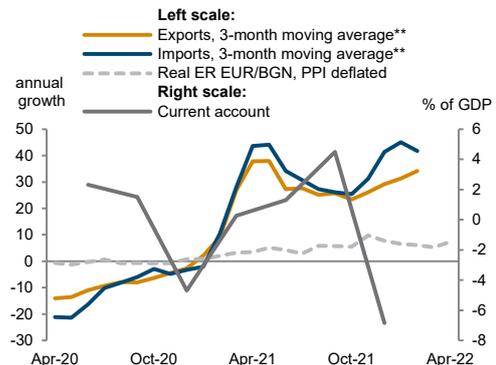
Inflation and policy rate



Financial indicators



External sector development



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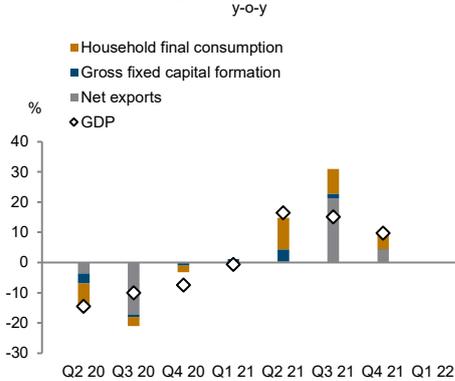
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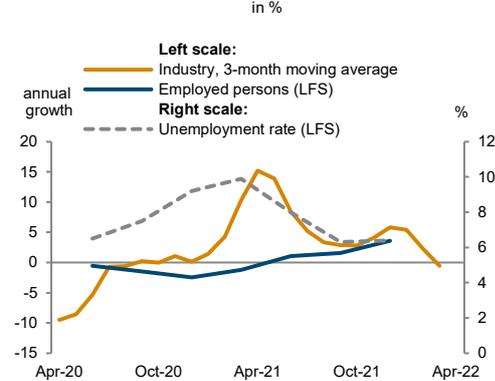
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Croatia

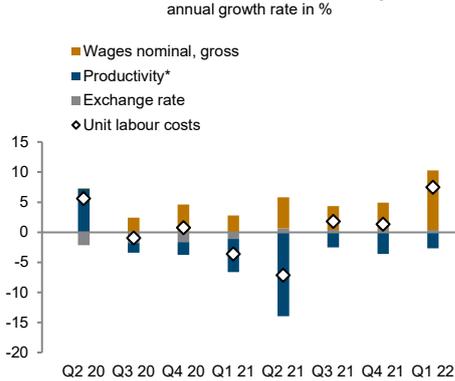
Real GDP growth and contributions



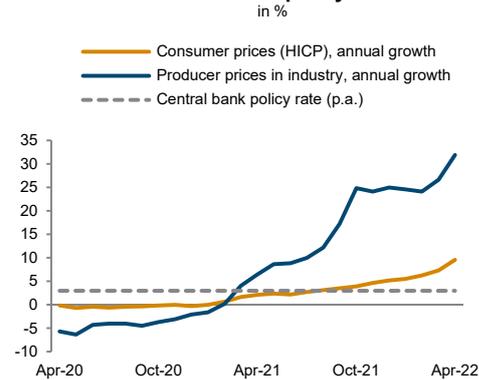
Real sector development



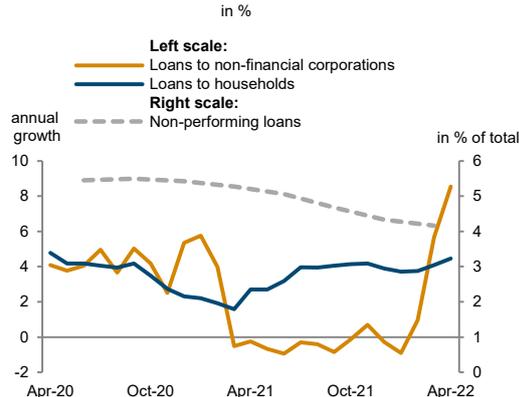
Unit labour costs in industry



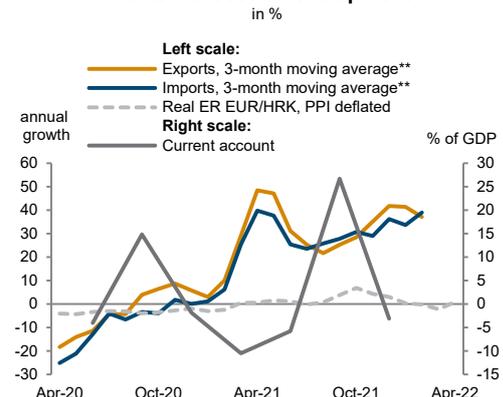
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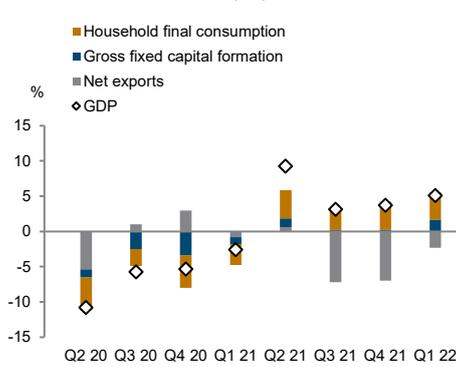
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

Baseline data, country-specific definitions and methodological breaks in time series are available under:

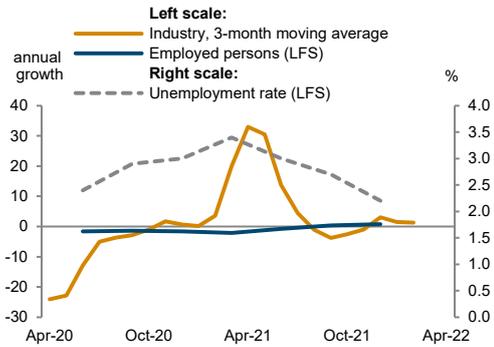
<https://data.wiiw.ac.at/monthly-database.html>

Czechia

Real GDP growth and contributions



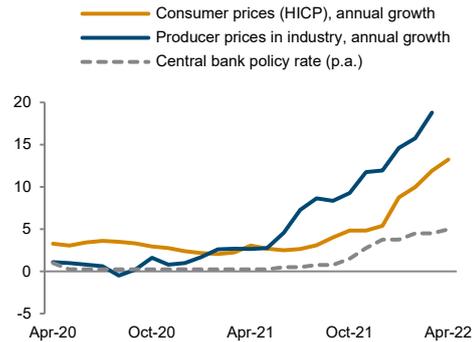
Real sector development



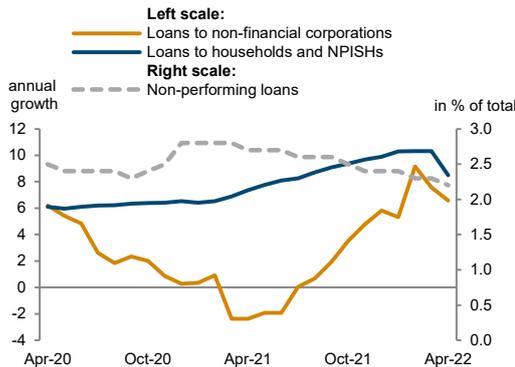
Unit labour costs in industry



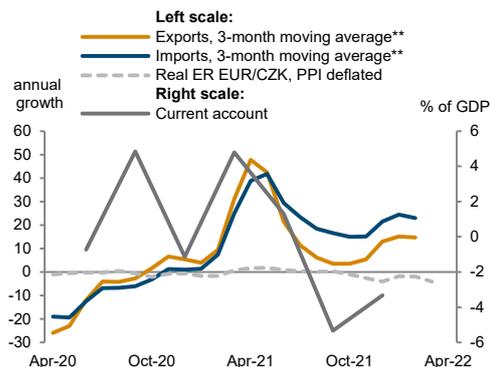
Inflation and policy rate



Financial indicators



External sector development



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

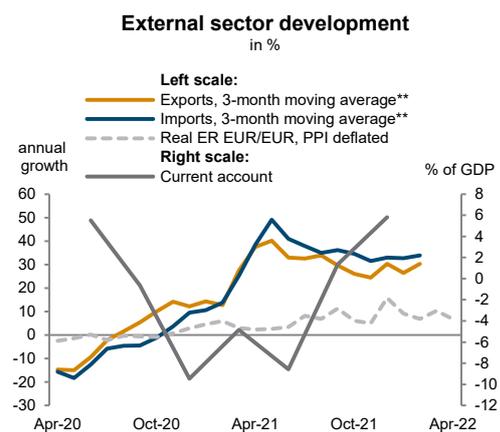
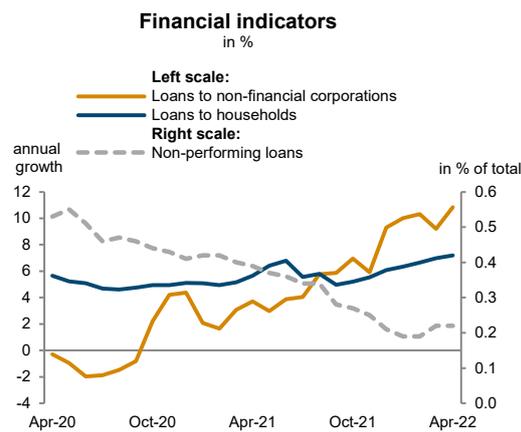
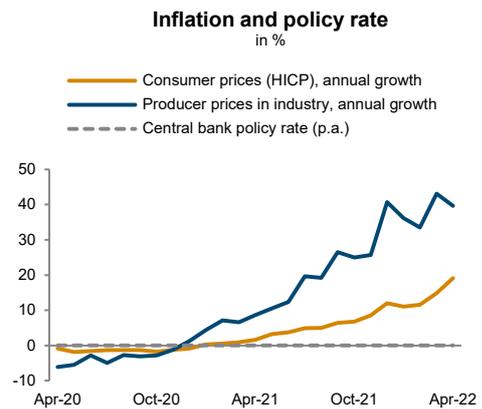
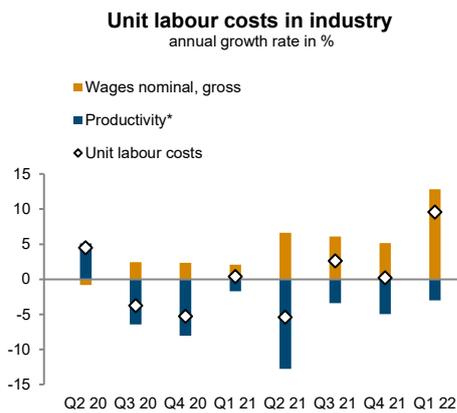
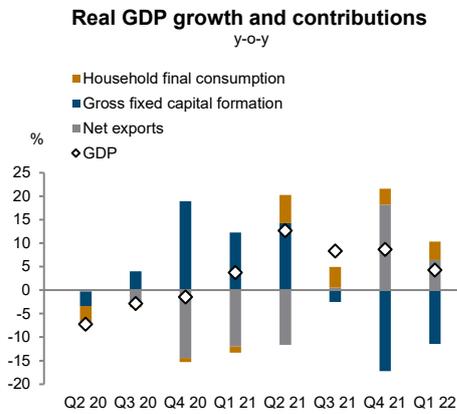
**EUR based.

Source: wiiw Monthly Database incorporating Eurostat and national statistics.

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Estonia



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

**EUR based.

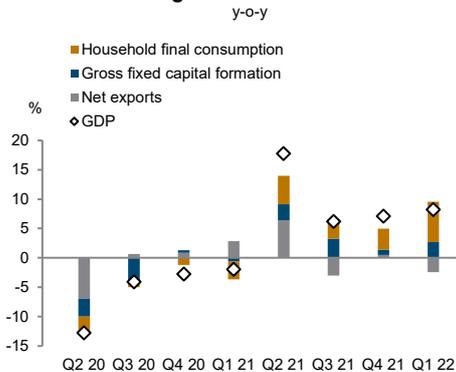
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

Baseline data, country-specific definitions and methodological breaks in time series are available under:

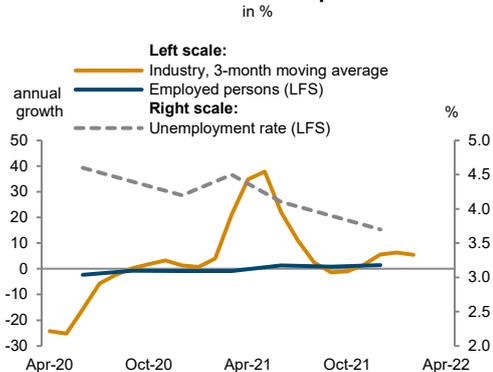
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Hungary

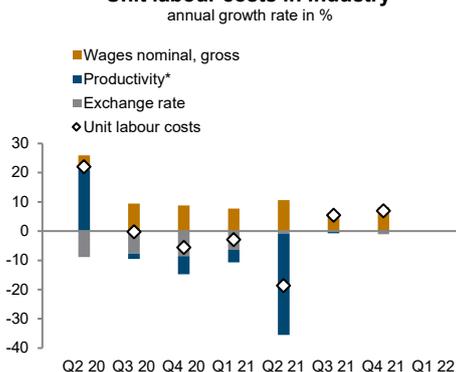
Real GDP growth and contributions



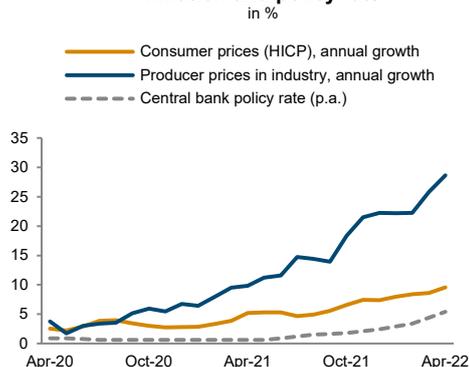
Real sector development



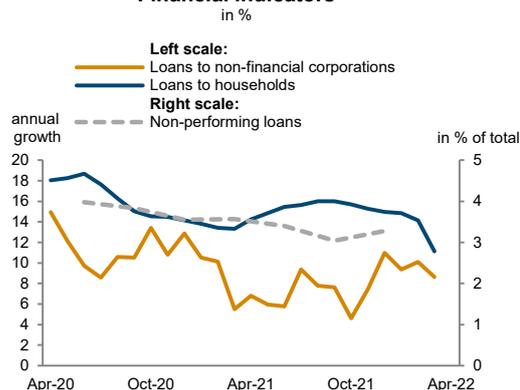
Unit labour costs in industry



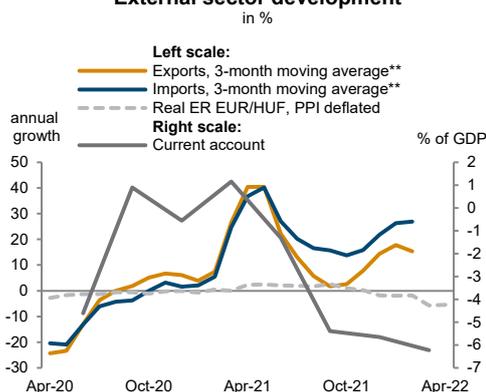
Inflation and policy rate



Financial indicators



External sector development



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**EUR based.

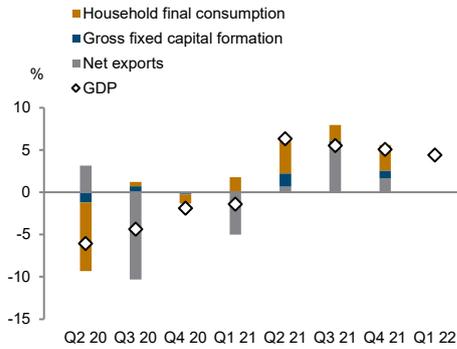
Source: wiw Monthly Database incorporating Eurostat and national statistics.

Baseline data, country-specific definitions and methodological breaks in time series are available under:

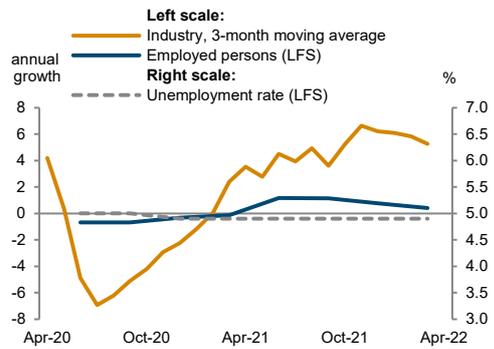
<https://data.wiw.ac.at/monthly-database.html>

Kazakhstan

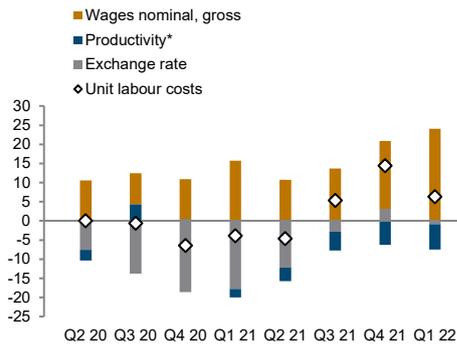
Real GDP growth and contributions
y-o-y



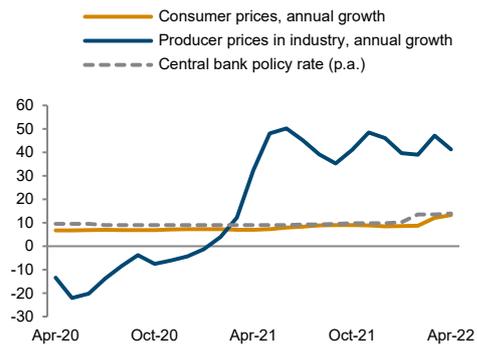
Real sector development
in %



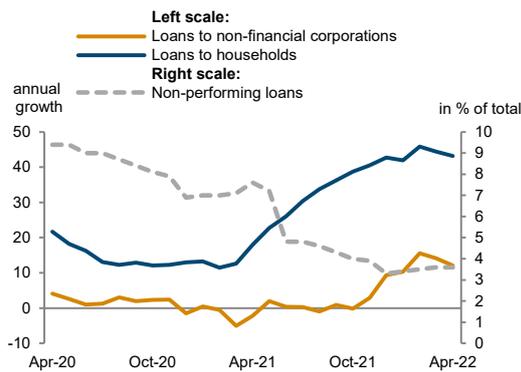
Unit labour costs in industry
annual growth rate in %



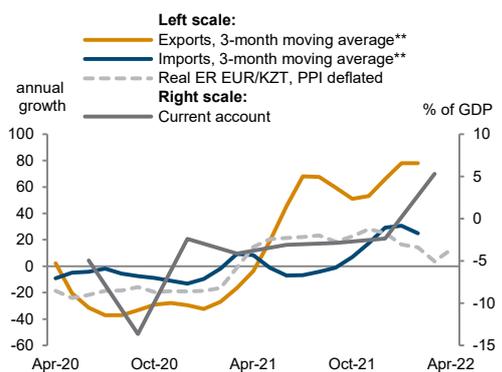
Inflation and policy rate
in %



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.

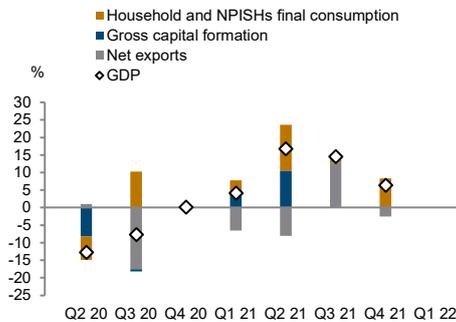
Baseline data, country-specific definitions and methodological breaks in time series are available under:

<https://data.wiiw.ac.at/monthly-database.html>

Kosovo

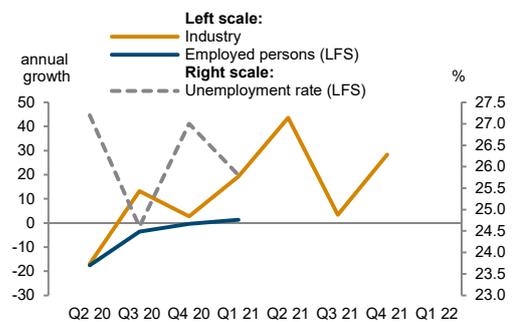
Real GDP growth and contributions

y-o-y



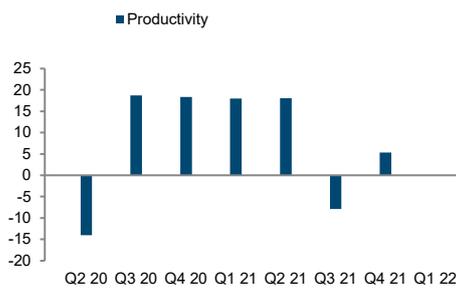
Real sector development

in %



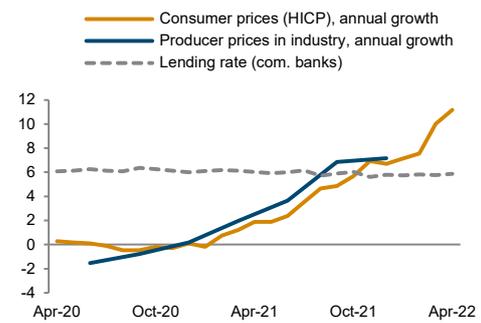
Productivity in industry

annual growth rate in %



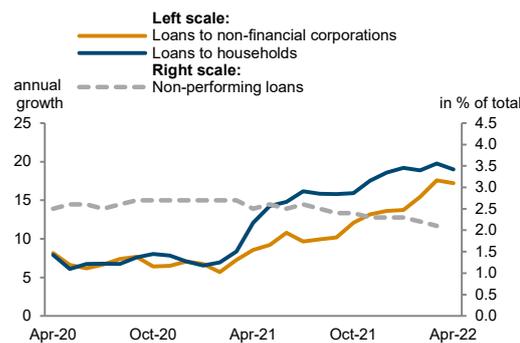
Inflation and lending rate

in %



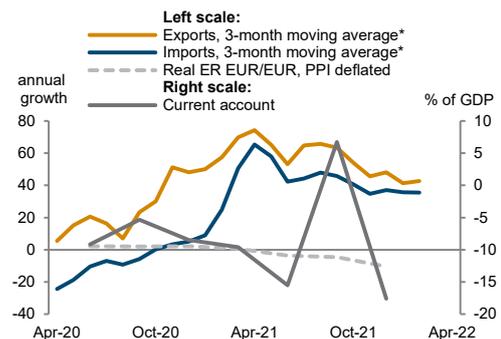
Financial indicators

in %



External sector development

in %



*EUR based.

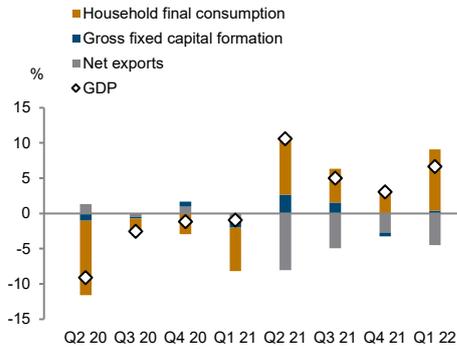
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

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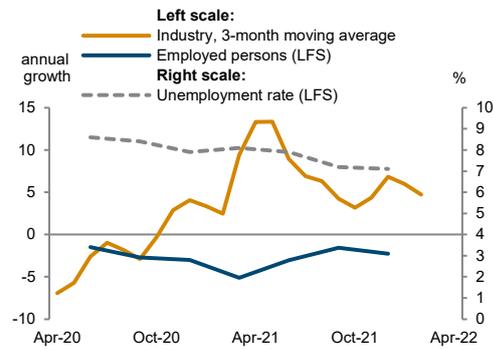
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Latvia

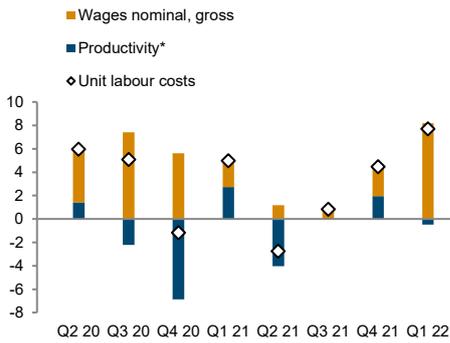
Real GDP growth and contributions
y-o-y



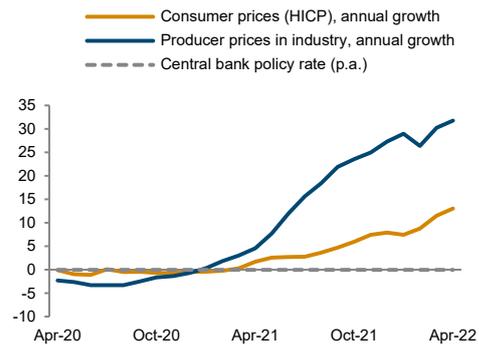
Real sector development
in %



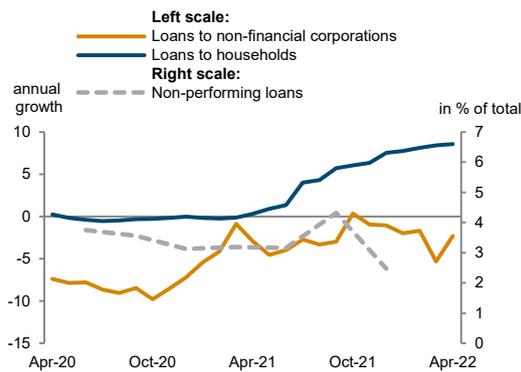
Unit labour costs in industry
annual growth rate in %



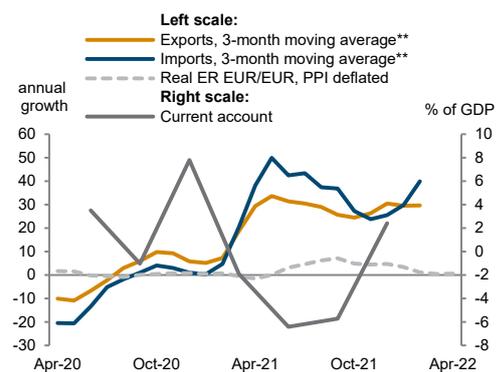
Inflation and policy rate
in %



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.

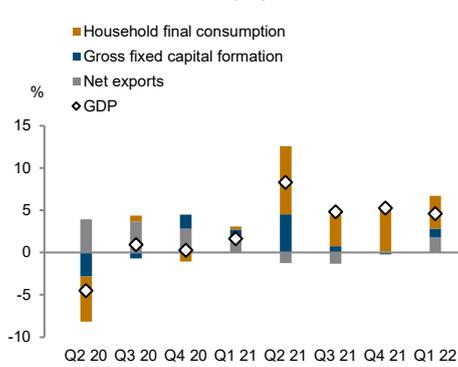
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

Baseline data, country-specific definitions and methodological breaks in time series are available under:

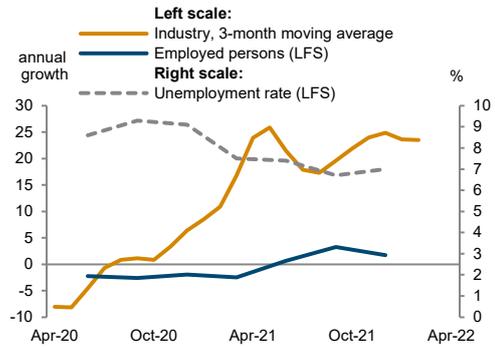
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Lithuania

Real GDP growth and contributions



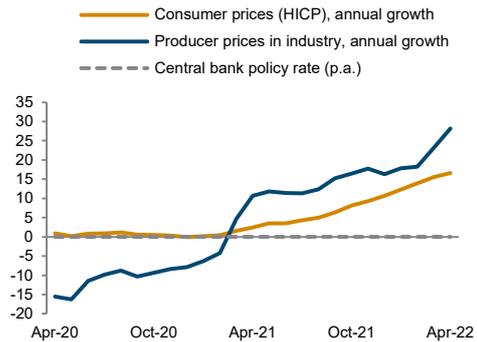
Real sector development



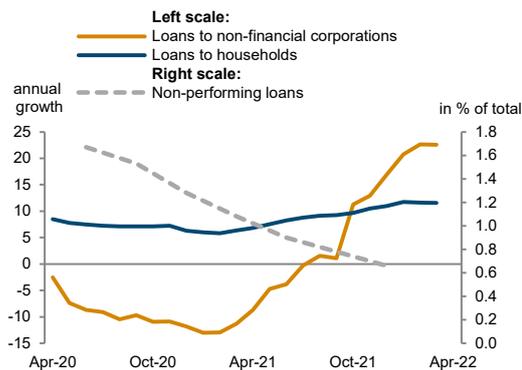
Unit labour costs in industry



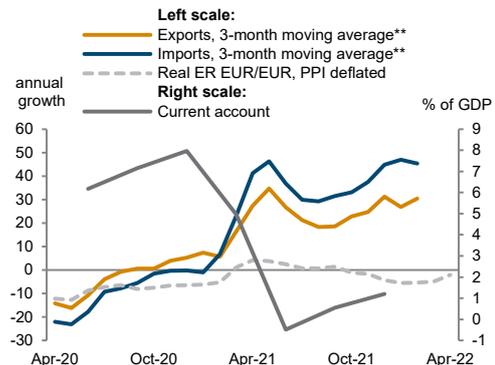
Inflation and policy rate



Financial indicators



External sector development



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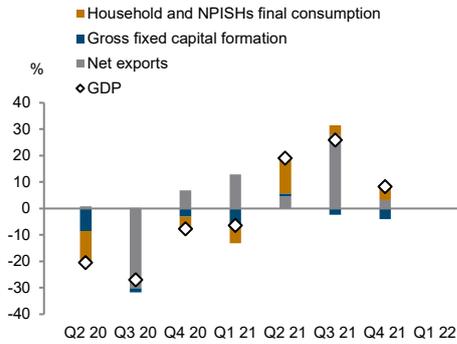
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

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Montenegro

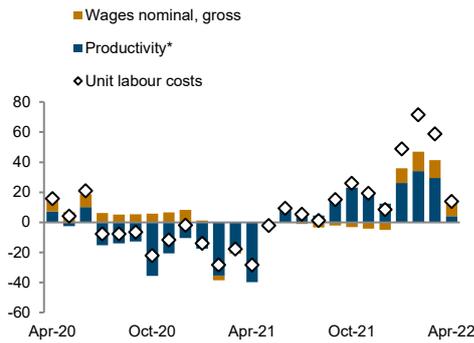
Real GDP growth and contributions
y-o-y



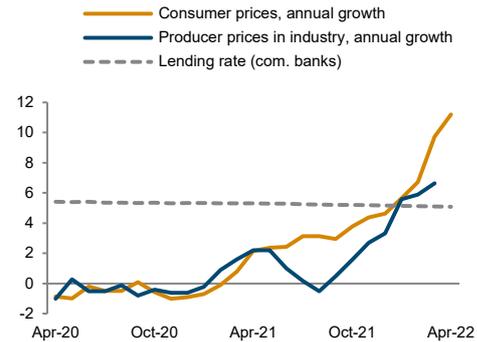
Real sector development
in %



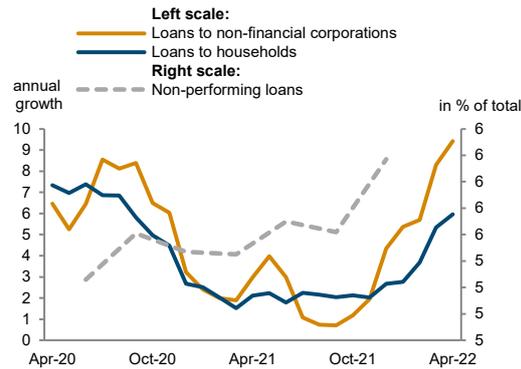
Unit labour costs in industry
annual growth rate in %



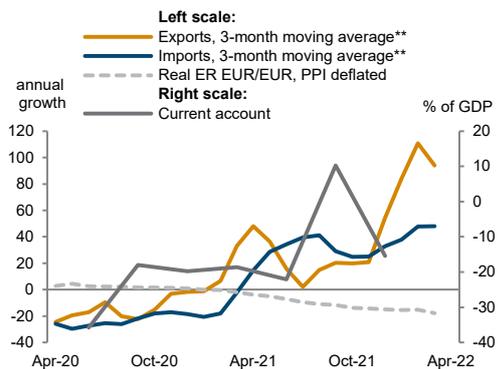
Inflation and lending rate
in %



Financial indicators
in %



External sector development
in %



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**EUR based.

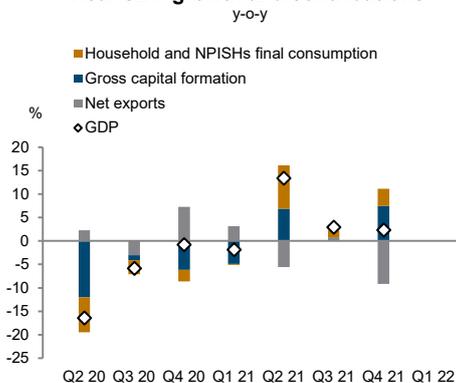
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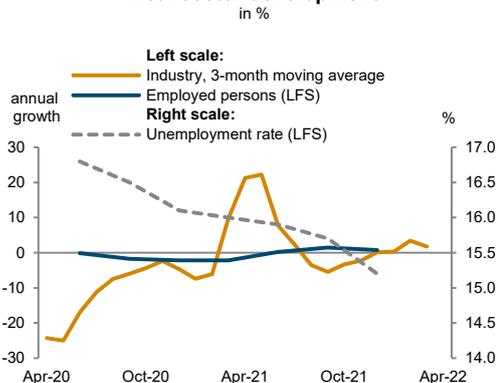
<https://data.wiiw.ac.at/monthly-database.html>

North Macedonia

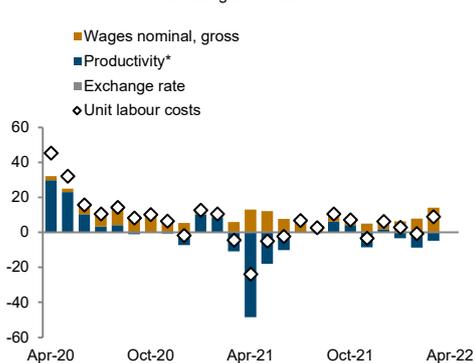
Real GDP growth and contributions



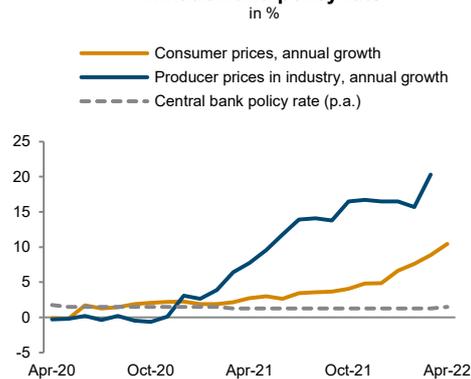
Real sector development



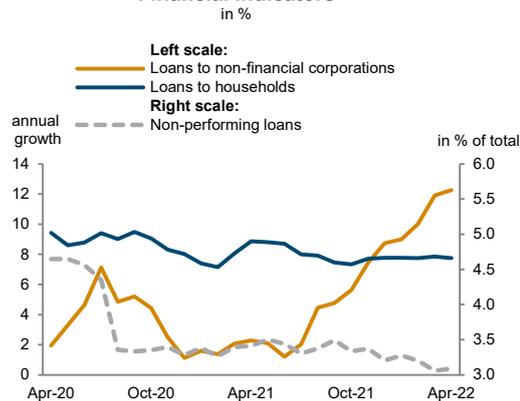
Unit labour costs in industry



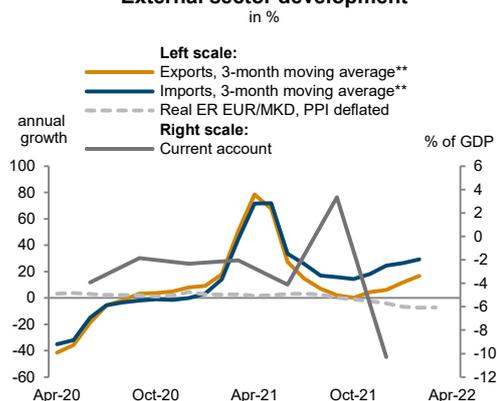
Inflation and policy rate



Financial indicators



External sector development



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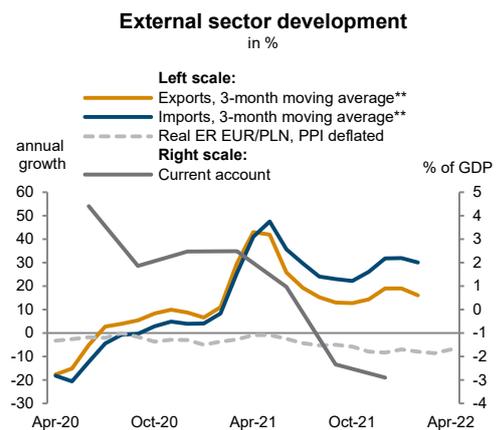
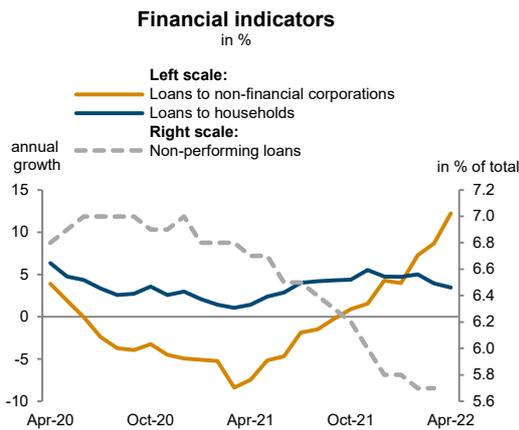
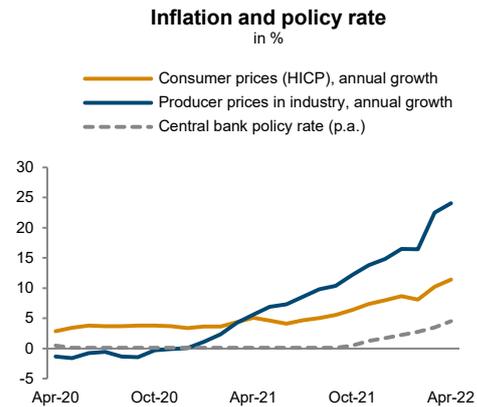
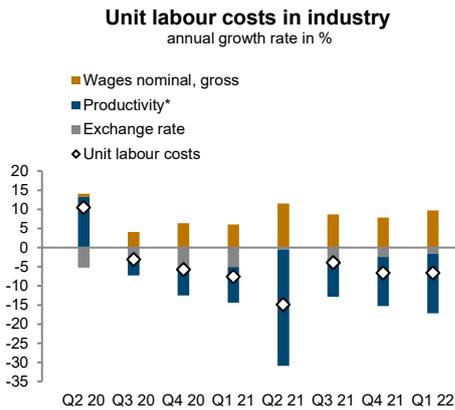
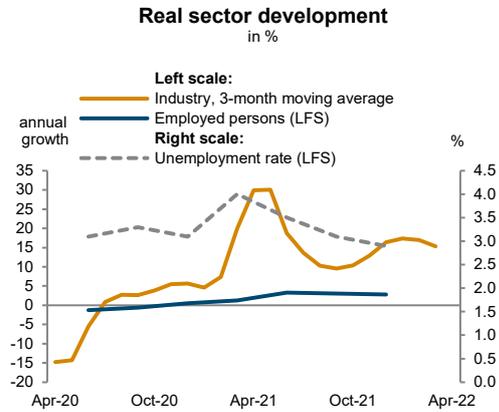
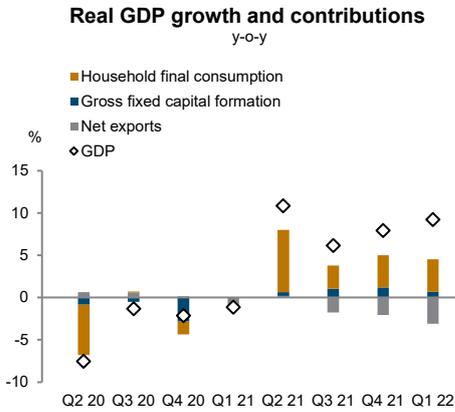
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Poland

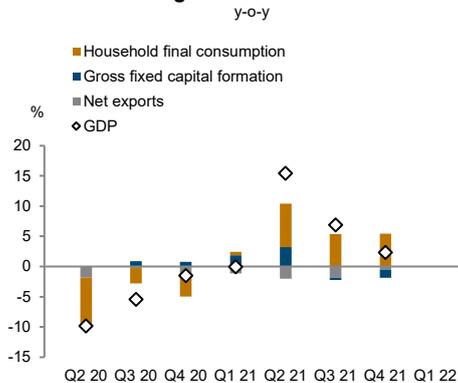


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**EUR based.

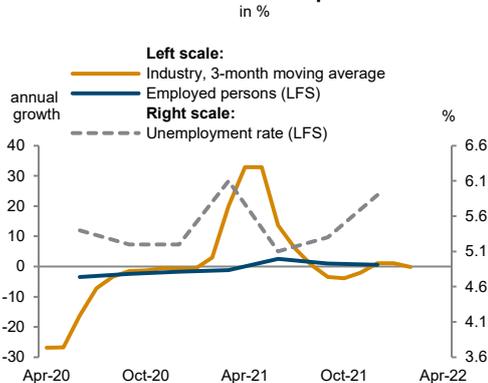
Source: wiiw Monthly Database incorporating Eurostat and national statistics.
Baseline data, country-specific definitions and methodological breaks in time series are available under:
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Romania

Real GDP growth and contributions



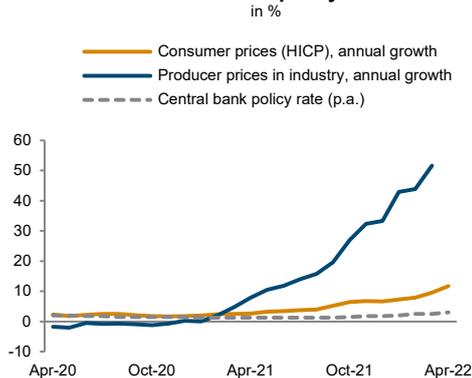
Real sector development



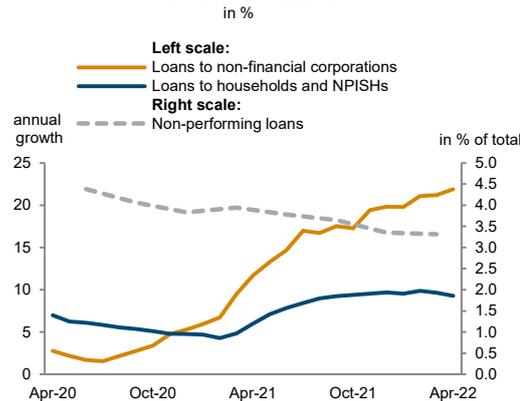
Unit labour costs in industry



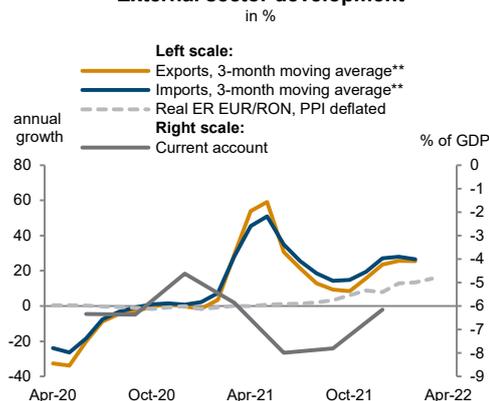
Inflation and policy rate



Financial indicators



External sector development



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**EUR based.

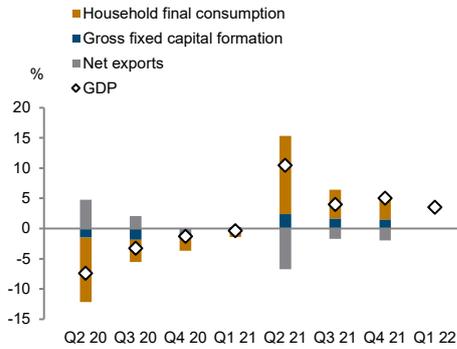
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

Baseline data, country-specific definitions and methodological breaks in time series are available under:

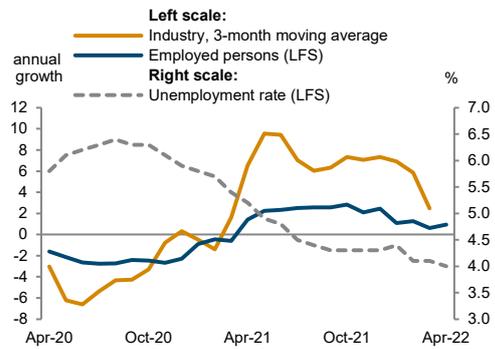
<https://data.wiiw.ac.at/monthly-database.html>

Russia

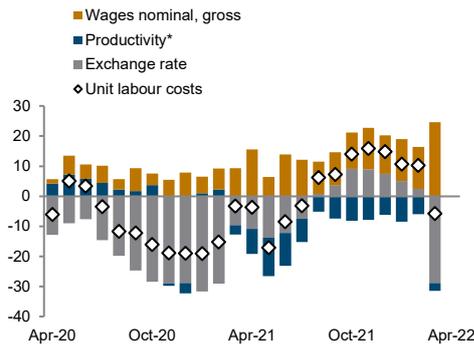
Real GDP growth and contributions
y-o-y



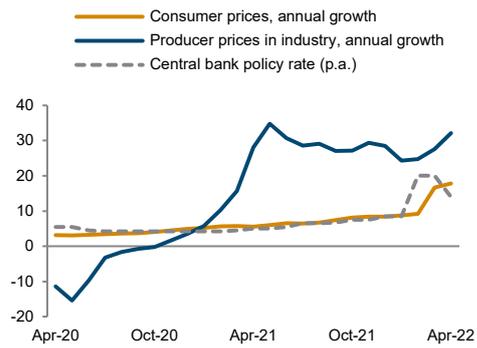
Real sector development
in %



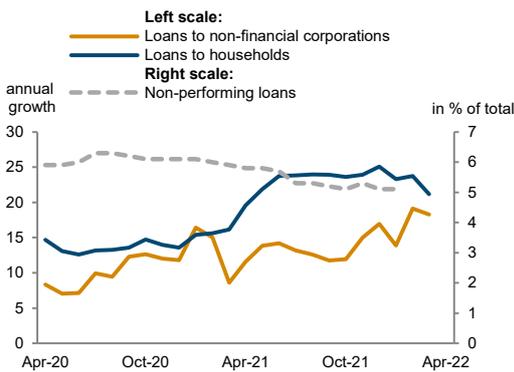
Unit labour costs in industry
annual growth rate in %



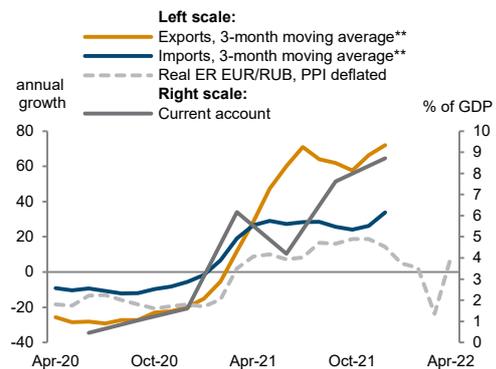
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %



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**EUR based.

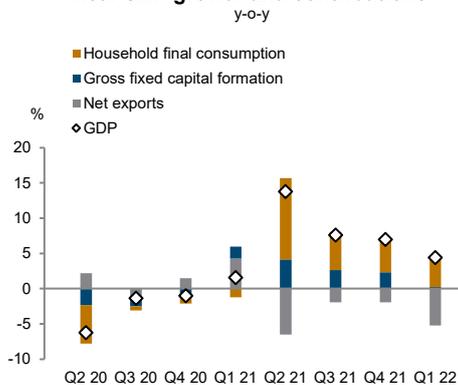
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

Baseline data, country-specific definitions and methodological breaks in time series are available under:

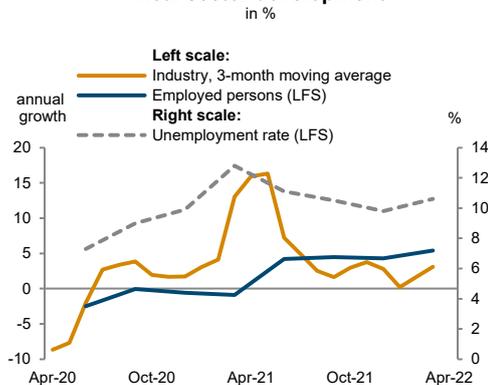
<https://data.wiiw.ac.at/monthly-database.html>

Serbia

Real GDP growth and contributions



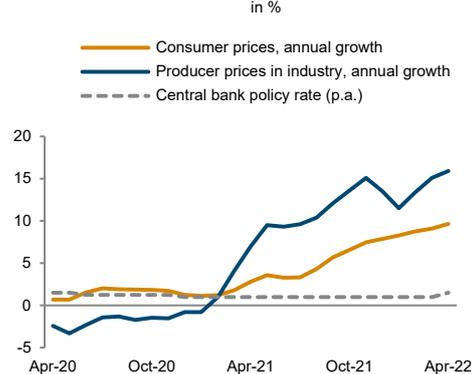
Real sector development



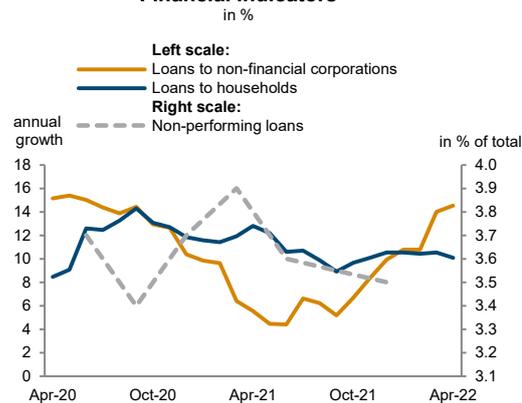
Unit labour costs in industry



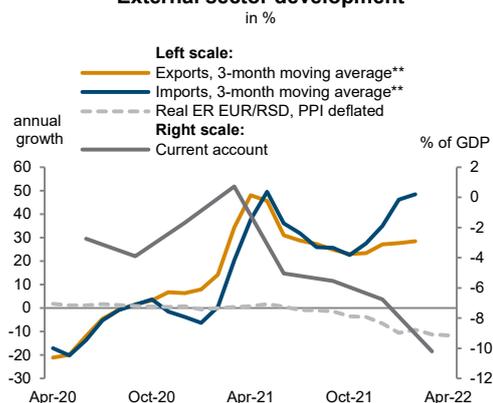
Inflation and policy rate



Financial indicators



External sector development



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**EUR based.

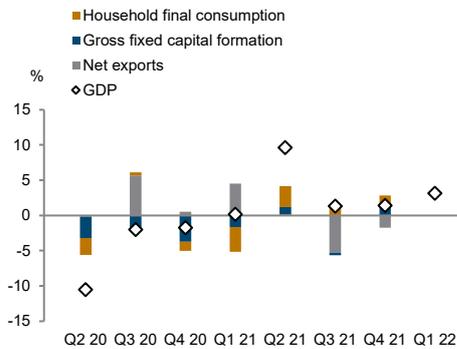
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

Baseline data, country-specific definitions and methodological breaks in time series are available under:

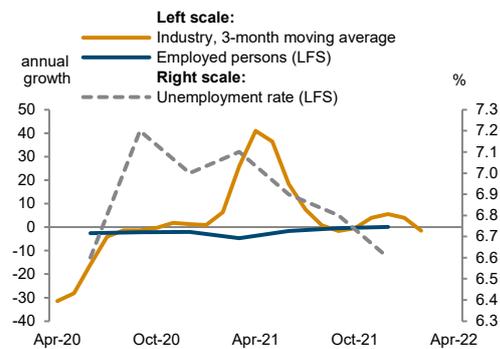
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Slovakia

Real GDP growth and contributions
y-o-y



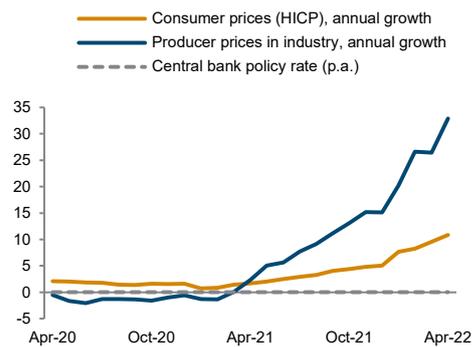
Real sector development
in %



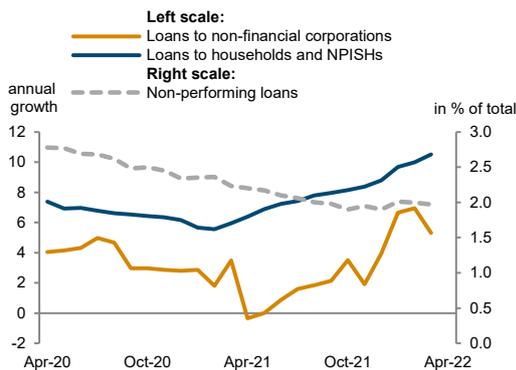
Unit labour costs in industry
annual growth rate in %



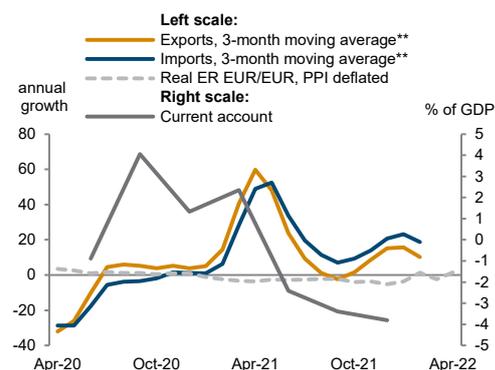
Inflation and policy rate
in %



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.

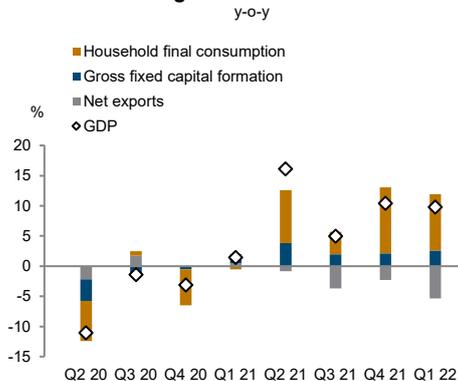
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

Baseline data, country-specific definitions and methodological breaks in time series are available under:

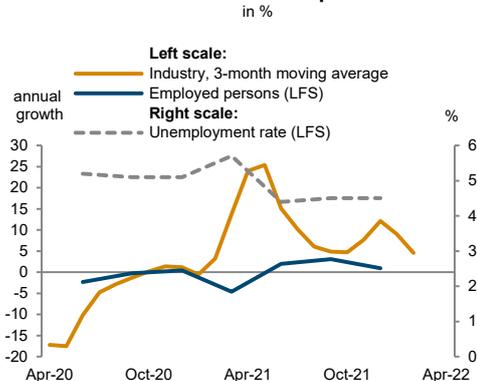
<https://data.wiiw.ac.at/monthly-database.html>

Slovenia

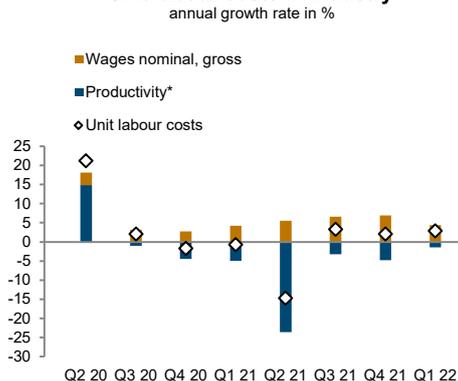
Real GDP growth and contributions



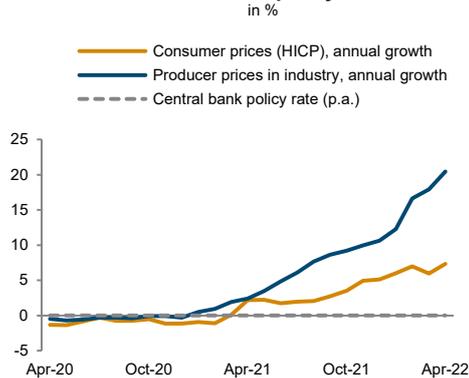
Real sector development



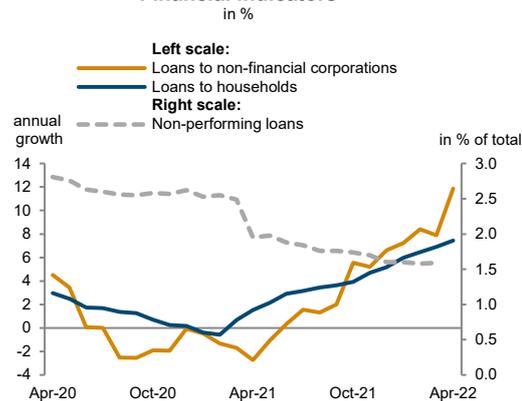
Unit labour costs in industry



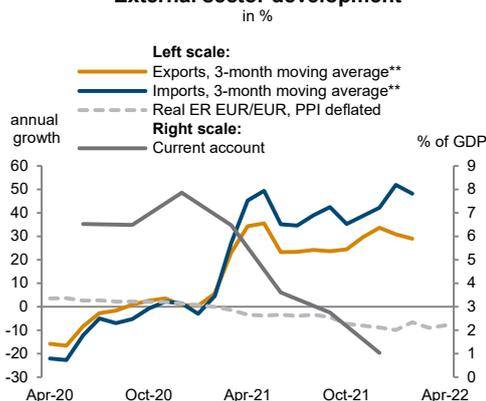
Inflation and policy rate



Financial indicators



External sector development



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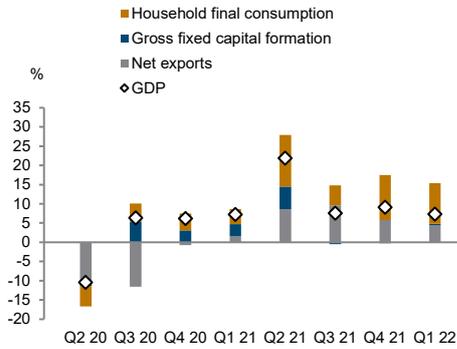
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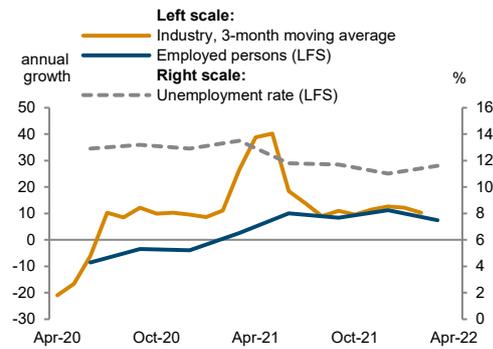
<https://data.wiiw.ac.at/monthly-database.html>

Turkey

Real GDP growth and contributions
y-o-y



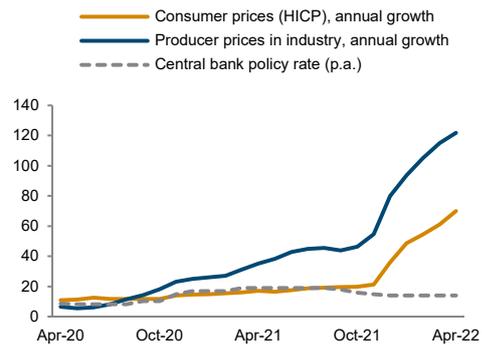
Real sector development
in %



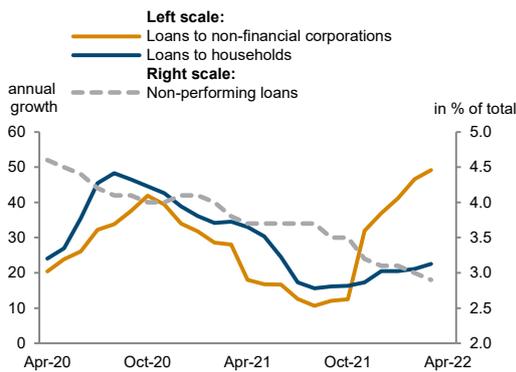
Unit labour costs in industry
annual growth rate in %



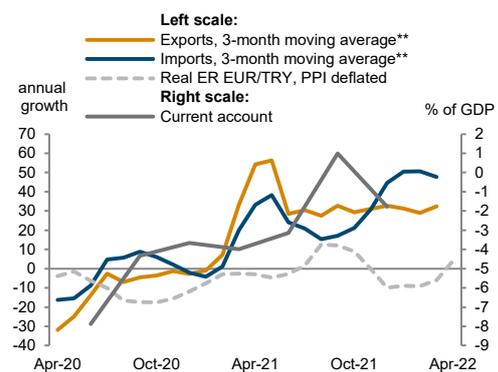
Inflation and policy rate
in %



Financial indicators
in %



External sector development
in %



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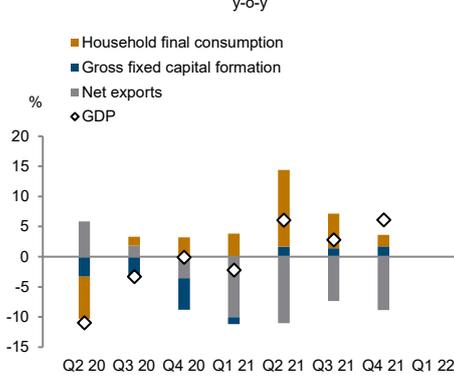
Source: wiiw Monthly Database incorporating Eurostat and national statistics.

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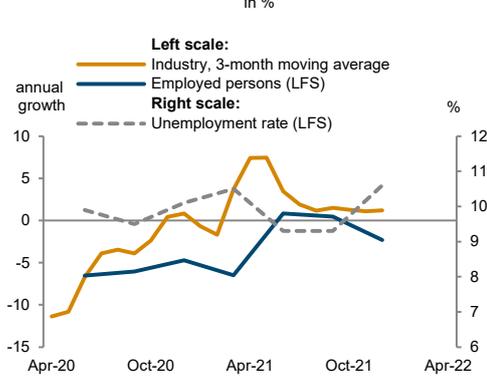
<https://data.wiiw.ac.at/monthly-database.html>

Ukraine

Real GDP growth and contributions



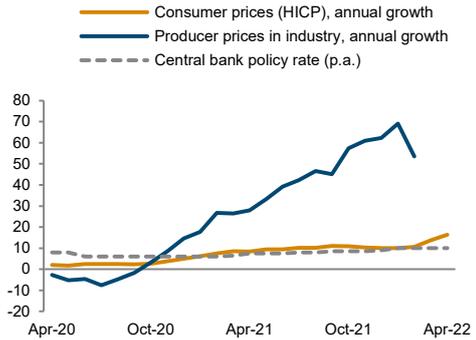
Real sector development



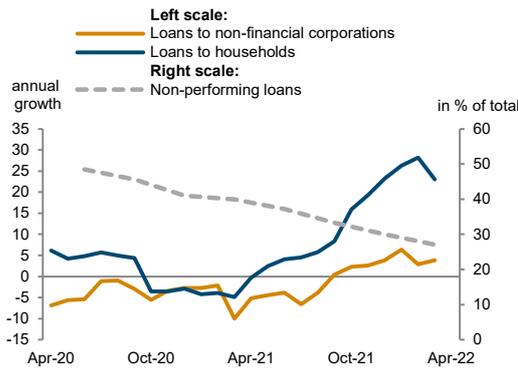
Unit labour costs in industry



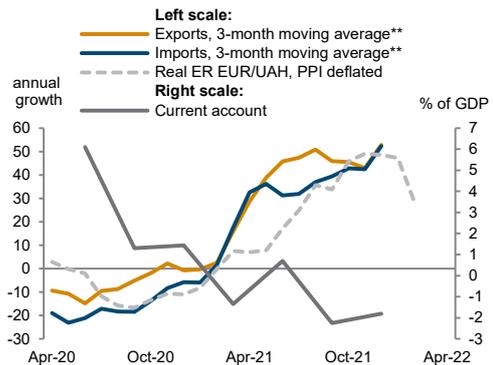
Inflation and policy rate



Financial indicators



External sector development



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