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Contents

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Call for applications: Klaus Liebscher Economic Research Scholarship

The Oesterreichische Nationalbank (OeNB) invites applications for the Klaus Liebscher Economic Research Scholarship. This scholarship program gives outstanding researchers the opportunity to contribute their expertise to the research activities of the OeNB's Economic Analysis and Research Department. This contribution will take the form of remunerated consultancy services.

The scholarship program targets Austrian and international experts with a proven research record in economics and finance, and postdoctoral research experience. Applicants need to be in active employment and should be interested in broadening their research experience and expanding their personal research networks. Given the OeNB's strategic research focus on Central, Eastern and Southeastern Europe, the analysis of economic developments in this region will be a key field of research in this context.

The OeNB offers a stimulating and professional research environment in close proximity to the policymaking process. The selected scholarship recipients will be expected to collaborate with the OeNB's research staff on a prespecified topic and are invited to participate actively in the department's internal seminars and other research activities. Their research output may be published in one of the department's publication outlets or as an OeNB Working Paper. As a rule, the consultancy services under the scholarship will be provided over a period of two to three months. As far as possible, an adequate accommodation for the stay in Vienna will be provided.

Applicants must provide the following documents and information:

- a letter of motivation, including an indication of the time period envisaged for the consultancy
- a detailed consultancy proposal
- a description of current research topics and activities
- an academic curriculum vitae
- an up-to-date list of publications (or an extract therefrom)
- the names of two references that the OeNB may contact to obtain further information about the applicant
- evidence of basic income during the term of the scholarship (employment contract with the applicant's home institution)
- written confirmation by the home institution that the provision of consultancy services by the applicant is not in violation of the applicant's employment contract with the home institution

Please e-mail applications to *scholarship@oenb.at* by the end of October 2020.

Applicants will be notified of the jury's decision by end-November.

Nontechnical summaries in English and German

Nontechnical summaries

Does digitalization require central bank digital currencies for the general public?

Paul Pichler, Martin Summer and Beat Weber

Should central banks start issuing digital money for everyone – that is, offer a new form of money to keep pace with digitalization? This issue is a hot topic, and we wish to contribute to the debate. To frame the discussion, we first provide some context by explaining how modern money works. A key aspect here is that the current monetary system is based on an infrastructure which combines public and private institutions and where money co-exists in digital and physical form. Both the functionality and legitimacy of modern money are highly dependent on this structure. Therefore, the debate about central bank digital currencies goes far beyond issues of the underlying technology. Any form of central bank digital currency made available for general use has the potential to crowd out cash and bank deposits as a means of payment and a store of value. This would have far-reaching consequences for privacy, financial stability and the division of labor between the private and public sector in providing credit – and give rise to the question of how to ensure the legitimacy of central bank digital currencies in the face of such disruptions to the institutional architecture of money, banking and finance as we know it. Ultimately, the debate is not about technology but about the kind of changes society is able and willing to embrace when it comes to payments.

The joint distribution of wealth, income and consumption in Austria: a cautionary note on heterogeneity

Peter Lindner, Martin Schürz

In this paper we analyze the joint distribution of wealth, income and consumption in Austria. We use data from three distinct surveys, each of which focuses on one of these components, and combine these data based on a statistical matching procedure. In the empirical analysis, we use data from the three waves of the Household Finance and Consumption Survey (HFCS) on Austria and the European Statistics on Income and Living Conditions (EU-SILC) as well as two waves of the Household Budget Survey (HBS).

A key contribution of our paper is to highlight problems of experimental statistics. We find that statistical data matching does not overcome the problems connected with each of the underlying data sources but rather multiplies them. There is a likely tendency toward the mean in the statistical matching procedure. The relationship between wealth, income and consumption does not get clearer by matching data from different surveys. The tails of the distribution emerge as particularly problematic. We document the differences between the three indicators usually used for describing the joint distribution. These differences are identified in particular for specific subgroups. Finally, we argue for using only one comprehensive source of data – the HFCS - to estimate the joint distribution.

Nontechnical summaries in German

Braucht es in Zeiten der Digitalisierung auch staatliches Digitalgeld?

Paul Pichler, Martin Summer und Beat Weber

Sollen Zentralbanken in Zukunft Digitalgeld für alle – also Geld in einer neuen Form – zur Verfügung stellen? Diese Frage taucht im Zusammenhang mit der Digitalisierung immer wieder auf. Und genau dieser Frage geht dieser Artikel nach. Zunächst sehen wir uns an, wie das moderne Geldsystem funktioniert. Es stützt sich auf eine teils staatliche, teils privatwirtschaftliche Infrastruktur und auf eine Zweiteilung des Geldumlaufs in Bargeld und herkömmliches Digitalgeld. Von dieser Struktur hängen die Einsatzmöglichkeiten und die Legitimität moderner Geldformen in hohem Maß ab. Daher beschränkt sich die Debatte über eine neue, von Zentralbanken ausgegebene Form von Digitalgeld nicht bloß auf technische Fragen. Allgemein verfügbares digitales Zentralbankgeld hat unabhängig von seiner Ausgestaltung das Potenzial, Bargeld und Bankeinlagen als Zahlungs- bzw. Wertaufbewahrungsmittel den Rang abzulaufen. Das hätte wiederum weitreichende Folgen für die Anonymität von Geldtransaktionen, für die Finanzmarktstabilität und für die Arbeitsteilung zwischen dem privatwirtschaftlichen und dem staatlichen Sektor bei der Einräumung von Kredit. Damit stellt sich die Frage, wie angesichts derartiger potenzieller Umwälzungen im Geld-, Banken- und Finanzsystem die Legitimität eines digitalen Gelds für alle zu gewährleisten wäre. Es geht also letztlich um die gesellschaftspolitische Frage, inwieweit Änderungen am bestehenden Geldsystem tragbar und erwünscht sind.

Die gemeinsame Verteilung von Vermögen, Einkommen und Konsum in Österreich: Anmerkung zur Heterogenität

Peter Lindner, Martin Schürz

In der vorliegenden Studie wird die gemeinsame Verteilung von Vermögen, Einkommen und Konsum in Österreich analysiert. Wir verwenden die Daten aus drei verschiedenen Erhebungen, die jeweils primär auf eine dieser Komponenten abstellen, und kombinieren die Daten mit Hilfe eines statistischen Matching-Verfahrens. In der empirischen Analyse verwenden wir Daten aus drei Wellen der Haushaltserhebung zu Finanzen und Konsum (Households Finance and Consumption Survey – HFCS) in Österreich und der Erhebung über Einkommen und Lebensbedingungen (EU-SILC) sowie aus zwei Wellen der Konsumerhebung (Household Budget Survey – HBS) der privaten Haushalte.
Die der experimentellen Statistik innewohnenden Probleme stehen im Fokus dieser Studie. Wir stellen fest, dass mit statistischem Matching die spezifischen Probleme der einzelnen Datenquellen nicht überwunden, sondern eher vervielfacht werden. Das statistische Matching-Verfahren weist eine wahrscheinliche Tendenz zur Mitte auf. Die Beziehung zwischen Vermögen, Einkommen und Konsum wird durch das Matching der Daten aus verschiedenen Erhebungen nicht klarer. Als besonders problematisch erweisen sich in der Analyse die Ränder der Verteilung. Weiters zeigen wir die Unterschiede zwischen den zur Beschreibung der gemeinsamen Verteilung üblicherweise verwendeten drei Indikatoren auf. Diese Unterschiede können insbesondere in bestimmten Untergruppen festgestellt werden. Aus der Analyse leiten wir Argumente für die Verwendung einer einzigen umfassenden Datenquelle – und zwar des HFCS – zur Schätzung der gemeinsamen Verteilung ab.

Analyses

Weak global trade darkens growth outlook for Austria

Economic outlook for Austria from 2019 to 2022 (December 2019)

Gerhard Fenz, Martin Schneider[1]
Cut-off date: November 19, 2019

1 Executive summary

The Oesterreichische Nationalbank (OeNB) expects economic growth in Austria to slow down visibly amid weakening international growth, with the decline being most pronounced in the internationally oriented sectors of the economy. Export growth has eased markedly, and the domestic manufacturing industry slipped into a recession in mid-2019. The setback has been cushioned by domestic demand, above all consumer demand and the thriving construction industry. Given strong economic activity in early 2019, the OeNB expects annual GDP growth to reach 1.6% after all, yet no more than 1.1% thereafter in 2020. This represents a downward revision by 0.5 percentage points for 2020 compared to the last OeNB outlook, published in June 2019. As a result of the assumed gradual recovery of the world economy, output growth in Austria is projected to rebound to 1½% over the following years. In line with cyclical conditions, the unemployment rate as defined by Eurostat will inch up from 4.6% in 2019 to 4.8% in 2021. The harmonized index of consumer prices (HICP) is expected to uptrend slightly and average 1.5% from 2019 to 2022. The general government is forecast to achieve a surplus every year from 2019 to 2022. In parallel, the debt-to-GDP ratio is expected to drop to 63.4% by 2022, from 74.0% in 2018. However, until a new government takes office, the fiscal forecast is subject to a high degree of uncertainty. In general, the risks to this forecast are pointing to the downside.

The international economy lost considerable momentum in the course of 2019, above all in the manufacturing sector. The cyclical downturn of global industrial production has been reinforced by a number of dampening factors, which are expected to fade only gradually. These factors mainly relate to trade tensions sparked by U.S. tariffs on imports from China in particular, Brexit-related uncertainties as well as the struggles of the automotive industry to meet climate goals and to catch up on e-mobility. The problems experienced by the automotive industry has been a key driver of the protracted industrial recession in Germany. The global economy will grow by no more than close to 3% per year over the forecast horizon.

Global trade, which has been particularly hard hit by the global industrial weakness, contracted in the first half of 2019. With regard to the assumptions on which this forecast is based, the outlook for export growth had to be revised downward visibly for all major countries and regions. The global economic climate is even affecting the Central, Eastern and Southeastern European (CESEE) economies,

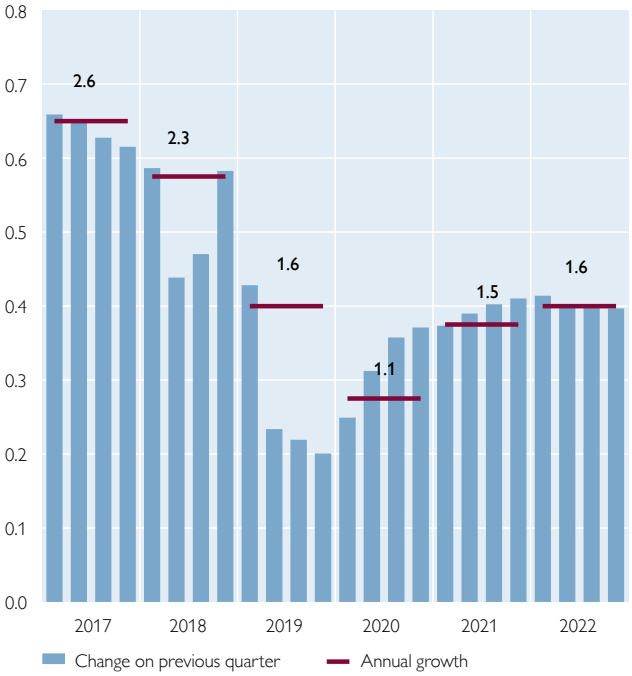
[1] *Oesterreichische Nationalbank, Economic Analysis Division, gerhard.fenz@oenb.at, martin.schneider@oenb.at. With contributions from Friedrich Fritzer, Ernst Glatzer, Ernest Gnan, Walpurga Köhler-Töglhofer, Doris Prammer, Doris Ritzberger-Grünwald and Alfred Stiglbauer.*

Chart 1

Main results of the forecast

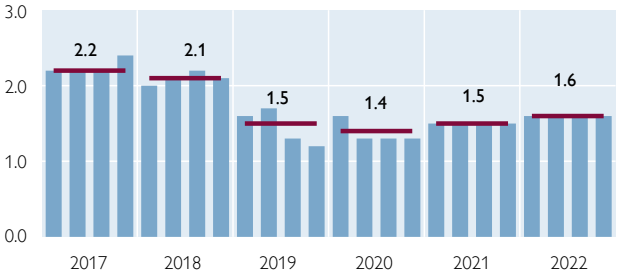
Real GDP growth

Change on previous quarter in %



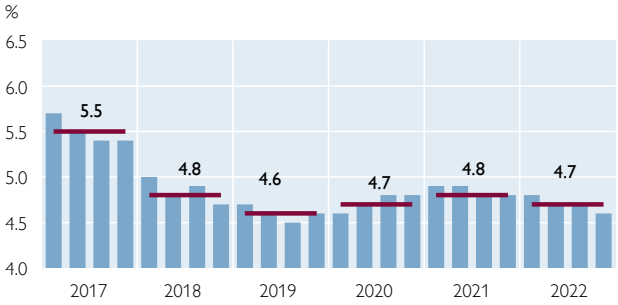
Harmonised Index of Consumer Prices (HICP)

Annual change in %



Unemployment rate (Eurostat definition)

%



Source: WIFO, Statistics Austria. OeNB December 2019 outlook.

Note: The GDP data are seasonally and working day-adjusted (trend-cycle component).

which continue to outperform the euro area economy. Global trade is set to broadly stagnate in 2019, before rebounding and catching up with global growth figures by the end of the forecast horizon.

The internationally oriented sectors of the Austrian economy already suffer from the global demand setback. Growth of nominal goods exports has virtually stagnated in recent months and, judging from the leading indicators, the tide is unlikely to turn in the months ahead. Hence, export growth is set to decelerate visibly in real terms in 2019, before bottoming out at 1.7% in 2020. In Austria's exported-oriented manufacturing industry, growth turned negative already in mid-2019, causing the boom cycle that had started in 2015 to come to a rather abrupt end. The long and pronounced cycle of investment in equipment finally ran its course during the current industrial recession. Austrian firms stopped raising their spending on equipment in the third quarter of 2019. Capacity utilization dropped to 85.3% during the fourth quarter, but continues to remain near the long-term average. Hence, there are currently no signs of a drop in investment spending. Still, investment in equipment is expected to grow by just 0.3% in 2020. As global trade is expected to recover thereafter, with the promise of newly improving industrial sales prospects, growth of investment in equipment stands to rebound to up to 1½% in 2021 and 2022. In this process, the continued favorable financing conditions are going to play an important role.

The domestically focused sectors of the Austrian economy have been benefiting from stable consumer demand and the thriving construction industry, thus

Table 1

OeNB December 2019 outlook for Austria – main results[1]

	2018	2019	2020	2021	2022
Economic activity	*Annual change in % (real)*				
Gross domestic product (GDP)	+2.3	+1.6	+1.1	+1.5	+1.6
Private consumption	+1.1	+1.2	+1.3	+1.3	+1.4
Government consumption	+0.7	+0.1	+1.1	+1.0	+1.0
Gross fixed capital formation	+4.2	+2.9	+1.0	+1.3	+1.5
Exports of goods and services	+5.9	+3.1	+1.7	+2.8	+2.9
Imports of goods and services	+4.3	+3.4	+1.8	+2.4	+2.5
	% of nominal GDP				
Current account balance	2.3	2.2	2.3	2.5	2.9
Import-adjusted contribution to real GDP growth[2]	*Percentage points*				
Private consumption	+0.3	+0.4	+0.4	+0.4	+0.5
Government consumption	+0.1	+0.0	+0.2	+0.2	+0.2
Gross fixed capital formation	+0.5	+0.3	+0.1	+0.2	+0.2
Domestic demand (excluding changes in inventories)	+0.9	+0.7	+0.7	+0.7	+0.9
Exports	+1.6	+0.8	+0.4	+0.7	+0.8
Changes in inventories (including statistical discrepancy)	–0.3	+0.0	+0.0	+0.0	+0.0
Prices	*Annual change in %*				
Harmonised Index of Consumer Prices (HICP)	+2.1	+1.5	+1.4	+1.5	+1.6
Private consumption expenditure (PCE) deflator	+2.1	+1.7	+1.5	+1.5	+1.6
GDP deflator	+1.6	+1.8	+1.6	+1.5	+1.7
Unit labor costs (whole economy)	+2.3	+2.4	+1.7	+1.2	+1.5
Compensation per employee (nominal)	+2.8	+2.8	+2.1	+2.1	+2.3
Compensation per hour worked (nominal)	+2.9	+2.9	+2.3	+2.0	+2.2
Import prices	+2.2	+0.7	+1.6	+1.8	+1.7
Export prices	+1.5	+0.6	+1.7	+1.8	+1.8
Terms of trade	–0.7	–0.1	+0.2	+0.0	+0.1
Income and savings					
Real disposable household income	+1.4	+1.1	+1.7	+1.3	+1.3
	% of nominal disposable household income				
Saving ratio	7.7	7.5	7.8	7.8	7.7
Labor market	*Annual change in %*				
Payroll employment	+2.2	+1.5	+0.9	+0.9	+1.0
Hours worked (payroll employment)	+2.1	+1.4	+0.7	+1.0	+1.1
	% of labor supply				
Unemployment rate (Eurostat definition)	4.8	4.6	4.7	4.8	4.7
Public finances	*% of nominal GDP*				
Budget balance	0.2	0.5	0.2	0.2	0.6
Government debt	74.0	70.4	68.2	66.0	63.4

Source: 2018: WIFO, Eurostat, Statistics Austria; 2019 to 2022: OeNB December 2019 outlook.

[1] *The outlook was drawn up on the basis of seasonally and working day-adjusted national accounts data (trend-cycle component: flash estimate for Q3 19). The data differ, in the method of seasonal adjustment, from the quarterly data published by Eurostat following the switch to the ESA 2010 framework in fall 2014 (the data published by Eurostat are much more volatile and do not facilitate detailed economic interpretation). The values for 2018 deviate also from the data released by Statistics Austria, which have not been seasonally adjusted.*

[2] *Contributions to GDP growth adjusted for their import content according to input-output-tables.*

offsetting the cyclical downturn to some extent. Unlike growth of investment in equipment, growth of investment in residential construction has remained strong in 2019 to date. For 2019 as a whole, residential construction investment is expected to grow by 4.0%, before decelerating somewhat in the following years, as signaled by the declining number of residential building permits. The other key

growth driver beyond the construction industry has been consumer spending, based on stable household income growth rates. While the growth rate of compensation of employees stands to drop from 4.4% in 2019 to 3% in the subsequent years in line with cyclical conditions, the delayed impact of the higher tax relief for families with children and additional legislative measures adopted in July and September are going to support household income above all in 2020. These additional measures are going to benefit in particular households with below-average average incomes and a high marginal propensity to consume. Last but not least, real incomes have been benefiting from the comparatively low inflation rates. Inflation as measured by the HICP is expected to inch up slightly, averaging 1.5% from 2019 to 2022.

The persistent improvement of labor market conditions observed in recent years will not continue over the forecast horizon. Employment growth is set to drop to around 1%, while labor supply growth remains high. Consequently, the unemployment rate as defined by Eurostat will rise from 4.6% in 2019 to 4.8% in 2021, before dipping to 4.7% in 2022.

The general government surplus achieved in 2018 – the first one after a string of deficits since the 1970s – will be followed by another and even higher surplus in 2019 (about 0.5%). This result is mainly attributable to an environment that is conducive to tax revenue generation (above all a thriving labor market). Moreover, the ongoing decline in interest expenditures is set to continue at least until 2022, as the sovereign bonds maturing until 2022 come with comparatively high yields. However, the impact of the cooling economy and new expansionary measures taking effect in 2020 and 2021 will cause the budget surplus to drop to about 0.2% of GDP in those two years. Thereafter, the brightening economic outlook and the absence of additional measures will drive up the surplus to 0.6% of GDP in 2022. As always, these projections are based on a no-policy-change assumption. Based on the current structural deficit target of –0.5% of GDP, higher potential output growth than in the early 2010s and the strong decline in interest expenditures do create significant fiscal leeway for expansionary measures until 2022. The government debt ratio is forecast to fall to about 63% of GDP by 2022. This will be the lowest level in several decades.

2 Technical assumptions

This forecast for the Austrian economy is the OeNB's contribution to the December 2019 Eurosystem staff macroeconomic projections. The forecast horizon ranges from the fourth quarter of 2019 to the fourth quarter of 2022. The cutoff date for all assumptions on the performance of the global economy, interest rates, exchange rates and crude oil prices was November 19, 2019. To prepare these projections, the OeNB used its macroeconomic quarterly model and national accounts data, adjusted for seasonal and working-day effects (trend-cycle component), provided by the Austrian Institute of Economic Research (WIFO). The data used by the OeNB differ from the quarterly series published by Eurostat since the changeover to the European System of Accounts (ESA 2010) in fall 2014. While also seasonally and working-day adjusted, the Eurostat data include irregular fluctuations that cannot be fully mapped to specific economic fundamentals. The values for 2018 also differ from the data published by Statistics Austria, which are not seasonally adjusted. Detailed national accounts data are based on the flash estimate for the

third quarter of 2019. Short-term interest rates are based on market expectations for the three-month EURIBOR, which market participants expect to remain negative throughout all three forecasting years. Long-term interest rates, which reflect market expectations for ten-year government bonds, are expected to rise from –0.3% in the third quarter of 2019 to 0.3% by the fourth quarter of 2022. The exchange rate of the euro vis-à-vis the U.S. dollar is assumed to remain at a constant USD/EUR 1.10. This projected path of crude oil prices is based on futures prices, which are characterized by a slight downward trend. The price of a barrel of Brent crude oil is expected to decrease from USD 63.8 in 2019 to USD 56.8 in 2022. The prices of nonenergy commodities are also assumed to move in line with futures prices.

3 Global trade affected by trade tensions

The global economy lost considerable momentum in the course of 2019, with the growth setback being particularly pronounced in the manufacturing sector. While industrial production contracted in a number of advanced economies, robust consumer demand has been supporting the services sector in many regions. The industrial weakness has affected above all global trade, which declined as a result in the first half of 2019. The cyclical downturn of global industrial production has been reinforced by a number of dampening factors. These factors mainly relate to trade tensions sparked by U.S. tariffs on imports from China in particular, the ongoing Brexit-related uncertainties as well as the struggles of the automotive industry to meet climate goals and to catch up on e-mobility. In this climate of uncertainty, firms have been investing less, thus creating a further drag on international trade.

The cyclical downturn prompted a number of central banks to take further accommodative monetary policy action. The U.S. Federal Reserve System cut the federal funds rate a second and third time this year in September and October 2019. The ECB adopted a comprehensive package of measures in September, providing further monetary easing. Essentially, the ECB redefined its forward guidance, announced its decision to restart net purchases under its asset purchase programme (APP) in November 2019 and decreased the interest rate on the deposit facility by 10 basis points to –0.5%. At the same time, however, the ECB introduced a two-tier system for reserve remuneration, thus offsetting the direct impact of negative interest rates on banks' profitability.

The *U.S. economy* has been going surprisingly strong, despite the global headwinds and trade tensions with China. The contribution from exports has been negative, though. Exports to China alone dropped by 19% in the first seven months of 2019 compared with the same period of 2018. Alongside exports, business investment has also had a dampening impact on growth, whereas private consumption fueled economic activity. Thus, output growth declined in the course of 2019, but remained fairly robust with 0.5% growth in the third quarter. The U.S. Congress suspended government borrowing limits until the end of July 2021, thus averting the risk of another budget showdown during the forthcoming presidential elections in November 2020. Despite the negative signals emanating from an inverse yield curve, the OeNB's projections entail only a slight decline of U.S. growth over the forecast horizon, to 1.7% by 2022.

The *Chinese economy* has been losing steam, given geopolitical trade tensions and a number of domestic factors. These factors include unfavorable demographic

developments, the shift to a growth model that relies more on consumption and less on investment, and the high debt levels of the private sector. Demand for vehicles dropped off when subsidies for electric and hybrid vehicles were phased out. The government has been seeking to take offsetting stimulus measures, including tax cuts, an easing of monetary policy conditions and credit standards as well as incentives for municipalities to invest in infrastructure. Yet, the impact of these measures has been limited so far. The OeNB expects China to see a further modest slowdown in growth, with substantial downside risks arising from a possible escalation of the trade disputes and the overheated property market.

The *Japanese economy* stagnated in the third quarter of 2019, following robust growth in the first half of 2019. First-half growth was driven by purchases consumers made in anticipation of the VAT increase from 8% to 10% announced for October 2019. Such frontloading led to a temporary stimulation of household spending, whereas exports declined. Exports have been suffering from weak global trade and from trade tensions with South Korea. At the same time, investment has been going up in view of the Summer Olympics that will place in Tokyo in 2020. The expected setback in consumption is projected to result in a contraction of GDP in the fourth quarter of 2019. In 2020, the Japanese economy is unlikely to grow much on account of subdued exports and consumer spending. The outlook for growth remains weak for Japan in 2021 and 2022 as well.

The *Central, Eastern and Southeastern European (CESEE) economies* continue to be a bright spot in the global economy, posting robust growth rats despite the global economic weakness. In 2019, growth has above all been driven by investment supported by EU structural funds. The uptake of these funds, and hence related growth, will decline somewhat in 2020. Consumption has been fueled by strong employment and wage growth and stands to remain the backbone of the CESEE economies. In addition, growth has been fueled by expansionary fiscal policies. Imports to CESEE are going to rise by about 4% in the coming years, which means that the CESEE economies will remain a stabilizing factor for Austrian exports.

Firms in the *United Kingdom* were building up inventories in the first quarter of 2019 ahead of the initial EU exit date agreed for March 29. Accordingly, imports jumped in the first quarter and dropped off in the second quarter. Weak private investment and modest export activity resulting from the uncertainty surrounding Brexit has, to some extent, been offset by public investment. Private consumption has been benefiting from expansionary fiscal policies and strong real wage gains. Since the Brexit date has been moved forward again, thus prolonging the climate of uncertainty, investment spending is expected to remain subdued. Hence, fiscal stimulus and private consumption will remain the key drivers of growth throughout the forecast horizon.

The *euro area economies* are currently characterized by weak industrial growth. The trade dispute between the United States and China and the ongoing uncertainty over Brexit continue to be a burden for the euro area's export-oriented manufacturing industries. Since manufacturing plays a bigger role in some euro area countries than in others, developments have been mixed. While economies such as France, Spain and Greece have been thriving, other euro area economies have been hit by stagnating growth. Growth has been stalling, for instance, in Germany, but even more so in Italy, which has been struggling with weak growth for a very long time. The services sector and the labor market have been robust in

most euro area economies, thus compensating the cooling of the economy to some extent. Euro area GDP is projected to grow by 1.1% in 2020, almost as much as in 2019 (+1.2%), before accelerating to 1.4% in both 2021 and 2022 on the assumption of rebounding world trade. Inflation in the euro area has been falling short of the Eurosystem's price stability goal of a medium-term increase of below, but close to, 2% for an extended period of time. Underlying factors include the development of energy prices and declines in the nonenergy industrial goods and services price components of HICP inflation.

The weakness of the euro area's manufacturing industry is essentially a reflection of developments in *Germany*. As a sought-after producer of machinery and other capital goods, the German manufacturing industry has been particularly hard hit by the global investment slowdown. The manufacturing industry slipped into a recession already one-and-half years ago, as a result of the weakening of world trade, but also as a result of the problems facing vehicle manufacturing. Compared with mid-2018 figures, vehicle production dropped by as much as 20%. With 0.1% output growth measured in the third quarter of 2019, the German economy technically avoided falling into a recession, defined as two successive quarters of negative output growth. In 2019 as a whole, output will, however, expand by no more than around ½%. On a more positive note, short-term indicators have been signaling initial signs of a stabilization of manufacturing output. While having declined since mid-2018, capacity utilization is only slightly below the long-term average. Based on these indicators, the manufacturing recession is expected to end in early 2020. In combination with ongoing employment growth, robust wage growth and fiscal stimulus (higher pensions, higher transfer payments and income tax relief), these prospects fuel assumptions of a recovery of GDP growth during 2020. Given the unfavorable growth conditions in 2019 and the carry-over effect from the weaker growth in 2019, annual growth in 2020 is projected to remain rather modest. Near-potential growth rates will not come within reach until 2021.

The *French economy* has been visibly outperforming the German economy of late because it is less dependent on the manufacturing industry than Germany. Supported by strong domestic growth, GDP grew by 0.3% in the third quarter of 2019. Reacting to "yellow vest protests," the government adopted a number of expansionary fiscal measures, which supported private consumption in 2019, but also caused the deficit to widen. The government plans to achieve a much smaller deficit in 2020. Exports are expected to benefit from growing export demand in the years ahead but also from visible price competitiveness gains. At the same time investment spending, which was very lively in recent years, will grow at a much smaller rate from 2020 onward, thus dampening GDP growth. The French economy will grow at potential over the forecast horizon.

The *Italian economy* has been an outlier among the crisis-affected economies: it has yet to recover from the economic and financial crisis. Adding to persistently subdued growth, manufacturing output has been declining since early 2018. Meanwhile, the services sector has started to weaken as well. Thus, GDP growth all but stagnated in the first three quarters of 2019. While the public sector has been stepping in with transfers to low-income earners and public investment projects, weak private sector investment and the modest export outlook do not bode well for growth in the years ahead.

Table 2

Underlying global economic conditions

	2018	2019	2020	2021	2022
Gross domestic product	*Annual change in % (real)*				
World excluding the euro area	+3.8	+2.9	+3.1	+3.3	+3.4
U.S.A.	+2.9	+2.3	+2.0	+1.8	+1.7
Japan	+0.8	+0.9	+0.2	+0.6	+0.5
Asia excluding Japan	+6.1	+5.2	+5.0	+5.2	+5.3
Latin America	+0.6	–0.4	+1.3	+2.0	+2.4
United Kingdom	+1.4	+1.3	+1.0	+1.0	+1.0
CESEE EU Member States[1]	+4.4	+4.0	+3.4	+3.3	+3.2
Switzerland	+2.8	+0.8	+1.2	+1.7	+1.9
Euro area[2]	+1.9	+1.2	+1.1	+1.4	+1.4
World trade (imports of goods and services)	*Annual change in %*				
World	+4.2	+0.6	+1.4	+2.6	+2.9
World excluding the euro area	+4.6	+0.0	+0.8	+2.4	+2.7
Growth of euro area export markets (real)	+3.8	+0.7	+1.0	+2.3	+2.6
Growth of Austrian export markets (real)	+3.9	+1.8	+1.9	+2.7	+2.9
Prices					
Oil price in USD/barrel (Brent)	71.1	63.8	59.6	57.4	56.8
Three-month interest rate in %	–0.3	–0.4	–0.4	–0.4	–0.3
Long-term interest rate in %	0.7	0.1	0.0	0.2	0.3
USD/EUR exchange rate	1.18	1.12	1.10	1.10	1.10
Nominal effective exchange rate of the euro (euro area index)	117.9	116.7	115.9	115.9	115.9

Source: Eurosystem.

[1] Bulgaria, Croatia, Czechia, Hungary, Poland and Romania.
[2] 2018: Eurostat; 2019 to 2022: results of the Eurosystem's December 2019 projections.

The *Spanish economy* has been growing at a healthy pace in 2019 despite the subdued international conditions. At the same time, the health of the Spanish economy is attributable, among other things, to the very low contribution of imports to final demand, given weak demand for consumer durables and capital goods, which typically have a high import content. Following a real estate boom, the Spanish property market started to moderate in mid-2018. This moderation has since been reinforced by new mortgage legislation that took effect in mid-2019. These developments have had a dampening effect on residential construction investment. Since neither investment in equipment nor exports are going to add real momentum in the near future, growth rates will continue to drop further. The lengthy and difficult negotiations to form a new government have been adding to forecast uncertainty.

4 Austrian economy under pressure from weak global trade

4.1 Major downtrend in export growth

Austria's export industry performed remarkably well in the first three quarters of 2019 given global headwinds. In part, the good results stem from services exports, which have gone up sharply since early 2019 and were able to offset weakening goods exports to some extent. Furthermore, Austrian exporters continue to benefit from the health of the CESEE economies, which have been compensating some of the negative impact resulting from the manufacturing recession in Germany. In the third quarter, real exports to the CESEE region continued to grow by as much

as 0.7% against the second quarter. However, the good figures mask the fact that Austrian exporters compromised on prices to refuel weakening demand. Nominal export growth was markedly weaker at 0.4%. Beyond the third quarter of 2019, the outlook is much bleaker, though. While purchasing managers polled for Bank Austria's Purchasing Managers' Index (PMI) see early signs of stabilizing export orders, a value of 43.8 points for October 2019 is still well below the expansion threshold of 50. The European Commission's business survey, while indicating a continued decline in export volume expectations, also implies that export activities should bottom out in the fourth quarter of 2019 and the first quarter of 2020. The OeNB projects Austrian exports of goods and services to grow by 3.1% in 2019. In line with the assumed recovery of world trade, exports should accelerate again in the second quarter of 2020 and thereafter. In 2020, exports are expected to grow by 1.7%, i.e. below the 2019 rate, reflecting subdued growth in early 2020 and low carry-over volumes from 2019. Thereafter, export growth is projected to accelerate to 2.8% in 2021, and to 2.9% in 2022.

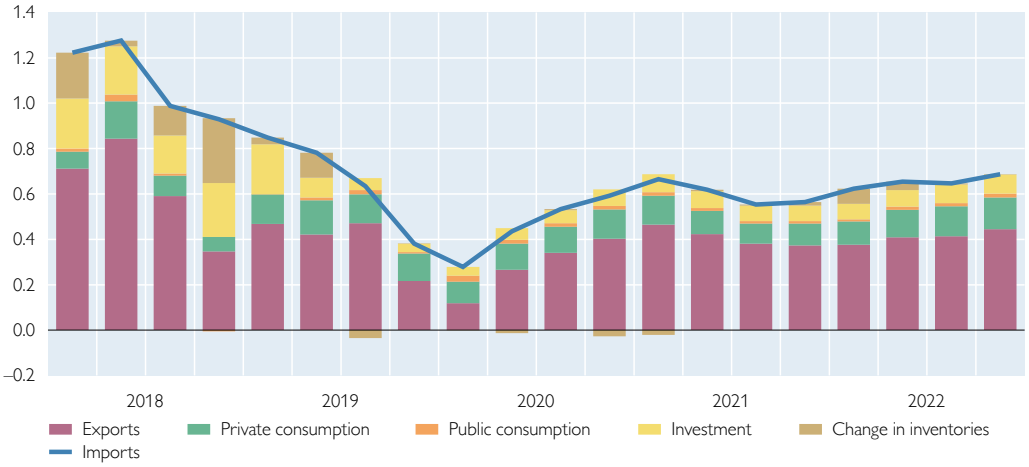
Austrian exporters kept their prices broadly stable in 2019 except for minor increases, thus improving their price competitiveness and gaining market shares. The price competitiveness gains will be sustained over the forecast horizon, but there will be no further room for market share gains. In fact, in line with the ongoing integration of emerging markets into the global economy, advanced economies like Austria can be expected to keep losing some market shares to emerging economies.

Import growth has also been slowing down markedly since mid-2018. See chart 2 for more detailed information on the contributions of the individual demand components to total import demand. The contributions were calculated on the basis of input-output tables (see box 1). The breakdown shows that the decline was driven above all by contracting business investment and changes in inventories in the first three quarters of 2019. Anemic exports are the main culprit of the drop in import growth in the fourth quarter of 2019 and the first quarter of 2020. As exports recover, imports are going to rebound as well over the forecast horizon.

Chart 2

Contributions of demand components to import growth

Change on previous quarter in %; contributions to growth in percentage points



Source: Q1 18–Q3 19. Statistics Austria, WIFO; Q4 19–Q4 22: OeNB December 2019 outlook.

Table 3

Growth and price developments in Austria's foreign trade

	2018	2019	2020	2021	2022
	Annual change in %				
Exports					
Competitor prices on Austria's export markets	+0.9	+2.1	+1.9	+1.9	+1.9
Export deflator	+1.5	+0.6	+1.7	+1.8	+1.8
Changes in price competitiveness	–0.7	+1.5	+0.2	+0.2	+0.1
Import demand on Austria's export markets (real)	+3.9	+1.8	+1.9	+2.7	+2.9
Austrian exports of goods and services (real)	+5.9	+3.1	+1.7	+2.8	+2.9
Austrian market share	+2.0	+1.3	–0.2	+0.0	–0.1
	Annual change in %				
Imports					
International competitor prices on the Austrian market	+0.7	+1.7	+1.6	+1.9	+1.7
Import deflator	+2.2	+0.7	+1.6	+1.8	+1.7
Austrian imports of goods and services (real)	+4.3	+3.4	+1.8	+2.4	+2.5
Terms of trade	–0.7	–0.1	+0.2	+0.0	+0.1
	Percentage points of real GDP				
Contribution of net exports to GDP growth	+1.0	+0.0	+0.0	+0.3	+0.3
	% of nominal GDP				
Export ratio	55.9	56.0	56.4	57.3	58.0
Import ratio	51.8	52.2	52.5	53.1	53.6

Source: 2018: WIFO, Eurosystem; 2019 to 2022: OeNB December 2019 outlook.

In 2019, Austria's balance of trade surplus increased to 0.9% of nominal GDP. The balance of services surplus deteriorated slightly in 2019, from 2.7% of GDP to 2.5% of GDP, reflecting the weakening growth rates of services exports. As global trade and hence Austrian exports improve, Austria's balance of trade is also going to improve again over the forecast horizon. With broadly unchanged balances of primary and secondary income, the current account balance is expected to improve from 2.2% of GDP in 2019 to 2.9% of GDP in 2022.

Table 4

Austria's current account

	2018	2019	2020	2021	2022
	% of nominal GDP				
Balance of trade	3.6	3.4	3.6	3.8	4.2
Balance of goods	0.9	0.9	1.1	1.3	1.6
Balance of services	2.7	2.5	2.6	2.6	2.6
Balance of primary income[1]	–0.3	–0.3	–0.3	–0.3	–0.3
Balance of secondary income[2]	–1.0	–1.0	–1.0	–1.0	–1.0
Current account balance	2.3	2.2	2.3	2.5	2.9

Source: 2018: OeNB; 2019 to 2022: OeNB December 2019 outlook.

[1] *Balance of primary income flows between resident and nonresident institutional units (compensation of employees, investment income, etc.)*
[2] *Balance of current transfers between residents and nonresidents.*

Box 1

Import-adjusted growth contributions and their calculation

The individual demand components and their significance for GDP growth can be illustrated by means of growth contributions. Such breakdowns typically include domestic demand components (private consumption, public consumption, investment), net exports (exports minus imports) and changes in inventories. The relevant calculation is simple; the only inputs required are the figures for GDP and for the individual demand components. Alas, the informative value of such an analysis is very limited, as import demand is not exclusively driven by exports, but – albeit to very differing degrees – by all the other demand components as well. For the sake of identifying economically meaningful growth contributions, import demand should be broken down by individual demand components. Then, the respective import share should be deducted from the final demand component to obtain import-adjusted components of demand.

The calculation of import shares is based on the input-output tables published by Statistics Austria. Within a given final demand component, the import share is divided into two parts, i.e. the share of direct imports and the share of indirect imports. The share of direct imports consists of imported goods intended to satisfy final demand without undergoing further processing in Austria. These goods are directly included in the input-output tables, broken down by demand component and by product (CPA-64). The share of indirect imports consists of imported goods needed as inputs for domestic production. The input-output tables show the demand for domestically produced goods, also broken down by demand component and by product (CPA-64). The share of imports required as production inputs is obtained by multiplying the demand for domestically produced goods by the import multipliers (also published by Statistics Austria). The aggregate import share for each final demand component is the sum total of the two subshares.

However, when added up, the import shares calculated according to this method for all demand components do not fully match the import figures evident from the national accounts statistics. The difference can be attributed to the fact that our analysis relies on real GDP growth and real final demand components, whereas the input-output tables show nominal

Table B1

Import shares of final demand components

	Total share of imports					Direct share of imports[1]					Indirect share of imports[2]				
	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015
Private consumption	0.21	0.25	0.25	0.25	0.27	0.12	0.14	0.13	0.14	0.15	0.10	0.11	0.12	0.11	0.12
Government consumption	0.08	0.08	0.10	0.10	0.11	0.01	0.02	0.02	0.02	0.03	0.07	0.06	0.08	0.08	0.08
Investment	0.33	0.39	0.38	0.37	0.37	0.19	0.26	0.22	0.20	0.19	0.15	0.13	0.16	0.16	0.18
Residential construction					*0.22*					*0.03*					*0.19*
Other construction					*0.22*					*0.01*					*0.21*
R&D					*0.20*					*0.07*					*0.13*
Equipment					*0.68*					*0.54*					*0.15*
Machinery					*0.61*					*0.43*					*0.18*
Vehicles					*0.81*					*0.73*					*0.08*
Cultivated assets					*0.35*					*0.11*					*0.23*
Exports	0.35	0.34	0.42	0.44	0.45	0.09	0.06	0.15	0.16	0.13	0.26	0.28	0.27	0.28	0.33
Changes in inventories	0.44	0.36	0.38	0.61	0.69	0.26	0.23	0.15	0.59	0.49	0.18	0.14	0.23	0.02	0.21

Source: Statistics Austria, OeNB calculations.

[1] *Goods or services imported directly.*
[2] *Imports made by domestic producers.*

values. Once published, input-output tables, are moreover not subject to later revisions, which leads to inconsistencies with later releases of national accounts data. For this reason, the annual weights were rescaled in such a way that the import demand calculated as explained above is consistent with real imports according to the national accounts. However, the necessary correction factor is small and came to a mere 3.2% in 2015. The table in this box shows the import shares computed by this method. Over time, a continuous increase can be observed. In 2015, the highest import share was reported for exports (45%), followed by investment (37%) and private consumption (27%). Public consumption had the lowest import share (11%). The import share of changes in inventories and its significance cannot be interpreted in a meaningful way, as these changes are a net figure (additions to and subtractions from inventory) and imports are only relevant when building up inventories.

For lack of data, the breakdown of import shares for the investment component is limited to 2015. Rather high import shares for investment in vehicles (0.81) and in machinery (0.61) compare with clearly less-than-average shares for construction investment (0.22) and investment in intangibles (0.20).

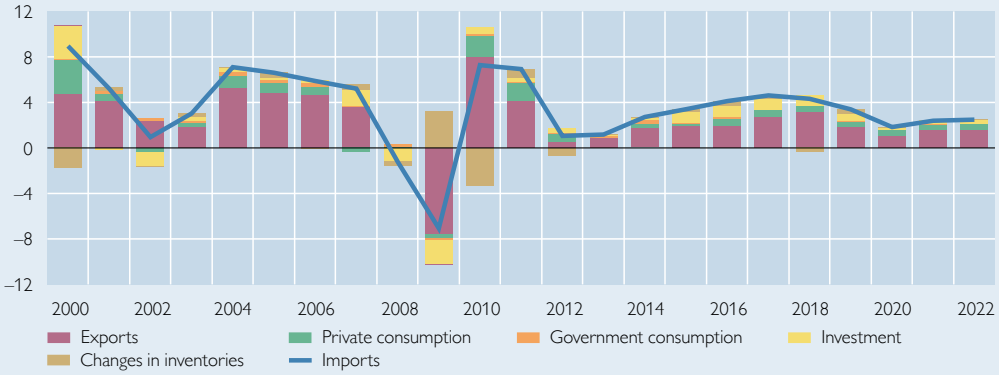
Using these import shares to calculate aggregate import demand (see chart1-B1) illustrates that, although import growth is mostly driven by exports, the other components are relevant as well. From 2004 to 2006, the export-induced share of import demand totaled 75% and was thus particularly high. The 2013–2017 average amounted to 61%.

Chart 2-B1 compares the contributions to growth of import-adjusted demand components (right panel) with those computed according to the traditional method (left panel), both for the period from 2015 to the end of the forecast horizon in 2022. According to the import-adjusted figures, exports contribute as much as 50% to domestic value added in the period from 2019 to 2022. Based on traditional measures, the contribution of net exports is as small as 10%. These percentages are more or less equivalent to the historical averages since 1995. Thus, the use of net exports in this context leads to a massive understatement of exports' significance for value added and economic growth in Austria. By contrast, an analysis based on import-adjusted figures provides a far more realistic picture of the contributions of GDP growth and, what is more, a correct description of the role of exports.

Chart 1 – B1

Contributions of demand components to import demand

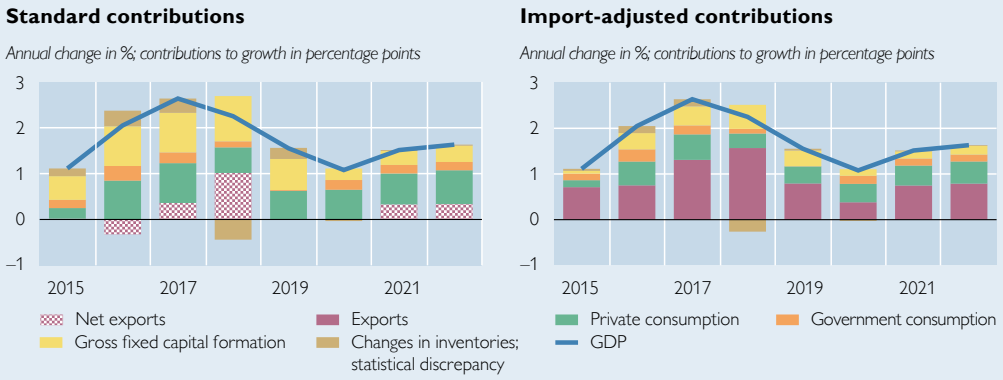
Change on previous year in %; contributions to growth in percentage points



Source: 2000–2018: Statistics Austria, OeNB calculations; 2019–2022: OeNB December 2019 economic outlook.

Chart 2 – B1

Comparison of methods used for calculating contributions to real GDP growth



Source: 2000–2018: Statistics Austria, OeNB calculations; 2019–2022: OeNB December 2019 outlook.

4.2 Unusually strong equipment investment cycle ending amid manufacturing recession

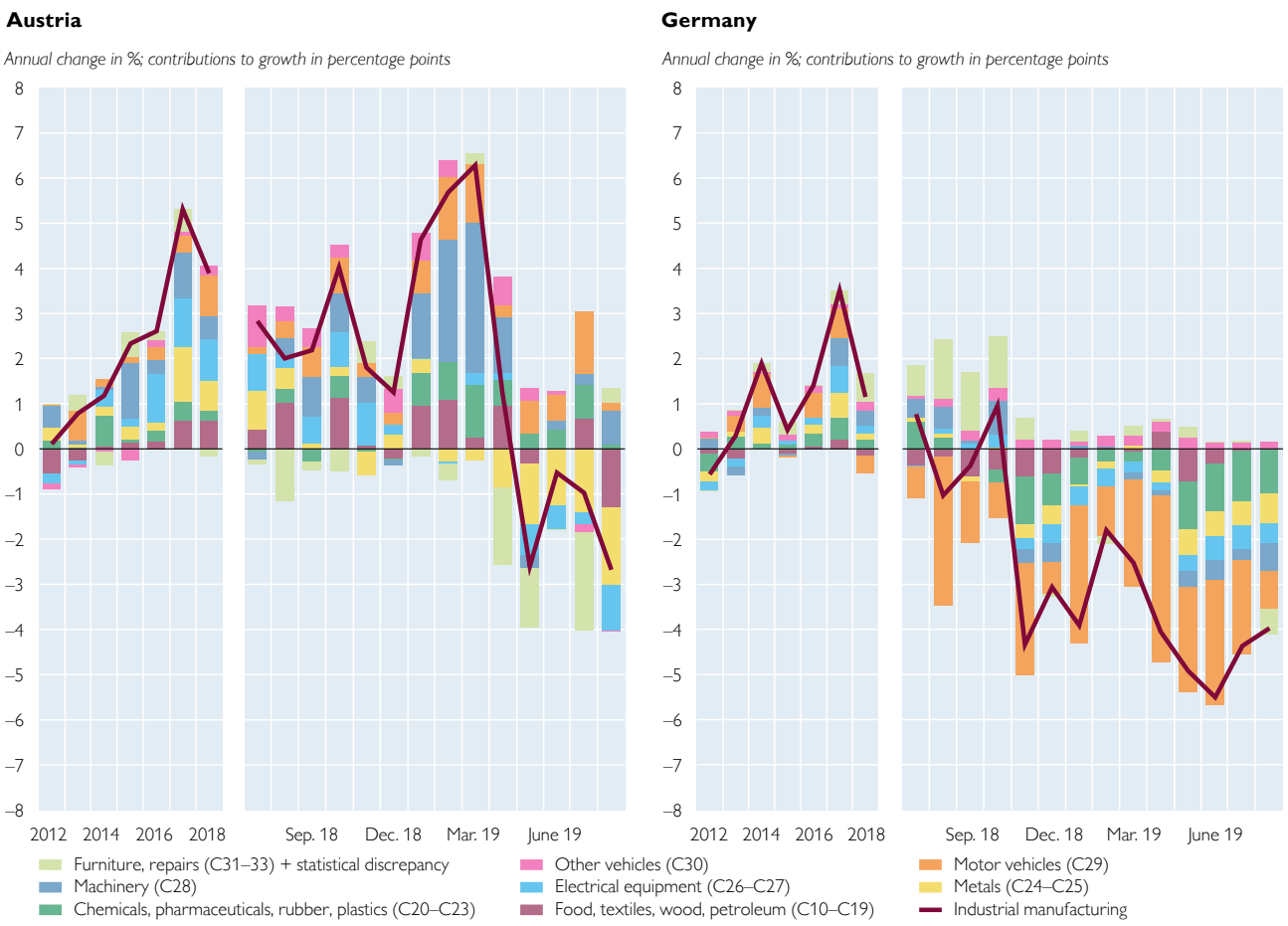
Investment, and heavy investment in equipment in particular, was a key pillar of the Austrian economy in recent years. Investment in equipment jumped by slightly more than 30% between the end of 2014 and the summer of 2019. This means that the current investment cycle was exceptionally long and strong compared with previous cycles. Robust investment growth was fueled by an extended boom of manufacturing in Austria. In the period between the fourth quarter of 2014 and the first quarter of 2019, manufacturing output rose by almost 20%. In early 2019, Austrian manufacturers were still surprisingly resilient to Germany's ongoing manufacturing recession. Whereas Germany's manufacturing industry has been challenged above all by the struggles of car makers to meet earlier manufacturing levels, export-oriented manufacturers in Austria were benefiting from robust growth in the CESEE economies and full order books from the previous boom years.

When these partly temporary factors subsided in the second quarter of 2019, manufacturing growth turned negative in Austria and the long and pronounced equipment investment cycle came to an end. Given the ongoing manufacturing recession in Austria and the continued headwinds from the global economy, investment in equipment stagnated also in the third quarter of 2019. Capacity utilization dropped to 85.3% during the fourth quarter, which is near the long-term average. Below-average order book levels do not signal a need for major expansions of existing investment, but neither are there signs of a sharp drop in investment spending. Continued positive growth of imports of machinery and transport equipment implies that domestic firms keep investing, even though the pace of expansion has slowed down visibly. As global trade is expected to recover in 2021 and 2022, with the promise of newly improving industrial sales prospects, investment in equipment stands to rebound gradually in 2020, not least because of the continued benign financing conditions. Still, the 2020 growth rate for investment in equipment will be no more than 0.3%, before faster acceleration to 1.2% in 2021 and 1.5% and 2022.

While investment in equipment is fundamentally driven by cyclical conditions, investment in residential construction is much less dependent on cyclical conditions

Chart 3

Sectoral growth contributions to manufacturing production



Source: Eurostat.

and typically follows a longer cycle. Following an extended period of weakness, residential construction investment has been growing at a healthy pace, exceeding 3% on average, since 2016. Unlike growth of investment in equipment, growth of investment in residential construction has remained strong in 2019 to date. Construction has thus remained one of the key pillars of growth. For 2019 as a whole, residential investment is expected to grow by 4.0%, before decelerating somewhat in the following years. Residential building permits – which typically lead building completions two years ahead – have been declining, albeit from high levels, which is why the growth of residential construction investment is projected to gradually decline to 1.5% on average in the period from 2020 to 2022. The future development of civil engineering investment, which is dominated by the public sector, is subject to a high degree of uncertainty in the absence of a long-term government program. These projections are based on the assumption that civil engineering investment will grow at an annual rate of 1% on average.

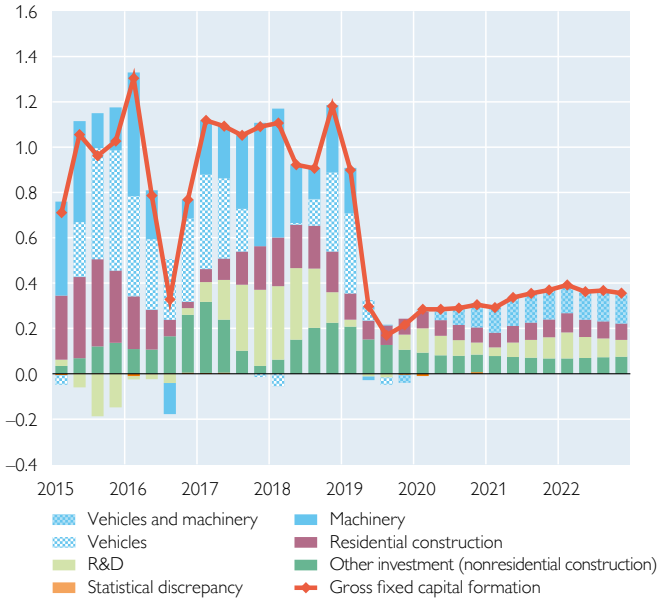
These figures add up to a growth of total gross fixed capital formation of 2.9% for 2019, reflecting still robust growth in late 2018 and early 2019. Thereafter, the OeNB projects investment growth to weaken to 1.0% in 2020, and to re-accelerate

Chart 4

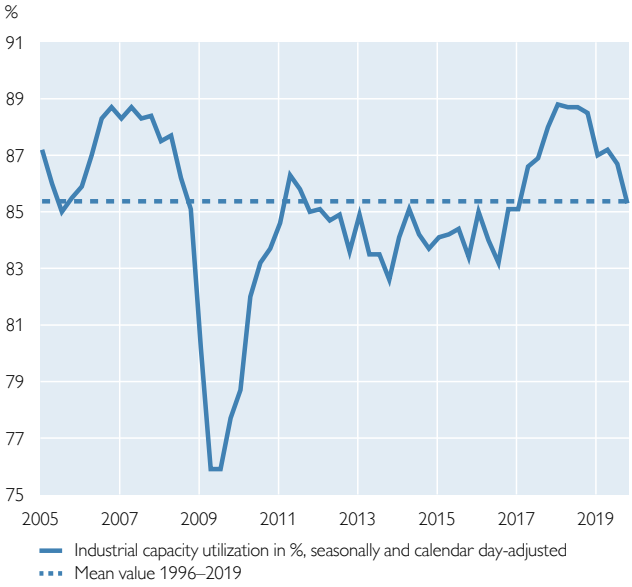
Business investment in Austria

Quarterly investment growth

Change from previous quarter %, contributions to growth in percentage points



Industrial capacity utilization



Source: Q1 05–Q3 19: WIFO, Eurostat; Q4 19–Q4 22: OeNB December 2019 outlook.

Table 5

Investment activity in Austria

	2018	2019	2020	2021	2022
	Annual change in %				
Total gross fixed capital formation (real)	+4.2	+2.9	+1.0	+1.3	+1.5
of which: Investment in plant and equipment	*+5.3*	*+3.7*	*+0.3*	*+1.2*	*+1.5*
Residential construction investment	*+2.5*	*+4.0*	*+2.1*	*+1.6*	*+1.5*
Nonresidential construction investment and other investment	*+4.5*	*+1.3*	*+1.0*	*+1.0*	*+1.4*
Investment in research and development	*+3.6*	*+2.5*	*+1.4*	*+1.4*	*+1.5*
Public sector investment	*–1.8*	*+1.2*	*+1.2*	*+1.1*	*+1.1*
Private investment	*+5.1*	*+3.1*	*+1.0*	*+1.3*	*+1.5*
Contribution to the growth of real gross fixed capital formation	*Percentage points*				
Investment in plant and equipment	+1.8	+1.3	+0.1	+0.4	+0.5
Residential construction investment	+0.5	+0.7	+0.4	+0.3	+0.3
Nonresidential construction investment and other investment	+1.2	+0.3	+0.3	+0.2	+0.4
Investment in research and development	+0.8	+0.5	+0.3	+0.3	+0.3
Public sector investment	–0.2	+0.1	+0.1	+0.1	+0.1
Private investment	+4.5	+2.7	+0.9	+1.1	+1.3
Contribution to real GDP growth	*Percentage points*				
Total gross fixed capital formation	+1.0	+0.7	+0.3	+0.3	+0.4
Changes in inventories	–0.3	+0.3	+0.0	+0.0	+0.0
	% of nominal GDP				
Investment ratio	23.9	24.3	24.3	24.2	24.2

Source: 2018: WIFO; 2019 to 2022: OeNB December 2019 outlook.

to 1.3% in 2021, and to 1.5% in 2022. The investment-to-GDP ratio is expected to remain stable at around 24% from 2019 to 2022.

4.3 Private consumption as a stabilizing factor for growth

Households continued to benefit from strong growth of compensation of employees in 2019. Employment growth weakened during the year in line with cyclical conditions, but remained rather high at 1.5%. Real wages grew by 1.1%, a figure last seen ten years ago. New tax relief measures for families with children took effect in January 2019, replacing the current regime of child tax exemption and child care cost deductibility. This measure is expected to have a phasing-in net effect of EUR 0.5 billion in 2019, before reaching its full effect (adding EUR 1.2 billion, or 0.5%, to household income) in 2020. In line with cyclical conditions, self-employment income also posted positive growth in 2019. At the same time, investment income dropped by 7% in 2019, which had a dampening effect on household income. The impact on consumer spending should be limited, however, as the marginal propensity to consume is much lower for income generated through investment than for labor income. Given strong income growth, the current national accounts calculations for the first three quarters of the current year reflect only weak annual consumption growth of 1.2% on average. Consumer growth spending was weaker than expected already in 2018. In 2019, consumer spending is expected to grow by 1.2%, and the saving ratio is projected to drop by 0.2 percentage points, to 7.5%.

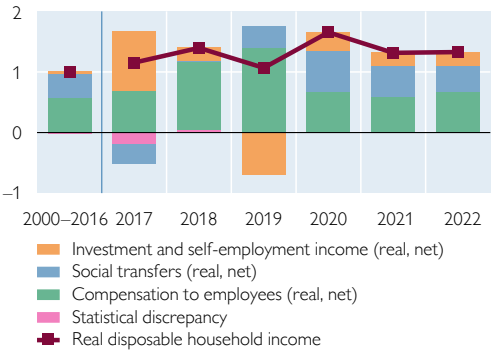
Private consumption will remain a key pillar of economic activity over the forecast horizon. While the growth rate of compensation of employees stands to drop to 3% on average, from 4.4% in 2019, the staggered impact of the higher tax relief for families with children and additional measures adopted by parliament in

Chart 5

Private consumption

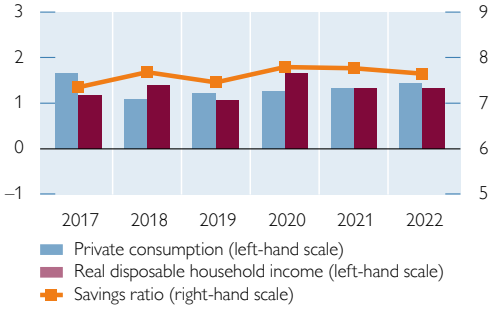
Contributions to growth of real disposable net household income

Annual change in %; contributions to growth in percentage points



Disposable household income, private consumption and saving ratio

Annual change in % *% of disposable household income*



Source: 2000–2018: WIFO, Statistics Austria; 2019–2022: OeNB December 2019 economic outlook.

July and September[2] is going to support household income above all in 2020. These additional measures are going to benefit in particular households with below-average average incomes and a high marginal propensity to consume. Self-employment income will grow in line with cyclical conditions, i.e. drop visibly in 2020 and not recover markedly until 2022. Investment income growth is not expected to drop any further. The inflation rate is projected to remain at around 1½% until the end of the forecast horizon. In the bottom line, real disposable household income is projected to grow by 1.7% in 2020, and by 1.3% in 2021 and 2022. Growth of real private consumption will reach 1.3% in 2020 and 2021, and 1.4% in 2022.

Box 2

Public finances from 2019 to 2022[3]

The OeNB's fiscal projections are based on a no-policy-change assumption.

***Budget surpluses expected for the entire forecast horizon**. The general government surplus has continued to grow from 0.2% of GDP in 2018 to 0.5% in 2019. The improvement compared with 2018 is above all attributable to a further decline in interest expenditure and robust growth of income-related taxes. These factors compensate the slight negative impact of discretionary fiscal measures on the budget balance (above all higher tax relief for families with children and lower unemployment and accident insurance contributions) in 2019.*

Thereafter, the budget balance will decline, but remain positive, in 2020 and 2021. The weaker economic activity will constitute a drag on revenue growth; moreover, new expansionary measures will become effective in 2020 and 2021, including tax relief for low-income earners and pensioners through higher tax deductibles and credits as well as pension adjustments well above inflation in 2020. Outlays for pensions are also on the rise in view of the baby boomer generation reaching the age of statutory retirement and as a result of some minor measures, such as the abolition of pension adjustment delays for new pensioners. For 2022, the OeNB expects the budget balance to improve again, in the absence of further expansionary measures (from today's perspective) and in anticipation of an economic recovery. Last but not least, interest expenditure is set to keep dropping sharply as sovereign bonds with comparatively high yields are about to mature.

***Government debt levels declining significantly**. The debt ratio will decline noticeably over the forecast horizon, mainly on account of successive budget surpluses and high nominal GDP growth rates. The debt reductions by publicly owned bad banks will be visibly smaller than in the 2016–2018 period. The debt ratio is expected to drop to about 63% of GDP in 2022.*

***Compliance with fiscal rules**. Adjusted for cyclical and one-off effects, the budget will be broadly balanced in 2019 and (increasingly) in surplus thereafter. In other words, Austria is going to overachieve the medium-term budgetary objective (currently –0.5% of GDP) applicable under EU fiscal rules and the budgetary objective defined in the context of the Austrian stability and growth pact (–0.45%, without chambers of commerce and industry). However, the improvements that will emerge over the forecast horizon include above all a visible drop in interest expenditure and a marked increase in potential GDP growth compared with the early 2010s (estimate based on the methodology of the European Commission). Overall, the projections imply comparatively large fiscal room for maneuver for the new government until 2022.*

[2] *These measures include one-off pension adjustments, higher tax deductibles and tax credits for low-income earners and pensioners, the abolition of pension adjustment delays for new pensioners, receipt of full pension entitlement with 62 years after 45 contribution years, adjustment of long-term care benefits for inflation, recognition of previous service credit for civil servants, and lower health insurance contributions for self-employed persons and farmers. These measures were not covered by the OeNB's June 2019 economic outlook.*

[3] *Author: Lukas Reiss, Oesterreichische Nationalbank, Economic Analysis Division, lukas.reiss@oenb.at.*

Table 6

Determinants of nominal household income and private consumption growth in Austria

	2018	2019	2020	2021	2022
	Annual change in %				
Payroll employment	+2.2	+1.5	+0.9	+0.9	+1.0
Wages and salaries per employee	+2.8	+2.8	+2.1	+2.1	+2.3
Compensation of employees	+5.1	+4.4	+3.0	+2.9	+3.3
Property income	+4.0	–7.1	+0.8	+0.7	+2.4
Self-employment income and operating surpluses (net)	+4.1	+4.2	+2.0	+2.1	+3.1
Contribution to household disposable income growth	*Percentage points*				
Compensation of employees	+4.3	+3.8	+2.6	+2.6	+2.9
Property income	+0.5	–0.8	+0.1	+0.1	+0.2
Self-employment income and operating surpluses (net)	+0.7	+0.7	+0.3	+0.4	+0.5
Net transfers less direct taxes[1]	–1.9	–0.9	+0.1	–0.1	–0.6
	Annual change in %				
Disposable household income (nominal)	+3.5	+2.8	+3.1	+2.9	+3.0
Consumption deflator	+2.1	+1.7	+1.5	+1.5	+1.6
Disposable household income (real)	+1.4	+1.1	+1.7	+1.3	+1.3
Private consumption (real)	+1.1	+1.2	+1.3	+1.3	+1.4
	% of nominal disposable household income growth				
Saving ratio	7.7	7.5	7.8	7.8	7.7
	% of nominal GDP				
Consumption ratio	51.8	51.6	51.6	51.5	51.4

Source: 2018: WIFO. Statistics Austria: 2019 to 2022: OeNB December 2019 outlook.

[1] Negative values indicate an increase in (negative) net transfers less direct taxes; positive values indicate a decrease.

5 Unemployment rate slightly on the rise in 2020 and 2021

The ending cyclical cycle was characterized by particularly strong employment growth. Payroll employment levels increased by 1.8% on average since 2016, lagging only slightly behind GDP growth of 2.3%. Employment growth peaked in 2018 at close to 2¼%. However, with the economy starting to cool in late 2018/ early 2019, the labor market dynamics have been affected as well with the usual lag of one to two quarters. Leading indicators, such as the number of registered vacancies and leased employees had been signaling these developments well ahead. The growth rates for leased employees were going down gradually from mid-2018 and almost stagnated in the third quarter of 2019. These developments also mirror the recession in the domestic manufacturing industry, which is the main employer for leased staff. Since the manufacturing industry offers hardly any part-time jobs, this means that the growth of hours worked declined more strongly than the growth of job numbers. Payroll employment had increased by 2.2% in 2018 and is expected to rise by only 1.5% in 2019. The number of hours worked will grow by 1.4% in 2019. However, the growth rates observed in the course of 2019 signal a further decline in employment growth, which will depress the growth path for the remainder of the forecast horizon in line with expectations for GDP growth. Payroll employment will increase by 0.9% in 2020 and 2021, before inching up to 1.0% in 2022. The number of hours worked by payroll employees will grow by 0.7% in 2020, i.e. at a slower rate than the number of jobs. In 2021 and 2022, the number

Table 7

Labor market growth in Austria

	2018	2019	2020	2021	2022
	Annual change in %				
Total employment (heads)	+1.7	+1.1	+0.7	+0.7	+0.8
Payroll employment	*+2.2*	*+1.5*	*+0.9*	+0.9	*+1.0*
of which: public sector employees	*+1.1*	*+0.5*	*+0.3*	+0.1	*+0.1*
Self–employment	*–1.6*	*–1.7*	*–0.8*	–0.6	*–0.3*
Total hours worked	+1.9	+0.9	+0.4	+0.7	+0.8
Payroll employment	*+2.1*	*+1.4*	*+0.7*	+1.0	*+1.1*
Self–employment	*+1.0*	*–1.7*	*–1.1*	–0.8	*–0.6*
Labor supply	+1.0	+0.9	+0.8	+0.8	+0.7
Registered unemployment	–11.8	–3.6	+2.5	+3.1	–2.0
	% of labor supply				
Unemployment rate (Eurostat definition)	4.8	4.6	4.7	4.8	4.7

Source: 2018: WIFO, Statstics Austria; 2019 to 2022: OeNB December 2019 outlook.

of jobs and the number of hours worked will grow in sync again. The Austrian labor market has been suffering from a high and increasing skills mismatch for some time. Together with skills shortages in a number of trades, the skills mismatch has prevented employment from growing at a faster rate.

Despite much weaker economic activity over the forecast horizon than in recent years, labor supply growth will drop only marginally. On average, up to 40,000 individuals will be actively joining the Austrian labor market per year in the period from 2019 to 2022.[4] Labor supply growth will be fueled by migration, the rising labor force participation rate of older workers and the procyclical response of the labor market supply (idle labor capacity). Net migration will hover around 30,000 individuals per year. As Croatian citizens become eligible to work in Austria, the labor supply will go up by close to 7,000 individuals per year in 2020, 2021 and 2022. Another 15,000 workers on average are attributable to rising labor force participation rates among older employees in particular. At the same time, the demographic change (excluding migration) is going to lower the labor supply over the forecast horizon. This impact will be particularly pronounced in 2022, with a minus of 30,000 individuals.

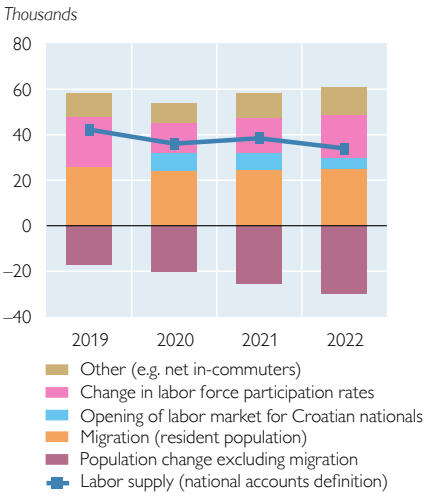
Austria's unemployment rate (Eurostat definition) decreased from a peak of 6.0% in 2016 to 4.8% in 2018, followed by a slight decline to 4.6% in 2019. Until 2021, the unemployment rate will go back up to 4.8%. The expected economic recovery and the weaker growth of the labor supply will cause the unemployment rate to drop slightly to 4.7% by the end of the forecast horizon.

[4] *The change in labor supply may be broken down into a population effect (change in population with unchanged participation rates) and a participation effect (change in participation rates with unchanged population figures). The population effect, in turn, may be decomposed into a change in population excluding immigration (based on population statistics underlying the Statistics Austria forecast excluding migrations) and a change in population including immigration (Statistics Austria – baseline forecast minus forecast excluding migration effects).*

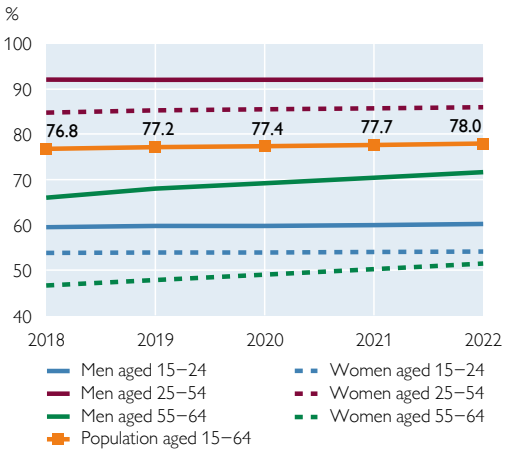
Chart 6

Structure of labor supply

Labor supply growth (resident population aged 15–64)[1]



Labor force participation (resident population)



Soruce: OeNB, Statistics Austria.

[1] *Resident population: Domestic households according to microcensus data, forecast extrapolated from trend labor force participation rates and Statistics Austria's November 2018 population forecast (adjusted for actual population figures for 2018). The projections for total population growth are based on the baseline scenario, whereas the projections for "population change excluding migration" are based on the "no migration" scenario. The data on labor supply used in the forecast (national accounts definition) may differ from the microcensus-based equivalent.*

6 Inflation to run to 1.5% over the forecast horizon

Austrian inflation is currently marked by a downward trend. Having come to 2.1% in 2018, HICP inflation decreased to an average of 1.6% in the first half of 2019, dropping further to 1.3% in the third quarter. This trend is expected to continue in the fourth quarter of 2019, which will see inflation bottoming out at 1.2%. For 2019 as a whole, inflation will come to 1.5%. The observed changes in HICP inflation are largely driven by the energy component, whose contribution to inflation has decreased gradually during the year and has recently reached slightly negative levels. Core inflation (HICP excluding energy), in contrast, has remained stable in 2019, with quarterly values ranging from 1.5% to 1.6%.

For the first quarter of 2020, HICP inflation is projected to climb to 1.6%, before decreasing to 1.3% later in the year. The temporary increase in headline inflation in the first quarter of 2020 is attributable to base effects associated with past fluctuations in energy prices. Once these effects have faded, HICP inflation is projected to decrease for the remainder of 2020, driven by the change in energy prices. Core inflation (excluding energy and food), however, will climb to 1.7% in early 2020 and will continue to exceed HICP inflation until the end of the year (see chart 7). This pattern will be driven by unit labor costs, which continue to be characterized by above-average growth rates that are projected to slow down over the course of 2020. For the full year 2020, HICP inflation is expected to come to 1.4%, with core inflation running to 1.7%. In subsequent years, the energy component's contribution to inflation is set to turn slightly positive again. Due to the assumed moderate cyclical upswing, wage pressures on inflation are not expected to intensify markedly. Overall, the OeNB projects HICP inflation to increase only

Table 8

Price, cost, productivity and profit indicators for Austria

	2018	2019	2020	2021	2022
	Annual change in %				
Harmonised Index of Consumer Prices (HICP)	+2.1	+1.5	+1.4	+1.5	+1.6
HICP energy	+5.3	+0.6	–1.7	+0.5	+0.8
HICP excluding energy	+1.8	+1.6	+1.7	+1.5	+1.7
Private consumption expenditure (PCE) deflator	+2.1	+1.7	+1.5	+1.5	+1.6
Investment deflator	+2.0	+2.1	+1.5	+1.6	+1.6
Import deflator	+2.2	+0.7	+1.6	+1.8	+1.7
Export deflator	+1.5	+0.6	+1.7	+1.8	+1.8
Terms of trade	–0.7	–0.1	+0.2	+0.0	+0.1
GDP deflator at factor cost	+1.6	+1.8	+1.7	+1.5	+1.6
Collective wage and salary settlements	+2.6	+3.0	+2.4	+2.2	+2.3
Compensation per employee	+2.8	+2.8	+2.1	+2.1	+2.3
Compensation per hour worked	+2.9	+2.9	+2.3	+2.0	+2.2
Labor productivity per employee	+0.6	+0.4	+0.4	+0.8	+0.8
Labor productivity per hour worked	+0.3	+0.7	+0.7	+0.8	+0.8
Unit labor costs	+2.3	+2.4	+1.7	+1.2	+1.5
Profit margins[1]	–0.7	–0.6	+0.1	+0.3	+0.1

Source: 2018: WIFO, Statistics Austria; 2019 to 2022: OeNB December 2019 outlook.

[1] GDP deflator divided by unit labor costs.

moderately to 1.5% in 2021 and to 1.6% in 2022, while core inflation is forecast to remain broadly stable.

The public sector's contribution to inflation (as measured by developments in administered prices and indirect taxes) is assumed to range between 0.2 and 0.4 percentage points from 2019 to 2022. The 2019 tax reform package, which included measures to increase the tobacco tax and to reduce the VAT rate on electronic publications, has only had minor effects on HICP inflation.

Wage settlements in the metals industry, which tend to set the tone for the pay deals for other industries, were concluded before the cut-off date for this forecast. As of November 1, 2019, wages in the metals industry were raised by 2.7%. This is 0.8 percentage points lower than the previous year's raise, which is attributable to both markedly lower inflation over the past 12 months (1.8%, compared to 2.2%) and the slowdown in the manufacturing sector. Based on those settlements, we expect overall collectively agreed wages to increase by 2.4% (2019: 3.0%). The continued decline in inflation is expected to lead to lower wage settlements in 2021 (+2.2%, down 0.2 percentage points from 2020). In 2022, moderately rising inflation and an expected cyclical upswing will result in a slight increase in collectively agreed wages (+2.3%). The slowdown in industrial production will lead to an increasing number of well-paid full-time jobs being lost, which is why we arrive at a negative wage drift (–0,3%) for 2020. In subsequent years, actual wages and collectively agreed wages should increase at approximately the same rate. Thus, the expansion of gross wages including employers' contributions is expected to recede from 2.8% in 2019 to 2.1% in 2020 and 2021, and to 2.3% in 2022. Real take-home pay (after inflation and taxes) is projected to increase by 0.7% in 2019. In subsequent years, this growth is expected to be markedly smaller, averaging 0.3%.

Table 9

Compensation of employees

	2018	2019	2020	2021	2022
	Annual change in %				
Gross wages and salaries[1]					
In nominal terms	+5.1	+4.4	+3.0	+2.9	+3.3
Consumption deflator	+2.1	+1.7	+1.5	+1.5	+1.6
In real terms	+2.9	+2.7	+1.5	+1.4	+1.7
Collectively agreed wages and salaries[2]	+2.6	+3.0	+2.4	+2.2	+2.3
Wage drift	+0.3	–0.2	–0.3	–0.1	+0.0
Compensation of employees per person employed					
Gross[2] compensation (nominal)	+2.8	+2.8	+2.1	+2.1	+2.3
Gross, in real terms	+0.7	+1.1	+0.6	+0.5	+0.7
Net,[3] in real terms	+0.3	+0.7	+0.3	+0.2	+0.3
Compensation of employees per hour worked					
Gross[2], in nominal terms	+2.9	+2.9	+2.3	+2.0	+2.2
Gross, in real terms	+0.7	+1.2	+0.8	+0.4	+0.6
	% of nominal GDP				
Wage share	48.0	48.4	48.5	48.5	48.5

Source: 2018: WIFO, Statistics Austria; 2019 to 2022: OeNB December 2019 outlook.

[1] *Overall economy.*

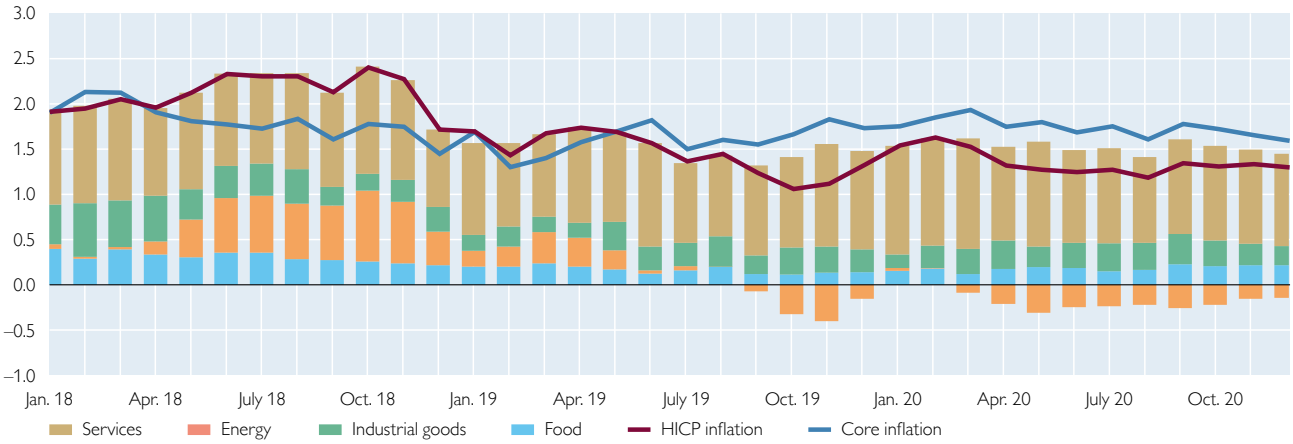
[2] *Including employers' social security contributions.*

[3] *After tax and social security contributions.*

Chart 7

Contributions to HICP inflation

Annual change in %; contributions to growth in perentage points



Source: Jan. 2018–Oct 2019: Eurostat; Nov. 19–Dec. 2020: OeNB December 2019 economic outlook.

7 Risks to the outlook are tilted toward the downside

The risks to this outlook are clearly tilted toward the downside and primarily concern external factors. The forecast is based on the assumption that Brexit will happen in an orderly fashion in early 2020. While Austria has fewer direct trade links with the U.K. than other European countries, a no-deal Brexit poses a significant downward risk to this forecast, primarily via third-country effects. Further escalation of international trade conflicts, geopolitical tensions or a stronger economic downturn in China could also lead to a more pronounced cooling of the

Austrian economy. Based on current national accounts data, the German economy managed to technically avoid dipping into a recession in 2019. Germany's manufacturing industry has, however, been in deep recession since the third quarter of 2019. While the manufacturing industry in Austria was able to evade this downward trend for longer than expected, industrial production started to decrease in mid-2019 after temporary factors, such as a large backlog of existing orders, ceased to apply. In the upcoming months, stronger spillover effects on Austria are possible if the German manufacturing industry remains mired in recession. The longer it takes the externally oriented industry to recover, the higher the risk that the manufacturing weakness will have a knock-on effect on the domestically oriented part of the economy. Thanks to strong employment growth and rising real wages, domestic demand in Austria has been resilient so far, and may continue to be resilient for a longer period. In Germany, domestic demand has been growing consistently even though the manufacturing industry has been in recession for over one-and-a-half years. At some point in the medium term, however, persistently weak exports and industrial production will start to spill over to domestic demand.

Fiscal policy is one of few upside risks to this forecast, given that Austria's future government can be expected to take measures in this field. However, this forecast is based on a no-policy-change assumption. Measures can only be taken into account if they have been laid out in detail and are likely to be implemented. A more expansionary fiscal policy, however, would imply an upward revision of the growth outlook.

The risks to inflation are balanced. A more severe economic downturn would be accompanied by weaker inflationary pressures. A de-anchoring of medium-term inflation expectations, driven by too prolonged a period of a low inflation, also constitutes a downward risk to inflation. Higher crude oil prices, on the contrary, would add to inflation. Labor shortages, as faced by many companies, can put higher upward pressure on wage formation than assumed in this forecast.

8 Major downward revision of the outlook for 2020

The external environment has deteriorated distinctly since the June 2019 outlook. While global economic growth was subject to only minor downward revisions over the forecast horizon, expectations for global trade had to be revised downward markedly. The trade conflict between the United States and China will dampen international trade throughout the forecasting horizon, without having immediate adverse repercussions for Austria – provided that the conflict remains geographically limited. At the same time, Austrian exporters will be affected by weakened import demand Germany, and to a lesser extent in the CESEE economies. Around half of all Austrian exports go to these countries. However, growth expectations also had to be revised downward for all other countries. Projections for Austrian export growth from 2019 to 2021 therefore had to be revised downward by 0.7 percentage points (2019), 1.2 percentage points (2020) and 0.8 percentage points (2021) compared to the June 2019 outlook, dampening real GDP growth by 0.3 percentage points in 2020 and 0.2 percentage points in 2021.

The nominal figures have also changed substantially compared to the June outlook. Markets currently expect oil prices to reach USD 59.6 per barrel Brent in 2020, about USD 6.2 below the level projected in June. Market expectations for short- and long-term interest rates had to be revised downward yet again. This is

due to more subdued economic prospects, interest rate cuts in countries such as the U.S.A. as well as action taken by the ECB in September to increase the degree of monetary policy accommodation. In sum, the revised assumptions for 2020 and 2021 have led to marked downward revisions to both the outlook for GDP growth and for inflation.

Table 11 provides a detailed overview of the reasons why revisions were made to the outlook. The revisions are attributable to the impact of changed external assumptions as well as to the impact of new data and a residual. The influence of new data includes the effects of the revisions of both historical data already available at the time of the OeNB's June 2019 economic outlook (i.e. data up to the first quarter of 2019) and forecasting errors for the periods now covered for the first time (i.e. new data releases for the second and third quarters of 2019). The residual includes new expert assessments regarding domestic variables, such as government consumption or wage settlements, as well as any changes to the forecasting model.

For 2019, GDP growth has been revised upward by 0.1 percentage points. However, this is entirely attributable to an upward revision of historical data up to the first quarter of 2019. In the second and third quarter of 2019, by contrast, growth was less dynamic than projected in June, and this slowdown is expected to continue in the fourth quarter.

At –0.5 percentage points, the downward revision for 2020 is significantly higher. The largest share of the revision (–0.3 percentage points) stems from increasingly adverse external conditions. A carry-over effect stemming from the weaker growth rates during 2019 adds another –0.1 percentage point to the downward revision of GDP growth in 2020. The outlook for 2021 was subject to minor revisions only (–0.1 percentage point).

Compared to the OeNB's June 2019 outlook, the HICP inflation forecast also had to be revised due to a slump in crude oil prices and weakening output growth. The June figure was revised downward by 0.3 percentage points for 2020 and downward by 0.1 percentage points for 2021.

Table 10

Change in external economic conditions since the June 2019 outlook

	December 2019				June 2019			Difference		
	2019	2020	2021	2022	2019	2020	2021	2019	2020	2021
	Annual change in %									
Growth of Austria's export markets	+1.8	+1.9	+2.7	+2.9	+2.5	+3.1	+3.5	–0.7	–1.2	–0.8
Competitor prices on Austria's export markets	+2.1	+1.9	+1.9	+1.9	+2.9	+2.2	+2.1	–0.8	–0.3	–0.2
Competitor prices on Austria's import markets	+1.7	+1.6	+1.9	+1.7	+2.3	+1.9	+2.0	–0.6	–0.3	–0.1
	USD per barrel (Brent)									
Oil price	63.8	59.6	57.4	56.8	68.1	65.8	62.7	–4.3	–6.2	–5.3
	Annual change in %									
Nominal effective exchange rate (exports)	+0.6	+0.3	+0.0	+0.0	+0.5	+0.0	+0.0	+0.1	+0.3	+0.0
Nominal effective exchange rate (imports)	+0.4	+0.2	+0.0	+0.0	+0.3	+0.0	+0.0	+0.1	+0.2	+0.0
	%									
Three-month interest rate	–0.4	–0.4	–0.4	–0.3	–0.3	–0.3	–0.2	–0.1	–0.1	–0.2
Long-term interest rate	0.1	0.0	0.2	0.3	0.3	0.4	0.6	–0.2	–0.4	–0.4
	Annual change in %									
U.S. GDP (real)	+2.3	+2.0	+1.8	+1.7	+2.5	+2.0	+1.8	–0.2	+0.0	+0.0
	USD/EUR									
USD/EUR exchange rate	1.12	1.10	1.10	1.10	1.12	1.12	1.12	+0.00	–0.02	–0.02

Source: Eurosystem.

Table 11

Breakdown of revisions to the outlook

	GDP			HICP		
	2019	2020	2021	2019	2020	2021
	Annual change in %					
December 2019 outlook	+1.6	+1.1	+1.5	+1.5	+1.4	+1.5
June 2019 outlook	+1.5	+1.6	+1.6	+1.7	+1.7	+1.7
Difference	+0.1	–0.5	–0.1	–0.2	–0.3	–0.2
Caused by:	*Percentage points*					
External assumptions	+0.0	–0.3	–0.2	+0.0	–0.3	–0.1
New data[1]	+0.1	–0.1	+0.0	–0.2	x	x
of which: revisions to historical data up to Q1 19	*+0.3*	*x*	*x*	*+0.0*	*x*	*x*
projection errors for Q2 19 and Q3 19	*–0.2*	*–0.1*	*x*	*–0.2*	*x*	*x*
Other changes[2]	+0.0	–0.1	+0.1	+0.0	+0.0	–0.1

Source: OeNB June 2019 and December 2019 outlooks. Note: Due to rounding, the sum of growth contributions subject to individual revisions may differ from the total revision.

[1] "New data" refer to data on GDP and/or inflation that have become available since the publication of the preceding OeNB outlook.
[2] Different assumptions about trends in domestic variables such as wages, government consumption, effects of tax measures, other changes in assessments and model changes.

Table 12

Comparison of the OeNB December 2019 outlook and the June 2019 outlook

	Actual figures	December 2019 outlook			Revision since June 2019 outlook		
	2018	2019	2020	2021	2019	2020	2021
Economic activity	*Annual change in % (real)*						
Gross domestic product (GDP)	+2.3	+1.6	+1.1	+1.5	+0.1	–0.5	–0.1
Private consumption	+1.1	+1.2	+1.3	+1.3	–0.4	–0.1	+0.0
Government consumption	+0.7	+0.1	+1.1	+1.0	–1.4	–0.1	–0.1
Gross fixed capital formation	+4.2	+2.9	+1.0	+1.3	+0.2	–0.9	–0.5
Exports of goods and services	+5.9	+3.1	+1.7	+2.8	+1.1	–1.1	–0.6
Imports of goods and services	+4.3	+3.4	+1.8	+2.4	+1.4	–0.8	–0.6
	% of nominal GDP						
Current account balance	2.3	2.2	2.3	2.5	+0.0	+0.0	–0.1
Contribution to real GDP growth[1]	*Percentage points*						
Private consumption	+0.6	+0.6	+0.6	+0.6	–0.2	–0.1	–0.1
Government consumption	+0.1	+0.0	+0.2	+0.2	–0.3	+0.0	+0.0
Gross fixed capital formation	+1.0	+0.7	+0.3	+0.3	+0.1	–0.2	–0.1
Domestic demand (excluding changes in inventories)	+1.7	+1.3	+1.1	+1.1	–0.4	–0.3	–0.2
Net exports	+1.0	+0.0	+0.0	+0.3	–0.1	–0.3	–0.1
Changes in inventories (including statistical discrepancy)	–0.4	+0.2	+0.0	+0.0	+0.5	+0.0	+0.0
Prices	*Annual change in %*						
Harmonised Index of Consumer Prices (HICP)	+2.1	+1.5	+1.4	+1.5	–0.2	–0.3	–0.2
Private consumption expenditure (PCE) deflator	+2.1	+1.7	+1.5	+1.5	–0.1	–0.1	–0.1
GDP deflator	+1.6	+1.8	+1.6	+1.5	+0.3	+0.0	–0.1
Unit labor costs (whole economy)	+2.3	+2.4	+1.7	+1.2	–0.1	+0.2	+0.1
Compensation per employee (nominal)	+2.8	+2.8	+2.1	+2.1	+0.1	+0.0	+0.3
Compensation per hour worked (nominal)	+2.9	+2.9	+2.3	+2.0	+0.0	+0.0	+0.1
Import prices	+2.2	+0.7	+1.6	+1.8	–0.9	–0.3	+0.0
Export prices	+1.5	+0.6	+1.7	+1.8	–0.7	–0.3	–0.1
Terms of trade	–0.7	–0.1	+0.2	+0.0	+0.3	+0.1	–0.1
Income and savings							
Real disposable household income	+1.4	+1.1	+1.7	+1.3	–1.1	+0.3	+0.4
	% of nominal disposable household income						
Saving ratio	7.7	7.5	7.8	7.8	–0.1	+0.4	+0.6
Labor market	*Annual change in %*						
Payroll employment	+2.2	+1.5	+0.9	+0.9	–0.1	–0.3	–0.2
Hours worked (payroll employment)	+2.1	+1.4	+0.7	+1.0	+0.0	–0.3	+0.1
	% of labor supply						
Unemployment rate (Eurostat definition)	4.8	4.6	4.7	4.8	–0.1	+0.0	+0.1
Public finances	*% of nominal GDP*						
Budget balance (Maastricht definition)	0.2	0.5	0.2	0.2	+0.2	–0.2	–0.3
Government debt	74.0	70.4	68.2	66.0	–0.3	0.2	0.7

Source: 2018 (actual figures): WIFO, Statistics Austria, OeNB; OeNB December 2019 and June 2019 outlooks.

[1] *Since the OeNB's June 2019 economic outlook was based on standard measures for GDP growth contributions (i.e. not adjusted for imports), this comparison is based on unadjusted contributions.*

Annex: detailed result tables

Table 13

Demand components (real)

Chained volume data (reference year = 2015)

	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
	EUR million					*Annual change in %*				
Private consumption	189,308	191,609	194,040	196,607	199,437	1.1	1.2	1.3	1.3	1.4
Government consumption	70,475	70,544	71,338	72,038	72,735	0.7	0.1	1.1	1.0	1.0
Gross fixed capital formation	87,839	90,344	91,286	92,441	93,812	4.2	2.9	1.0	1.3	1.5
of which: Investment in plant and equipment	*30,449*	*31,568*	*31,651*	32,046	*32,522*	*5.3*	*3.7*	*0.3*	1.2	*1.5*
Residential construction investment	*16,158*	*16,798*	*17,154*	17,432	*17,692*	2.5	*4.0*	*2.1*	1.6	*1.5*
Nonresidential construction investment and other investment	*23,043*	*23,340*	*23,575*	23,800	*24,144*	*4.5*	*1.3*	*1.0*	1.0	*1.4*
Changes in inventories (including statistical discrepancy)	4,103	4,989	4,904	4,979	5,062	1.6	2.8	2.3	2.2	1.8
Domestic demand	351,726	357,486	361,568	366,065	371,046	1.3	1.6	1.1	1.2	1.4
Exports of goods and services	209,982	216,490	220,093	226,174	232,631	5.9	3.1	1.7	2.8	2.9
Imports of goods and services	192,637	199,176	202,820	207,665	212,831	4.3	3.4	1.8	2.4	2.5
Net exports	17,345	17,314	17,273	18,509	19,801	3.6	4.6	4.1	3.5	3.6
Gross domestic product	369,071	374,801	378,841	384,574	390,846	2.3	1.6	1.1	1.5	1.6

Source: 2018: Eurostat; 2019 to 2022: OeNB December 2019 outlook.

Table 14

Demand components (current prices)

	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
	EUR million					*Annual change in %*				
Private consumption	199,863	205,719	211,390	217,498	224,174	+3.2	+2.9	+2.8	+2.9	+3.1
Government consumption	74,411	77,042	79,559	81,652	83,789	+3.0	+3.5	+3.3	+2.6	+2.6
Gross fixed capital formation	92,328	96,904	99,414	102,246	105,412	+6.3	+5.0	+2.6	+2.8	+3.1
Changes in inventories (including statistical discrepancy)	3,572	3,690	3,238	3,298	3,414	+5.2	6.8	+4.7	+3.7	+3.5
Domestic demand	370,175	383,355	393,601	404,694	416,788	+3.4	+3.6	+2.7	+2.8	+3.0
Exports of goods and services	215,517	223,529	231,227	241,841	253,145	+7.5	+3.7	+3.4	+4.6	+4.7
Imports of goods and services	199,924	208,079	215,197	224,328	233,748	+6.6	+4.1	+3.4	+4.2	+4.2
Net exports	15,593	15,450	16,030	17,513	19,397	+2.5	7.1	+5.3	+5.3	+5.4
Gross domestic product	385,767	398,805	409,631	422,207	436,185	+3.9	+3.4	+2.7	+3.1	+3.3

Source: 2018: Eurostat; 2019 to 2022: OeNB December 2019 outlook.

Table 15

Demand components (deflators)

	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
	2010 = 100					*Annual change in %*				
Private consumption	105.6	107.4	108.9	110.6	112.4	+2.1	+1.7	+1.5	+1.5	+1.6
Government consumption	105.6	109.2	111.5	113.3	115.2	+2.3	+3.4	+2.1	+1.6	+1.6
Gross fixed capital formation	105.1	107.3	108.9	110.6	112.4	+2.0	+2.1	+1.5	+1.6	+1.6
Domestic demand (excluding changes in inventories)	105.5	107.7	109.4	111.2	112.9	+2.1	+2.1	+1.6	+1.6	+1.6
Exports of goods and services	102.6	103.3	105.1	106.9	108.8	+1.5	+0.6	+1.7	+1.8	+1.8
Imports of goods and services	103.8	104.5	106.1	108.0	109.8	+2.2	+0.7	+1.6	+1.8	+1.7
Terms of trade	98.9	98.8	99.0	99.0	99.1	−0.7	−0.1	+0.2	+0.0	+0.1
Gross domestic product	104.5	106.4	108.1	109.8	111.6	+1.6	+1.8	+1.6	+1.5	+1.7

Source: 2018: Eurostat; 2019 to 2022: OeNB December 2019 outlook.

Table 16

Labor market

	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
	Thousands					*Annual change in %*				
Total employment	4,489.9	4,540.0	4,570.8	4,602.4	4,640.8	+1.7	+1.1	+0.7	+0.7	+0.8
of which: private sector	*3,737.9*	*3,784.5*	*3,812.8*	*3,843.7*	*3,881.4*	*+1.8*	*+1.2*	*+0.7*	*+0.8*	*+1.0*
Payroll employment (national accounts definition)	3,945.7	4,004.9	4,040.0	4,074.7	4,114.9	+2.2	+1.5	+0.9	+0.9	+1.0
	% of labor supply									
Unemployment rate (Eurostat definition)	4.8	4.6	4.7	4.8	4.7	x	x	x	x	x
	EUR per real unit of output x 100									
Unit labor costs (whole economy)[1]	57.1	58.4	59.4	60.1	61.0	+2.3	+2.4	+1.7	+1.2	+1.5
	EUR thousand per employee									
Labor productivity (whole economy)[2]	82.2	82.6	82.9	83.6	84.2	+0.6	+0.4	+0.4	+0.8	+0.8
	EUR thousand									
Compensation per employee (real)[3]	44.4	44.9	45.2	45.4	45.7	+0.7	+1.1	+0.6	+0.5	+0.7
	At current prices in EUR thousand									
Compensation per employee (gross)	46.9	48.2	49.2	50.2	51.4	+2.8	+2.8	+2.1	+2.1	+2.3
	At current prices in EUR million									
Total compensation of employees (gross)	185,057	193,144	198,866	204,727	211,442	+5.1	+4.4	+3.0	+2.9	+3.3

Source: 2018: Eurostat; 2019 to 2022: OeNB December 2019 outlook.

[1] Gross wages and salaries divided by real GDP.
[2] Real GDP divided by total employment.
[3] Gross wages and salaries per employee divided by private consumption expenditure deflator.

Table 17

Current account balance

	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
	EUR million					*% of nominal GDP*				
Balance of trade	13,905.0	13,693.9	14,812.0	16,078.9	18,198.2	3.6	3.4	3.6	3.8	4.2
Balance of goods	3,633.0	3,574.8	4,332.5	5,312.6	6,816.2	0.9	0.9	1.1	1.3	1.6
Balance of services	10,272.0	10,119.2	10,479.5	10,766.3	11,382.0	2.7	2.5	2.6	2.6	2.6
Balance of primary income	–1,059.0	–1,224.1	–1,224.1	–1,224.1	–1,224.1	–0.3	–0.3	–0.3	–0.3	–0.3
Balance of secondary income	–3,861.0	–3,848.9	–3,968.9	–4,316.9	–4,516.9	–1.0	–1.0	–1.0	–1.0	–1.0
Current account balance	8,985.0	8,620.9	9,618.9	10,537.8	12,457.1	2.3	2.2	2.3	2.5	2.9

Source: 2018: Eurostat; 2019 to 2022: OeNB December 2019 outlook.

Table 18

Quarterly outlook results

	2019	2020	2021	2022	2019				2020				2021				2022			
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Prices, wages, costs	*Annual change in %*																			
HICP	+1.5	+1.4	+1.5	+1.6	+1.6	+1.7	+1.3	+1.2	+1.6	+1.3	+1.3	+1.3	+1.5	+1.5	+1.5	+1.5	+1.6	+1.6	+1.7	+1.6
HICP excluding energy	+1.6	+1.7	+1.5	+1.7	+1.5	+1.7	+1.6	+1.7	+1.8	+1.7	+1.7	+1.7	+1.5	+1.5	+1.5	+1.6	+1.7	+1.7	+1.7	+1.7
Private consumption expenditure deflator	+1.7	+1.5	+1.5	+1.6	+1.9	+1.7	+1.6	+1.5	+1.5	+1.5	+1.5	+1.5	+1.5	+1.5	+1.6	+1.6	+1.6	+1.6	+1.6	+1.6
Gross fixed capital formation deflator	+2.1	+1.5	+1.6	+1.6	+2.2	+2.1	+2.0	+1.9	+1.7	+1.5	+1.5	+1.5	+1.5	+1.6	+1.6	+1.6	+1.6	+1.6	+1.6	+1.6
GDP deflator	+1.8	+1.6	+1.5	+1.7	+1.8	+1.8	+1.8	+1.9	+1.8	+1.7	+1.6	+1.4	+1.5	+1.5	+1.6	+1.6	+1.6	+1.7	+1.7	+1.6
Unit labor costs	+2.4	+1.7	+1.2	+1.5	+2.5	+2.3	+2.4	+2.3	+2.1	+1.8	+1.5	+1.3	+1.2	+1.2	+1.3	+1.3	+1.4	+1.4	+1.5	+1.6
Compensation per employee (nominal)	+2.8	+2.1	+2.1	+2.3	+2.9	+2.9	+2.8	+2.7	+2.3	+2.1	+1.9	+1.9	+2.0	+2.1	+2.1	+2.1	+2.2	+2.2	+2.3	+2.3
Productivity	+0.4	+0.4	+0.8	+0.8	+0.5	+0.6	+0.3	+0.4	+0.2	+0.3	+0.4	+0.6	+0.8	+0.8	+0.8	+0.8	+0.8	+0.8	+0.8	+0.7
Compensation per employee (real)	+1.1	+0.6	+0.5	+0.7	+1.0	+1.1	+1.2	+1.2	+0.9	+0.7	+0.4	+0.4	+0.5	+0.5	+0.5	+0.5	+0.6	+0.6	+0.7	+0.7
Import deflator	+0.7	+1.6	+1.8	+1.7	+1.5	+0.9	–0.1	+0.4	+0.8	+1.3	+2.1	+2.0	+1.9	+1.8	+1.8	+1.8	+1.7	+1.7	+1.7	+1.6
Export deflator	+0.6	+1.7	+1.8	+1.8	+1.1	+0.6	+0.1	+0.6	+1.1	+1.6	+2.3	+2.1	+1.9	+1.8	+1.7	+1.7	+1.7	+1.8	+1.8	+1.7
Terms of trade	–0.1	+0.2	+0.0	+0.1	–0.4	–0.2	+0.2	+0.2	+0.3	+0.2	+0.2	+0.1	+0.0	+0.0	–0.1	–0.1	+0.0	+0.1	+0.1	+0.1
Economic activity	*Annual and/or quarterly changes in % (real)*																			
GDP	+1.6	+1.1	+1.5	+1.6	+0.4	+0.2	+0.2	+0.2	+0.2	+0.3	+0.4	+0.4	+0.4	+0.4	+0.4	+0.4	+0.4	+0.4	+0.4	+0.4
Private consumption	+1.2	+1.3	+1.3	+1.4	+0.4	+0.3	+0.2	+0.3	+0.3	+0.3	+0.4	+0.4	+0.3	+0.3	+0.3	+0.3	+0.4	+0.4	+0.4	+0.4
Government consumption	+0.1	+1.1	+1.0	+1.0	–0.1	+0.0	+0.2	+0.0	+0.6	+0.3	+0.3	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.3	+0.3	+0.3
Gross fixed capital formation	+2.9	+1.0	+1.3	+1.5	+0.9	+0.3	+0.2	+0.2	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.4	+0.4	+0.4	+0.4	+0.4	+0.4
Exports	+3.1	+1.7	+2.8	+2.9	+0.8	+0.6	+0.7	+0.3	+0.2	+0.4	+0.6	+0.7	+0.8	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7	+0.7
Imports	+3.4	+1.8	+2.4	+2.5	+0.8	+0.8	+0.6	+0.4	+0.3	+0.4	+0.5	+0.6	+0.7	+0.6	+0.6	+0.6	+0.6	+0.7	+0.6	+0.7
	Contribution to real GDP growth in percentage points																			
Domestic demand	+1.3	+1.1	+1.2	+1.3	+0.4	+0.2	+0.2	+0.2	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3
Net exports	+0.0	+0.0	+0.3	+0.3	+0.0	–0.1	+0.1	+0.0	+0.0	+0.0	+0.1	+0.1	+0.1	+0.1	+0.1	+0.1	+0.1	+0.1	+0.1	+0.1
Changes in inventories	+0.2	+0.0	+0.0	+0.0	+0.0	+0.1	+0.0	+0.0	+0.0	+0.0	+0.0	+0.0	+0.0	+0.0	+0.0	+0.0	+0.0	+0.0	+0.0	+0.0
Labor market	*% of labor supply*																			
Unemployment rate (Eurostat definition)	4.6	4.7	4.8	4.7	4.7	4.6	4.5	4.6	4.6	4.7	4.8	4.8	4.9	4.9	4.8	4.8	4.8	4.7	4.7	4.6
	Annual and/or quarterly changes in %																			
Total employment	+1.1	+0.7	+0.7	+0.8	+0.2	+0.2	+0.2	+0.1	+0.2	+0.2	+0.1	+0.1	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2
of which: private sector	+1.2	+0.7	+0.8	+1.0	+0.3	+0.2	+0.2	+0.1	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.3	+0.3	+0.3
Payroll employment	+1.5	+0.9	+0.9	+1.0	+0.4	+0.4	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2	+0.3	+0.3	+0.3
Additional variables	*Annual and/or quarterly changes in % (real)*																			
Disposable household income	+1.1	+1.7	+1.3	+1.3	+0.0	+0.0	+0.1	+0.9	+0.4	+0.4	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.3	+0.4	+0.4
	% of real GDP																			
Output gap	0.7	0.1	0.0	0.1	1.0	0.8	0.6	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2

Source: OeNB December 2019 outlook. Quarterly values based on seasonally and working day-adjusted data.

Table 19

Comparison of current economic forecasts for Austria

	OeNB				WIFO		IHS		OECD			IMF		European Commission		
	December 2019				October 2019		October 2019		November 2019			October 2019		November 2019		
	2019	2020	2021	2022	2019	2020	2019	2020	2019	2020	2021	2019	2020	2019	2020	2021
Main results	*Annual change in %*															
GDP (real)	+1.6	+1.1	+1.5	+1.6	+1.7	+1.4	+1.5	+1.3	+1.5	+1.3	+1.3	+1.6	+1.7	+1.5	+1.4	+1.4
Private consumption (real)	+1.2	+1.3	+1.3	+1.4	+1.5	+1.6	+1.5	+1.3	+1.3	+1.6	+1.6	×	×	+1.5	+1.5	+1.3
Government consumption (real)	+0.1	+1.1	+1.0	+1.0	+1.3	+0.9	+0.5	+1.0	+0.1	+0.2	+0.9	×	×	+0.9	+1.3	+1.1
Gross fixed capital formation (real)	+2.9	+1.0	+1.3	+1.5	+2.9	+1.5	+2.5	+1.1	+2.9	+1.7	+1.5	×	×	+2.9	+1.2	+1.1
Exports (real)	+3.1	+1.7	+2.8	+2.9	+2.3	+2.3	+2.2	+1.7	+3.3	+1.4	+1.3	+1.8	+1.3	+2.3	+2.3	+2.3
Imports (real)	+3.4	+1.8	+2.4	+2.5	+2.4	+2.5	+2.2	+1.5	+3.4	+2.0	+1.5	+1.2	+1.1	+2.6	+2.3	+2.0
GDP per employee[1]	+0.4	+0.4	+0.8	+0.8	+0.5	+0.4	+0.0	+0.5	+0.5	+0.6	+0.5	×	×	+0.5	+0.7	+0.8
GDP deflator	+1.8	+1.6	+1.5	+1.7	+1.9	+1.7	+1.9	+1.6	+1.6	+1.4	+1.4	+1.6	+1.8	+1.9	+1.7	+1.7
CPI	×	×	×	×	+1.6	+1.7	+1.5	+1.5	×	×	×	×	×	×	×	×
HICP	+1.5	+1.4	+1.5	+1.6	+1.6	+1.7	+1.5	+1.5	+1.6	+1.5	+1.4	+1.5	+1.9	+1.5	+1.6	+1.6
Unit labor costs	+2.4	+1.7	+1.2	+1.5	+2.4	+1.5	+2.6	+1.6	×	×	×	×	×	+2.3	+1.3	+1.1
Payroll employment	+1.5	+0.9	+0.9	+1.0	+1.6	+1.0	+1.6	+0.8	+0.9	+0.8	+0.8	+0.7	+1.1	+1.1	+0.7	+0.6
	% of labor supply															
Unemployment rate (Eurostat definition)	4.6	4.7	4.8	4.7	4.6	4.6	4.6	4.8	4.6	4.5	4.6	5.1	5.0	4.6	4.6	4.6
	% of nominal GDP															
Current account balance	2.2	2.3	2.5	2.9	2.5	2.3	×	×	1.4	0.7	0.6	1.6	1.8	2.2	2.1	2.2
Budget balance (Maastricht definition)	0.5	0.2	0.2	0.6	0.6	0.4	0.3	0.3	0.3	0.4	0.3	0.1	–0.2	0.4	0.2	0.4
External assumptions																
Oil price in USD/barrel (Brent)	63.8	59.6	57.4	56.8	66.0	63.0	64.0	60.0	63.4	60.0	60.0	61.8	57.9	63.3	57.4	56.1
Short-term interest rate in %	–0.4	–0.4	–0.4	–0.3	–0.4	–0.5	–0.4	–0.4	–0.4	–0.4	–0.4	–0.4	–0.6	–0.4	–0.5	–0.5
USD/EUR exchange rate	1.12	1.10	1.10	1.10	1.12	1.10	1.12	1.11	1.12	1.11	1.11	1.12	1.12	1.12	1.11	1.11
	Annual change in %															
Euro area GDP (real)	+1.2	+1.1	+1.4	+1.4	+1.2	+1.3	+1.1	+1.2	+1.2	+1.1	+1.2	+1.2	+1.4	+1.1	+1.2	+1.2
U.S. GDP (real)	+2.3	+2.0	+1.8	+1.7	+2.3	+1.8	+2.3	+1.7	+2.3	+2.0	+2.0	+2.4	+2.1	+2.3	+1.8	+1.6
World GDP (real)	+2.7	+2.9	+3.1	+3.1	×	×	+3.0	+3.1	+2.9	+2.9	+3.0	+3.0	+3.4	+2.9	+3.0	+3.1
World trade[2]	+0.6	+1.4	+2.6	+2.9	×	×	–0.5	+1.3	+1.2	+1.6	+2.3	+1.2	+3.2	+1.4	+2.3	+2.6

Source: OeNB, WIFO, IHS, OECD, IMF, European Commission.

[1] *WIFO: GDP per hour worked.*
[2] *Institute for Advanced Studies (IHS): Goods as published by the CPB Netherlands Bureau for Economic Policy Analysis; European Commission: Global imports.*

Does digitalization require Central Bank Digital Currencies for the general public?

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This paper critically discusses the idea of introducing central bank digital currencies (CBDC) in view of central banks' responsibility for monetary and financial stability. We first argue that cash cannot be digitalized without being deprived of its characteristics as an inclusive, crisis-proof and anonymous means of payment. We then lay out that much of the debate about CBDC is a debate about structural reforms of the monetary-financial system rather than technological innovation. While CBDC has the potential to increase the speed and efficiency of the payment system, it involves risks associated with financial disintermediation, centralization of credit allocation within the central bank, and bank runs. We discuss the channels through which money today acquires legitimacy as a means of payment, a store of value, and a unit of account, and we stress that it cannot be taken for granted that CBDC will achieve the same level of legitimacy that currency enjoys today.

JEL classification: E42, E58, H11, O33
Keywords: central bank digital currencies, monetary reform, digital transformation, payment systems

Innovations in digital technologies, such as social media, artificial intelligence, big data analysis, cloud computing, the Internet of Things[2] or blockchain technology, are expected to transform all realms of society (OECD, 2019). This *digital transformation* brings about fundamental changes in socio-economic structures, organizational patterns, business models and consumption patterns: Online communication, online collaboration, online banking, and online shopping and the like have become ubiquitous in our everyday lives.[3] Against this background, people often expect that money, too, must undergo a *digital transformation* in order to satisfy the needs of an increasingly digital economy. Because physical banknotes and coins cannot be used to pay for online purchases, they are sometimes viewed as technologically outdated.[4] Proponents of this view call for the provision of central bank-issued digital currencies (CBDC), enabling the public to store value and make payments also in electronic central bank money. They argue that CBDC should replace banknotes and coins, or at least complement physical cash.

In this paper we examine the potential implications of central banks issuing digital currencies for the general public. In section 1 we argue that cash cannot be

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[2] *See for instance https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot.*

[3] *See Cochoy et al. (2017) for a detailed discussion of the effects of digital transformation on consumers.*

[4] *Clearly, the exchange of physical objects such as cash requires both counterparties of a transaction to be in the same physical location.*

digitized without being deprived of several of its advantages as a means of payment and store of value, because many of its unique characteristics are inherent in the physicality of cash. In section 2 we discuss the role of cash in the prevailing monetary-financial system, where many monetary instruments are created not by the central bank but by private commercial banks extending credit to the economy. We argue that the introduction of CBDC, independent of its technological implementation, will radically transform the monetary-financial system, with potentially large consequences for financial intermediation, money creation, credit allocation, monetary policy implementation and macroeconomic stabilization. Any decision about the introduction of CBDC must be based on the social desirability of these fundamental changes. In section 3 we argue that money needs 'legitimacy' to perform its economic functions, and that it cannot be taken for granted that a monetary system involving CBDC will maintain, or even improve, the level of legitimacy that money enjoys today. In section 4 we conclude that issuing CBDC is ultimately a political, not a technological issue.

1 Cash and CBDC: outdated versus advanced technology?

Banknotes and coins dominate our perception of money today, because they provide the most direct encounter of money and its functions in everyday life.[5] Small children, even, are well aware that the banknotes and coins they receive as pocket money from their parents can be used to buy goods (such as candy bars) and services (such as pony rides), that they can be put in a piggy bank and stored for later purchases, and that the price tags displayed in shops reflect how many (and what type of) banknotes and coins have to be handed over in exchange for a particular item. Children thus already understand the three key economic functions of cash as a *means of payment*, a *store of value*, and a *unit of account*.

But in modern economies, cash is not the only object that fulfills these functions and hence serves as *money*. Most payments in modern economies are made by transfers between accounts of bank customers. Due to the technological advances of the last decades, deposits held with commercial banks can quickly and easily be transferred today through devices such as smartphones and contactless debit cards, serving as an efficient means of payment. Moreover, as deposits are redeemable in cash at par value, they inherit the properties of cash as a store of value and unit of account.[6] Bank deposits thus are a very close substitute for cash from any individual user's perspective. Indeed, among retail payments, electronic transfers of funds held in commercial banks already surpass the use of banknotes and coins in many economies. Most money that is being used today is hence *digital* rather than *physical* in nature, and the trend toward cashless payments leads to a steady decline in cash payments.[7] Against this background, many view the calls for a digital version of cash provided by the central bank as an almost inevitable next step in the evolution of money.

[5] *See Pichler et al. (2018).*

[6] *This is true except for extremely rare periods of banking crises, where users question a bank's ability to honor its promise to redeem deposits with currency.*

[7] *See Bagnall et.al. (2016) for evidence on the growing use of cashless payments. Note also that while the use of cash in payments has been declining the total circulation of cash over the past decade (to be used as a store of value and other purposes) has even been increasing in many countries and in the world (Jobst and Stix, 2017).*

However, when thinking about CBDC as a replacement for cash, it is important to realize that physical cash has very distinct characteristics as a payment instrument.[8] The first characteristic is that cash is the most *inclusive* means of payment at the current stage. Cash is particularly easy to use and is available to everybody in society, including people without access to electronic devices (e.g., children, the extremely poor, or elderly people). Its device-independence makes cash also particularly *crisis-proof*; physical banknotes and coins can be used to make payments even in extreme scenarios where electronic devices fail on a large scale, such as extended power blackouts or regional internet outages in the aftermath of natural disasters (events which are expected to become more frequent in the years to come). Moreover, cash is the only means of payment that allows for true *peer-to-peer* transactions, i.e. transactions between two parties without the physical presence of a third party.[9] For two contracting parties to exchange cash, they do not depend on the issuer or another intermediary to verify the authenticity of the means of payment (i.e. because banknote security features enable users to easily spot common forgeries[10]). Nor do they need to disclose their identities and the change in ownership to third parties (making anonymous payments possible).[11]

Importantly, the advantages of cash outlined above cannot be preserved to full extent in any form of CBDC. Clearly, digital means of payment under current conditions cannot be as inclusive and crisis-proof as cash, because they necessarily rely on electronic devices for storage and transfers. Moreover, any digital currency without physical representation requires record-keeping of each transaction to verify its authenticity and record changes in ownership. There is a clear need for a register that records who is the legitimate owner of a unit of digital currency, since digital objects ultimately consist only of bits and bytes and hence can be copied easily and at virtually zero cost. Record-keeping, in turn, requires third parties for validating and processing transactions,[12] making true offline transactions infeasible. Finally, the reliance of digital means of payment on electronic devices and a register necessarily brings about technical traceability of payment flows, which limits their anonymity relative to cash.

The discussion about cash versus CBDC is thus not primarily a discussion about the (outdated versus advanced) technology underlying the currency issued by the central bank. CBDC would necessarily be less inclusive, less crisis-proof and less anonymous (for better or worse) compared to physical currency (cash). Moreover,

[8] *See Wissenschaftlicher Beirat des Bundesministeriums für Wirtschaft und Energie Berlin (2017).*

[9] *At the technological research frontier, concepts of offline digital payments, which are peer to peer payments have been known since the seminal work of Baqer, Anderson. et. al. 2017. Now these technologies are not yet widely available for payments in practice. We thank Rainer Böhme for pointing us to this literature.*

[10] *The security features of the Euro banknotes such as the watermark, the feel of paper, the security thread, the hologram and the color changing number support the easy detection of forgeries. How easy these forgeries are to detect by users in practice is less clear.*

[11] *At the individual level, anonymity is an advantage because it allows for effective protection against the abuse of information about individual payments. For society, however, anonymity can be a disadvantage of payment instruments, because it facilitates criminal activities such as money laundering or the financing of terrorism.*

[12] *This register can take different forms, e.g. it can be a ledger of account balances (as in the case of bank deposits) or a ledger of transactions (as in the case of crypto coins such as Bitcoin). Within the traditional payment system, banks perform record-keeping and intermediation tasks as trusted third parties. The ledger of crypto coins such as Bitcoin (i.e. blockchain technology) does not require a single trusted third party but still requires record-keeping and intermediation, which is performed in a decentralized way by the mining community.*

as we will argue in the following section, the introduction of CBDC – either as a substitute for or a complement to cash – would necessarily bring about fundamental changes to the prevailing monetary-financial system, which must be evaluated to assess the potential benefits and costs of CBDC.

2 The monetary-financial system, cash and CBDC

In all major economic areas, physical banknotes and coins are the only form of central bank-issued money available to individual citizens.

While public perception of money is focused on the tangibility of cash and the manual process of banknote printing or coin minting, most payments exchanged today do not involve the physical exchange of cash. Most payments today are made by banks or central banks moving money electronically on behalf of their customers. Behind both tangible and intangible monetary objects, there is an elaborate immaterial architecture, where monetary instruments are liabilities of an issuer who guarantees their value and backs these liabilities with corresponding assets. A large part of this architecture has been digital for a long time, and is therefore not challenged by digitalization per se.

Commercial banks have access to reserves accounts with the central bank, where they hold central bank money in electronic form. This electronic central bank money serves as means of payment in interbank transfers, and hence banks critically depend on it for their operations. The central bank increases the supply of cash and electronic central bank money by purchasing financial assets from commercial banks (paying banks with central bank money) and reduces it when selling assets to banks (being paid with central bank money).[13] At all times, its liabilities (cash and reserves) are fully backed by financial assets. By setting and periodically adjusting the terms at which commercial banks can access its balance sheet (i.e. exchange money against financial assets or vice versa), the central bank implements monetary policy to fulfill its public mandate to maintain price stability, guaranteeing money's value relative to goods and services.

While the central bank can directly control its monetary liabilities, often described as "high-powered money," the total supply of non-cash money (e.g. bank deposits) is determined endogenously in the monetary-financial system. The monetary policy stance (availability, level of interest rates, and collateral required for central bank reserves) is a key determinant for commercial banks' ability to create new means of payment for their customers. When a commercial bank gives out a new loan, it credits its customer's deposit account, thereby issuing a liability that can be used as means of payment by the recipient (the latter being required to repay the loan over time). The bank's balance sheet grows because of this lending activity: total bank liabilities increase (due to the newly created deposits) in tandem with total bank assets (due to the buildup of claims on, e.g., credit customers or the government). Like central bank money, the money created by banks is thus also backed by assets. Regulatory requirements ensure further that a fraction of banks' deposits is invested in central bank reserves, to guarantee that banks can meet their customers' liquidity needs and are able to honor their promise to redeem deposits in cash at par value, and that banks issue equity to absorb possible losses.

[13] *In principle, of course, the central bank can purchase assets from anyone. In practice, the main transaction partners are, however, commercial banks.*

This supports banks' willingness and ability to extend credit to the economy and allows for the financing of various forms of economic activity (corporate investment, household asset acquisition, public sector expenditures, etc.) based on the decentralized decisions of competing banks within the prevailing regulatory framework, with little direct involvement of public institutions such as the central bank.

Monetary policy can influence this process because commercial banks depend heavily on the central bank for their operations; they need central bank money to settle liabilities among each other (e.g. resulting from deposit transfers on behalf of customers), to satisfy cash withdrawal demands by their customers, and to fulfill minimum reserve or other regulatory requirements. By varying the price (interest rate) banks must pay for obtaining central bank money, a central bank influences the operating costs of commercial banks and hence their lending and money creation activities. An increase in the policy rate, for example, increases banks' cost of obtaining central bank money, and commercial banks in general respond to this increase by raising the interest rate they charge on new loans; all else equal, a higher interest rate reduces the demand for new loans in the economy, such that borrowing and lending (and hence money creation) declines.

The dependence of commercial banks on the central bank introduces an element of hierarchy into the monetary system. Unlike in a hierarchy, however, the central bank is not in a direct line of command vis-à-vis the commercial banks; all financial transactions between the central bank and the commercial banks are based on voluntary contracting and governed by price mechanisms, within the requirements for commercial banks set by the regulatory framework. Moreover, the central bank as a government institution does not use its position in the system to maximize financial profits. Rather, monetary policy is conducted to fulfill the central bank's public mandate, which – in the euro area – is primarily to stabilize and guarantee the purchasing power of money relative to goods and services.[14] Commercial banks, in turn, guarantee the equivalence of cash and their customers' deposits in terms of nominal value and transferability. The main mechanisms in place to support this guarantee are proper risk management of banks, monitored by equity owners, creditors and competing banks, the regulation and supervision of banks by government agencies, and deposit insurance provided by the banking sector community (together with the central bank's ability to serve as a lender of last resort). This elaborate institutional setup enables money, independent of its physical or digital representation, to fulfill its functions as a means of payment, a store of value, and a unit of account.[15]

Note finally that modern money exists as various national currencies. Most currencies are used as a unit of account, a means of payment and a store of value only within the borders of a single economic area, whereas a few currencies such as the euro or dollar take these roles also in international transactions. At both the national and international level, a currency's dominant status is explained by network effects. From each individual user's perspective, the attractiveness of a

[14] *To achieve its mandate, the central bank regulates the access of commercial banks to its balance sheet. It determines, e.g., the interest rate on new credit provided to commercial banks, the maturity of new loans, as well as collateral requirements.*

[15] *This aspect is emphasized by Borio (2019), who argues that "… money is much more than a convention; it is a social institution. It is far from self-sustaining. Society needs an institutional infrastructure to ensure that money is widely accepted, transactions take place, contracts are fulfilled, and, above all, agents can count on that happening."*

currency increases with the number of other users,[16] because it implies a greater choice of available goods priced in the currency as well as a larger number of potential transaction partners accepting this currency as means of payment. Moreover, because the parallel use of several different currencies involves costs, there is a tendency for the dominance of a single currency in any economic area. The fact that national tax systems impose tax duties on domestic economic actors in domestic currencies, together with the costs of switching to a foreign currency, keeps users anchored in domestic currencies and prevents the spread of the network logic across national borders toward the evolution of a single world currency.[17]

2.1 Cash and CBDC in the monetary-financial system

Our discussion so far has made clear that, even though most money being used today is digital in nature and issued by private commercial banks, cash plays an important role in the monetary-financial system: eventually, all digital means of payment represent an issuer's promise to provide cash at par value on demand. The value of commercial banks' privately issued money is tied to their ability and willingness to honor this promise, and thus anchored to the value of central bank money.

The growing use of cashless payments in industrialized economies[18] has led to a steady decline in the share of cash among payment instruments. In some countries, most notably Sweden, the total demand for cash has declined so strongly that the possibility of a demand-driven disappearance of cash cannot be ruled out completely.[19] If cash were to disappear indeed, which means that bank deposits would no longer be redeemable in cash, individual citizens would lose the possibility to hold cash (a central bank liability) rather than deposits (a commercial bank liability). In vast countries such as Sweden there is also the issue that making cash available to customers in remote northern regions creates considerable costs for commercial banks. A CBDC would enable commercial banks to refuse handling cash and save considerable costs.[20] Against this background of loss in variety, the Swedish central bank has started to elaborate concepts for a central bank digital currency, referred to as the e-krona, which would provide individuals with access to central bank money should cash disappear and parliament should decide to call for a CBDC (Sveriges Riksbank, 2017). The Swedish experience as well as the pervasive media coverage of cryptocoins such as Bitcoin has spurred the interest of the general public in alternative digital payment instruments, which explains why the recent debate about CBDC has gained a much higher profile than similar discussions in the past.[21]

[16] *In this respect, money has similar properties like language, digital social networks, computer software and other infrastructural phenomena.*

[17] *Nevertheless, if the perceived quality of a national currency departs too much from available alternatives, users can become prepared to overcome switching costs and adopt a foreign currency in domestic transactions (this is the experience of countries having undergone dollarization, euroization etc.).*

[18] *See Bagnall et. al. (2016).*

[19] *While the use of cash in payments has been declining, the total circulation of cash over the past decade has even been increasing in many countries and in the world. For more detailed evidence, see Jobst and Stix (2017).*

[20] *We thank our referee for having pointed out this motivation for introducing an e-krona.*

[21] *The debate on electronic money and related issues emerged two decades ago but was limited to small circles of academics and central bankers at the time. See Capie et. al. (2005) or Stix (2002).*

2.2 Token-based versus account-based CBDC

Technically, CBDC could be implemented in one of two ways: either based on tokens or based on accounts. CBDC tokens, working very much like cryptocoins (Bitcoin, Ethereum, etc.), would be the closest digital equivalent of physical banknotes and coins. In other words, users would store CBDC in electronic wallets and use their tablet computers or smartphones to make transfers to other users. The wallet software would be either provided directly by the central bank or the central bank would provide a reference implementation. It would also maintain the ledger for recording all token transactions. Essentially, this means that, unlike today, we would no longer necessarily have to rely on private profit-oriented banks for transfers. At the same time, these institutions would continue to play the role of the agent that brings the money into circulation. Like physical currency today, newly issued electronic tokens would be bought first by commercial banks, who can acquire these tokens from the central bank in exchange for financial assets. Individual citizens, in turn, would then be able to acquire these tokens from banks in exchange for cash or bank deposits. Token-based CBDCs are thus close to cash in their functionality (within the limitations for digitalizing cash discussed in section 1).[22]

Alternatively, central banks could offer individuals and firms access to central bank CBDC accounts, which are currently the prerogative of banks.[23] Note, however, that providing central bank accounts to citizens requires an identification system. It raises the challenge whether the central bank would then rely on national identification systems or must build a universal (national) identification system on its own. The requirement for identification to get access to a CBDC account makes such an implementation less inclusive than a token-based system. Providing CBDC based on accounts does hence not necessarily require central banks to adopt fundamental technological innovations such as distributed public ledgers like the blockchain. History teaches us that central banks have in fact run accounts for households and firms before (see Bindseil, 2019). Nevertheless, upscaling the current central bank system to serve the general public would have huge operational and resource implications, and the engineering problems that come with the implementation of a CBDC, even when building on known concepts such as systems of deposit accounts, are typically underrated. Böhme (2019) points out that the potential marginalization of cash and bank deposits as payment instruments by CBDC could require central banks to engage in new infrastructure activities like the provision of network services or the supervision of telecommunication systems, to guarantee the ability of the monetary system to recover from technical failures and thus provide resilience. It is debatable whether we want central banks to take on this key player position in critical infrastructures.

Note that the distinction between token-based and account-based systems is less clear cut than often claimed in the literature. While implementation details might be different, for reasons discussed in section 1, both forms of CBDCs must be based on a form of record-keeping and are thus very similar. Referring to some technical implementations of CBDC as "tokens," i.e. playing with a physical

[22] *See Mancini-Griffoli et al. (2018) or Kahn et al. (2018).*

[23] *Bindseil (2019) estimates that for the Eurosystem this would require an increase from approximately 10.000 accounts today to approximately 500 million accounts.*

metaphor, may be misleading. There is, in fact, no such thing as a digital token; there are only register records of imagined token ownership.[24]

Finally, independent of the implementation details, a CBDC would represent central bank liabilities, like banknotes and central bank reserves today.

2.3 CBDC, cash and deposits: complements or substitutes?

In the current monetary-financial system, each form of money – cash, bank deposits, and electronic central bank reserves – has a unique combination of characteristics (see Bjerg, 2017). Cash and bank deposits are both universally accessible, but electronic reserves (which are only available to commercial banks) are not. Bank deposits and reserves are both digital, but cash is not. Cash and electronic reserves are issued by the central bank, but bank deposits are not. Because of these differences in attributes, there is no single form of money that dominates other forms in terms of usability. By contrast, independent of its technological implementation a CBDC for the public would combine all three desirable attributes: it would be universally accessible, digital, and central bank issued. As stressed by Bjerg (2017), CBDC would thus be in fierce competition with all the different forms of money existing today, and potentially replace cash or even bank deposits as a means of payment and store of value. Clearly, this could have large (and potentially adverse) consequences for the current monetary-financial system, where banks' ability to extend credit inter alia depends on their ability to privately create a universally accepted means of payment. The debate about CBDC thus necessarily invokes a debate on the basic architecture of the current monetary system (Grym, 2018).

Bindseil (2019) contributes to this debate by analyzing the system of financial accounts between households, corporates, government, commercial banks and the central bank. For the Eurosystem, his estimates show that in an assumed scenario where CBDC replaces only the use of banknotes by households, the balance sheets of commercial banks and the central bank would hardly be affected; the overall effects on financial intermediation by banks, and hence on the macroeconomy, would be minor. If, however, users were to substitute CBDC for bank deposits, the fierce competition for funds would imply higher funding costs and lower profits for commercial banks. The Eurosystem balance sheet would lengthen, because the funding gap of commercial banks would have to be filled by central bank credit. Moreover, larger recourse to central bank credit would increase collateral scarcity in the economy, and the collateral framework would become more instrumental for the allocation of credit. Bindseil (2019) argues that this risk of structural disintermediation of banks and centralization of the credit allocation process within the central bank could be a controversial consequence of introducing a CBDC.

A full substitution of bank deposits by CBDC would lead to an elimination of money creation by commercial banks and would lead to the establishment of what some monetary reform enthusiasts call a "sovereign money system."[25] It would also fundamentally change the way monetary policy works. Rather than steering overall money creation by setting interest rates for the refinancing of commercial banks

[24] *It might be appropriate to point out that proposals for true digital tokens exist in the literature, but these proposals rely on hardware or cryptographic assumptions nobody so far considered in the CBDC discussion. An important reference in this respect is Chaum 1983. We thank Rainer Böhme for pointing this out.*

[25] *Huber 2017.*

with the central bank, monetary policy in such a system would control money creation through the interest rate paid on CBDC. Whether it would be a good or bad idea to actively pursue a monetary reform agenda which would result in a "sovereign money" system is controversial, and it is not logically linked to the concept of a CBDC. It is clear that centralizing the function of issuing means of payment at the central bank would be a major revision of the current division of labor between the public and the private sector.[26] While CBDC implemented as accounts at the central bank might in fact lead to the implementation of a "sovereign money" system, CBDC and "sovereign money" are conceptually different issues.

A further important concern in the CBDC debate[27] is financial stability. Clearly, the existence of CBDC accounts at the central bank would facilitate systemic runs[28] on banks in crisis situations, for the simple reason that risk-free central bank issued deposit money could be perceived as vastly more attractive than bank deposits.[29] As stressed by Bindseil (2019), this is a second key argument against CBDC. Against this background, he proposes a two-tier remuneration system for CBDC that addresses both structural disintermediation and bank runs. Under this scheme a menu of interest rates would discourage CBDC holdings that exceed the amounts needed for day-to-day transactions of most customers. While Bindseil's proposal provides interesting ideas for the implementation of an account-based CBDC potentially avoiding the immediate crowding-out of commercial banks, many details still need to be clarified. While – for instance – the proposal might work well for individuals and households, it is not so clear how it would work for (financial and nonfinancial) firms of differing sizes and complexity. Taking into account households and firms would perhaps make the system very messy.[30]

Irrespective of this, the analysis by Bindseil (2019) makes clear that whether a central bank should actively pursue the idea of introducing CBDC is a matter of monetary-financial system design and politics. It is not primarily a question of technological innovation, and hence should not be guided by the debate on digital transformation.

As a matter of fact, there are currently many different forms of money available, including digital forms. If the digital transformation results in a growing demand for digital forms of money relative to banknotes and coins over time, a simple shift in market shares among already existing forms of money could be expected. Such shifts in payment preferences can be handled already within the current institutional setup. There may be room for innovation by established or new payment providers with respect to cost or other payment features of increased relevance in a digitalized economy. But it is hard to see a technological case why the current monetary system needs CBDC to provide digital forms of payments.

[26] *For a detailed discussion on the "sovereign money" proposal, see Weber (2018), pp. 160–192.*

[27] *See Mersch (2018) for a typical example.*

[28] *It is sometimes argued that as long as cash exists, and can be withdrawn by owners of bank deposits on demand, the availability of CBDC would not significantly increase the likelihood of a panic run on banks. We doubt that this is true for the simple fact that with the availability of CBDC and the online infrastructure coming with it the costs of a run on the bank from the perspective of a depositor are much lower because withdrawing money is much easier: No queuing in front of cash machines, all it takes would be a few mouse clicks.*

[29] *Brunnermeier and Niepelt (2019) argue that this will not, however, necessarily lead to financial instability if the central bank is willing to replace private deposits with central bank lending.*

[30] *We thank our referee for pointing out these important aspects.*

Box

Libra and currency competition: a new case for CBDC?

What if money became increasingly challenged by a more digitalized means of payment in a currency other than one's own? Cryptocoin advocates have promoted this narrative for a decade by now, but a digital "coin" that would be able to compete with official currency in terms of stability, cost, and usability has yet to emerge. Thus, cryptocoins have not been adopted for retail payments; much rather, they have fostered the development of a niche of speculative trading activity.

Many expect this situation to change following the presentation of plans for a global virtual currency called "Libra" by the U.S. online social media and social networking service company Facebook in 2019.[31] According to Facebook, Libra will be conceptualized as a "stable coin," i.e., the receipts earned from selling Libra coins against official currency will be used to acquire safe backing assets in a basket of stable currencies. The Libra issuer (a consortium of corporations including Facebook and other platform-based businesses) will thus closely resemble a central bank running a currency board to peg its currency to foreign currencies. This concept breaks fundamentally with the core characteristics of cryptocoins such as Bitcoin or Ethereum, whose supply is predetermined by algorithms, whose administration is decentralized, and whose value is not backed by any official currencies or other assets (and thus fluctuates strongly in response to changes in demand).

Given Libra's improved design in terms of stability compared to the major cryptocoins and given the market power of Facebook and its allies, many expect Libra to challenge existing official currencies, even if some of its features are inferior to official currency (e.g. stability in relation to domestic prices). Some observers see the introduction of a CBDC in official currency as a necessary defense measure against this alleged challenge (e.g. Landau, 2019).

Indeed, the introduction of Libra may lead to the same disruptions of the monetary-financial system that the introduction of CBDC could lead to. If users of official currency were to convert bank deposits in official currencies into Libra and use Libra instead of euros or dollars to make payments, bank deposits could stop to function as a retail payment instrument and become relegated to exist as reserve assets held by the Libra Association to back its virtual currency. In an extreme scenario, Libra could dominate the global digital retail payment market as a result of de facto currency substitution, with cash in official currency becoming a relic for hoarding wealth and a niche for offline payments. Under such circumstances, central-bank issued digital currencies could become a means to uphold the possibility to make digital retail payments in domestic currency.

Such an extreme scenario is, however, unlikely. First, it is hard to believe that Libra will be able to deliver its promise – making money transfers as easy and cheap as sending a text message – and at the same time fulfill global regulatory standards. For example, banks and payment providers are required to ensure the legitimacy of any international payment against the background of anti-money-laundering and financing-of-terrorism laws, which is both cost- and time-intensive. Moreover, switching to Libra (or any other currency that is backed by a basket of various currencies) would result in a loss of purchasing power stability for any user whose salary is paid in euro.[32] Libra would have to offer massive comparable advantages in other dimensions in compensation for that weakness (e.g. financial incentives to use Libra, exclusive access to goods and services when paying in Libra etc.). It is hard to think of any features which could neither be copied by competitor payment services in official currency, nor challenged by competition authorities or other regulatory measures (G7 Working Group, 2019). Prima facie, while the Libra project deserves full regulatory and supervisory scrutiny, it does not create a clear case to introduce a CBDC in major currency areas.

[31] *See https://libra.org/.*

[32] *Because exchange rate fluctuations between official currencies within the backing basket, Libra can be expected to result in fluctuations of Libra's purchasing power as measured in prices of goods and services denominated in any single official currency.*

3 Legitimacy and CBDC

Our economic system is mainly characterized by decentralized decision-making of private property owners, coordinated through markets. In this system, monetary instruments require legitimacy to be accepted and perform monetary functions; after all, value is a social phenomenon and acceptance of an instrument by market participants is a social phenomenon, too. Accordingly, introducing a new form of money into the economy requires ensuring a widespread perception among potential users that it is legitimate, which involves two key dimensions. The first dimension, "input legitimacy," refers to the relation between issuer's and users of a monetary instrument. Do users trust the issuer, do they have a form of influence or control over its goals and behavior? The second dimension, "output legitimacy," refers to the characteristics of a monetary instrument with respect to its economic performance. Does it conform to users' quality requirements? The notion of legitimacy thus goes beyond a narrow focus on technical or economic properties of money, instead involving a comprehensive look at all features that turn a (physical or digital) object into money.

3.1 Input legitimacy

In the current monetary system, issuers are subject to several channels aimed at producing "input legitimacy," a trustful relationship between issuers and users of money. Central banks are subject to a public mandate, which in general comprises, or at least includes, some form of inflation target. In most currency areas, legal provisions require independence of central banks with respect to employing instruments at their disposal in pursuit of their mandates without government interference (e.g. interest rate policy). Equity of central banks is held and guaranteed by the public sector, and it is the prerogative of governments to appoint central bank management. Accountability toward parliaments and the general public typically takes the form of mandatory hearings, and transparency requirements (publications, minutes of key meetings etc.). Commercial banks are subject to licensing requirements, public regulation and supervision, as well as market competition among banks, plus monitoring by their equity owners and creditors. The co-existence of public and private issuers in the contemporary monetary system in each currency area mirrors the co-existence of both sectors in the broader system of economic activity, where both the public sector and commercial activity by private property owners share responsibility. This elaborate institutional setup is key to a trustful relationship between issuers and users of money, and hence to "input legitimacy."

Any project to introduce CBDC must be prepared to face a public debate involving questions regarding input legitimacy concerns. This is because a CBDC does have potential implications for the division of labor and the relative weight among current issuers of monetary instruments. For instance, the introduction of CBDC could be perceived as an attempt to monopolize the payment system and restrict freedom of choice among means of payment, leading to the crowding out of private issuers. Conversely, CBDC could be perceived as a measure to uphold freedom of choice among digital means of payment, by closing a gap created by the market-driven disappearance of cash. When citizens become owners of central bank deposits, the more direct contact with the central bank could challenge current legitimacy arrangements built on a narrow mandate and central bank independence to fulfill it (e.g. by nurturing expectations that the central bank

allows overdrafts on accounts, finances transfers, grants attractive interest rates and other fiscal demands that may conflict with monetary policy objectives).[33]

Input legitimacy concerns are a key reason why both advocates of a purely state-based or purely private monetary system are very active participants in the debate on digital currency. They perceive digitalization as a window of opportunity to uproot the current hybrid monetary system, which is based on a hierarchical division of labor among public and private entities, and as a window of opportunity to trigger monetary reform.

For example, in parts of the debate led by Rogoff (2016), the key rationale behind CBDC is to proactively eliminate cash from the current monetary system. This, it is argued, would facilitate the achievement of policy goals such as fighting criminal activities (money laundering and the financing of terrorism). In the debate led by Barrdear and Kumhof (2016), the key argument in favor of CBDC is to expand the toolkit available to monetary policymakers. In a world where CBDC replaces cash, the central bank could implement negative interest rates, and the issuance of CBDC could be a source of revenue for direct monetary finance of government expenditures or for lump-sum transfers in the form of helicopter money (see Assenmacher and Krogrstrup, 2018; Meaning et al., 2019; Agarwal and Kimball, 2019). In this context, it is important to realize that in today's monetary-financial system, money creation results from an exchange of liabilities between an issuer and a counterparty. When central banks acquire securities against issuing either banknotes or crediting central bank reserves to deposit accounts, the returns on these securities in general surpass the interest paid to holders of banknotes and reserves. The spread of income earned on central bank assets over income paid on their liabilities results in *monetary income*. Importantly, monetary income is *not* equal to the full nominal value of money created minus operational costs, and hence certainly not a free lunch for the issuer. This aspect is frequently neglected in proposals that view CBDC as a novel instrument to finance public spending and transfers. Finally, it is important to realize that the engagement of a central bank in essentially *fiscal* policies could undermine its credibility and acceptance within society, with potentially detrimental effects on its ability to fulfill the public mandate of price and financial stability.

While a continuous debate on reforming and regulating the economic and financial system is ongoing and inevitable given expected future challenges, there are strong doubts on the workability and potential benefits of currently known proposals for *monetary* reform (see Weber, 2018). But whatever one's view on this issue, it is important not to conflate a debate on the form of money with a debate on its institutional architecture. From a central bank's viewpoint, it is particularly important to avoid any impression that questionable institutional changes are promoted under the guise of digitalization.

3.2 Output legitimacy

Money acquires the second dimension of legitimacy, "output legitimacy," if it conforms to quality requirements of users. These requirements include, but are not limited to, general acceptance of money as a means of payment, the stability of its value, the stability of the monetary-financial system, and other practical usability

[33] *We thank Martin Hellwig for pointing that out; see also Hellwig (2018).*

aspects. Macroeconomic effects are certainly of key importance but are too vast a dimension to consider in the context of this article. In what follows we assess whether (or how) CBDC could fulfill these requirements and hence acquire output legitimacy.

3.2.1 General acceptance

In many currency areas, cash enjoys broader acceptance than currently available digital means of payment. Should digitalization result in the gradual degradation of the infrastructure supporting the circulation of cash (ATMs, cash transport services etc.), some groups in society could become constrained in their access to means of payments. In this context, CBDC aimed at replacing cash in terms of easy accessibility could be part of an effort to enhance financial inclusion (see Lagarde, 2018).[34]

In determining the accessibility of CBDC, its compatibility with existing payment infrastructures (mobile phone apps, point-of-sale terminals) or development of specific infrastructure with specific focus on broad accessibility would be key aspects. Depending on policy intentions, specific measures could be taken to influence the use of CBDC, e.g. encourage it by offering incentives for payment of taxes or certain public services in CBDC or discourage its use for large value payments by imposing limits on the value of individual payments or account holdings in CBDC.

A different route for securing broad accessibility of digital payment instruments in domestic currency in a cashless economy would be to impose regulation on private issuers of payment instruments securing broad access for users and imposing limits on user costs of these instruments.

3.2.2 Stability of value

It can be taken for granted that any CBDC would be denominated in the domestic unit of account (in the European case in euro) and maintain stable nominal value against other means of payment in domestic currency. But does the central bank goal of ensuring the purchasing power of money *require* the introduction of a CBDC? After all, digitalization may lead to the market-driven disappearance of cash. In a monetary system where commercial bank deposits represent a claim on cash, one may be led to believe that the market-led vanishing of cash implies a capping of the anchor tying banks' issuing behavior to stability-oriented monetary policies, resulting in the central bank becoming powerless – unless a CBDC is introduced to replace cash.

But such fears are unsubstantiated. Demand for cash as a means of payment on the retail level may revert to zero without hampering monetary policy focused on price stability. Commercial banks still require central bank reserves to settle payments among each other, and to fulfill both minimum reserve and regulatory liquidity requirements. Monetary policy operates via terms imposed on banks holding central bank liabilities, irrespective of whether they are held in cash or noncash form.

In academic research, some economists have discussed whether CBDC could be used as an instrument to enhance the toolkit available to central banks to pursue price stability beyond current means, e.g. enforcing negative interest rates, establishing a monopoly on the issuing of payment instruments and attempting money supply control etc. But most of these models suffer from a simplified view of the complex

[34] *Note, however, as we pointed out in section 2.2. a CBDC model which aims at enhancing financial inclusion is incompatible with an account-based implementation, if access to central bank accounts were available on the same terms and conditions as access to commercial banks.*

legitimacy requirements for money and possible trade-offs created by such measures. The imposition of negative interest rates on domestic currency beyond a certain limit is constrained not only by the availability of cash in domestic currency, but also by the risk of widespread substitution of domestic by foreign currency and other forms of liquid value. Making CBDC the only legal means of payment may enable the central bank to put all components of the money supply under central control. But it would not contribute to make money demand conform to the stability expectations underlying the quantity theory of money. In both respects, the ability of the central bank to fulfill its mandate is unlikely to improve.

3.2.3 Stability of the monetary-financial system

As users of financial services and products, as borrowers, as recipients of income in an economy dependent on a functioning circuit of money and credit, all economic subjects depend directly or indirectly on financial stability.

Like cash, CBDC could provide a potential safe asset in financial crises. If cash vanished because of reduced demand in markets resulting from digitalization, CBDC could be introduced to secure public access to central bank money, the least risky means of payment and means to self-insure against shortfalls in future personal income. If this sounds reasonable and attractive from an individual user's perspective, it may still create a problem on a collective level. The accessibility and attractiveness of CBDC by itself can have destabilizing effects, by either creating or intensifying banking crisis because of an attractive alternative to holding deposits at commercial banks triggering a bank run among retail customers more easily. It could also structurally crowd out commercial bank deposits. Because retail deposits in commercial banks refinance a major part of banks' credit to the economy, a shift of deposits to the central bank would result in the central bank acquiring an increased role as supplier of credit to the economy, either indirectly (if the central bank decided to compensate retail depositors' role as a supplier of funds to the banking system) or directly.[35] To avoid this, the attractiveness and accessibility of CBDC could be limited with respect to maximum holdings per person, returns and costs offered to holders, and various other features aimed at regulating accessibility and user behavior.

3.2.4 Practical usability aspects

The use of digital monetary instruments requires an infrastructure on which to record their existence, ownership and transfer. Such infrastructures involve access requirements for users and can be equipped with several services related to storing and transferring users' funds. Digitalization of the economy may result in a shift of user needs and requirements with respect to access and associated services. The introduction of a CBDC would require decision-making on which kind of access criteria and services would be available to users:

[35] *Inter alia, this could imply a huge rise in banks' requirement for adequate collateral to access central bank reserves, potentially resulting in collateral undersupply and price implications on the securities markets concerned, or a pressure on central banks to relax current collateral requirements, resulting in increased risk absorption by the central bank, and an increased role of the collateral framework for credit allocation in the economy. We would like to thank Hans Gersbach for stressing this fact.*

- Which functionalities and which terms of access would the associated payment service offer (fees, interest)? Would there be restrictions related to the amount of funds available per user, and on the purposes for which they could be used?
- Which kind of account services would be provided?
- Which kind and amount of privacy would be offered to users?

These design elements can be used by the central bank to influence a CBDC's attractiveness and availability to users compared to cash and privately issued digital means of payment. Design decisions will be strongly influenced by the expected impact of a CBDC's usability on the output legitimacy criteria referred to above. There are two main dimensions where user requirements are expected to change because of digitalization, creating a gap that could arguably be filled by a CBDC: with respect to the speed of payments and with respect to data protection. Growing demand for instantaneous payments, available around the clock, results from the tendency for time compression in digital commerce. One reason for introducing a CBDC could be to increase the availability of secure instant payments. The collection and analysis of user data, including payment data, has become a major component of business models in the digital domain. The digitalization of payments has also increased the vulnerability of user data to cyber incidents. These trends could over time erode current patterns of privacy protection in existing digital payment instruments, potentially creating a demand for CBDC with superior privacy protection features.

For the time being, European authorities have concluded that both requirements should be approached with measures less bold than the introduction of a CBDC. In 2018, the Eurosystem started a system for instant payments in central bank money among its counterparties, which private payment service providers like commercial banks can use to settle instant payments among retail customers based on commercial payment applications. With respect to data protection, the introduction of the EU's General Data Protection Regulation is a major effort to address privacy concerns in a digitalized economy, while anti-money laundering laws are regularly updated to address misuse of the financial system for illicit activity.

Finally, should cash vanish altogether as a result of market-driven processes, protection of the payment system against a major power failure remains a tricky issue. One may argue that the availability of a CBDC might at least provide an available alternative to private payment systems, but ultimately it is not clear why the central bank would have a better chance to protect its own payment system against a power failure than private system providers.

4 Conclusion

Should central banks issue digital currencies? And if so, how should they be implemented? These questions are inherently difficult to address, as they go far beyond questions concerning the technology underlying central bank money. Any form of central bank digital currency has the potential to crowd out cash, bank deposits, or both as a means of payment and a store of value, with far-reaching consequences for privacy, financial stability and the division of labor between the private and public sector in the allocation of credit. These major disruptions in the institutional architecture of money, banking and finance pose a challenge to the legitimacy of CBDC as a form of money. Ultimately, introducing a CBDC is the outcome how a society is able and willing to handle a broad range of questions, which are by far not only technological ones.

5 References

Assenmacher-Wesche, K. and S. Krogstrup. 2018. Monetary Policy with Negative Interest Rates: Decoupling Cash from Electronic Money. IMF Working Paper 18/191.

Agarwall, R., and M. Kimball. 2019. Enabling deep negative interest rates to fight recessions: A guide. IMF Working Paper 19/84.

Bagnall, J., D. Bouni, A. Kosse, K.P. Huynh, T. Schmidt, S. Schuh and H. Stix. 2016. Consumer Cash Usage and Management: A Cross-Country Comparison with Diary Survey Data. In: International Journal of Central Banking. 12, 4, 1–61.

Baqer, K., and Anderson, R., and Payne, J. and Mutegi, L., and Sevilla, J., 2017. DigiTally: Piloting Offline Payments for Phones, Symposium on Usable Privacy and Security (SOUPS) 2017, July 12–14, 2017, Santa Clara, California.

Barrdear, J., and M. Kumhof. 2016. The macroeconomics of central bank issued digital currencies. Bank of England Staff Working Paper No. 605.

Bindseil, U. 2019. Central bank digital currency – financial system implications and control. Available at SSRN: https://ssrn.com/abstract=3385283 or http://dx.doi.org/10.2139/ssrn.3385283

Bjerg, O. 2017. Designing new money – The policy trilemma of central bank digital currency, CBS Working Paper.

Böhme, R. 2019. The technology behind CBDCs: State of the art, design options, and implications. Presentation at the BIS-OeNB workshop on Digital currencies, central banks and the blockchain: policy implications, Vienna, October 25, available at: https://www.oenb.at/dam/jcr:0b5d72a7-e154-4495-8084-098f470325ff/BOEHME.pdf.

Borio, C. 2019. On money, debt, trust and central banking. BIS Working Paper No 763.

Brunnermeier, M., and D. Niepelt. 2019. On the Equivalence of Private and Public Money. In: Journal of Monetary Economics (forthcoming).

Capie, F, F. Saurwein, S. Schmitz, D. Tsomocos, G. Wood and L. White. 2005. Institutional change in the payment systems by electronic money innovations: Implications for monetary policy. Institute of Technology Assessment of the Austrian Academy of Sciences, Vienna.

Chaum, D., 1983. "Blind Signatures for Untraceable Payments". In Advances in Cryptology: Proceedings of Crypto 82, ed. David Chaum, R.L. Rivest, and A.T. Sherman. New York: Plenum Press, 1983.

Cochoy, F., J. Hagberg, M. P. McIntyre, and N. Sörum (eds.) 2017. Digitalizing consumption. Routledge

G7 Working Group on Stablecoins. 2019. Investigating the impact of global stablecoins. Available at: https://www.bis.org/cpmi/publ/d187.pdf

Grym, A., 2018. The great illusion of digital currencies. Bank of Finland Economics Review 1.

Hellwig, M. 2018. Bargeld, Giralgeld, Vollgeld: zur Diskussion um das Geldwesen nach der Finanzkrise. 4. Bargeldsymposium der Deutschen Bundesbank, Frankfurt. 95–147.

Huber, J. 2017. Sovereign Money – Beyond Reserve Banking. Palgrave Macmillan.

Jobst, C., and H. Stix. 2017. Doomed to Disappear? The Surprising Return of Cash Across Time and Across Countries. CEPR Discussion Paper DP12327

Kahn, Ch., F. Rivadeynera and T. Wong. 2018. Should central banks issue e-money? Available at SSRN: https://ssrn.com/abstract=3271654 or http://dx.doi.org/10.2139/ssrn.3271654

Lagarde, C. 2018. Winds of Change: The Case for New Digital Currency. Speech given at the Singapore Fintech Festival. Available at: https://www.imf.org/en/News/Articles/2018/11/13/sp111418-winds-of-change-the-case-for-new-digital-currency

Landau, J.-P. 2019. Central banks should issue digital currencies of their own, Available at: https://www.ft.com/content/ad1a6ae8-9be5-11e9-9c06-a4640c9feebb

Mancini-Griffoli T., M. Peria, I. Agur, A. Ari, J. Kiff, A. Popescu and C. Rochon. 2018. Casting Light on Central Bank Digital Currency. IMF staff discussion note, 18/08.

Meaning, J., Dyson, B., Barker, J., and E. Clayton. 2019. Broadening narrow money: monetary policy with a central bank digital currency. Bank of England Staff Working Paper 724.

Mersch, Y. 2018. Virtual or virtueless? The evolution of money in the digital age. Lecture at the Official Monetary and Financial Institutions Forum, London.

OECD, 2019. Going Digital: Shaping Policies, Improving Lives. OECD Publishing, DOI: https://doi.org/10.1787/9789264312012-en.

Pichler, P., A. Schierlinger-Brandmayer and M. Summer 2018. Digital Money. In: OeNB Monetary Policy and the Economy Q3/18. 87–99.

Rogoff, K. 2016. The curse of cash. Princeton University Press.

Stix, H. 2002. Die Auswirkungen von elektronischem Geld auf die Geldpolitik, Wirtschaftspolitische Blätter 2/2002. 110–119.

Sveriges Riksbank. 2017. The Riksbank's e-krona project, Report 1 and 2. Available at: https://www.riksbank.se/en-gb/payments--cash/e-krona/e-krona-reports/

Weber, B. 2018. Democratizing Money? Debating Legitimacy in Monetary Reform Proposals. Cambridge University Press.

Wissenschaftlicher Beirat des Bundesministeriums für Wirtschaft und Energie. 2017. Zur Diskussion um Bargeld und die Null-Zins-Politik der Zentralbank. Bundesministerium für Wirtschaft und Energie, Berlin.

The joint distribution of wealth, income and consumption in Austria: a cautionary note on heterogeneity

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In this paper we analyze the joint distribution of wealth, income and consumption in Austria. We use data from three distinct surveys, each of which focuses on one of these components, and combine these data based on a statistical matching procedure. We find that statistical data matching does not overcome the problems connected with each of the underlying data sources but rather multiplies them. There is a likely tendency to the mean in the statistical matching procedure. Thus, the tails of the distribution emerge as particularly problematic. We document the enormous difference between the three indicators usually used for describing the joint distribution. These differences can be identified in particular for specific subgroups. Finally, we argue for using only one comprehensive source of data – the Household Finance and Consumption Survey (HFCS) – to estimate the joint distribution.

JEL classification: D30, I31, G51
Keywords: joint distribution, net wealth, statistical matching, HFCS

In this paper we address conceptual issues of measuring social inequality. We study the joint distribution of wealth, income and consumption in Austria. To this end, we utilize statistical data matching techniques that focus on the components of this joint distribution at the household level. In the empirical analysis, we use the data of three waves of the Household Finance and Consumption Survey (HFCS) in Austria and the European Statistics on Income and Living Conditions (EU-SILC) as well as two waves of the Households Budget Survey (HBS).

A key contribution of our paper is to highlight problems of experimental statistics. The relationship between wealth, income and consumption does not get clearer by matching data from different surveys. Issues that remain unresolved are normative issues of justification of the weight of these variables in a joint distribution plus the specific determination of technical details. Statistical data matching might not create a useful joint distribution because it takes data from multiple surveys that have different strengths and weaknesses. In consequence, matching does not bring diverse data closer together but rather multiplies the data problems of different surveys. Thus, we underline the advantages of the HFCS data despite the fact that it covers the consumption variable only by a few questions.

This paper is structured as follows: Section 1 provides theoretical considerations and discusses the three variables considered in the analysis of the joint distribution. In section 2, we introduce the survey data underlying the analysis. In section 3, we present the statistical data matching method. In section 4, we provide our results, where we first analyze the differences in the composition of the variables for the joint distribution and its development over time. Then we look at distinct groups of households and include a link to the analysis of household vulnerability. The last

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part of section 4 analyzes the tails of the joint distribution and their connection to the statistical matching process. Section 5 concludes.

1 Theoretical considerations

Former IMF Managing Director Christine Lagarde once claimed that "reducing excessive inequality [...] is not just morally and politically correct but it is good economics".[2] And on the occasion of the launch of a report on inequality, the Secretary-General of the OECD, Angel Gurría, declared that "inequality can no longer be treated as an afterthought. We need to focus the debate on how the benefits of growth are distributed."[3]

When looking into social inequality, should wealth, income and consumption be analyzed together or separately? Intuitively, we would expect a strong relationship between these variables. However, at least in developed countries, the Gini coefficient for household wealth is in the range between 0.65 and 0.85, and for post-tax income it is between 0.25 and 0.35. So far, most studies investigating household well-being take a partial view by looking at wealth, income or consumption separately. But since the publication of the Stiglitz-Sen-Fitoussi Report on the measurement of economic well-being 2009, it has been clear that we should take a more comprehensive view of households.

Hence, international institutions like Eurostat and the OECD have acknowledged the need to broaden the view when analyzing households. The joint distribution, which takes all three components into account, is thus gaining prominence in international discussions.

The three-dimensional distribution is at the core of this paper, which will also focus on the characteristics of different groups of households in society. Do differences between household groups with respect to the joint distribution pose potentially different threats to financial stability? Using all three waves of the HFCS and the available information from the other two surveys, we can analyze a timespan of about seven years. Thus, we can get a first idea of how the composition of specific groups changed in the recent past. And how are the tails of the distribution affected if we take into account the multidimensionality as well as different variants of statistical matching? These are the questions that we analyze in this paper.

The annex to this study provides more detailed information about the matching technique that we applied to generate the single data source for our analysis. We discuss the explicit and implicit assumptions needed in the matching procedures and investigate how sensitive our results are with respect to these assumptions.

The conceptual challenges of a multidimensional approach in understanding wealth, income and consumption are considerable. Assigning weights within multidimensional inequality to single variables is a difficult task. "Equality of what" is the title of a seminal contribution by Nobel prize winner Amartya Sen. Sen's approach was operationalized in the Human Development Index produced by the UN Development Program, which focuses on life expectancy, education and income. As we look at wealth, income and consumption, we deviate from this approach.

[2] *Taken from a speech given in Brussels on June 17, 2015, available at https://www.imf.org/en/News/Articles/2015/09/28/04/53/sp061715.*

[3] *Taken from the launch of "In It Together – Why Less Inequality Benefits All" held in Paris on May 21, 2015, available at https://www.oecd.org/social/publication-launch-in-it-together-why-less-inequality-benefits-all.htm.*

But an all-encompassing metric is still not available and the heterogeneity in different forms of inequality is easily overseen. For instance, a person may have accumulated substantial wealth over their working life, but following retirement they have a modest level of income. On the other hand, young people may have high incomes but may have not yet had the opportunity to generate substantial assets. Theoretically, we should be concerned with inequality across the entire distribution. But the notions of (top) percentiles are not the same for the distribution of income, wealth and consumption. They can be correlated strongly or less strongly, and, in any case, they will be different across countries. Moreover, the classification of percentiles is mostly ad hoc and arbitrary in inequality studies. Whether one focuses on the bottom 50% or the bottom 10% will make a huge difference in substance.

As will be seen below, the distributions of wealth, income and consumption can hardly be compared directly. Piketty (2014) assumes that "the future structure of inequality might bring together extreme forms of domination based simultaneously on property and culture (in brief: Marx and Bourdieu reconciled)" (Piketty, 2014, p. 743). This broader view has not been conceptualized up to now. Groups defined along indicators that are wealth based – such as renters, owners, and capitalists – are not necessarily the same as groups defined along income and consumption indicators.

Many studies on inequality, particularly in developing economies, have focused on consumption or expenditure. And theoretically, people are expected to smooth consumption over their lifetime. Measuring consumption often gives a more direct estimate of well-being than income as particularly in developing economies, income is hard to measure because of non-market activity. Consumption possibilities are determined by currently earned income and accumulated wealth and by the possibility to borrow against an existing stock of wealth.

Income indicates the ability to meet material needs in the short term. Because of income taxation, long-time series on income are available in most countries. The World Inequality Database brings together estimates for numerous OECD countries (see: *https://wid.world/*). The median of disposable household income is an indicator of normal living standard. These statistics, however, abstract from the source of this income. Income from labor is inherently different from income from capital. The mechanisms that determine labor income include supply and demand for different skills, the state of the education system, institutions that affect the labor market and the determination of wages. For capital income, by contrast, savings and investment behavior play a decisive role.

Wealth measures the private ownership of assets. Wealth is more stable than income over time and less reliant on personal effort. Laws governing inheritances and gifts and the functioning of the real estate and financial markets matter a lot (see Piketty, 2014, p. 243; Pistor, 2019). There are numerous methodological challenges in studying wealth. Due to the sensitivity of the topic, measuring wealth involves participation and reporting problems to an even larger extent than income and consumption surveys. In particular, wealthy people are less likely to participate in voluntary surveys. Additionally, wealth has a fictitious component. Its true value is determined on the market only once it is liquidated. Furthermore, its composition is a topic of discussion, e.g. the inclusion of human capital, social capital or pension wealth.

Table 1

Schematic overview of underlying data and documentation

HFCS (basis, three waves every 3 years)	EU-SILC (yearly, from 2003 to 2018)	HBS (every 5 years, starting 1999/2000)
2010/**11**: Wave I (almost equal share of households in each year) Fessler et al. (2012) and Albacete et al. (2012)	EU-SILC wave 2010 Statistics Austria (2012)	HBS 2009/10 Statistics Austria (2013)
20**14**/15: Wave II (almost all households interviewed in 2014) Fessler et al. (2016) and Albacete et al. (2016)	EU-SILC wave 2014 Statistics Austria (2016)	HBS 2014/15 Statistics Austria (2018b)
2016/**17**: Wave III (almost all households interviewed in 2017) Fessler et al. (2018) and Albacete et al. (2018)	EU-SILC wave 2017 Statistics Austria (2018a)	HBS 2014/15 Statistics Austria (2018b)

Source: Authors' compilation.

There are, however, subfields in the literature where the results from a multi-dimensional approach are combined. Household vulnerability and fragility based on micro data commonly take into account the three indicators wealth (net wealth as well as gross wealth), income and consumption. Debt-to-income (DTI) and debt service-to-income (DSTI) ratios, for example, are based both on asset components and income. In macroprudential policy, which sets limits on DTI and DSTI, consumption is taken on board, i.e. it is considered how much income a household needs for basic consumption in order to still be able to service its debt (see Albacete and Lindner, 2013, for an early attempt for Austria).

2 Data

There is no single data source in Austria that covers all aspects of wealth, income and consumption of households in sufficient detail. There are essentially three surveys that collect household micro data: The Household Finance and Consumption Survey (HFCS) conducted by the OeNB tackles the most difficult item, wealth, and Statistics Austria conducts two major surveys for households, the European Statistics on Income and Living Standards (EU-SILC) and the Household Budget Survey (HBS). The former mainly targets income while the latter has extensive information on consumption. As we want to shed some light on the development over time, we use multiple waves of each survey in this analysis.

Table 1 gives an overview of the data we use and their documentation. For the HFCS, the field period encompasses two calendar years, so we highlighted the year we take as the main reference year and state the share of households interviewed in each year.

We do not adjust the results for inflation over the waves. The main reason for that is that we are interested in the joint distributional information rather than the changes in levels. Applying a constant factor of inflation adjustment does not alter the ranking in a distribution but only shifts the level.

3 Matching basics

Analyzing a joint distribution of wealth, income and consumption would ideally require one data source covering all the necessary information. Since no survey in Austria covers all items for wealth, income and consumption, it is possible to use

statistical matching techniques to come up with one dataset including all desired variables.[4]

In statistics, there are various approaches to matching data. D'Orazio et al. (2006) provide an overview, and the annex to this study ("Technical aspects of the matching process") discusses some matching possibilities. There are differences in the number of observations that remain missing after matching and the precision of the matching procedure. It is beyond the scope of this article to evaluate these pros and cons of different matching algorithms.[5] Instead, we simply opt for a stratified single random (rank) hotdeck procedure since it is commonly used in the literature and easy to implement. We analyze the sensitivity of this procedure with regard to the assumptions by experimenting with two distinct stratification implementations (see below). Essentially, this technique starts with one dataset. In our case, this is the HFCS, since information on wealth is hardest to impute. We look for similar households in a donor dataset, i.e. EU-SILC and the HBS. Once such similar households are found, one of the households from the donor data is randomly taken and the value of the desired information, i.e. income or consumption, respectively, attached to the specific household in the HFCS. Once this value is attached, all the survey specifics, such as weighting and imputation, are taken from the HFCS and into account for the estimation.

The stratification in this process defines how similar these matched households must be. It basically defines bins along dimensions of the sociodemographic information households are assigned to. Theoretically, for the statistical matching process to yield unbiased results, the stratification has to ensure that the conditional independence assumption (CIA) holds. This assumption says that given the bin, no other information can provide insight into the target variable. We use two different stratification definitions in order to show the impact on one of our central results. In the main matching ("matching I") procedure we use the following information for stratification in matching EU-SILC data to HFCS data:

- *Household type:*
  "single;" "couple (no children);" "more than two adults, no children;" "single with at least one child;" "couple with at least one child;" "more than two adults with at least one child"
- *Tenure status (household main residence):*
  "owner;"[6] "renter"
- *Floor space of the household's main residence:*
  Five quintiles in each of the underlying data sets[7]
- *Age of the household head:*[8]
  eight categories in ten-year steps
- *Education of the household head:*
  "without secondary;" "secondary education;" "tertiary education"[9]

[4] *The HFCS is the most complete data set but lacks some information on income, while the data from EU-SILC can draw from register information and has more information about the details of consumption.*

[5] *D'Orazio et al. (2006) are a good starting point for this discussion.*

[6] *Including households who live in their main residence free of charge.*

[7] *This basically assumes similarity of households in the same rank of the distribution of floor space.*

[8] *Household head is defined as the main income earner.*

[9] *The Austrian education system has various tracks to reach the highest level of education. Austrian education levels are then coded to international standards.*

The choice of the stratification variables is essential in this exercise. We made sure to include information on household structure, indicators for wealth (tenure status and floor space) and sociodemographic information. The inclusion of education is of particular importance due to its correlation with income. In the matching procedure of HFCS and HBS data, we use the same information as above except the age categories, which are reduced to three categories, and additionally use five quintiles of disposable household income.

For the less granular "matching II" of EU-SILC and HFCS data, we exclude the tenure status as well as the information on floor space and reduce the number of household types and age categories. Similarly, for the matching II of HBS and HFCS data, we exclude the tenure status as well as the information on floor space and reduce household type categories. We implement a single imputation of the matched households with no special attention paid to the additional statistical uncertainty.

4 Results

Analyzing the joint distribution of wealth, income and consumption, we focus first on a general overview and on the development over time. We then divide society into groups of households along a natural split emerging from the wealth distribution. Rounding up the empirical part of the study, we take a closer look at the tails of the distribution.

4.1 Overview

Table 2 allows us to compare the information from the three data sources. The results from EU-SILC and the HBS are those of the matched data. We display mean, median and the 5th and the 95th percentiles. Net wealth is reported as defined in the HFCS (see e.g. Fessler et al., 2018). For gross income, we show the equivalized yearly level, with the equivalization being based on the OECD method. The same is applied to monthly consumption. While consumption data from the HFCS are based on a single question that asks for total monthly consumption, the information from the HBS is a sum of all the various components of consumption.

Net wealth ranges from zero (5th percentile) to about EUR 900,000 (95th percentile), while yearly income ranges from EUR 12,000 to EUR 81,000, and monthly consumption ranges from below EUR 1,000 to above EUR 4,000. Wealth is much more skewed than income and consumption. This is the reason why income and consumption should be matched to information on wealth and not the other way round. Table 2 shows higher levels of income (except at the bottom of the distribution) and consumption in EU-SILC and HBS data compared to their HFCS counterparts. This is due to the focus of the respective surveys and the fact that the EU-SILC can access register income data.

Table 2

Descriptive statistics

	P5	Median	Mean	P95
	EUR thousand			
HFCS				
Net wealth	0.0	82.7	250.3	865.9
Gross income	11.9	28.2	33.2	63.6
Consumption	0.4	0.7	0.8	1.3
EU-SILC				
Gross income	11.9	32.5	37.9	80.9
HBS				
Consumption	0.8	1.8	2.0	4.3

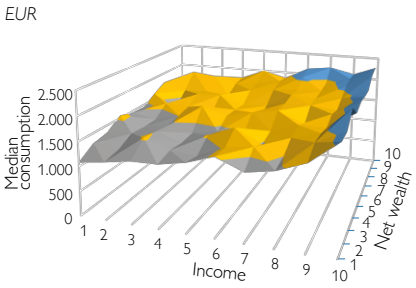
Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.

The overview descriptive statistics, however, do not give any information about the joint distribution of the three

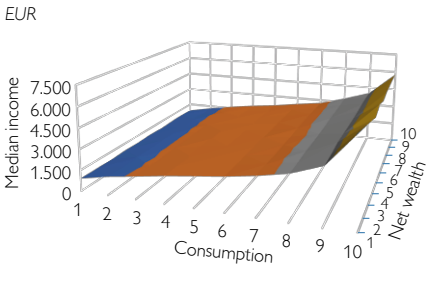
Chart 1

Joint distribution from 2010 to 2017

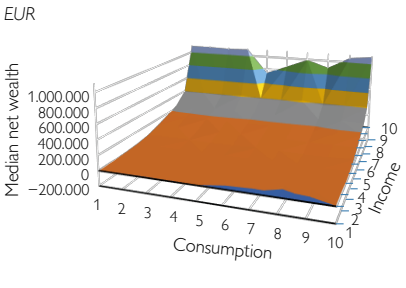
Distributions of consumption over net wealth and income deciles – 2010



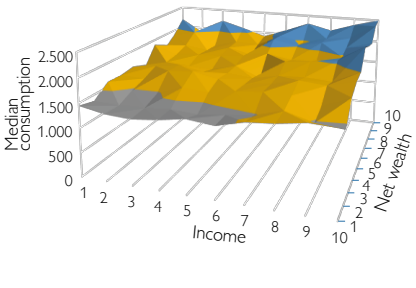
Distributions of income over net wealth and consumption deciles – 2010



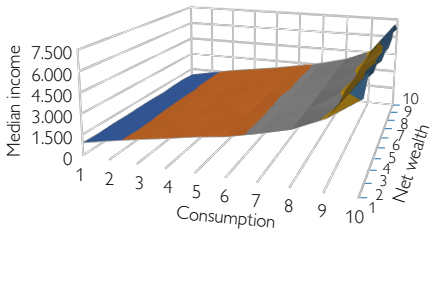
Distributions of net wealth over income and consumption deciles – 2010



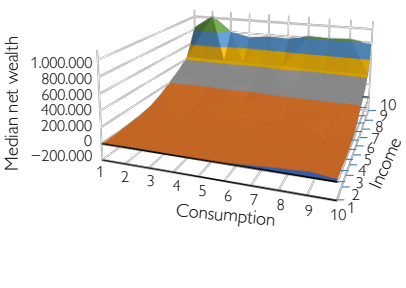
Distributions of consumption over net wealth and income deciles – 2014



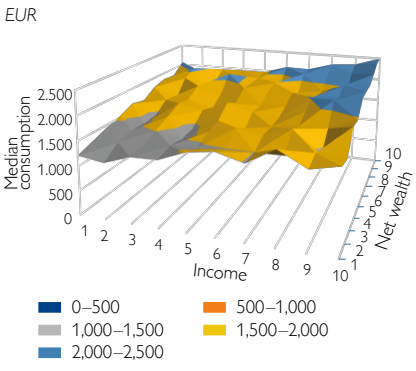
Distributions of income over net wealth and consumption deciles – 2014



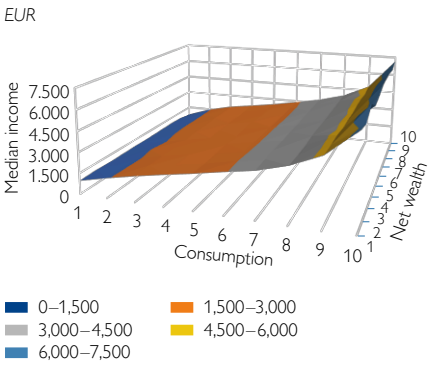
Distributions of net wealth over income and consumption deciles – 2014



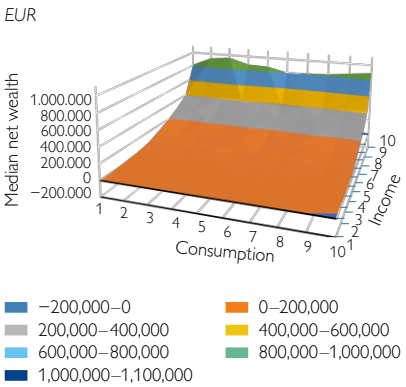
Distributions of consumption over net wealth and income deciles – 2017



Distributions of income over net wealth and consumption deciles – 2017



Distributions of net wealth over income and consumption deciles – 2017



Source: HFCS 2010-2017, OeNB; EU-SILC 2010, 2014, 2017, HBS 2009/10 and 2014/15, Statistics Austria.

indicators together. To obtain such information, we split the sample of each of the combinations of two out of the three indicators according to ten deciles of equal population size in each variable. We sort the data according to one indicator – consumption, for instance – and calculate by using weights ten groups of society with increasing consumption. These groups are then crossed with the groups from the other indicator to obtain 100 subgroups of the whole population in each of the two-dimensional spaces, i.e. wealth–income, wealth-consumption, and income-consumption. As there are about 3,000 households in the sample, the number of

households is in general large enough to estimate the results in a cell. Although it would be interesting to go beyond this split, data limitations in terms of small sample size are problematic.[10] For each of the cells we calculate the median of the third indicator in each subgroup. For example, we calculate deciles for net wealth and income. In each of the net wealth decile, there are households from each of the ten income deciles. The interaction of these two decile groups yields 100 cells. In each of the 100 cells, we calculate median consumption. This is shown in the bottom-left panel of chart 1 for the information in the year 2017.

We see that in general, consumption rises with income and wealth. There are, however, high levels of consumption also at low levels of wealth or at low levels of income. Due to high income, for example, high consumption can be afforded despite a lack of wealth. Also, for households with substantial wealth, a low level of income does not necessarily translate into low levels of consumption.

The panel in the middle at the bottom of chart 1 shows median income levels across the wealth-consumption space. The highest levels of income are found at the top of the consumption distribution. Also, the slope of income along the distribution of consumption becomes steeper, meaning that the level of income is relatively flat at the bottom and middle of the consumption distribution but rises sharply at the top of the consumption distribution. In other words, at the lower and middle consumption levels, income is relatively flat, while it increases sharply at the top. Over the wealth distribution, income is relatively flat, with the highest levels being reached at the bottom of the net wealth distribution combined with the highest level of consumption. These are households that display high levels of income which is then consumed. Looking at the data underlying chart 1, we see that median monthly income actually increases slightly with ascending net wealth deciles, so there is also a small positive slope along the distribution of net wealth.

Lastly, the bottom-right panel of chart 1 portrays the median level of net wealth in the income-consumption space. The level of net wealth is relatively flat along the consumption distribution while it increases along the income distribution dimension. Thus, there is a higher correlation between income and wealth than between consumption and wealth. This result hints at a satiation point to consumption for households. Even with high resources available there is a kind of upper boundary to consumption.

Additionally, we see that there are households with high levels of consumption and low levels of income (bottom-right corner in the bottom right panel of chart 1) that, accordingly, have very low, or even negative levels of net wealth. These are the households that are of special concern in the analysis of financial stability. It is also worth noting that, again, the range of values covered in the bottom-right panel of chart 1 dwarfs what we found for consumption and income in the two other bottom panels. This once again shows that focusing on wealth instead of income and consumption seems warranted (see e.g. Piketty, 2014).

In addition to the results (bottom panels) for the 2017 wave, chart 1 also shows the results for 2014 (middle row) and 2010 (top row). Overall, there seems to be stability over time. Each of the three-part sets displays a pattern similar to the one described above for 2017.

[10] *We repeated the whole exercise with 20 vingtiles for each indicator instead of ten deciles. The overall results remain unchanged. However, the crossing of two dimensions are resulting in estimations of medians for 400 cells which are sensitive to outliers.*

As the results are not inflation adjusted, the absolute level of consumption increased broadly over time. Furthermore, the highest levels of income increased noticeably while the remaining results in this regard over the consumption-net wealth space remained broadly stable.

4.2 Three groups of households aligned to joint distribution

In the following section, we look at the multidimensional distribution and distinguish the following three distinct groups of households (as done in Fessler and Schürz, 2018): households that rent their main residence (renter), households that own the main residence (owner) and households that own their main residence and/or have business wealth and/or have income from renting out real estate other than the household's main residence (capitalist). This split is done according to the data in the HFCS, meaning that the information necessary for the classification is taken from the HFCS.

Table 3 breaks indicators of the joint distribution down by these three groups.

Consumption remains roughly the same over the three groups. The average income of capitalists (about EUR 59,000) in the HFCS is twice as high than for renters (about EUR 29,000). Looking at the matched information from the EU-SILC, renters earn, on average an income of about EUR 45,000, which compares to EUR 44,000 for capitalists. This illustrates the issue of statistical matching and reversion to the mean along a dimension that is not part of the stratification process, such as the groups defined above. In terms of wealth, however, the three groups of households display completely different levels. Median net wealth for renters amounts to about EUR 15,000, while it is many times this amount for owners – EUR 250,000 – and even higher for capitalists – around EUR 650,000. Thus, levels of wealth differ substantially among the household groups, while levels are quite similar when it comes to income and consumption.

Over the whole distribution, we can analyze which type of households resides in which part of the distribution by looking at chart 2.[11]

Although the share of renters decreases over the income and consumption distribution and the share of owners increases therein, in both cases we cannot find the clear separation among groups of households known from the net wealth distribution. Furthermore, capitalists are spread out over both income and consumption distribution spaces.

Compared to their share in the overall population, both owners and capitalists have a disproportionately high share of wealth, income and consumption (see table A3). This result is stronger for capitalists than for owners. It is also a lot stronger for wealth than for income and consumption. The shares across

Table 3

Descriptive statistics over groups in society

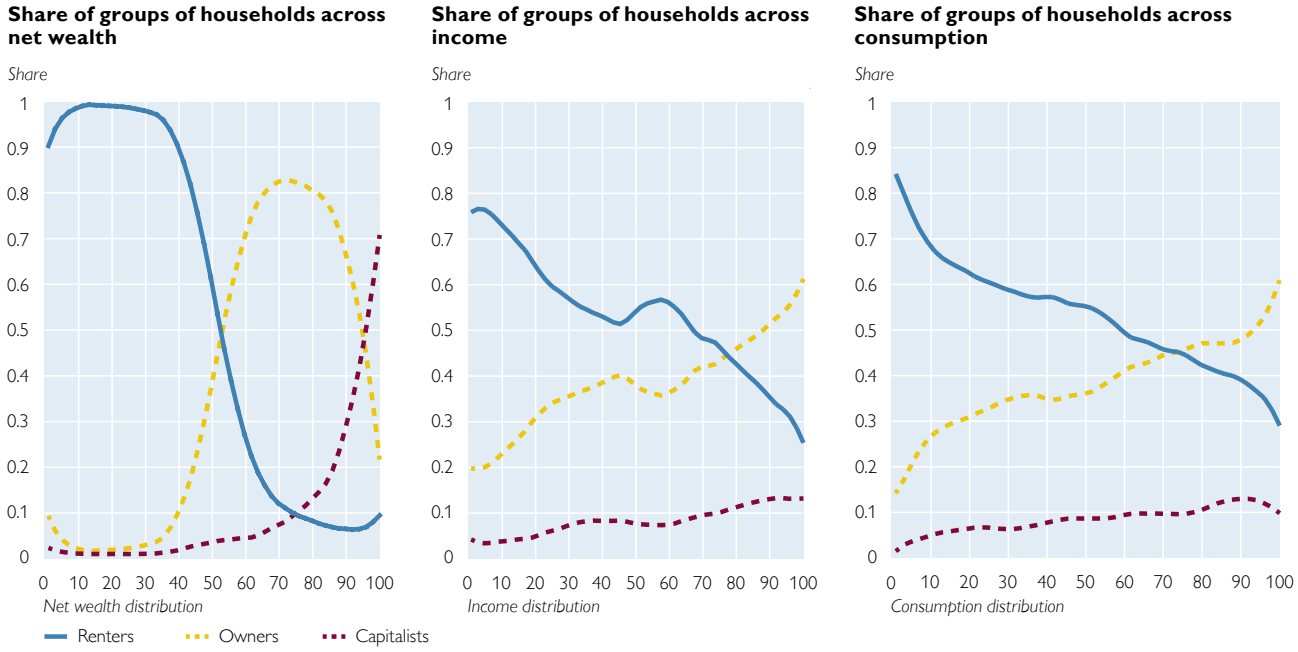
	Renter		Owner		Capitalist	
	Median	Mean	Median	Mean	Median	Mean
	EUR thousand					
HFCS						
Net wealth	14.8	58.2	252.2	323.4	648.6	1,176.4
Gross income	25.6	28.7	30.6	34.0	38.1	58.8
Consumption	0.7	0.7	0.7	0.9	0.7	0.8
EU-SILC						
Gross income	39.3	45.0	29.1	32.8	36.9	43.7
HBS						
Consumption	2.0	2.4	2.0	2.3	1.6	1.8

Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.

[11] *These charts are based on the smoothed results of a kernel-weighted local polynomial regression with an Epanechnikov kernel function, a degree of 1 and a half width of 5.*

Chart 2

Share of groups of households



Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.

these three groups of income and consumption are remarkably similar. Only net wealth displays a different pattern.

For a more precise discussion of the multidimensional distribution of wealth, income and consumption for each of the groups of households, we calculate a similar chart as chart 1 for the three household groups. Due to the small number of observations on some parts of the distribution, we refrain from including the chart in the paper. We discover that renters are to be found over all parts of the combination of all 2D distributions. In the consumption-income space, owners and capitalists also occupy most of the cells. Thus, in each combination, there are households that have high, middle and low income connected to different consumption levels. For owners and capitalists, however, the space using also net wealth shows that at the bottom of the net wealth distribution, there are few owner households and almost no capitalists.

Table 4

Basic indicators for household debt burden

	Renter	Owner	Capitalist
	%		
Share of households holding debt (HFCS)	25	38	55
	Ratio		
Debt-to-asset ratio (HFCS)	7.7	0.3	0.1
Debt-to-(gross) income ratio (HFCS, EU-SILC)	0.3	2.6	1.6
	%		
Share of debtors with negative financial margin (HFCS, EU-SILC, HBS)	24	23	23

Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.

4.3 Household debt burden over three groups of households

Table 4 provides an overview of indicators generally used in the analysis of household debt burden and based on the matched data for each group of households.

The share of households holding debt is highest among capitalists, but the debt-to-asset ratio is lowest in this

group and highest for renters. The debt-to-income ratio is highest for owners, which indicates a higher level of debt. Financial fragility – measured by the share of debtors with a negative financial margin – is roughly the same for all groups of households conditional on having debt. A deeper discussion of this topic going toward the estimation of potential exposure and loss given default is left for future research.

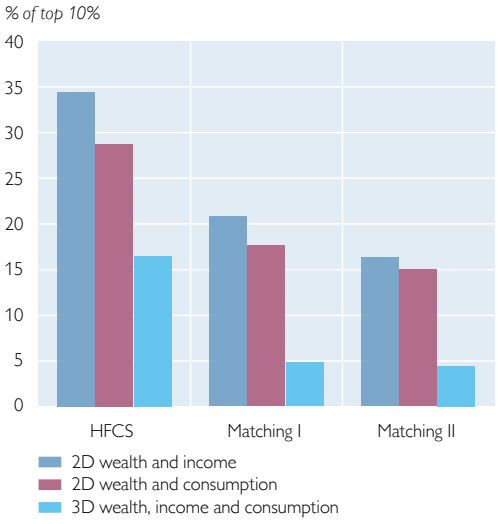
4.4 Robustness of the tails of the joint distribution

The tails of the distribution are of particular interest for many topics addressed with micro data. For the analysis of household vulnerability, we consider the left tail of the distribution. In the literature, analyses often also focus on the top tail of the distribution. This is why we concentrate on these parts and analyze the impact of the statistical matching procedure on them.

To this end, we look at the top and bottom 10% according to each indicator.[12] Extending the distribution by one or two dimensions, we analyze how many households remain in the tail of the joint distribution. Essentially, we investigate the cross-combination of belonging to the top 10% in each of the underlying one-dimensional distributions and show the share of households remaining in the top 10%. If all households in the top 10% of the net wealth distribution are also in the top 10% of the income distribution and the top 10% of the consumption distribution, we would see that 100% remain in the 2D and 3D distribution. We complement this analysis of results from the HFCS with the results from the matched data as well as another less granularly stratified single random hotdeck matching procedure. For the "matching II" procedure, we exclude ownership status of the household main residence and square meter of real estate and reduce age (EU-SILC as with

Chart 3

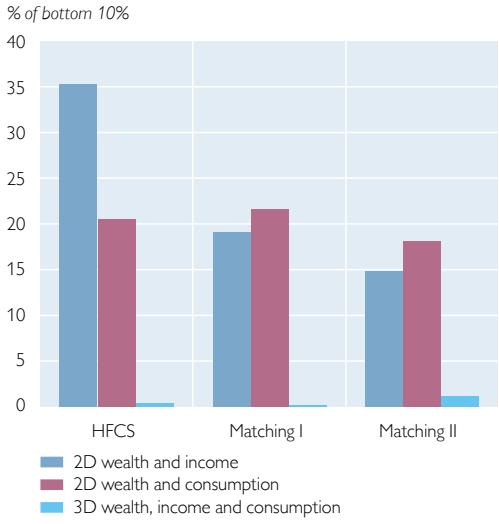
Top of the joint distribution and matching data sources



Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.

Chart 4

Bottom of the joint distribution and matching data sources



Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.

[12] *We tried to look at the top and bottom 5%, however, there are almost no households left when we look at the joint distribution. Thus, we turned toward the top and bottom 10%.*

HFCS) and household type to 3 categories (single, couple without children, rest) in the stratification.

Chart 3 splits the results in three blocks. First, we look at the information based solely on the HFCS, second, we use data from matching I, and third, we use a reduced-form matching procedure II. The first combination of wealth and income shows that from the 10% in each of the distributions of wealth and income, there are about 35% of households left (dark blue bar). The connection of wealth and consumption has under 30% of the top 10% in each category left. Taking the 3D distribution of wealth, income and consumption (light blue bar) together, only about 15% remain at the top in each indicator. Thus, increasing the dimensions of inequality reduces the share of households belonging to the top.

Taking the matched data in the two other blocks, we find an even larger reduction of the share of households remaining at the top of the multidimensional distribution. Therefore, depending on the specifics of the matching process, the procedure itself reduces the tail of the distribution. These results are deemed highly problematic when the data are used to discuss issues of inequality. Any statistics referring to matched data must be used with great caution.

Secondly, we turn toward the left, i.e. the bottom, tail of the distribution (see chart 4). The bottom of the distribution displays a similar picture as the top tail. The 3D distribution leaves almost nobody at the bottom of the distribution in each single dimension. Even if households have no wealth, they might have enough income to be lifted out of the bottom 10%. At the bottom tail of the 3D distribution, there are even fewer households left than at the top. The results show that we have to be very careful when analyzing household vulnerability and financial fragility. This is the reason why several indicators for vulnerable households are used.

The main reason for the impact of matching on the results seems to be the loss in correlation between the variables due to the random nature of matching. In order to investigate this result further, we show simple pairwise correlations of each of the involved indicators in the analyses in table 5. The correlation between income and wealth in the HFCS is about 0.7 and thus more than 6 times higher than the correlation of wealth from the HFCS and the matched income information from the EU-SILC, which is 0.1. Though less drastic for the correlation between wealth and consumption, there is still a factor of almost 2 comparing the matched information with variables contained in one dataset. A similar difference is found between the income and

Table 5

Correlation matrix

	HFCS			EU-SILC	HBS
	Net wealth	Gross income	Consumption	Gross income	Consumption
	EUR thousand				
HFCS					
Net wealth	1.00				
Gross income	0.65	1.00			
Consumption	0.24	0.35	1.00		
EU-SILC					
Gross income	0.10	0.09	0.15	1.00	
HBS					
Consumption	0.14	0.12	0.21	0.20	1.00

Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.

consumption correlation within the HFCS (0.4) compared to the correlation between income and consumption using both matched information (0.2).

5 Conclusion

The conceptual challenges of a multidimensional and relational approach in understanding inequality are far-reaching and call for caution.

In our empirical results, we find a tendency of the statistical matching process toward the mean. Additionally, the issue of estimating uncertainty is largely unresolved in the literature. A closer inspection of this and differences across countries, however, is left for future research.

The distributional information covered in the HFCS is limited but it is unbiased and should be sufficient to base scientific discussions of the joint distribution on this data base. The correlation between wealth, income and consumption is substantially higher in the HFCS data than in the statistically matched data. Research on financial stability is already taking into account the multidimensional nature of inequality but the unresolved conceptual challenges remain manifold.

References

Albacete, N., S. T. Dippenaar, P. Lindner and K. Wagner. 2018. Eurosystem Household Finance and Consumption Survey 2017. Methodological notes for Austria. In: Monetary Policy & the Economy Q4/18 – Addendum. Vienna: OeNB.

Albacete, N., P. Lindner and K. Wagner. 2016. Eurosystem Household Finance and Consumption Survey 2014. Methodological notes for Austria. In: Monetary Policy & the Economy Q2/16 – Addendum. Vienna: OeNB.

Albacete, N., P. Lindner, K. Wagner and S. Zottel. 2012. Eurosystem Household Finance and Consumption Survey 2010. Methodological notes for Austria. In: Monetary Policy & the Economy Q3/12 – Addendum. Vienna: OeNB.

Albacete, N. and P. Lindner. 2013. Household Vulnerability in Austria – A Microeconomic Analysis Based on the Household Finance and Consumption Survey. In: Financial Stability Report 25. Vienna: OeNB. 57–73.

D'Orazio, M., M. Di Zio and M. Scanu. 2006. Statistical Matching. Theory and Practice. New York: Wiley.

Eurostat. 2013. Statistical Matching: a model-based approach for data integration. Methodologies and Working papers. Luxembourg: Eurostat.

Fessler, P., P. Lindner and M. Schürz. 2018. Eurosystem Household Finance and Consumption Survey 2017 for Austria. In: Monetary Policy & the Economy Q4/18. Vienna: OeNB. 36–66.

Fessler, P., P. Lindner and M. Schürz. 2018. Eurosystem Household Finance and Consumption Survey 2017 – first results for Austria. In: Monetary Policy & the Economy Q4/18. Vienna: OeNB. 36–66.

Fessler, P., P. Lindner and M. Schürz. 2016. Eurosystem Household Finance and Consumption Survey 2014 – first results for Austria (second wave). In: Monetary Policy & the Economy Q2/16. Vienna: OeNB. 34–95.

Fessler, P., P. Mooslechner and M. Schürz. 2012. Household Finance and Consumption Survey of the Eurosystem 2010 – first results for Austria. In: Monetary Policy & the Economy Q3/12. Vienna: OeNB. 24–62.

Fessler, P. and M. Schürz. 2018. The functions of wealth: renters, owners and capitalists across Europe and the United States. OeNB Working Paper 223.

Fisher, J., D. Johnson, T. Smeeding and J. Thompson. 2018. Inequality in 3-D: Income, Consumption, and Wealth. Finance and Economics Discussion Series 2018-001. Washington: Board of Governors of the Federal Reserve System.

Lamarche, P. 2017. Measuring Income, Consumption, and Wealth jointly at the micro-level. Luxembourg: Eurostat.

Leulescu, A. and M. Agafitei. 2013. Statistical matching: a model based approach for data integration. Eurostat Methodologies and Working Papers.

Meyer, B. D., W. K. C. Mok and J. X. Sullivan. 2015. Household Surveys in Crisis in Journal of Economic Perspectives – Volume 29. Number 4. Fall 2015. 199–226.

OECD. 2013. OECD Framework for Statistics on the Distribution of Household Income, Consumption and Wealth. Paris: OECD Publishing.

Piketty, T. 2014. Capital in the Twenty-First Century. Cambridge, Massachusetts: The Belknap Press of Harvard University Press.

Pistor, K. 2019. The Code of Capital. How Law creates wealth and inequality. Princeton University Press.

Statistics Austria. 2018a. Standard-documentation – Meta information (Definitions, comments, methods, quality) on EU-SILC 2017.

Statistics Austria. 2018b. Standard-documentation – Meta information (Definitions, comments, methods, quality) on Household Budget Survey 2014/15.

Statistics Austria. 2016. Standard-Dokumentation Metainformationen (Definitionen, Erläuterungen, Methoden, Qualität) zu EU-SILC 2014.

Statistics Austria. 2013. Standard-documentation – Meta information (Definitions, comments, methods, quality) on Household Budget Survey2009/10.

Statistics Austria. 2012. Standard-Dokumentation Metainformationen (Definitionen, Erläuterungen, Methoden, Qualität) zu EU-SILC 2010.

Stiglitz, J. E., A. Sen and J. P. Fitoussi. 2009. Report of the Commission on the Measurement of Economic Performance and Social Progress. https://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+Commission+report.

Annex

Technical aspects of the matching process

Statistical matching does not come in a single agreed upon method. There are the following approaches that are commonly taken when statistically matching disjoint data sets that cannot be linked with a common identifier:

- Regression-based parametric approach
- (stratified) random hotdeck
- rank hotdeck
- reweighting

The first method involves a regression of the desired information that is missing in the dataset of choice – say A – but is included in another dataset, e.g. income in our case, on a set of common variables in both datasets. The coefficients of the regression are transferred and applied to the values in dataset A, thereby forecasting the missing information. In the hotdeck procedures, a random donor household is chosen and its value attached to the receiver data. This random process is complemented by a strategy to find similar households, i.e. stratification or ranking along a certain distribution. In the stratification process, a set of information is used to create bins certain households belong to because they fulfill characteristics from the chosen parameters. Depending on the information, the stratification can be more or less

granular, meaning there are many bins with few similar households or there are few bins with many households. If there are no households from the donor data set in a bin, the households cannot be assigned a value in the receiver dataset in this bin. This leads to bias, since these households ultimately have to be left out of the analysis. In the "rank hotdeck" procedure, the characteristics defining the bin are whether they belong to a certain rank in a chosen distributional dimension. In the univariate case with only one distribution, there are no missing households from the donor dataset, since the distribution in each dataset is complete. The choice of the distribution, however, is crucial and a single dimension might not be enough to guarantee conditional independence. In the last method, the weights of households are adapted in such a way that the distribution of the desired outcome variable, like income, follows what is observed in the donor data. This approach requires some similar information in the receiver dataset. As explained in the main text, we opted for a stratified single random (rank) hotdeck procedure.

In practice, the stratified single random hotdeck procedure requires at least the following steps to generate the desired dataset:

1. select donor and receiver datasets
2. select stratification variables
3. select variables from the donor data that should be matched to the receiver data
4. stratify your sample
5. randomly select a donor household for a receiver household

Each of the above steps requires assumptions that potentially affect the results and the variance estimation around a specific result. Far from giving a complete in-depth analysis what each and every assumption entails, we want to lay out here which assumptions we have made in order to provide for transparency in the choices made and make it possible to discuss alternatives.

First, as introduced in the main text in table 1, we base our analysis on the three main surveys in Austria. The HFCS covers information on wealth, income and consumption. The EU-SILC focuses on income and the HBS on consumption. Although the HFCS is arguably the most complete survey, details on consumptions are covered to a larger extent in the HBS, and the EU-SILC has access to register income data, which should improve the quality of the data provided. We consider both EU-SILC and HBS data as the donor datasets for income and consumption, respectively. This means our receiver dataset is the HFCS. This choice is largely due to the issue that it is even harder to match wealth information to another dataset compared to matching any other information to the data containing wealth. However, apart from this, the decision is ad hoc and results would change if it is altered. In our case the decision is made more complicated by the time dimension. The most obvious choice is to use the same data sources as receiver and donor datasets over time. That is what we have done. However, considering some information on the quality of the matching process, e.g. how many households ultimately end up remaining missing, alterations to the receiver and donor datasets could enhance quality. Additionally, since there are three waves of the HFCS, we looked for information from the EU-SILC and HBS in the respective time period. While this seems relatively unproblematic for matching with EU-SILC data, there are serious complications in the matching process with data from the HBS, which is conducted only every 5 years. The first consumption information was provided one to two years earlier than the information provided in the HFCS, and the 2014 wave

of the HBS has to be used twice for both the second and the third waves. Although this implies limitations in the results, there is nothing that can be done about it apart from urging the data provider to provide for a common survey period.

Table A1

Stratifiction variables

		Matching I			Matching II		
Matching information	Description	Number of categories	Coding	Used in the matching of	Number of categories	Coding	Used in the matching of
Age	Age of household head	8	Up to 19 20 to 29 30 to 39 40 to 49 50 to 59 60 to 69 70 to 79 80 and above	HFCS-EU-SILC	× × × × × × × ×	× × × × × × × ×	× × × × × × × ×
	Age of household head	3	Up to 29 30 to 59 60 and above	HFCS-HBS	3	Up to 29 30 to 59 60 and above	HFCS-EU-SILC HFCS-HBS
Education	Level of education of household head	3	Without secondary education Secondary education Tertiary education	HFCS-EU-SILC HFCS-HBS	3	Without secondary education Secondary education Tertiary education	HFCS-EU-SILC HFCS-HBS
Household structure	Type of household classified with respect to age of household members and their relationship	6	Single – no children Couple – no children More than 3 adults – no children Single with children Couple with children Three or more adults with children	HFCS-EU-SILC HFCS-HBS	3	Single Couple – no children Other	HFCS-EU-SILC HFCS-HBS
Tenure status	Ownership structure of main residence	2	Owner (including free usage) Renter	HFCS-EU-SILC HFCS-HBS	× ×	× ×	× ×
Income	Disposable household income	5	1st quintile 2nd quintile 3rd quintile 4th quintile 5th quintile	HFCS-HBS	5	1st quintile 2nd quintile 3rd quintile 4th quintile 5th quintile	HFCS-HBS
Wealth indicator	Size of main residence	5	1st quintile 2nd quintile 3rd quintile 4th quintile 5th quintile	HFCS-EU-SILC HFCS-HBS	× × × × ×	× × × × ×	× × × × ×

Source: Authors' compilation.

As regards the choice of stratification variables, for most of the results in the paper we opt for a relatively fine stratification. This implies that matched households are relatively similar along the dimensions age, education, household structure, tenure status, income (only for HFCS-HBS matching) and the size (in square meters) of the households' main residence. Table A1 shows the details. The categories of the household structure follow a logical separation in households with and without children followed by households with 1, 2 and 3+ persons. Underlying this information, there are additional assumptions, we have to make along the way. As a start, the details of the definition of a household and the coverage of the total household population is not identical over datasets. The HFCS, e.g., also collects information on households that are not in the register of residents. Another example, the way how the data are collected, and the definition of income are not completely identical in the HBS and HFCS. Also, net income is available only starting from wave 2 in the HFCS, so in wave 1 gross income is used instead. Another example is that floor space is top coded in the EU-SILC but not in the HFCS, which limits what can be done in terms of percentiles. It would be preferable to ensure harmonized definitions over the underlying datasets. This should be at the core of further improving the surveys. There is also an implicit assumption of whether to hold stratification stable over time or change it appropriately in each wave. We opted for a constant stratification over time in order to ensure that changes over time are not affected by this choice. There is an indefinite number of imaginable breakdowns for stratification. In order to be able to discuss the impact of changes in the assumption about stratification, we discuss in the paper an exercise where we simplify our matching procedure to what we call "matching II." As shown in table A1, this essentially reduces the number of similar characteristics households need to have for being matched. Thus, it reduces the number of observations that cannot be matched and hence remain missing, but this comes at the cost that households that are matched now are more dissimilar. Thus, there is a trade-off between the two ways of stratification and hence a priori no clear advantage of one over the other. The distribution of households in these stratification categories should be similar over the underlying datasets to ensure a smoothly working matching procedure. This similarity is guaranteed only for quintiles in which there are, by definition, 20% of the household population. Some of the other variables are used in the post-stratification process to reach final household weights and each, in turn, is based on the micro census and hence should be relatively similar. Due to space constraints, we refrain from reporting tests for the similarity of the distribution, such as Hellinger distance, but instead perform sensitivity analyses with respect to different matchings.[13]

Table A2 gives an overview of the practical implications of the stratification introduced above. It shows the number of distinct bins in the matching process between all datasets. Additionally, we see how many bins are occupied to what extent and what the missing rate pattern in the matched data is. The first two columns headed "matching I" provide the information for the finely stratified procedure that underlies most of the results in the paper.

There are 1,440 and 2,700 possible distinct bins in matching HFCS with EU-SILC and HBS data, respectively. This number does not change over time, since the

[13] *For more details on the testing of similarity of the underlying distributions of households see e.g. Leulescu and Agafitei (2013).*

Table A2

Number of matching strata

	Matching I		Matching II	
	Matching HFCS EU-SILC	Matching HFCS HBS	Matching HFCS EU-SILC	Matching HFCS HBS
Number of possible strata (bins)	1,440	2,700	27	135
Wave 2017				
Occupied strata in the HFCS	591	819	27	119
Occupied strata in donor data	725	1.039	27	129
Number of strata in HFCS without any complete cases in donor data	69	163	0	2
Number of strata with only 1 complete case	183	348	0	3
Number of strata with only 2–5 complete cases	241	356	0	19
Approximate number of households with missing matched information	83	162	0	2
Wave 2014				
Occupied strata in the HFCS	589	843	×	×
Occupied strata in donor data	754	1.039	×	×
Number of strata in HFCS without any complete cases in donor data	65	182	×	×
Number of strata with only 1 complete case	202	348	×	×
Number of strata with only 2–5 complete cases	261	356	×	×
Approximate number of households with missing matched information	73	169	×	×
Wave 2010				
Occupied strata in the HFCS	589	937	×	×
Occupied strata in donor data	744	1.100	×	×
Number of strata in HFCS without any complete cases in donor data	79	208	×	×
Number of strata with only 1 complete case	183	362	×	×
Number of strata with only 2–5 complete cases	273	423	×	×
Approximate number of households with missing matched information	87	160	×	×

Source: HFCS Austria 2017, OeNB, Statistics Austria, EU-SILC 2016 and HBS 2014/15.

Note: The number of households with missing matched information is the average over the five implicates and thus can only be given as an approximation.

categories used in the stratification are not altered either. The number of occupied cells, however, does change over time and is about 590 and from 820 to 940 for the HFCS in the matching with EU-SILC and HBS data, respectively. In the EU-SILC, the number of occupied cells ranges from 725 to 754 and for the HBS from 1,039 to 1,100. Due to the sample size, the number of occupied cells in the donor datasets is larger than in the receiver dataset. Although this is desirable, it is not sufficient to ensure that all households in the HFCS actually have potential matches. Depending on the indicator and the wave, there are between 70 and 170 households that cannot be matched and remain missing in the desired information. This obviously introduces bias in the estimation. There is thus a trade-off between the precision of the stratification and the resulting number of missing observations. Inspecting the last two columns headed "matching II," where we simplified the stratification, we see almost no missing observations reported. To repeat, the cost of that is that the matched households are not very similar in many dimensions and thus the CIA assumption is hardly met.

Furthermore, table A2 shows the number of cells where there are very few households in the donor dataset. This number ranges from about 180 to 360, depending on the survey wave and donor for cases, where there is only one household to be matched to potentially many HFCS households. The randomness of the matching procedure reduces to this single household being selected with certainty. Even in the case where two to five households are in a specific bin in the donor dataset (240 to 420 cases), the likelihood of one household being selected is high. Comparing this information to "matching II" shows the trade-off between the similarity of households to be matched and the randomness in the process. Any choice has implications for the results and, to the best of our knowledge, there is no agreement in the literature on the optimal choices to be made.

Table A3

Shares held by groups in society

	Population share	Net wealth	Gross income	Consumption
	%			
Renter	54	32	47	47
Owner	38	54	43	43
Capitalist	8	14	10	10

Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.

For us it is relatively clear which information to be matched from which database, and thus, steps three to five are straightforward to implement. We use the user-written Stata command "hotdeck" for the matching procedure.[14] As the data of the HFCS are multiply imputed (see e.g. Albacete et al., 2018), one complication arises in the choice of how to match households across implicates. This implicitly means that we have to assume either that one household is matched with the same household from the donor dataset over all implicates or that each household in each implicate is treated as separate unit and thus can be matched with different households across implicates. We opted for the latter since some information from the stratification might be imputed and thus change over implicates and hence falls in a different bin in the matching process. There is also the possibility to use multiple matches for one household, similar to multiple imputation. This, however, would extensively enlarge the dataset and thus is disregarded in the analysis at hand. Nonetheless, all the assumptions might have an impact on the results.

Shares of groups of households in society

Table A3 shows the share of each group of households in society. More than half of the population rents their main residence, only 8% are capitalists. The remaining 38% are classified as owners. We see that in terms of wealth, renters hold a disproportionately small share while owners and capitalists hold a disproportionately large share. These results are far less pronounced – though still visible – for income and consumption.

Additional information at the top and bottom of the distribution

While the main results are portrayed in the paper, table A4 looks at the top of the distribution and how shares are impacted by the extension to more than one dimension and by the matching procedure. For each of the possible three 2D distributions and the 3D distribution, we show the share of households remaining at the top of the distribution.

Table A5 provides similar information for the left tail of the distributions.

[14] *The command was written by Adrian Mander, MRC Human Nutrition Research, Cambridge, U.K.*

Table A4

Impact of matching on the share of households at the top of the distribution

		HFCS			Matching I			Matching II		
		Net wealth	Income	Con-sumption	Net wealth	Income	Con-sumption	Net wealth	Income	Con-sumption
		%								
Single indicator	**Share of households**	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
2-dimensional distribution	Net wealth and income	**3.4**			**2.1**			**1.6**		
	One without the other	6.5	6.5		7.9	7.6		8.3	8.3	
	Net wealth and consumption	2.9		2.9	1.8		1.8	1.5		1.5
	One without the other	7.1		7.1	8.2		7.7	8.5		8.5
	Income and consumption		**3.7**			**1.9**			**1.7**	
	One without the other		6.3	6.3		7.9	7.6		8.3	8.3
3-dimensional distribution	Share of households	**1.6**			**0.5**			**0.4**		
	Net wealth and income but not consumption	**1.8**			**1.6**			**1.2**		
	Net wealth and consumption but not income	1.2		1.2	1.3		1.3	1.1		1.1
	Income and consumption but not net wealth		**2.1**			**1.4**			**1.2**	

Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.

Table A5

Impact of matching on the share of households at the bottom of the distribution

		HFCS			Matching I			Matching II		
		Net wealth	Income	Con-sumption	Net wealth	Income	Con-sumption	Net wealth	Income	Con-sumption
		%								
Single indicator	**Share of households**	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
2-dimensional distribution	Net wealth and income	**3.5**			**1.9**			**1.5**		
	One without the other	**6.5**			8.1	7.9		8.6	8.6	
	Net wealth and consumption	2.0		2.0	2.2		2.2	1.8		1.8
	One without the other	8.0		8.0	7.9		7.4	8.2		8.2
	Income and consumption		**2.3**			1.6	1.6		**1.3**	
	One without the other		7.7	7.7		8.2	7.9		8.8	8.7
3-dimensional distribution	Share of households	**0.0**			**0.0**			**0.1**		
	Net wealth and income but not consumption	**0.2**			**0.3**			**0.6**		
	Net wealth and consumption but not income	0.5		0.5	0.5		0.5	0.6		0.6
	Income and consumption but not net wealth		**2.3**			1.6	1.6		**1.2**	

Source: HFCS 2017, OeNB; EU-SILC, HBS, Statistics Austria.