EURONA

EUROSTAT **R**EVIEW
ON **N**ATIONAL **A**CCOUNTS
AND MACROECONOMIC
INDICATORS
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EUROSTAT REVIEW ON NATIONAL ACCOUNTS AND MACROECONOMIC INDICATORS

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Contents

Aims and scope

EURONA is an open access, peer-reviewed, scholarly journal dedicated to National Accounts and Macroeconomic Indicators. EURONA aims at providing a platform for researchers, scholars, producers and users of macroeconomic statistics to exchange their research findings, thereby facilitating and promoting the advancement of National Accounts and Macroeconomic Indicators.

EURONA publishes empirical and theoretical articles within the scope of National Accounts and Macroeconomic Indicators, as well as articles on important policy uses of these statistics. They may relate to both users' and producers' interests, present subjects of general relevance or investigate specific topics.

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Production

This publication was produced by Giovanni Albertone, Simon Allen and Andrew Redpath – INFORMA s.à r.l.

Editorial

This is the fifteenth and very last issue of EURONA. Since its inception in 2014, this journal has published 61 articles (including the five included in the current issue) related to national accounts and macro-economic statistics. The articles discussed and investigated a large variety of topics, including highly conceptual debates, practical measurement issues, inter-country comparisons, innovative methodologies and statistical techniques, as well as many other subjects. They were written by statistics producers, users, policymakers and researchers. They had one thing in common: the search for better measurement of important aspects of our economy and society in order to contribute better to policymaking.

These values are again demonstrated in this last issue. In the first article, Paul Schreyer makes an important contribution to the debate on accounting for free digital services. An extended measure of activity is proposed that includes own-account household production of digitally-enabled leisure services.

Camille Gonseth and Philippe Küttel present in the second paper the treatment of international sports organisations in the Swiss national accounts. There are no less than 45 such organisations in Switzerland and the paper estimates the contribution they make to Swiss GDP. The paper discusses the conceptual and practical challenges to do this.

Climate change being an important issue for small island developing states, Patrice Guillotreau and Kevin Bistoquet estimate, in the third article, the CO_2 footprint for the Seychelles, using, among other data, Eurostat's input-output tables.

Pau Gayà Riera, Andreas Hertkorn, Enrico Infante, Balint Murai, Orestis Tsigkas and Leonor Zubimendi analyse, in the fourth article, the consistency of the financial and non-financial accounts by institutional sector, by deriving implicit property income in relation to the respective financial positions. They find that the results are fairly plausible. The methodology may be of use for data compilers and users of sector accounts.

The last paper in this issue is from Duncan Coughtrie, Andy Fuller, Paolo Passerini and Corrado Peperoni and discusses the challenges in compiling data on social benefit recipients in the context of the European system of integrated social protection statistics. Demand for such data has increased during the COVID-19 pandemic. They outline different possible approaches but conclude there is no 'one size fits all' solution.

I think that EURONA has made its own precious contribution to the development of national accounts and macro-economic statistics. I hope that you have enjoyed reading EURONA over these nine years.

Goodbye!

Paul Konijn

Editor of EURONA

1 Accounting for free digital services and household production – an application to Facebook (Meta)

PAUL SCHREYER ([1])

Abstract: Choice experiments show that individuals attribute significant value to digitally-enabled services such as social media. We integrate this consumer value into an accounting framework by treating it as the value of own-account production by households of a particular type of leisure services. Time spent by households, along with social media and information technology capital services constitute the relevant inputs. We derive a quality-adjusted unit cost index for such household-produced leisure services whereby the number of network users acts as the main vehicle to capture quality change. These quality adjustment effects turn out to be key when assessing the quantitative importance of own-account leisure services. To illustrate, we consider an extended measure of activity (EMA) that encompasses gross domestic product (GDP) and own-account household production of digitally-enabled leisure services. A simulation for the United States shows that the effects due to Facebook use alone would cause the EMA to grow anywhere between about +0.04 and about +0.2 percentage points per year more than United States real growth GDP between 2004 and 2017, depending on the size of network effects.

JEL codes: C43, D60, E01, E23, O3, O4.

Keywords: national accounts, welfare measurement, GDP mismeasurement, productivity slowdown, free digital services, GDP-B

([1]) Chief Statistician and Director of Statistics and Data Directorate, Organisation for Economic Co-operation and Development (OECD).

1. Introduction

In an inspiring paper, Brynjolfsson, Collis, Diewert, Eggers and Fox (Brynjolfsson et al. (2018b)) accomplish two important tasks with regard to the measurement of the digital economy. First, they derive explicit index number expressions for the contributions of free products to welfare change. Second, the authors quantify these contributions in the case of several free digital services – notably Facebook – by using incentive compatible choice experiments to determine the value at which consumers are willing to forego the use of Facebook and other digital services. A new metric, 'GDP-B' (gross domestic product – benefits), that includes the so-measured welfare effects turns out to have grown by about 0.5 percentage points per year faster than established GDP growth per year since 2004 in the United States.

The paper at hand puts these results in a framework of production, income and expenditure. A first observation is that free services are not typically free but imply a barter transaction whereby consumers agree to accept advertisements or the use of the data they generate in exchange of the digital service. There is thus some production (and consumption) value equivalent to advertising or data sales revenue that provides a first benchmark for valuing free services and Nakamura and Soloveichik (2015) and Ahmad et al. (2017) have gone a long way towards exploring the relevant conceptual and empirical issues. Byrne and Corrado (2021) take a consumer perspective and value household consumption of digital services as the combination of non-market capital services associated with the relevant digital consumer durables plus the market consumption of access to contents. Byrne and Corrado (2021) further introduce a quality-adjusted price index for these services with significant consequences for the resulting evolution of volume measures of household consumption. Identification of quality-adjusted volume indices is indeed a key element in the measurement of free digital goods, and we shall come back to this point below.

However, Brynjolfsson et al. (2018b) discrete choice experiments introduce a new element by providing a direct measure of the value that consumers attach to a free digital service. This may well be different from the imputed values based on costs for consumers (the Byrne and Corrado (2021) approach) or different from the value of advertising or data revenues of digital providers (the Nakamura and Soloveichik (2015) approach). These consumer values are not captured by measures of GDP and income thus ignoring potentially important effects of the digital economy.

One way of recognising otherwise unmeasured consumer value is integrating it into the price index used to derive real measures of consumption: when a new service becomes available but is not yet used, there is a reservation price in the spirit of Hicks (1942) that is just high enough to drive demand to zero. At one point the reservation price drops – possibly to zero – and there is positive demand. This one-off price decline from the reservation price to the actual price, if integrated into a price index, raises measured real consumption. This is effectively how Brynjolfsson et al. (2018b) derive an adjusted measure for real United States GDP growth ([2]). Byrne and Corrado (2021) develop a price index for the digital services that households derive from paid services. Their key element in their quality adjustment is accounting for intensity of use of services by consumers, captured by the volume of dataflows and IP traffic.

([2]) In this context, Diewert et al. (2017b) have shown how reservation prices can be derived from contingent valuations as in Brynjolfsson et al. (2018b) for possible inclusion in a price index.

Alternatively, or in addition, consumer valuation of a service can be reflected in nominal measures of economic activity and Brynjolfsson et al. (2018b) second, *total income approach* follows this avenue, by adding consumer value to measured nominal GDP without, however, modifying price indices. Here, effects on measured GDP are more permanent as long as there is added consumer value. The total income method avoids the rather tricky issue of measuring reservation prices or relying on the rather strong assumption that the volume of services can be reasonably approximated by the volume of dataflows.

However, recognition of this type of consumer value in an accounting framework raises the question to whom the *generation* of such supplementary value should be attributed – the providers of the digital service such as Facebook or Google or the consumers themselves who combine capital services or intermediate services from digital providers with household time to produce own-account entertainment or communication services. Similarly, new, quality adjusted price indices and the corresponding volumes for consumers cannot stand in isolation in an accounting framework and the question needs to be answered who delivers these services.

This paper will argue that the value associated with free digital services (above and beyond advertising and data sales revenues) is produced and consumed by the household itself rather than by the provider of the digital tool.

We can also derive own-account volume measures that are independent of the volume changes that apply to the corporate provider without running into issues of inconsistency in a national accounts framework. We note that current national accounts conventions place the production and consumption of own account services by households outside the production boundary for GDP measurement ([3]).

However, current conventions should not deter from reflecting on concepts and from carrying out experimental computations and reasoning in terms of broader measures of economic activity. Our approach also makes it possible to derive a consistent unit cost index for own account household production.

When it comes to services produced from social media, a particular question arises, namely how to deal with the network effects associated with a changing number of users of social media. Our contribution here is treating the number of users akin to exogenous quality change (or technical change) that reduces the unit costs for the household producing its own services. The introduction of such network effects into the household's unit cost index turns out to be key when assessing the quantitative importance of own-account leisure services. Equipped with nominal values, and unit cost and volume indices, we can simulate the effects of combining household production of leisure services from Facebook with GDP into an extended measure of activity (EMA) or a corresponding satellite account. Depending on the choice of parameter values for the network effects in the household's unit cost index, the EMA aggregate would grow anywhere from +0.04 to about +0.2 percentage points per year more than United States GDP growth between 2004 and 2017. This is significant as an effect from a single social media service.

([3]) The only exception is owner-occupied housing where the System of National Accounts makes an imputation for the value of housing services that an owner-user provides to themselves.

Section 2 takes a closer look at the question to whom consumer value should be attributed; Section 3 lays out the measurement of unit cost and volume indices of own-produced services; Section 4 takes the case of Facebook and assesses potential price and volume effects in relation to United States GDP based on Brynjolfsson et al. (2018b) and data from the United States NIPA; and Section 5 concludes.

2. Who produces?

A good or service, whether provided for free or not, needs to be produced somewhere in the economy (or imported). The answer to 'who produces a free digital service?' may seem obvious at first, namely the software provider or the supplier of a social media network (whether located in the domestic economy or abroad). Before discussing digital services further, consider the most prominent and most longstanding case of services that are provided for free to consumers, government services. While provided for free, government services are not costless and need to be financed via current or future taxes. The costs for producing health, education or defence services to residents are the standard way of valuing freely-provided services. This is by convention and in principle, a different valuation could be envisaged, embracing, for instance, a consumer perspective that allows for cases where citizens value a freely provided service higher or lower than at its unit cost of production ([4]). For many practical reasons, such an approach has not been pursued in the national accounts.

Digital services produced by private agents and provided for free to consumers are not altogether different except that financing occurs not via taxes but via sales of advertising services or via sales of data generated by users of the free services. Also, unlike government, market corporations make profits or losses when revenues exceed or fall short of factor costs. A natural choice for valuing free services provided by private operators is thus costs plus or minus residual profits or losses, in other words, the value-added or income generated in the advertising or data sales business. One can then go further and explicitly recognise an indirect barter transaction that exists between consumers and the digital service provider by assuming that households sell 'advertising watching services' and use the revenues to pay for accessing Facebook. Such an additional services would increase measures of production and income correspondingly ([5]).

But there is evidence that consumers' valuation of free services can be quite different from the value-added originating in the advertising or data sales business. In the case of Facebook, a back-of-the-envelope calculation shows that its advertising revenues of about USD 50 billion in 2017 correspond to about USD 25 per user (2 billion users worldwide), a far cry from the USD 500 of value per Facebook user and year as assessed by Brynjolfsson et al. (2018b). How should we deal with such a discrepancy?

([4]) For a discussion of valuing government services see Schreyer (2012) and Diewert (2011).
([5]) Nakamura and Soloveichik (2015) were first to provide relevant estimates that turned out to be of small quantitative impact on United States GDP. Other estimates with similar conclusions were provided by Ahmad et al. (2017). We note in passing that advertising services, unless exported, and unlike government services, constitute intermediate inputs to other producers of final products in the domestic economy whose value will ultimately reflect the value of advertising services. Ahmad and Schreyer (2016) have pointed out that in this sense the value of free products is already captured in final expenditure and GDP. By the same token, the wages, salaries, profits and taxes that are being earned as part of the digital service provider's business are part of national income and GDP.

Before exploring this point, we clarify terminology. 'Consumer value' is understood as the marginal willingness to pay for or willingness to forego one unit of a particular product – a shadow price, not to be confused with 'consumer surplus' in the sense of a cumulative measure across all consumers' willingness to pay for the utility derived from all the units consumed. The latter is conceptually different from valuation at market prices in the national accounts and would make any comparison with GDP meaningless, whereas the former permits such comparisons, at least in principle.

Now consider the service provider's production process. Our example here is Facebook with an advertising-only business model but the reasoning can easily be transposed to related cases ([6]).

Ex-ante, when various business models are considered, the price for services to consumers constitutes a choice variable for Facebook. It is not necessary to model the decision process here because the intuition is simple: if the *observed ex-post* business model relies on financing through advertising and the observed price to consumers equals zero, we consider this as a profit maximising choice (perhaps a corner solution but profit maximising all the same) and consequently, the observed price and quantity for advertising services are also profit-maximising.

Thus, unlike government, where both a consumer or a producer valuation can be envisaged *in principle*, the private supplier of free services plausibly acts as a market producer and profit maximiser and if consumers were truly willing to pay for benefitting from social media services above and beyond accepting advertisements this begs the question why Facebook would chose an advertising financed-only service in the first place rather than charging a positive price. Indeed, in a world of rational and well-informed consumers and producers, it is difficult to explain how consumer valuation of a service would deviate from producer valuation ([7]).

This leaves only three interpretations to the observed difference between the per user revenues from advertising services and Brynjolfsson et al. (2018b) marginal willingness to forego Facebook: (i) Facebook does not act as a profit maximiser (unlikely), (ii) the Brynjolfsson et al. (2018b) figures are vastly overstated (implausible) and (iii) the value measured by Brynjolfsson et al. (2018b) relates to a *different* act of production and consumption, not to the implicit barter transaction between consumers and Facebook. This is indeed the avenue that we shall pursue in what follows.

The way forward is to allow for a production process by households who use their time, along with capital services (hardware, software) including freely-provided access to Facebook's network to produce, typically, leisure services associated with the use of social media. These services are own-account outputs by households and neither their prices nor quantities need to coincide with the advertising or data sales values that correspond to the production

([6]) Li et al. (2019) provide an extensive overview of the business models of digital companies. Common to the various configurations is that free or cheap services are provided to consumers with a financing model that operates by selling targeted advertising services or data collected from consumers to third parties.

([7]) Also, if consumer valuation is intrinsically different from Facebook's measured value added and should be recognised in Facebook's production accounts, a number of important accounting issues would have to be faced. For instance, 'shadow profits or losses' would have to be imputed to Facebook to account for consumer valuation. Further, any imputation of this kind would have to include user value generated *world-wide* by Facebook and 'shadow exports' would have to be invoked, with corresponding improvements in Instabook's home country's measured trade balance.

of the digital service provider. The latter are inputs to, the former are outputs of household production. Our main point is that empirical valuations such as by Brynjolfsson et al. (2018b) can be instrumental in valuing this own-account output of services. Also, the household sector rather than the corporate sector becomes the relevant producer/consumer and a different valuation of these services from the transacted revenues registered by Facebook can be fully accommodated in an accounting framework ([8]). This form of conceptualisation – attributing an explicit role to households in transforming products into utility – is closely related to that of Hulten and Nakamura (2021). They follow Lancaster (1966) who formulates consumer utility as being derived from the characteristics of the consumed products and not from the products themselves. A specific consumption technology transforms products into consumption 'activities' that provide utility.

3. How does production take place?

Having brought in households as producer–consumers of their own leisure services rather than mere consumers of such services provided by the corporate sector, measurement implications remain to be worked out. The first implication is that of identifying the right (implicit) prices and quantities of household production, along with its inputs. This is essentially a problem of time allocation by households, first invoked by Becker (1965) and further discussed by Pollak and Wachter (1975), Barnett (1977) or Golschmidt-Clermont (1993). Diewert et al. (2017a) generalise the analysis by allowing for different types of households and by considering a situation where households make implicit or explicit decisions to spend time either on:

- working in the labour market (*type 1 production*);
- the production of those household goods and services that could also be purchased from the market such as cooking a meal or looking after an invalid parent (*type 2 production*);
- the production of leisure services that could not be purchased from the market such as watching a film, playing football or interacting with others by using Instabook's social media software (*type 3 production*).

The third case includes the type of household production enabled by free digital products. We shall now introduce some notation to explore this case further.

Denote with q_F and p_F the quantity and price of leisure services that a household provides to itself. As this is own-account production neither the quantity nor the price of these services are observable. Indeed, by definition, p_F has to be a shadow value absent any transaction. To produce leisure services, the household uses a certain quantity of capital services K_F (to use Facebook, a computer and software are required) at price u_F. Some of these capital services may be for free or in exchange of readiness to accept advertisement but as indicated above we refrain from modelling such barter transactions here as they would not alter the basic

([8]) We hasten to add that *by convention* the production of own-account leisure services by households is excluded from GDP calculations and we shall return to the question of the production boundary below.

conclusions to follow ([9]). Similarly, other intermediate inputs are ignored here for simplicity but could easily be integrated.

In addition to capital services, the household allocates time t_F to produce own-account services. Let t_F stand for the minutes per day that go into producing leisure services. Note a specificity associated with many digitally-enabled services, the existence of network effects: the evolution of the quantity and implicit price (unit cost) of services produced by a household using social media will typically depend on the number of other users of the same service. The household's capacity to produce q_F is thus conditional on Z, the number of network participants:

$$q_F = F\left(K_F, t_F, Z\right). \quad (1)$$

$F\left(K_F, t_F, Z\right)$ is a continuous, non-negative production function that is nondecreasing in its elements and linear homogenous in K_F and t_F. Z is entirely exogenous. Household utility depends positively on the leisure services produced, along with other own-account production as well as consumption of products that are purchased on the market. Utility may also directly depend on the time spent in working on the labour market and for purposes of own-account production ([10]) None of this needs to be spelled out formally here but it is worth recalling that the household's budget constraint is not only made up of monetary income but also includes a binding and non-extensible constraint on time as there are only 24 hours per day that can be allocated to various activities. A central question is how to value the time spent on these activities as it constitutes the single most important cost of input into household production, including of leisure services. How to value the time spent on leisure activities is no matter of course and discussed at length in Diewert et al. (2017a). Recent standard empirical applications include Ahmad and Koh (2011) or Van de Ven et al. (2018).

For present purposes, we simplify and consider a situation where the household has already made a utility-maximising decision on the quantity of digitally-enabled services q_F that it wants to consume given its monetary and time constraints. An optimal programme of time allocation for the household must then also entail cost minimising behaviour in regards to producing leisure services.

Define a conditional cost function $c\left(q_F, u_F, w_F, Z\right)$ as the minimum cost required to produce the digitally-enabled own-account services given input prices u_F, w_F and a certain number of users Z in the network:

$$c\left(q_F, u_F, w_F, Z\right) = min_{K_F, t_F}\left[u_F K_F + w_F t_F : F\left(K_F, t_F, Z\right) \geq q_F\right] \quad (2)$$

In (2), u_F stands for the user cost of capital services K_F – essentially the user costs of IT equipment in the Facebook case – and w_F stands for the shadow price of the household's time t_F devoted to leisure production. Note that while u_F is a price that is exogenously given, w_F is an endogenous variable that depends on the household's overall constraints, its preference orderings across types of production and consumption, and the household's socio-economic status. For the purpose at hand, we assume that w_F is the equilibrium

([9]) This was tested for the case at hand but, given the comparatively small size of advertising revenues per user, played hardly any role for the results.
([10]) See Schreyer and Diewert (2014).

imputed price of time spent on leisure services ([11]) so that (2) depicts the minimum cost for achieving q_F and these are

$$c\left(q_F,u_F,w_F,Z\right)=q_F c^F\left(u_F,w_F,Z\right)=u_F K_F+w_F t_F \qquad (3)$$

In (3) we have made use of the linear homogeneity property of F to identify the unit cost function $c^F\left(q_F,u_F,w_F,Z\right)$ which constitutes the household's shadow output price for the own-produced leisure service: $p_F \equiv c^F\left(u_F,w_F,Z\right)$. p_F depends on input prices and the exogenous variable Z.

As is usual in the measurement of non-market production, we have equated the total value of digital-enabled services with the sum of costs. In principle, the nominal value $p_F q_F$ could thus be built up by adding the value of labour input and capital services. However, as explained further in Section 4, determining the price for labour w_F in own-account production is notoriously difficult. We circumvent this issue by making use of Brynjolfsson et al. (2018b) discrete choice experiments for measuring $p_F q_F$: we interpret the answer to their question 'How much compensation would be required to forego the digitally-enabled service?' as an indication of the cost of own account production compared to zero production ([12]):

$$\begin{aligned}&\text{Willingness to forego} = \\ &c\left(q_F,u_F,w_F,Z\right)-c\left(0,u_F,w_F,Z\right)=q_F c^F\left(u_F,w_F,Z\right)=p_F q_F\end{aligned} \qquad (4)$$

In (4), the second equality follows from the assumption of constant returns to scale in production. It is now possible to derive a unit cost index for own-account leisure services. The established way of defining a price index is by comparing the unit minimum costs of producing output or utility in two periods, given the set of prices that prevail in these periods (Konüs (1924)). But not only input prices u_F and w_F change between periods, so does the number of network users, Z. A rising number of users will *de facto* reduce the unit cost, in other words, the price for leisure services that the household generates for itself. Equivalently we could say that a rise in Z increases the quantity of leisure services for each dollar of input costs 'expended' on capital input and leisure time. Expression (5) below then constitutes a quality-adjusted unit cost index of own-produced leisure services between two periods 0 and 1. Quality adjustment reflects the number of users in the network. Put differently, the evolution of the number of users Z acts like exogenous technical change to the household's production of leisure services.

$$P_F\left(u_F^1,w_F^1,Z^1,u_F^0,w_F^0,Z^0\right)=\frac{c^F\left(u_F^1,w_F^1,Z^1\right)}{c^F\left(u_F^0,w_F^0,Z^0\right)}. \qquad (5)$$

([11]) See Diewert et al. (2017a) for a derivation of the equilibrium value of wF for various types of households.
([12]) Diewert et al. (2019) use Brynjolfsson et al. (2018b) discrete choice in a model of consumer choice to derive Hicksian reservation prices with a view to integrating new digital goods into consumer price indices.

If the unit cost function in the two periods takes a translog form, Diewert (1976) has shown that, for a cost-minimising producer, (5) can be represented exactly by a Törnqvist index P_F^T:

$$\begin{aligned}
&\ln P_F^T\left(u_F^1,w_F^1,K_F^1,t_F^1,u_F^0,w_F^0,Z^0,K_F^0,t_F^0\right)= \\
&=0.5\left(\frac{u_F^0K_F^0}{u_F^0K_F^0+w_F^0t_F^0}+\frac{u_F^1K_F^1}{u_F^1K_F^1+w_F^1t_F^1}\right)\ln\left(\frac{u_F^1}{u_F^0}\right)+ \\
&+0.5\left(\frac{w_F^0t_F^0}{u_F^0K_F^0+w_F^0t_F^0}+\frac{w_F^1t_F^1}{u_F^1K_F^1+w_F^1t_F^1}\right)\ln\left(\frac{w_F^1}{w_F^0}\right)+ \\
&+0.5\left(\frac{\partial\ln c^F\left(u_F^0,t_F^0,Z^0\right)}{\partial\ln Z}+\frac{\partial\ln c^F\left(u_F^1,t_F^1,Z^1\right)}{\partial\ln Z}\right)\ln\left(\frac{Z_1}{Z_0}\right)
\end{aligned} \tag{6}$$

(6) indicates that the rate of change in the unit price for own-account leisure services is a share-weighted average of the input prices for capital services and for time spent

plus a quality adjustment effect that depends on the rate of change of network users $\ln\left(\frac{Z_1}{Z_0}\right)$. Note that the elasticity of leisure price change with regard to Z is non-positive: $-\varepsilon\equiv 0.5\left(\frac{\partial\ln c^F\left(u_F^1,t_F^1,Z^1\right)}{\partial\ln Z}+\frac{\partial\ln c^F\left(u_F^0,t_F^0,Z^0\right)}{\partial\ln Z}\right)\leq 0$ and cannot directly be derived from observed prices and quantities.

(3) indicates how to account for the value of leisure services in *level* terms, and (6) indicates how to account for their *price change*. If we manage to evaluate (3) and (6) we can assess the relative importance of Facebook-enabled leisure services compared to GDP, as well as the level and growth rates of any extended measure of economic activity that would include digitally-enabled household services in addition to GDP.

We conclude this section by pointing to the long-standing discussion of valuing public sector non-market services that are provided for free (or at economically insignificant cost) to consumers. The convention is to measure the value of such services by the sum of costs. However, at least in principle, as put forward by Atkinson (2005) such a value could also be framed as the contribution of a service to outcomes (such as the state of health), using willingness-to-pay measures, akin to the case at hand for digital services. This has not been attempted in official accounts in light of the significant practical implications. Quality adjustment of service flows is another link to the discussion at hand. Efforts at the United Kingdom's Office for National Statistics stand out here. Foxton et al. (2019) provide a very useful overview of these developments and their impact on measured United Kingdom economic activity.

4. Extended measure of activity

4.1. Approach

Let $p \equiv [p_1, \ldots p_N] > 0$ and $q \equiv [q_1, \ldots q_N] \geq 0$ be the prices and quantities of final goods and services that constitute GDP as measured ([13]). The value of GDP at prices of year $t = 0, 1$ is then

$$Y^t = \sum_{i=1}^{N} p_i^t q_i^t \equiv p^t \cdot q^t \tag{7}$$

As we want to assess orders of magnitude relative to United States GDP, we note that the United States Bureau of Economic Analysis uses a Fisher Ideal price and quantity index in the construction of its national accounts. However, the Törnqvist price index generally constitutes a close approximation to the Fisher price index ([14]) and for matters of convenience we shall therefore represent the deflator of US GDP by the following expression:

$$\ln P\left(p^1, p^0, q^1, q^0\right) = 0.5 \sum_{i=1}^{N} \left(\frac{p_i^1 q_i^1}{p^1 \cdot q^1} + \frac{p_i^0 q_i^0}{p^0 \cdot q^0} \right) \ln\left(\frac{p_i^1}{p_i^0} \right) \tag{8}$$

Now suppose that the production-consumption of leisure services were combined with GDP to form an extended measure of activity (EMA). Define the nominal EMA $\widetilde{Y^t}\left(t = 0,1\right)$ including leisure services as:

$$\widetilde{Y^t} = p_t \cdot q_t + p_F^t q_F^t \quad \text{t} = 0, 1. \tag{9}$$

The corresponding Törnqvist price index for EMA is:

$$\begin{aligned} &\ln \tilde{P}(p^1, p^0, p_F^1, p_F^0, q_F^1, q_F^0, q^1, q^0) = \\ &= 0.5 \sum_{i=1}^{N} \left(\frac{p_i^1 q_i^1}{p^1 \cdot q^1 + p_F^1 q_F^1} + \frac{p_i^0 q_i^0}{p^0 \cdot q^0 + p_F^0 q_F^0} \right) \ln\left(\frac{p_i^1}{p_i^0} \right) + \\ &+ 0.5 \left(\frac{p_F^1 q_F^1}{p^1 \cdot q^1 + p_F^1 q_F^1} + \frac{p_F^0 q_F^0}{p^0 \cdot q^0 + p_F^0 q_F^0} \right) \ln\left(\frac{p_F^1}{p_F^0} \right) \end{aligned} \tag{10}$$

To assess the differences between EMA and GDP, we construct two measures.

The first one is:

Percentage difference between *levels* of nominal EMA and GDP

$$= \frac{\widetilde{Y}_t - Y_t}{Y_t}; t = 0,1 \tag{11}$$

Expression (11) corresponds to Brynjolfsson et al. (2018b) nominal GDP effects under their *total income approach*. However, due to our set-up the interpretation differs somewhat: whereas Brynjolfsson et al. (2018b) $\left(\widetilde{Y^t} - Y^t\right)$ captures the amount that consumers in aggregate would need in compensation for foregoing Facebook, our reading is that this is the value of their leisure production and consumption to which Facebook provides one particular input.

([13]) Imports can be captured via negative q_i.

([14]) Diewert (1978) showed that the Törnqvist and Fisher index numbers (along with other superlative index numbers) approximate each other to the second order around any point where the price vectors of the comparison periods are equal and where the quantity vectors of the comparison periods are equal.

The second comparison relates to the difference in measured growth of real EMA and real GDP:

$$\begin{aligned}&\text{Percentage point difference between real EMA and GDP growth rates}\\&=\ln\frac{\tilde{Y}^1}{\tilde{Y}^o}-\ln\frac{Y^1}{Y^o}\\&-\left[\ln\tilde{P}\left(p^1,p^0,p_F^1,p_F^0,q_F^1,q_F^0,q^1,q^0\right)\right]-\ln P\left(p^1,p^0,q^1,q^0\right)\end{aligned} \tag{12}$$

We can again compare this expression with Brynjolfsson et al. (2018b) total income approach. The authors do not explicitly consider the difference between deflators $\left(\ln\tilde{P}-\ln P\right)$ and assume that $\ln P$ will typically be greater than $\ln\tilde{P}$. Brynjolfsson et al. (2018b) total income approach then constitutes a lower boundary for real GDP effects as long as $\left(\ln P\geq\ln\tilde{P}\right)$. In other words, the price change of the self-produced service has to be less than or equal to the overall rate of inflation. This is plausible in a pure consumer context but less obvious in our set-up of household production where the evolution of wage rates (however measured see below) constitutes an important part of the deflator for own-account production. Wage rates typically rise quicker than GDP deflators so the conjecture $\left(\ln P\geq\ln\tilde{P}\right)$ may appear less obvious. This will be further explored as we turn to results.

4.2. Orders of magnitude

Equation (3) states that the nominal value of leisure services for a representative household equals the value of capital services for the activity at hand plus the value of leisure time that the household allocates to the activity. The various components of (3) shall be measured as described below. We use 2017 for period 1 and 2004 for period 0.

Starting with the **quantity of leisure time** t_F^1, we follow Brynjolfsson et al. (2018b) and estimate that, on average, a user of social media allocates about 40 minutes per day or 240 hours per year to this activity in 2017 ([15]). We take a guess and set t_F^0 to 20 minutes per day in 2004 (see also Table 1). This appears to be roughly consistent with the time series on the use of the internet for leisure reported by Brynjolfsson and Oh (2012). While in 2017 Facebook counted about 200 million users in the United States, Facebook only operated in university networks during its beginnings in 2003 and 2004. We set the number of users in 2004 to 100 000 (see Table 2), noting that this choice is both somewhat arbitrary and important as it has significant impact on the ensuing quality adjustment of the price index for leisure services discussed earlier.

Valuation of leisure time (*type 3* household production in the classification above) with a unit rate w_F is more complicated. Studies such as Ahmad and Koh (2011) or Van de Ven et al. (2018) have used both replacement and opportunity cost approaches to value time spent in *type 2* household production (see above). Brynjolfsson and Oh (2012) and Goolsbee and Klenow (2006) have also used time valuation to gauge the value of digital services. However, Schreyer and Diewert (2014) and Diewert et al. (2017a) have shown that the choice for valuing different types of household production depends on the socio-economic characteristics of

([15]) See https://www.emarketer.com/Chart/Average-Time-Spent-per-Day-with-FacebookInstagram-Snapchat-by-US-Adult-Users-of-Each-Platform-2014-2019-minutes/211521.

the household – for example whether or not it is constrained in its supply of labour on the market. Even in the simplest case of an unconstrained person who both works on the labour market and uses market services for household work such as cleaning, the authors show that the correct valuation of leisure time is the minimum of the household's wage rate on the labour market and the wage rate of a person who provides household services. We have no possibility to establish the socio-economic situation of the representative Facebook user.

However, the median valuation for the use of Facebook that was established through discrete choice experiments by Brynjolfsson et al. (2018a) and Brynjolfsson et al. (2018b) gives rise to an additional degree of freedom in empirical implementation. As indicated in the previous section, our interpretation of the WTA measure is the *total value of leisure services per person*, or $p_F q_F$ in the notation at hand. This is a value measure, the product of the quantity of unobserved leisure services per person and their price. Given the total value of the leisure service, the quantity of time input and a value for the capital services used (see below), we can derive the shadow wage rate for the time spent on leisure services from (4) as $w_F = \frac{p_F q_F - u_F K_F}{t_F}$.

Table 1 starts from the value of USD 506 per year in 2017, reflecting the WTA to forego Facebook during a year, as established by Brynjolfsson et al. (2018b). We then deduct the user costs of ICT capital services for Facebook use per year – a rather modest sum of USD 6.6 – to derive a value of leisure time of USD 499 per year in 2017 or an hourly shadow wage of w_F = USD 2.05. To obtain a value for 2004, we apply the rate of change of average hourly earnings in the US between 2004 and 2017 (approximately 30 %) ([16]) and obtain a shadow wage rate of USD 1.58 per hour. The imputed wage rates are clearly lower than any market wage rate, implying that the USD 506 of leisure value in 2017 and the USD 194 in 2004 constitute a lower bound.

([16]) See https://www.bls.gov/news.release/empsit.t19.htm.

Table 1: Value of leisure services corresponding to Facebook use

Variable		Unit	Acronym	Year	
				2004	2017
Time spent on Facebook	1	Minutes/day		20	40
	2	Hours/year	t_F	122	243
WTA (Brynjolfsson et al. (2018b))	3	USD/year			506
User costs					
All ICT capital services	4	USD/hour		0.01	0.03
Facebook ICT capital services	5=4*2	USD/year	$u_F K_F$	1.46	6.58
Implied wage rate	6	USD/hour	w_F	1.58	2.05
Value of leisure time per person	7=6*2	USD/year	$w_F t_F$	192	499
Value of leisure services per person	8=7+5	USD/year	$p_F q_F$	194	506

Source: authors' calculations, see text

User costs of ICT capital for Facebook use were derived using the net stock of consumer ICT durables at current prices as published by the BEA to which we applied a constant real rate of return of 4 % and a depreciation rate of 20 % per year. The resulting country-wide value is then divided by the working-age population and expressed as an hourly rate of about 3 cents. Multiplied by 243 hours of Facebook use per year yields a user cost of USD 6.58 ([17]). A similar calculation is put in place for 2004. The price change for ICT capital services corresponds to the implicit deflator of the net stock of consumer ICT durables as published by the BEA. By 2017, it had fallen to 36 % of its 2004 level (2nd line in Table 2). We are now in a position to construct a Törnqvist unit cost index for the household production of leisure services, as a weighted geometric average of the log price change of the wage rate for leisure services and the log price change of ICT capital services for leisure services. Weights are the average shares in 2004 and 2017 of the value of leisure time and the value of ICT capital services in the total value of leisure services. Table 2 shows that in the simplest case without any quality adjustment ($\varepsilon = 0$), in other words, ignoring the size of the user network, the unit cost index rises by about 25 % between 2004 and 2017.

When the effects of a growing network are accounted for, the quality-adjusted unit cost index changes significantly. For instance, in the case of a unitary elasticity $\varepsilon = 1$, the quality adjusted unit cost of leisure production drops to 0.0062 in 2017, at an annual rate of about −57 %. With an elasticity of 1.5, this drops further to an annual rate of −86 % ([18]).

With the value of Facebook leisure services and of their unit costs (and therefore quantities) in hand, we can now proceed to a comparison between EMA and existing GDP figures for the United States. Table 3 starts out by computing the total value of Facebook leisure services by multiplying the average value per user into the number of Facebook users, yielding about 101 billion dollars in 2017, corresponding to 0.517 % of the United States GDP as measured. With the small number of Facebook users in 2004, household production value of leisure services is essentially zero in 2004.

([17]) This is a lower bound that underestimates the actual user costs as computers depreciate even when not in use. However, figures are so small that even tripling the ICT capital costs would not materially affect conclusions.

([18]) Note that we have put the number of Facebook users in 2017 at 200 million, in other words, the number of United States users. The worldwide number of Facebook users in 2017 was around 2 billion users (https://techcrunch.com/2017/06/27/facebook-2-billion-users/?guccounter=1). Allowing for the network effects of worldwide users would further bring down the price index of leisure services but we have no empirical handle on assessing these effects.

Table 2: Unit cost index for leisure services

Variable		Unit	Acronym	Year	
				2004	2017
Change of wage rate for leisure services		Index	w_F^1/w_F^0	1.00	1.30
Price change of ICT capital services		Index	u_K^1/u_K^0	1.00	0.3604
Unites States Facebook users		Million persons	Z	0.10	200
Törnquist unit cost index of leisure services		Index	p_F^1/p_F^0		
– no quality adjustment	$\varepsilon = 0.0$			1.00	1.2493364
– quality adjustment	$\varepsilon = 0.5$			1.00	0.0279360
– quality adjustment	$\varepsilon = 1.0$			1.00	0.0006247
– quality adjustment	$\varepsilon = 1.5$			1.00	0.0000140

Source: authors' calculations, see text

Table 3: Extended measure of activity

Variable		Unit	Acronym	Year	
				2004	2017
Value of leisure services all Facebook users		USD million/ year	$p_F q_F Z$	19	101 200
GDP		USD million/ year		12 213 700	19 485 400
Extended measure of activity (GDP plus Facebook-enabled leisure services)		USD million/ year		12 213 719	19 586 600
Facebook-enabled leisure services related to GDP		Percent		0.000	0.517
Deflator GDP		Index	P^1/P^0	1.000	1.273
		Percent change per year	$\ln(P^1/P^0)$		1.86
Deflator extended measure of activity		Index	$\tilde{P}^1/\tilde{P}^0$		
– no quality adjustment	$\varepsilon = 0.0$			1.000	1.273
– quality adjustment	$\varepsilon = 0.5$			1.000	1.261
– quality adjustment	$\varepsilon = 1.0$			1.000	1.248
– quality adjustment	$\varepsilon = 1.5$			1.000	1.236
Real GDP		Index	$(Y^1/Y^0)/(P^1/P^0)$	1.000	1.253
		Percent change per year	$\ln(Y^1/Y^0) - \ln(P^1/P^0)$		1.73
Real extended measure of activity		Index	$(\tilde{Y}^1/\tilde{Y}^0)/(\tilde{P}^1/\tilde{P}^0)$		
– no quality adjustment	$\varepsilon = 0.0$			1.000	1.260
– quality adjustment	$\varepsilon = 0.5$			1.000	1.272
– quality adjustment	$\varepsilon = 1.0$			1.000	1.285
– quality adjustment	$\varepsilon = 1.5$			1.000	1.297
Real extended measure of activity		Percent change per year	$\ln(\tilde{Y}^1/\tilde{Y}^0) - \ln(\tilde{P}^1/\tilde{P}^0)$		
– no quality adjustment	$\varepsilon = 0.0$				1.77
– quality adjustment	$\varepsilon = 0.5$				1.85
– quality adjustment	$\varepsilon = 1.0$				1.93
– quality adjustment	$\varepsilon = 1.5$				2.00
Difference: real extended measure of activity minus real GDP		Percentage point change per year	$\ln(\tilde{Y}^1/\tilde{Y}^0) - \ln(Y^1/Y^0) - [\ln(\tilde{P}^1/\tilde{P}^0) - \ln(P^1/P^0)]$		
– no quality adjustment	$\varepsilon = 0.0$				0.04
– quality adjustment	$\varepsilon = 0.5$				0.12
– quality adjustment	$\varepsilon = 1.0$				0.19
– quality adjustment	$\varepsilon = 1.5$				0.27

Source: authors' calculations, see text

Next is computing the difference between the growth of real GDP and the growth of real EMA. We first observe that in the case where no account is taken of the number of Facebook users in the construction of the household deflator (ε=0), EMA growth is slightly larger than GDP growth as measured, by 0.04 percentage points per year on average. Allowing for effects of a rising Z significantly widens the gap – for instance with an elasticity of ε=1), EMA grows by 0.19 percentage points per year more than GDP between 2004 and 2017. An elasticity of 1.5 would bring that figure up to nearly 0.3 percentage points. By way of comparison, Brynjolfsson et al. (2018b) reservation price approach produces a measurement effect between 0.08 percentage points per year and 0.37 percentage points per year, depending on the estimated reservation price. Their total income approach yields an addition to GDP growth of 0.04 percentage points per year. So the ballpark is not altogether different in spite of a different framework.

A final comparison relates to labour productivity growth (Table 4). With United States GDP having grown by about 1.7 % per year in 2004–2017 and corresponding official hours worked by about 0.6 % per year, standard labour productivity growth was about 1.1 % per year. EMA growth was estimated between about 1.8 % and 2.0 % per year. Adding hours spent on Facebook to the official hours worked yields a growth rate of labour input that is consistent with EMA of around 1.9 % per year – a great deal more than the official, mainly market-based change in hours worked. The consequence is that labour productivity if based on EMA would at best have risen by 0.09 % per year (assuming a strong network effect) and at worst have fallen by –0.14 % per year (assuming no network effect).

5. Discussion and conclusions

Treating the household as a producer and consumer of own-account services based on freely provided digital services along with capital and time, brings several advantages over treating the household as just a consumer of such services produced elsewhere in the economy.

- A situation can be accommodated where user valuation of leisure services deviates from market revenues by the corporations that provide free data services – the former is the value of own-account production by households and the latter are the results of whatever business model a profit-oriented corporation chooses.
- Unit costs or shadow prices and quantities of own-account production and consumption are conceptually clearly identified. In particular, the unit cost for own-account leisure services depends on the user costs of household capital, on the value of time spent on producing-consuming leisure services and on the size of the network. These network effects can be interpreted as a quality adjustment to the household's unit cost index of producing its services. We have found no good empirical handle to assess the size of these network effects as their cost elasticity is unknown. We took refuge in simulating three different scenarios, each reflecting a different cost elasticity. When time series of observations on WTA become available it will be possible to estimate the relevant cost elasticity.

- As the quantity of leisure services is not directly observable, we estimate it by deflating the nominal value of household leisure services (revealed via discrete choice experiments) with the relevant unit cost index. As the latter declines with a rising number of network users, the measured quantity of services will increase accordingly. Network effects then play a role akin to technical change.

A fundamental question is whether such *type 3* household production should be included in GDP rather than forming part of a satellite measure like EMA. A good portion of caution is

Table 4: Labour productivity

Variable		Unit	Year	
			2004	2017
Real GDP		%/year		1.73
Hours worked		%/year		0.64
Labour productivity based on GDP and official hours worked		%/year		1.09
Real extended measure of activity				
– no quality adjustment	$\varepsilon = 0.0$	%/year		1.77
– quality adjustment	$\varepsilon = 0.5$	%/year		1.85
– quality adjustment	$\varepsilon = 1.0$	%/year		1.93
– quality adjustment	$\varepsilon = 1.5$	%/year		2.00
Hours worked				
– as measured		Million	249 065	270 679
– in Facebook-enabled leisure production		Million	12	48 667
Total		Million	249 077	319 345
		%/year		1.91
Labour productivity based on EMA				
– no quality adjustment	$\varepsilon = 0.0$	%/year		−0.14
– quality adjustment	$\varepsilon = 0.5$	%/year		−0.06
– quality adjustment	$\varepsilon = 1.0$	%/year		0.01
– quality adjustment	$\varepsilon = 1.5$	%/year		0.09

Source: authors' calculations, see text

needed here, for at least three reasons.

- First is that it is not obvious why *type 3* household production (leisure) should be brought inside the production boundary rather than or before *type 2* household production (cooking a meal) that corresponds more closely to a notion of production. Reid's (1937) *Third Party Criterion* ([19]) has long constituted a reference for separating production activities from other activities and Facebook-type leisure activities would not qualify as production. A broadening of the production boundary to include *type 3* activities would naturally entail to also include *type 2* activities. Given the size of the latter (anywhere between 25 % and 45 % of GDP in OECD countries – see Van de Ven et al. (2018) such a move would fundamentally alter the nature of GDP, its measured level and growth rates. Clearly, such a decision would warrant extensive discussions and consultation with users before going near implementation. While an inclusion of only *type 3* own-account leisure service

([19]) Reid (1934) states her criterion as follows: 'if an activity is of such character that it might be delegated to a paid worker, then that activity shall be deemed productive' (pp. 11).

production in GDP would be less consequential, proceeding in this way appears to be *ad hoc*. We have also conveniently glossed over several complications that arise if applying the logic of leisure production more broadly. For consistency, this would entail that many acts of consumption would have to enter household production as intermediate inputs in generating utility from leisure services ([20]).

- Second is robustness of estimates of *type 3* (and *type 2*) activities. While discrete choice experiments such as those used above are a defensible way of valuing leisure services, there tend to be large variations between empirical findings. Also, the break-down into price and volume components is subject to significant uncertainty. Clearly the biggest gap exists in regards to the quality adjustment of prices (or volumes) – witness the discussion on the size of the elasticity of the unit costs of leisure services with regard to the size of the user network. Longer time series or cross-section observations of WTA with corresponding information about the number of users could help here but some time will pass before reliable estimates are available.
- Third is communication on the inclusion of leisure services into the production boundary and the consequences for acceptance and credibility of national accounts variables. Consider for instance real household consumption and consumption price indices. An inclusion of leisure services would raise the level of measured household consumption and income in nominal and, likely, in real terms if measured consumer inflation declines. Already today, with the current production boundary, subjective measures of inflation (as revealed by surveys) tend to be higher than measured inflation, in other words, there is a perception that inflation is understated and, correspondingly, real income and consumption, overstated ([21]). A related point is how time spent on producing leisure services should be counted: most people would object to treating it as a form of self-employment as this would define away all unemployment, defeating common sense. So it has to be something different with a notion yet to be defined. Overall, an inclusion of leisure services into our standard production framework would run the risk of weakening trust in statistics – it is hard to convey that people are actually better off than they think because they produce consumption services for themselves. Incomprehension would probably be exacerbated if relevant statistics such as consumption price indices were used to escalate social transfers or pensions or as a benchmark in wage negotiations.

Research into the measurement of household activity is important and needs encouragement. This concerns both *type 3* and *type 2* activities as these will gain in importance in modern societies as a consequence of digitalisation and demographic developments. From that position to bringing these activities inside GDP is still a long way, however, and deserves a good deal of reflection among national accountants and, more importantly, with society's stakeholders. A useful way forward at this junction is the systematic and periodic development of measures of household production and consumption outside the current SNA boundaries but inside a framework of satellite accounts so that accounting concepts are adhered to, results can be compared with established national accounts aggregates and experimental aggregates like EMA can be constructed.

([20]) For instance, purchase of a cinema ticket would constitute acquisition of a right to access a cinema – an intermediate input that would then be combined with household time to generate leisure services in the form of viewing a film.
([21]) This is not necessarily backed up by the academic literature with many examples that point in the opposite direction.

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2 The treatment of international sports organisations in Swiss national accounts

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Abstract: Switzerland is home to numerous international sports organisations and federations. They represent a major measurement challenge for statisticians in Switzerland because of their cyclical and increasingly important revenues generated by the staging of major sports events. By influencing Swiss GDP growth rates, they make official figures more difficult to interpret for domestic policy purposes. In Switzerland's decentralised statistical system, they also threatened to increase inconsistency between the national accounts and the balance of payments. To address this situation, the producers of these statistics worked together to provide a coordinated response to improve the quality and consistency of the data of these organisations in the different statistical domains and to provide new statistical information for short-term analyses. This work started in 2019 and is still ongoing. It has led to the establishment of a permanent working group between these institutions to discuss the treatment of international sports organisations and major sport events. In addition to monitoring their development, the next steps involve further deepening the understanding of their functioning and moving towards more international cooperation. The paper presents the economic model and examines the characteristics of the three most important organisations, namely FIFA, the IOC and UEFA. It then discusses the work carried out in the Swiss statistical system, which resulted in the implementation of a revised statistical treatment of their transactions in the benchmark revision of the Swiss national accounts in 2020. The paper concludes with a discussion of outstanding issues.

JEL: E01, F55, F60, Z20

Keywords: national accounts, international sports organisations, major sports events, globalisation, intellectual property products

([1]) Federal Statistical Office of Switzerland.

1. Introduction

International sports associations (ISAs) are strongly represented in Switzerland. There are no less than 45 of them! These include the International Olympic Committee (IOC), sports associations directly linked to the Olympic movement, such as the Fédération internationale de football association (FIFA) and one other major football association which is the Union of European Football Associations (UEFA). This number rises to 67 if one considers a broader spectrum of sports organisations such as the World Anti-Doping Agency's (WADA) European office, the Court of Arbitration for Sport (CAS) or the International Centre for Sports Studies (CIES) (Rütter and Schmid (2013), Bousigue and Stricker (2015)).

Since the early 2000s, various studies have examined the economic weight of sport and ISAs on the Swiss economy (Rütter and Schmid (2013), Bousigue and Stricker (2015), Hoff et al. (2020), Stricker and Derchi (2021)). They point to their growing economic weight, especially that of the three main ISAs (FIFA, IOC and UEFA). For example, Derchi and Stricker (2021) reveal that between 2014 and 2019 international sports organisations generated a 57 % greater economic impact for Switzerland compared with the period 2008–2013.

At the level of the Swiss national accounts, interest in these associations is more recent. Their effect on business and macroeconomic statistics has begun to be felt more strongly with the continuing rise in license fee revenues (sales of broadcasting and marketing rights).

The development of these revenues is partly linked to the globalisation of sport and, in particular, football, especially in Asia. But the link with globalisation does not end there. Parallels can also be drawn between the functioning and statistical impact of ISAs and those of multinational enterprises (MNEs). In particular, the central role played by intangible assets can be mentioned. Therefore, ongoing discussions and work on globalisation and initiatives in this area shed light on the treatment of ISAs. Issues such as the exchange of micro-data between different statistical partners or the close contact with respondents are also very important in this context. For these reasons, the paper tries, as much as possible, to refer to this work and to show the similarities that may exist with the treatment of MNEs more generally.

That said, ISAs also differ from MNEs in a number of ways. For example, they have a fairly similar business model, which contrasts with the diversity found among MNEs even within the same economic sector. Moreover, the majority of their foreign subsidiaries are short-lived. They are created for the needs of the organisation of a competition and then liquidated once the competition is over. Above all, their revenues (and expenses) display a cyclical pattern that biases and complicates the interpretation of the economic indicators of the Swiss economy.

The paper focuses on FIFA, IOC and UEFA. It first presents their business model and examines their characteristics in detail. It then provides a brief overview of the measures taken in the Swiss statistical system to improve and coordinate their treatment. Finally, it describes the current statistical treatment of their transactions, which was fully implemented in the 2020 revision of the Swiss national accounts. This treatment raises some questions as well as a growing need for collaboration at both national and international levels.

2. Presentation of FIFA, IOC and UEFA

2.1. A shared business model

FIFA, IOC and UEFA are not-for-profit associations with the legal form of an association under Swiss law. Their statutes contain two main purposes: the management and promotion of sport and the organisation of sports competitions ([2]). Their business model can be explained quite simply in the light of these two objectives. They centralise broadcasting and commercial rights, which gives them the legitimacy to organise and market sports competitions ([3]). The organisation of these events generates income that is largely 'reinvested' in the sport. This in turn increases the level, attractiveness and coverage of sports competitions and thus the financial returns. There are two main types of financial flows associated with this model: (a) the revenue and expenses associated with the organisation of major sports events and (b) the 'transfers' to the member associations, federations and other bodies. These transfers may be of a lump sum nature or they may be associated with development programmes (infrastructure, promotion of youth and women's teams and competitions, and so on) or represent an explicit form of solidarity financing (for example, for those members most in need or who are geographically isolated). Some transfers are not addressed to the members of the association but to other organisations active in areas as diverse as the fight against doping (WADA), the resolution of legal disputes arising in the field of sport (CAS), or education (CIES). All these flows are recorded in the consolidated income statements of FIFA, IOC and UEFA ([4]).

The strategic objective of ISAs is to increase their revenues and the share of these revenues distributed to their members. This objective has a determining influence in explaining their choices both in terms of organising sports events and managing and selling the various rights.

2.2. Four-year financial cycles

ISAs derive the majority of their revenues from the major sporting events that take place every four years (Winter Olympics, Summer Olympics, FIFA World Cup, UEFA EURO). It is for these competitions that the sale of the various rights is most lucrative.

In the period 2015–2018, from a total of USD 6 421 million, 83 % of FIFA's revenue was generated by the 2018 World Cup. In contrast, the organisation of annual events, such as the Club World Cup, generated only a small proportion of this. Among the sports associations, UEFA is an exception, as it organises annual club competitions (such as the Champions League and Europa League) which generate significant revenue.

In accordance with accounting recommendations, revenue is recognised in the year in which the major sporting event takes place. This primarily concerns revenue from broadcasting rights and ticketing rights and, to a lesser extent, hospitality and marketing rights. In the case

([2]) Annex 1 provides the current list of competitions and tournaments prepared and organised by these sports associations.
([3]) None of FIFA, the IOC or UEFA capitalise these rights. From an accounting point of view, this is because these associations have not purchased or traded these rights and the expenses for branding and marketing cannot be capitalised under IFRS.
([4]) Indeed, member associations are not subsidiaries of international sports associations. They are therefore not included in the scope of their consolidated accounts.

of hospitality rights, the amount of revenue may include a variable part based on profit share agreements, which is recognised only once the profit share for the major sporting event has been determined by the licensee. For the marketing rights, it can be noted that part of the income is recognised on a straight-line basis over the entire contractual cycle. This is because the sponsorship is not necessarily associated with a specific competition, but can take the form of a 'long-term strategic alliance' with the ISA.

This financial dependence on major sporting events explains why associations operate on four-year cycles where three of the four years of the cycle may be marked by negative operating results. Their non-profit status must therefore be understood in terms of this four-year cycle during which the redistribution of income is observed, in accordance with the statutory objectives.

For a given accounting period, the presentation of the consolidated results will differ somewhat from one sports association to another because they apply different accounting standards, work in different currencies and do not all have the same accounting period ([5]).

2.3. Type and development of revenues

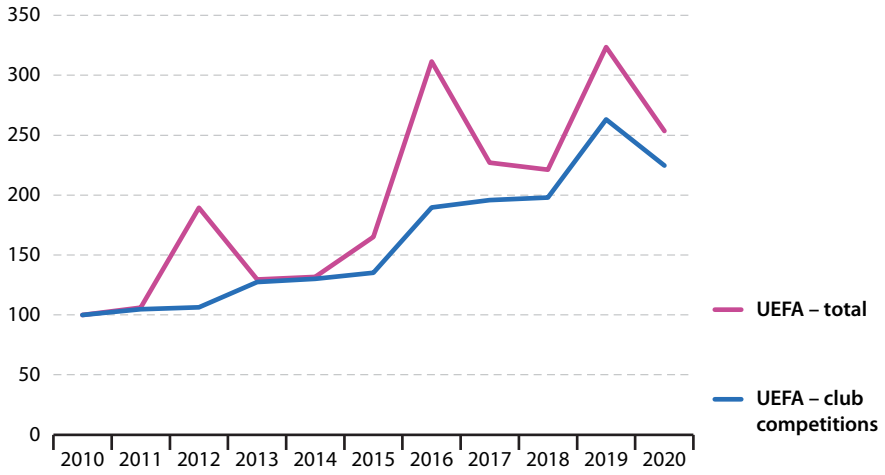
Revenue is mainly derived from the sale of various rights and therefore from the holding of intangible assets. Over a four-year cycle, the sale of television rights is the main source of revenue. Television broadcasting rights are mainly sold to television stations and other broadcasting institutions. These rights allow a television signal to be broadcasted for a given period of time in a particular territory. Next comes the sale of marketing rights, followed by revenue from hospitality and ticketing and finally revenue from other rights.

From year to year, the revenues tend to increase, especially the prices of broadcasting rights. Globalisation explains this phenomenon as well as the efforts of associations to promote, popularise and market sport ([6]). Other phenomena also contribute to this, such as the concentration within these associations of the rights associated with sports events, the creation of new competitions and tournaments, the increase in the number of participating teams and the shift from free-to-air to pay-television (TV) contracts. The following figure shows the development of broadcasting rights for UEFA since 2010.

([5]) Annex 2 provides details of these differences. In the absence of access to the statutory financial statements of legal units domiciled in Switzerland, the consolidated financial statements are generally the main source of information for the Swiss national accounts. Although they complicate the analysis because of the inclusion of foreign subsidiaries, they provide more detailed results than the statutory financial statements. Annex 2 provides details of these differences.

([6]) The emergence of Asia is particularly striking. In the 2015–2018 cycle, FIFA had 20 sponsors, seven of which were Chinese companies. Moreover, the Asian and North African territory generated the most substantial part of the revenue from TV broadcasting rights, exceeding the European territory for the very first time. On the IOC side, it was announced in January 2017 that the Chinese group Alibaba would become a Worldwide Olympic Partner. Alibaba has become the official partner for cloud and e-commerce services, as well as a founding partner of the Olympic chain.

Figure 1: Recent developments in broadcasting rights for UEFA, 2010–2020
(index, 2010 = 100)



Source: UEFA financial reports

Even if they benefit in the medium and long term from the increase in the number of competitions and participating teams (and therefore in the number of matches played), the development of hospitality rights and ticketing is nevertheless limited by the capacity of stadiums ([7]). Their smaller share of total revenues is also explained by the fact that national associations and clubs retain ticketing and hospitality revenues for some smaller competitions and/or given matches. In the case of the IOC, ticketing and hospitality rights are mainly held by the local Organising Committees for the Olympic Games (OCOG).

2.4. Use of revenues

FIFA, IOC and UEFA use the generated revenues for different purposes, following different programs and according to different criteria. This section provides a detailed description of these different uses. It is intended to give an accurate picture of how the revenues are used and thus provide the basic information needed to understand these flows.

The IOC's total revenue for the period 2013–2016 ('the 2013–2016 Olympiad'), amounted to USD 5.7 billion. Of this total, USD 5 billion, or approximately 90 %, was paid out by the IOC to support the staging of the Olympic Games and to promote the development of sports and the Olympic Movement worldwide. The remaining 10 % was used to cover the operating costs of running the Olympic Movement. More precisely, the IOC redistributes a share of the revenues generated by the television broadcasting and marketing rights to the OCOGs. Another share of revenues generated by these rights is distributed to the United States Olympic committee (USOC) ([8]). To determine, for each Olympic Games, the (equal) shares

([7]) For example, the UEFA EURO finals have seen the number of participating national teams increase from 8 in 1992 to 24 in 2016. In the context of COVID-19, these products should also suffer a sharp decline or even be virtually non-existent, as in the case of the Tokyo Olympic Games, which took place almost without spectators.

([8]) The special treatment given to the USOC is explained by the particular situation in the United States where a public law gives the USOC exclusive rights to the Olympic marks and emblems on the United States territory.

that belong respectively to the International Federations (IFs), the (205) National Olympic Committees (NOCs) and the IOC, revenues distributed to the OCOG and the USOC have to be subtracted, together with the Olympic Games-related expenditure from total revenues. For the Rio 2016 Summer Olympics, the latter residual corresponded to a total amount of USD 1 621 million, of which USD 540.3 million was for the IFs, USD 540.3 million for the NOCs and USD 540.3 million for the IOC. To promote Olympic values and sports and to support athletes, the IOC withdraws money from two funds related to the Olympic solidarity programme and the Olympic Movement fund. Distributions of the Olympic solidarity programme are directed towards NOCs and athletes' support. Distributions from the Olympic Movement fund serve for instance to grant resources to the World Anti-Doping Agency and to the International Council of Arbitration for Sport (ICAS).

For FIFA, information on the 2018 World Cup cycle (2015–2018) shows that around 80 % of the total revenue was distributed within football. Of this 80 %, half was used to finance the organisation of competitions and events and to pay participating member associations and football clubs ([9]). Among the costs recorded for the organisation of the 2018 FIFA World Cup Russia were the expenses for the financing of the Local Organising Committee (LOC) consisting of staff costs, rent, IT infrastructure, and so on. This committee was responsible for implementing all local operational aspects of its organisation ([10]). In addition, more than 25 % of the total revenue was allocated to various development and education programmes, the main one being the Forward 1.0 programme, while 16 % was added to reserves for future distribution in football. Launched in 2016, the USD 1 079 million Forward 1.0 programme provided direct financial support to member associations, confederations and regional/territorial associations for their projects, covering operational costs as well as travel and equipment grants. According to the explanations provided by FIFA in its financial reports, the Forward programme is a solidarity programme that also offers incentives (promotion of best practices). Solidarity is expressed in different ways. Part of the amounts are paid on a lump sum basis and therefore do not depend on the size and importance of the associations. Additional financial support is provided to associations in need. Finally, FIFA encourages associations and confederations that do not need their funds to transfer them to those that do. The Forward 1.0 programme has been replaced in 2019 by a version 2.0 which will run until 2022 with an increased budget of USD 1 746 million. Forward 2.0 was also used as part of a relief plan to help the football community affected by the COVID-19 pandemic.

In the case of UEFA, 80 % of all revenue was distributed to participating clubs and associations in the 2018/2019 financial year ([11]). At club competition level, just over three-quarters of all revenue was distributed to participating clubs. In detail, the net revenue generated was distributed between the participating clubs and UEFA according to a new division agreed with the European Club Association in 2018 (93.5 % for the clubs compared with 6.5 % for UEFA). UEFA's share is used to support football and to cover its administrative and institutional costs. Net revenue is obtained by deducting competition-related costs, qualifying round payments and solidarity payments for non-participating clubs from the total gross revenue

([9]) As regards football clubs, they benefit from the 'Club Protection Programme', which compensates them if one of their players suffers an injury while playing with their national 'A' team in an international match. In addition, a portion of the World Cup revenue is shared with the players' clubs through the 'Club Benefits Programme' so that they too can benefit from the success of the competition. The amounts allocated are calculated on the basis of a lump sum per player per day.

([10]) Its staff reached 1 374, which is more than the number of FIFA employees.

([11]) In previous years, this percentage was between 70 % and 75 %, and even 50 % in the 2015/2016 financial year including EURO 2016.

of club competitions. Both the qualifying round payments and the solidarity payments are calculated as a fixed share (3 % and 4 % respectively) of the total gross revenue ([12]). As far as national team football is concerned, the distribution of the total EURO 2016 revenue to the participating associations was 15.7 %. The distribution is split between participation bonuses and, depending on the sporting success of the teams, result bonuses. UEFA also contributes to the travel costs of the participating teams. Solidarity payments are made through the HatTrick programme ([13]). With the HatTrick IV programme (2016–2020), each member association received a one-off payment of EUR 3.5 million for investments in projects related to football infrastructure, development and training, and grassroots football, as well as up to EUR 1.9 million per season in the form of fixed solidarity payments and incentive payments. These fixed solidarity payments and annual incentive payments are intended to contribute to the operating costs of the associations and to encourage them to participate in junior, women's and futsal competitions. In total, EUR 610.5 million was made available to the member associations during the HatTrick IV cycle.

3. Work carried out

Following the growing impact of ISAs on Swiss statistics, it became increasingly important to adequately record the relevant flows. The 2020 revision of the national accounts made it possible to do so and to adapt, rather than completely revise, the treatment applied to them and also to recalculate the impact of the cycles before 2014. More details will be provided in subchapter 4.6. It can be stated here that the impressive and recent development of their income and expenses required a new analysis of their structure and activities carried out from Switzerland. To this end, exchanges and meetings with the associations took place. They were conducted jointly by staff from business statistics and national accounts, with the aim of ensuring the emergence of a consistent view of these associations and their flows within the Federal Statistical Office. With the growth of financial flows, the risk of inconsistency with the data published in the balance of payments also became greater. To prevent this, a working group of the Swiss National Bank (SNB), the State Secretariat for Economic Affairs (SECO) and the Federal Statistical Office (FSO) was set up to discuss financial flows and their treatment and presentation in the system of national accounts ([14]).

The following paragraphs give some highlights of this work by addressing the contact with associations and the cooperation with the SNB.

([12]) Solidarity payments are distributed through national associations to non-participating clubs for the development of their youth sector. A share of 80 % of these payments shall be distributed to national associations and/or leagues with at least one club participating in the group stage of the Champions League and 20 % to those without clubs participating in the group stage of the Champions League.
([13]) This programme was launched in 2004.
([14]) In Switzerland, the SECO is responsible for the quarterly national accounts and for providing economic forecasts and trends. The SNB is responsible for the balance of payments.

3.1. Meeting with international sports associations

In order to determine whether and how the treatment of ISAs should be adapted, it was necessary to carry out in-depth work to understand the structure and activities of the three largest ISAs, namely FIFA, IOC and UEFA. To do this, their financial accounts were scrutinised and meetings were held with each of these associations in the first half of 2019. The main purpose of these meetings was to gain a better understanding of their structure and activities in Switzerland and to obtain additional information that was not included in the financial reports. They also allowed the associations to be made aware of the impact they have on macroeconomic statistics and the development of GDP. They were interested and surprised by the extent of their impact on economic developments ([15]). This was an important step in motivating them to collaborate and provide good quality information. In the future, specific meetings are envisaged to address topics such as the way future sports events are organised, their financial impact, changes in financial reporting and the implementation of new accounting standards (for example, with regard to the 'IFRS 16 – Leases' standard).

3.2. Cooperation with the Swiss National Bank

A central element of the revision was the search for greater consistency between national accounts and balance of payments data. Consistency checks were first carried out at an aggregate level in order to compare the data from the FSO (production, intermediate consumption) with the data from the balance of payments (imports and exports of services). The comparisons showed that the data used in the balance of payments and the national accounts were not consistent. The problems were more related to the expenditure side than related to the revenue side. The reasons for this included the use of different data sources. While the SNB uses survey data to compile the current account, the FSO mainly uses information from consolidated financial reports. As a result of these analyses, the SNB has adapted the survey guidelines sent to ISAs concerning the treatment of distributions and solidarity payments made to member associations, regional associations and confederations based abroad. In addition, with the endorsement of the three major international sports associations, it provided the FSO with the current account survey data concerning them ([16]). This made it possible to compare data at the level of each association, allowing for more detailed checks on their consistency, similar to what is done in a large case unit (LCU) for large multinationals.

([15]) The interest of associations in knowing their economic impact was in itself not surprising, given that FIFA and the IOC had each already commissioned studies to quantify the impact of ISAs on the Swiss economy (Rütter and Schmid (2013), Bousigue and Stricker (2015), Stricker and Derchi (2021)).

([16]) Currently, the exchange of micro-data between the SNB and the FSO is made difficult by the legal framework. The implementation of a revised legal framework could change this in the medium term.

4. Treatment adopted in the Swiss national accounts

This section details the treatment of the ISAs currently applied in the Swiss national accounts. Based on this treatment, it then compares the impact in terms of gross value added of different major sporting events. Finally, it describes the adjustments developed in the framework of the annual and quarterly national accounts.

4.1. Residency

The very first thing to mention is that FIFA, IOC and UEFA have a strong physical presence in Switzerland. At the end of 2018, they employed around 1 900 full-time equivalents.

The key question is whether the ISAs are international organisations, in other words whether the places they occupy in Switzerland constitute territorial enclaves over which they have jurisdiction (BPM6, paragraph 4.7; International Monetary Fund (2014)).

The current status of these associations is the result of a long process that began with the establishment of the IOC in Lausanne over 100 years ago. Over the years, their status has evolved according to the demands made by ISAs and the handling of the issue by the authorities in the Swiss political context of federalism and direct democracy. The analysis of the current situation shows contradictory signals. In particular, the following points should be highlighted.

- Legally, ISAs are not-for-profit associations subject to Swiss private law.
- They are constituted and organised according to the Swiss Civil Code.
- Anyone who wishes to do business through an association in Switzerland must register it with the trade register. Therefore, they are registered in the trade register, which means that their accounts are subject to the Swiss Code of Obligations.
- When they are deemed to pursue public purposes, ISAs are exempt from the federal corporate income tax ([17]).
- Depending on the canton, they may be completely exempt from direct taxes. In the Canton of Vaud, where the IOC and UEFA are located, the IFs and the ISAs, provided they are affiliated with the IOC, are fully exempt from income and capital taxes. On the contrary, FIFA, which is based in the Canton of Zurich, is taxed according to the ordinary taxation rules applying to associations. It is subject to direct federal tax as well as cantonal and municipal taxes ([18])
- Only ISAs as such are exempt ([19]); natural persons (employees, committee members, officials, and so on) are not.
- At the federal level, the exemption is limited to the corporate income tax: other federal taxes and levies (for example, VAT) are not affected.
- ISAs are not eligible for the privileges, diplomatic immunities and facilities given to international governmental organisations (IGOs).

([17]) The federal direct tax on associations amounts to 4.25 %. It is already a reduced rate compared with the rate applied to capital firms, which is equal to 8.5 %. There is no capital tax at the federal level in Switzerland. It was abolished for all legal structures as of 1 January 1998.
([18]) The canton of Zurich levies a profit tax of 4 % on associations.
([19]) Note that the exemption does not apply to all legal units of one ISA's group. Especially, Swiss subsidiaries providing services to the ISAs are taxed according to the relevant tax legislation.

Taken together, we consider that these elements rather show that ISAs should not be treated as international organisations. However, as the exemption from the federal corporate income tax demonstrates, ISAs have currently a status of public interest organisation, which may still evolve. So we must remain vigilant and assess the situation again in case of changes.

4.2. Classification

Having decided that some ISAs are not international organisations, the question of their classification arises. As stated in the previous section, ISAs are not-for-profit associations under Swiss law. In Switzerland, an association may also be a company managed in accordance with commercial practices, but for the greater good. According to the Swiss Civil Code, its business purpose must not be for profit. However, non-profit does not mean that the association has to forego profits altogether. In the case of profits, the association has the obligation to spend them in order to achieve its purpose.

The Swiss national accounts currently consider FIFA, IOC and UEFA as market producers on the basis of the 50 % criterion (covering at least the majority of production costs by sales revenue). These units are therefore classified in the non-financial corporate sector (S.11) and within sports activities and amusement and recreation activities (NACE Division 93).

As mentioned in the introduction, Switzerland is home to a large number of ISAs outside of FIFA, IOC and UEFA. The financing of these ISAs is highly dependent on the revenue distributions made by FIFA, IOC and UEFA. The outcome of the market test for these associations will thus depend on whether the revenues distributed by FIFA, IOC and UEFA are treated as purchases of services or as transfers. At present, we consider a large part of these flows as being used to pay for services. This is the case, for example, of the amounts allocated to the IFs and NOCs by the IOC since they are considered to play an important role in the organisation and promotion of the Olympic Games. The IFs have the responsibility to organise the events for the sports included in the Olympic Games programme whereas the NOCs prepare their Olympic teams and manage their delegations during the Olympic Games. For this reason, these associations are also treated as market producers which are classified in NACE Division 93.

4.3. Treatment of income

We have seen that there are four main types of income: from broadcasting rights, from marketing rights, from hospitality/accommodation rights and ticket sales, and from licensing rights. The current treatment in the Swiss national accounts is as follows.

- Revenues from broadcasting rights are considered to be an output of associations that is fully exported. The export of services is classified under 'charges for the use of intellectual property n.i.e.' according to the classification established for the balance of payments. With respect to the time of recording of these flows, we follow the international recommendations that specify that amounts paid, even if they extend over several years prior to the event, should be recorded as charges for use of intellectual property in the period when the event actually takes place (BPM6-CG 12.129; International Monetary Fund (2014)).

- Marketing rights are non-produced non-financial assets. Their use should result in a transaction in the primary income account. However, payments may also contain a service component that in general cannot be distinguished from property income. If this is the case, the total payments of this type are by default recorded under 'franchise and trademark licence fees (charges for the use of intellectual property n.i.e.)' (BPM6-CG 12.124; International Monetary Fund (2014) and MSITS, § 3.219; United Nations (2012)). At present, we have no information to make a possible split between services and income for the international transactions related to the rights to use marketing assets. Together with the fact that the sponsors are large MNEs based abroad, this explains why the payment flows generated by these sponsorship contracts are considered exports of license fees from a national accounts perspective.
- Revenue from hospitality rights and ticket sales is considered to be an output of the associations and an export of services. Revenue from the sale of hospitality rights is recorded under 'charges for the use of intellectual property n.i.e.' while direct ticket sales are recorded under 'other personal, cultural, and recreational services'. However, there are situations where the sale of tickets and hospitality is done through a subsidiary in the host country. In these cases, no output nor export is recorded in the Swiss national accounts.
- We apply the same treatment to the income from licensing rights as we do to other fees; in other words, we consider it to be output of the ISAs that is fully exported ('charges for the use of intellectual property n.i.e.').

4.4. Treatment of expenses

We have seen that there are three main types of expenses of these associations: operational costs related to competitions, distribution to participating associations and teams, and solidarity payments. The current treatment in the Swiss national accounts is as follows.

- Operational costs related to competitions are mainly treated as intermediate consumption ([20]). As competitions are mostly held abroad, they are also recorded as imports of services.
- Distributions to participating associations and teams and distributions to teams releasing players are considered a purchase of services in the context of events where the association plays the role of organiser. These amounts should also be included in intermediate consumption and imports of services.
- Although the total amount of solidarity payments depends on the income generated, it does not seem appropriate to consider them as a kind of dividend distribution. One of the reasons for this is that they are earmarked for specific purposes (infrastructure, organisation of competitions, aid to associations lacking resources, and so on). Even if the use of the funds is defined beforehand, no direct provision of services is requested from the national associations. Therefore, they are not to be considered as purchases of services and should not be considered as intermediate consumption. These amounts are treated as current transfers (D.75) and also included in the secondary income account of the balance of payments.

([20]) One exception is insurance premiums, where only the portion related to the service should be included in intermediate consumption.

Participation distributions or solidarity payments for units located in Switzerland should obviously not be included in the balance of payments data. These amounts should be excluded as far as possible, even if they are usually relatively small. For example, during the 2018 World Cup, in which the Swiss national 'A' team participated, the amounts paid to the Swiss Football Association (SFA) amounted to USD 13.5 million (out of a total of USD 448 million paid to the 32 participating member associations) ([21]). In addition to the participation in the 2018 World Cup, a total of USD 3.75 million has been allocated by FIFA to the SFA for the years 2016 to 2018 as part of the Forward program (out of a total of USD 873 million allocated to member associations).

In the case of IOC payments, the situation is different. A significant part of these payments concern entities based in Switzerland. In fact, the IOC allocates part of the income to the IFs, many of which have their headquarters in Switzerland, and to the National Olympic Committees. For the latter, the distribution of the allocated amounts is carried out by the Olympic Solidarity, which is an autonomous entity of the IOC. As a result, it is slightly more difficult to identify the flows paid abroad. In addition, the IOC distributes part of the Olympic revenues to recognised international organisations, some of which, such as ICAS, are also located in Switzerland.

4.5. Impact of major sporting events

Table 1 shows the total revenue generated as well as the costs treated as intermediate consumption as a share of total revenue for the 2018 FIFA World Cup, the UEFA EURO 2016 and the 2013–2016 Olympiad ([22]).

Table 1: FIFA World Cup 2018, UEFA EURO 2016 and the 2013–2016 Olympiad – key figures to understand their impact on Swiss national accounts

	Total revenue – output (million)	Costs treated as intermediate consumption as a share of total revenue (%)
FIFA – World Cup 2018	USD 5 357	34.0
UEFA – EURO 2016	EUR 1 916	44.2
IOC – 2013-2016 Olympiad	USD 5 662	77.4

Source: FIFA, IOC and UEFA financial reports

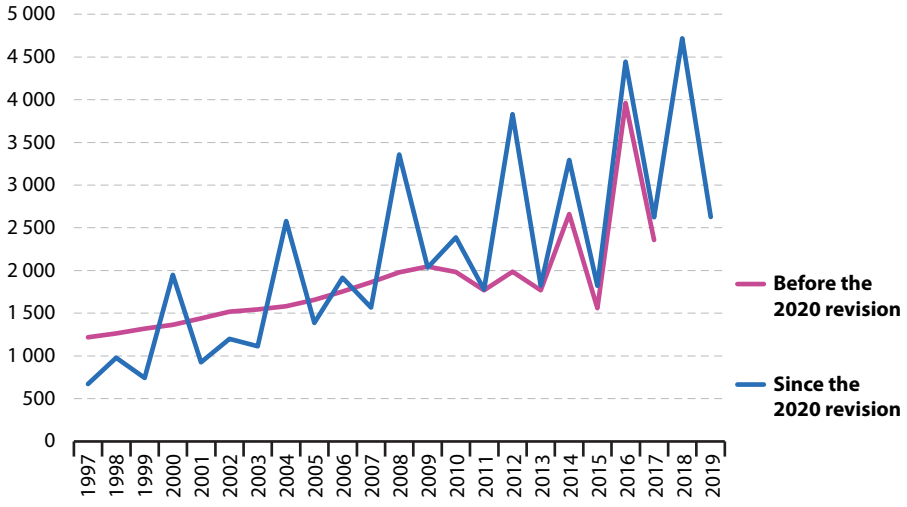
([21]) They include a prize money of USD 12 million and a lump sum of USD 1.5 million to cover the preparation costs of the participating teams.
([22]) The 2013–2016 Olympiad covers the Olympic Winter Games Sochi 2014 and the Olympic Summer Games Rio 2016.

As can be seen from Table 1, the impact of the events on the Swiss GDP is not the same. Compared with EURO 2016, the 2018 World Cup has had a stronger impact since the revenues generated are higher and the costs treated as intermediate consumption (expressed as a share of total revenue) are lower. Despite roughly similar revenues, the GDP impact of the 2018 World Cup is also larger than that of the 2013–2016 Olympiad (which is additionally spread over 2014 and 2016), due to a lower share of intermediate consumption.

4.6. Revision and adaptation of the annual and quarterly national accounts

Until 2014, ISAs had received little attention from the Swiss national accounts and their functioning was still poorly understood. The data received from the value added survey for NACE Division 93 'sports, recreational and leisure activities' were smoothed to avoid strong cyclical fluctuations. From 2014 onwards, however, when the combined impact of the Winter Olympics and the football World Cup was felt, it was decided to stop this smoothing and to represent the cycles as they appeared in the raw data. The 2020 revision of the Swiss national accounts allowed the same procedure to be applied to the entire series. In this revision, the value of output, intermediate consumption and gross value added were first recalculated for FIFA, IOC and UEFA on the basis of the financial reports until 2009. Backward calculations were then made for earlier years. As the following graph shows, the two-year cycles of the sports events are now clearly visible in the annual data of the system of national accounts.

Figure 2: Development of NACE Division 93 gross value added before and after the 2020 revision of the Swiss national accounts , 1997–2019
(CHF million, at current prices)



Source: Federal Statistical Office

FIFA's adoption in 2016 of the international accounting standard 'IFRS 15 – Revenue from contracts with customers', which defines how and when revenue should be recognised in IFRS-compliant reporting, explains the break observed for 2015 (the first year of FIFA's 2015–2018 cycle) and, in part, also the weaker impact of the years with a Football World Cup before 2018 in the revised series. Prior to 2015, FIFA reported its revenue proportionately over the four-year cycle. As a result, the time series contain a break which can be removed in the next major revision of the national accounts if appropriate information is available ([23]).

The renegotiation cycles of the contracts for the rights of the various competitions overlap. As they are renegotiated upwards, they mainly show their effect through the increasing trend of the curve but can occasionally also amplify the effect observed over an even year ([24]).

The development of the nominal gross value added of Division 93 'sports, recreation and leisure activities' shows considerable variations. For example, this development was +143.7 % in 2016, −40.9 % in 2017 and +79.9 % in 2018! Although Division 93 represents only about 0.5 % of GDP in nominal terms ([25]), such high rates of change have a significant impact on the development of the aggregate.

In autumn 2017, the Staatssekretariat für Wirtschaft SECO (2017) assessed this effect in an analysis, the results of which are shown in the figure below ([26]). It shows that entertainment activities (NACE Divisions 90–96) added 0.1 percentage points (p.p.) to real GDP growth in 2014, reduced it in 2015 by 0.2 p.p. and then increased it by 0.3 p.p. in 2016. The main lesson of the analysis is very clear: major sporting events interfere or even distort the picture of Switzerland's economic situation. Its modelling and forecasting also become more complicated.

In order to obtain more informative series on the economic situation, SECO has developed a 'sports event-adjusted' series which treats the value added resulting from major sports events separately and spreads it over five years ([27]).

Productivity analyses are also greatly affected by the activities of ISAs. Productivity varies greatly because value added fluctuates much more than employment. It is true that employment within ISAs increases momentarily in connection with the organisation of major sports events, but in much more modest proportions than gross value added.

([23]) The IOC adopted IFRS 15 in 2018 and applied it retroactively to 2017, the first year of its 2017–2020 cycle. However, the impact was virtually negligible, as the IOC previously recorded the entire broadcast rights in the year the Olympic Games were held.

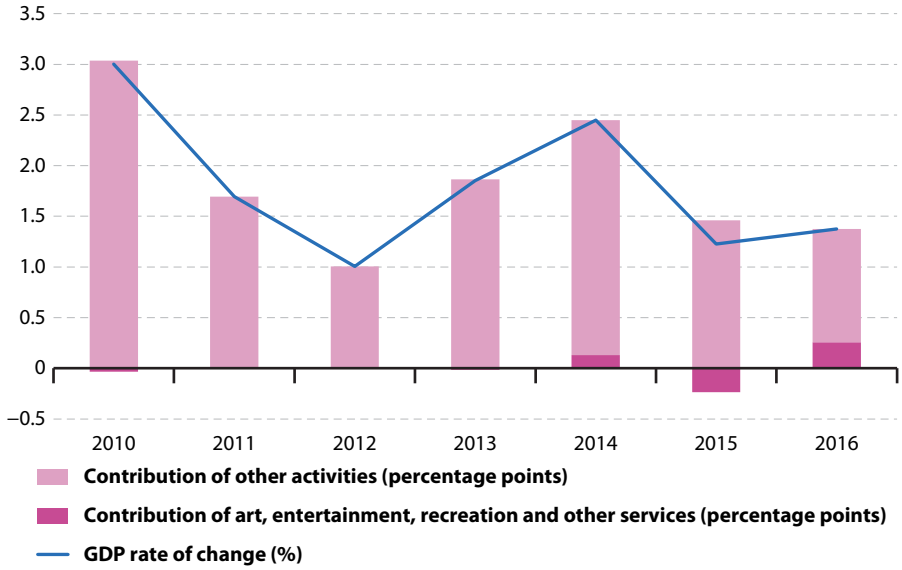
([24]) As was the case in 2016 for UEFA, where the holding of EURO 2016 coincided with the beginning of a new cycle of club competitions. This happens every 12 years by virtue of the fact that contracts for these club competitions are negotiated for a three-year cycle.

([25]) In view of the fluctuations, this share varies greatly from year to year.

([26]) To avoid confusion, it is worth recalling here that the data used in this analysis precede the 2020 revision of the national accounts.

([27]) This correction procedure is analogous to the one recommended for the correction of working days at international level. 'Corrected' quarterly series have been published by SECO since mid-2018, but only for the time being for the production side: https://www.seco.admin.ch/seco/en/home/wirtschaftslage---wirtschaftspolitik/Wirtschaftslage/bip-quartalsschaetzungen-/daten.html.

Figure 3: Contribution of the entertainment activities to real GDP growth, 2010–2016



Source: Federal Statistical Office

5. Outstanding issues

At the conceptual level, the discussion among statistical authorities in Switzerland has focused on whether solidarity payments should be considered as transfers or as a form of intermediate consumption necessary for the organisation of sports competitions. In the Swiss national accounts, we have favoured treating the costs directly related to the organisation of sports events as intermediate consumption and solidarity payments as transfers. We consider these transfers, often of a lump sum nature and made possible by the ownership of intellectual property rights, as a core activity of ISAs. In the background, however, is the question of the nature and extent of the services that the member associations and federations of FIFA, IOC and UEFA provide for the organisation of major sports events. In the discussions, some of our partners argued that the solidarity payments are in fact an indirect remuneration for their services and that, without these payments, the major sports events could not take place.

On the other hand, the current choices could also be questioned by adopting a more restrictive view in defining the flows that should be considered as intermediate consumption. In fact, the arguments for treating certain flows as intermediate consumption remain rather vague. It is sometimes unclear what types of services are provided to the three major ISAs by sports federations, national associations and local organising committees and it is unclear how and when they are consumed or transformed by the former. Moreover, this vagueness could lead to somewhat arbitrary decisions, being a potential cause for the very different percentages (costs treated as intermediate consumption as a share of total revenue) displayed in Table 1 for the major sports events.

As described above, the rules for distributing the TV and marketing rights revenues of an Olympiad are not the same between the USOC and the 205 other NOCs. This is due to the fact that, the Amateur Sports Act, a public law passed in 1978, gives the USOC exclusive rights to the Olympic marks and emblems on the US territory. The USOC did not cede its rights to the IOC but clearly used them to negotiate a beneficial revenue-sharing agreement with the IOC. However, it also gives rise to a long-running dispute over the US share of Olympic television and sponsorship revenues. In 2012, USOC and the IOC eventually signed a long-term agreement that reduced the USOC's percentage share of TV and marketing revenues. It came into effect in 2020. The terms of the agreement have not been made public but it seems that it also covers issues related to ownership of Olympic rights and trademarks. All this information raises two questions. Firstly, is our current treatment of the revenues distributed to USOC adequate for the situation up to 2020 (in other words, treated entirely as an intermediate consumption as for the other NOCs)? Since 2020, has the situation changed sufficiently for the conceptually correct treatment of revenues distributed to the USOC to be different? These questions should be discussed with the IOC and our US colleagues.

Despite the efforts made, there is still work to be done to harmonise the treatment of flows between the system of national accounts and the balance of payments. The data sources used in the compilation of national accounts (consolidated annual accounts) and the SNB (quarterly survey data) may also be the cause of important differences (for example, scope of coverage, temporal distribution of flows, recording concept). These aspects will have to be analysed in depth and solutions found to further reduce inconsistencies.

Royalties from the licensing of television rights are typically paid in instalments. Conceptually, these payments should be recorded in the balance of payments under the other accounts receivable/payable position. We are in the process of checking whether the advances made in the framework of the television rights contracts are indeed recorded as such.

Given their non-profit status and tax advantages, gross value added of the major ISAs should be roughly equal, over a four-year cycle, to the sum of their personnel costs, depreciation, transfers and, if applicable, the surplus added to reserves for future distribution in football. For FIFA, for example, this represents an average annual gross value added of around USD 770 million over the 2015–2018 cycle. While their gross value added is significant, the main impact of these associations on the Swiss national accounts is less in terms of levels than in terms of rates of change. Like the negative net operating results presented in their profit and loss accounts, the calculation of gross value added of these units may result in negative values in some years and be followed in the next year by gross value added exceeding CHF 1 billion. This high variability is related to the distribution of income and expenses over a four-year cycle. Its magnitude depends on the amount of income generated by the major sports events and the amount of associated expenses processed as intermediate consumption. Even if all solidarity payments were treated as intermediate consumption, the problem would remain, albeit mitigated. The question of smoothing the calculation of gross value added to avoid the appearance of negative figures arises.

Since the Swiss national accounts do not apply a treatment or techniques that smooth the results of ISAs, it has been necessary to produce 'sports event-adjusted' series for the purposes of business cycle analysis. In another context, some studies (Rütter and Schmid (2013), Bousigue and Stricker (2015)) have moved away from national accounts concepts in order to

better estimate their impact on the Swiss economy. One of the options chosen was to exclude solidarity payments from gross value added by subtracting them from the gross output value. To the extent that ISAs distort the link of the usual macroeconomic indicators for the domestic economy, such an option could also be considered at the level of the Swiss national accounts as an alternative measure. However, the option of creating new indicators is not the preferred one at the international level, especially in the context of the treatment of MNEs.

We have no idea what impact our treatment has on bilateral asymmetries. The question arises as to whether and, if so, how the various financial flows of ISAs based in Switzerland are recorded abroad. Are the treatments consistent with those in the Swiss national accounts? What is the time of their recording? As a first step, cooperation with statistical offices of event hosting countries implying the sharing, exchange and reconciliation of data would probably benefit the compilation of consistent statistics to a considerable degree.

6. Conclusions

The treatment of ISAs has been the subject of extensive analysis and discussions in the context of the 2020 revision of the Swiss national accounts, culminating in a visit to these associations.

This work became necessary because of the increasing impact of these associations on Swiss macroeconomic statistics. With the emergence of a global market for the commercialisation of major sports events, their revenues from broadcasting and marketing rights have increased dramatically in recent decades. These revenues, which are cyclical by nature, influence the development of GDP and make it more difficult to understand the domestic economic situation. Since they take place abroad, the financial flows associated with these competitions are generally recorded in the balance of payments, which further raised the question of their consistency with the national accounts data.

At the conceptual level, the discussion with our partners on the treatment of distributions and solidarity payments made by FIFA, IOC and UEFA abroad is probably not yet complete.

Since 2018, SECO has been providing additional series for the production side that adjust for the impact of major sports events. Apart from that, there are currently no plans to provide supplementary analyses or tables on ISAs as part of the Swiss national accounts.

With the chosen treatment, part of the distorting effect of the activity of ISAs on the Swiss national accounts is similar to that of foreign MNEs. A significant amount of production, made possible by the holding of intangible assets, is recorded in Switzerland, while most of the income is distributed abroad. In this context, it is particularly striking, but perhaps not surprising, that some of the recommendations issued for the treatment of MNE and intra-MNE flows by the Globalization Task Team (GZTT) are also relevant for the recording of ISAs.

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Annex 1

Table 2: Current portfolio of competitions and tournaments

FIFA national teams	FIFA club teams	IOC	UEFA national teams	UEFA club teams
World Cup	Club World Cup	Summer Olympic Games	European Championship	Champions League
Women's World Cup	Blue Stars/FIFA Youth Cup	Winter Olympic Games	Women's European Championship	Women's Champions League
U-20 World Cup		Summer Youth Olympic Games	U-21 European Championship	Europa League
U-20 Women's World Cup		Winter Youth Olympic Games	U-19 European Championship	Europa Conference League
U-17 World Cup		Paralympic Games	U-19 Women's European Championship	Super Cup
U-17 Women's World Cup			U-17 European Championship	Youth League
Arab Cup			U-17 Women's European Championship	Regions' Cup
Olympic Football Tournament			Nations League	Futsal Champions League
Women's Olympic Football Tournament			CONMEBOL-UEFA Cup of Champions	
Youth Olympic Football Tournament			Futsal Championship	
Women's Youth Olympic Futsal Tournament			Women's Futsal Championship	
Futsal World Cup			U-19 Futsal Championship	
Beach Soccer World Cup				

Annex 2

Table 3: Key features of the consolidated financial statements of FIFA, IOC and UEFA

	Consolidated financial statements		
	Accounting period	Currency	Accounting standard
FIFA	Civil year	USD	IFRS for the accounts / IFRS 15 since financial year 2015 / IFRS for the budget since financial year 2017
IOC	Civil year	USD	IFRS
UEFA	From 2005/06: 01.07 to 30.06	EUR	Swiss Code of Obligations

3 An estimation of the Seychelles CO_2 footprint using Eurostat data

PATRICE GUILLOTREAU [1] AND KEVIN BISTOQUET [2]

Abstract: Small island developing states (SIDS) are particularly vulnerable to climate change and ought to pay attention to their own contribution in the form of carbon dioxide (CO_2) emissions resulting from domestic production and consumption levels. Although barely responsible for worldwide carbon emissions by way of the modest level of their domestic demand, they can nonetheless contribute to the problem because of global demand for their exported commodities. However, the CO_2 footprint of SIDS is rarely assessed because of a lack of data about greenhouse gas emissions or national account statistics. Taking the opportunity of the COVID-19 pandemic and the resulting economic shock, an environmentally-extended input–output model based on Eurostat data on air emissions is used to disentangle CO_2 emissions embodied in domestic production and international trade, and to identify clearly the origin of emissions by industry. Not surprisingly, the consumption-based CO_2 footprint of Seychelles is deemed lower (6.79 tonnes of CO_2 per inhabitant) than the production-based inventory (9.55 tonnes of CO_2 per inhabitant) for this small open economy relying to a large extent on exports of canned tuna and tourism services. Hence CO_2 emissions decreased (−16 %) in 2020 because of the COVID-19 pandemic. Could it be the right time to re-frame the international specialisation of Seychelles?

JEL codes: D57, N57, Q25

Keywords: environmentally-extended input–output (EE-IO) model, air emission accounts, CO_2 footprint, COVID-19, Seychelles economy

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1. Introduction

It is well acknowledged that small island developing states (SIDS) are among the most vulnerable nations regarding global warming (Robinson et al. (2010), Guillotreau et al. (2012), Kelman (2018), Robinson (2020)). In particular, the issues of sea-level rising and climate variability for SIDS are under particular scrutiny since the United Nations (UN) Barbados Global Conference held in 1994 (https://sdgs.un.org/). Agricultural land, population and infrastructure are often concentrated in the coastal zones, making SIDS highly vulnerable to extreme climatic events. Although barely responsible for worldwide carbon emissions by way of the modest level of their domestic demand, they can nonetheless contribute to the problem because of global demand for their exported commodities. Assessing the carbon dioxide (CO_2) emissions of SIDS would make it possible to identify the main sources of emissions and to implement targeted abatement policies ('charity begins at home'). The UN international Mauritius programme of action for the sustainable development of SIDS (2005) and the Bali Action Plan (2007) have first defined some nationally appropriate mitigation actions (NAMAs) to reduce the impact of SIDS and other developing countries on climate change through 'common but differentiated responsibilities and respective capabilities' (UNDP (2008)). The NAMAs aim at inventing pathways and specific steps for developing countries to reduce their emissions trajectory. Several conditions are required to follow the adopted action plans: the initiatives must be measurable, verifiable and reportable (*Ibid.*). Developing such actions can be seen as a means of meeting sustainable development aspirations. It can also shed new light on particular industries which are vital, although overlooked for SIDS economies, such as natural resource-based industries and tourism (Burns and Vishan (2010), Pratt (2015)).

Depending to a great extent on foreign trade, the economic benefits of these activities for SIDS in terms of income can be outweighed by the negative environmental consequences of trade liberalisation (Sannassee and Seetanah (2016)). While developed countries tax more heavily polluting activities, the pollution haven hypothesis would tend to concentrate the most polluting industries in developing countries (Zheng and Shi (2017)). Separating production-based from consumption-based CO_2 emissions would show the respective responsibilities of developed trade partners and of small developing nations in global emissions (Nath and Madhoo (2021)). By reducing the weight of their most emission intensive activities, the SIDS economies can also become less dependent on fossil fuel energy, providing the double dividend of a 'no-regret' strategy, in other words a net gain even if the climate change does not result in too severe consequences (Hallegate (2009)). They can do so by shifting to 'green' or 'blue' energy sources and deploying defensive strategies to enhance their environmental productivity (Nath and Madhoo (2021)).

Currently, the emission levels of CO_2 are calculated by both the International Energy Agency (IEA) and the Carbon Dioxide Information Analysis Center (CDIAC) ([3]). However, there is no information regarding industry level breakdowns in the data, nor up-to-date input–output tables as developed in an environmentally-extended input–output (EE-IO) (Hertwich and Peters (2009), Wiedmann et al. (2011), Moran and Wood (2014), Wiebe and Yamano (2016), Wu et al. (2020), Brown et al. (2021)). Therefore, we propose in this research

([3]) The CDIAC is a research centre of the United States Department of Energy calculating the CO_2 footprint through the multi-regional input-output model GTAP (global trade and analysis project). Their estimations can be found on the World Bank website (Hertwich and Peters 2009).

to develop an EE-IO model for the first time in Seychelles on the basis of Eurostat data on air emissions (Gajos and Prandecki (2016)), and to estimate both the CO_2 footprint and national inventory before and after the COVID-19 pandemic.

The concept of a CO_2 footprint is defined as a synthetic indicator of ecological sustainability (Boutaud and Gondran (2018)). The CO_2 footprint of a resident population represents the set of greenhouse gas (GHG) emissions, of which CO_2 is a major component, associated with domestic consumption, irrespective of the originating country where the goods and services are produced. The national inventory is a domestic production-based assessment, including the demand for exports but excluding the emission content of imports. Since the Kyoto Protocol signed in 1997 and the various Conferences of Parties afterwards, many countries have committed to reduce their emissions of CO_2. Several studies have shown a transfer of emissions between developed countries and emerging or developing countries because of emissions embodied in international trade (Ahmad and Wyckoff (2003), Aichele and Felbermayr (2012), Wiebe and Yamano (2016), Wu et al. (2020)). As largely open economies, SIDS are particularly concerned by the gap between consumption-based and production-based emissions (Robinson (2020)). In particular, in many SIDS, the economic pillars are tourism and primary sectors (mining, agriculture and fishing), which may release a great deal of greenhouse gases into the atmosphere (Archer and Fletcher (1996), Chassot et al. (2021)). This is why it is of major importance to assess the Seychelles CO_2 footprint and inventory, attempting to disentangle the emissions embodied in trade and domestic production.

Such an assessment is a timely necessity as new challenges are arising for SIDS like Seychelles since the recent pandemic shock. On 11 March 2020, the World Health Organization (WHO) declared COVID-19 a worldwide pandemic resulting in a wave of lockdowns for many countries. The International Monetary Fund (IMF) considered that global GDP for 2020 would be reduced by 3.5 % in their revised estimation of January 2021, before bouncing back to growth of 5.5 % in 2021 and 4.2 % in 2022 according to projections (IMF (2021)). The African Bank of Development (AfdB), in its outlook of March 2021, predicted the lowest rate of change (−12 % in 2020) of all East-African countries (AfDB (2021)). The World Trade Organization (WTO) predicted that global trade would contract between 13 and 32 % in 2020 (WTO (2020)). On the basis of autoregressive models and impulse response functions, the UN Department of Economic and Social Affairs predicted a situation for SIDS that should be even worse than the financial crisis of 2008–2009, since the length of recovery depends on the magnitude of the initial shock: SIDS are projected to take about four years to return to the baseline forecast path (Kim (2020)). Consequently, the level of CO_2 emissions associated with production and consumption should be somehow affected by the trade restrictions imposed by the pandemic.

SIDS rely heavily on foreign trade and supply of commodities for day-to-day life. In particular, the energy required by the Seychellois households and industries is fossil fuel-based. Machinery and transport equipment represent 30 % of imports. Even the fish canning plant, the main private employer of the archipelago, needs a large quantity of raw materials like frozen tuna and tin metal cans from overseas. A sudden disruption of foreign trade affects dramatically the whole economy (Kontovas and Sooprayen (2020)). In Seychelles, a comprehensive report assessing the economic consequences of the COVID-19 pandemic for the country was published by the government and the United Nations in December 2020 (Rassool et al. (2020)). It clearly showed the extent of the social and economic shock caused by

the pandemic, with a gross domestic production (GDP) contraction of 11.5 % in 2020 (the IMF's 2020 forecast was even higher at −13.8 % for 2020). The budget balance relative to GDP was one of the lowest among SIDS at −15.5 % in 2020, with a projection of −6 % in 2021 (Rassool et al. (2020)). Exports decreased by 38.9 % in 2020 (IMF (2021)), and the actual GDP contraction in 2020 estimated by the National Bureau of Statistics finally amounted to −11 % relative to the previous year (NBS (2021)).

The COVID-19 pandemic deeply affected the whole economy but some industries suffered more than others, like the tourism sector which experienced a 70 % reduction in its number of visitors in 2020. Tourism is considered as the main pillar of the economy in Seychelles and would normally represent one quarter of the Seychelles GDP directly, and two thirds after including indirect and induced effects (Archer and Fletcher (1996), Valenghi (2004), Pratt (2015)). The second most important source of income comes from the fishing and tuna processing industries, contributing 10 % to 15 % of the GDP directly and indirectly (Rassool et al. (2020)). A new prevailing role was assigned to fishery-related industries and the 'blue economy' after the COVID-19 shock. In recent years, Seychelles has developed an ambitious and innovative programme for the development of the blue economy (Republic of Seychelles (2018)). The blue economy is hard to define and delineate accurately, though it follows the overarching objective of UN-SDG 14 ('conserve and sustainably use the oceans, seas and marine resources for sustainable development'). However, these two industries (tourism and fishing) are both highly energy-dependent, and hence responsible for a great deal of CO_2 emissions in Seychelles. How is the new deal of economic activity after the pandemic changing the rules and re-allocating carbon emissions between industries? Will the economy come back to the current specialisation after the shock, or take this opportunity to re-direct its resources to a 'greener' (or 'bluer') economy? A thorough analysis of carbon emissions resulting from domestically-produced and imported commodities might help the government to decide what the best options are for the country.

This article starts in Section 2 with a first glance at Seychelles CO_2 emissions as reported by some international agencies. An original EE-IO model is introduced in Section 3, following the international methodological standards used by the EU Member States and other OECD countries to allow for comparisons. A numerical application, including the estimated impact of the COVID-19 pandemic on carbon emissions, is proposed in Section 4 on the basis of a supply-use table recently released by the National Bureau of Statistics for the first time. Finally, the last section discusses the results in terms of international specialisation for Seychelles.

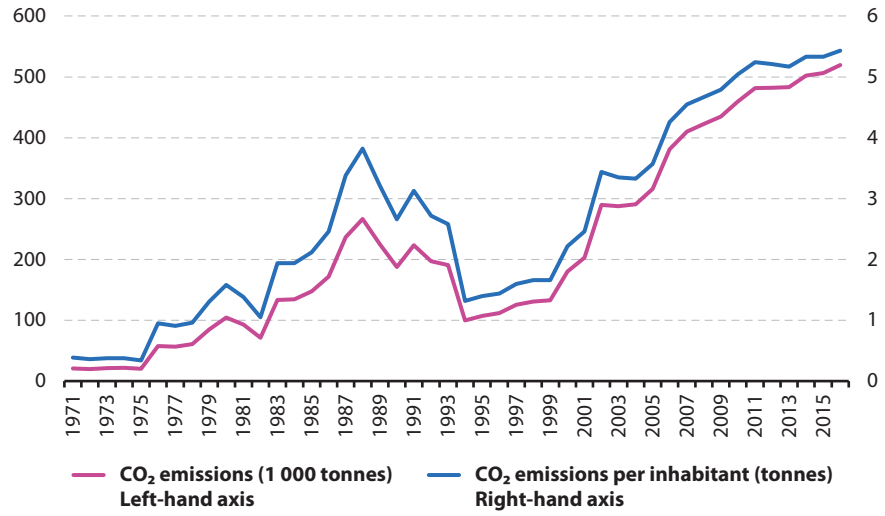
2. Overall CO_2 emissions in Seychelles

Data about emissions from fuel combustion are made available, among others, by the International Energy Agency (IEA) (www.iea.org). CO_2 emissions are calculated using IEA energy databases and the default methods and emission factors given in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories ([4]). From IPCC sources, we learn that CO_2 emission factors for electricity and heat have been derived as 'the ratio of CO_2 emissions from fuel inputs of power plants relative to the electricity and heat delivered' (www.ipcc.ch). The

([4]) See https://www.worldometers.info/co2-emissions/seychelles-co2-emissions/.

calculation is conducted at the country level, indirect emissions being derived by multiplying the amount of energy and heat consumed by CO_2 emission factors at the sectoral level. The Emission Database for Global Atmospheric Research (EDGAR) developed by both the European Commission Joint Research Centre (JRC) and the Dutch environmental assessment agency provides an independent database of atmospheric emissions for all countries in the world since 1970. The calculation of emissions uses a technology-based emission factor approach combining data from the IEA, the Food and Agricultural Organization (FAO) and additional sources (Crippa et al. (2021)) ([5]). The results for Seychelles are presented in the figure below (Figure 1).

Figure 1: CO_2 **emissions from fuel combustion, Seychelles, 1971–2016**



Source: own calculations from IEA and EDGAR data released by www.worldometers.info

The amount of emissions can vary between sources, for instance between the IEA and the World Bank indicators based on data issued by the Carbon Dioxide Information Analysis Center (CDIAC). The IEA appears to be the most cited reference when dealing with CO_2 emissions from heat and energy. The level of air emissions in Seychelles has grown tremendously since the early 1970s, from 20 000 tonnes annually to more than 500 000 tonnes in 2016 (Figure 1). A large proportion (82 %) of these emissions is released by the power industry itself, based on fossil fuels, and the remaining part by other process of combustion, including transport and in buildings. The increasing trend is obviously explained by the growing population but also by the economic development of the country, as illustrated by the steadily increasing level of emissions per inhabitant, from less than half a tonne to more than 5.4 tonnes over the same period of time. We can compare this last figure to the average worldwide carbon emissions of 1.35 tonnes per inhabitant in 2014, meaning that Seychelles is well above average and very close to the EU level of 5.7 tonnes according to Eurostat ([6]).

([5]) Emission Database for Global Atmospheric Research EDGARv6.0_GHG websites: https://edgar.jrc.ec.europa.eu/dataset_ghg60; https://data.europa.eu/doi/10.2904/JRC_DATASET_EDGAR; more information about the methodology can be found in Crippa et al. (2021).

([6]) See the Eurostat portal https://ec.europa.eu/eurostat/, including air emissions accounts (AEA) by NACE Rev. 2 activity.

However, the above figures do not tell anything about the import content of emissions relative to domestic production, nor the details by industry. This is why we suggest to use the standard input–output approach extended to environment proposed by Leontief in 1970 and introduced in greater details in Suh (2009) or Miller and Blair (2009). In Chapter 10, Miller and Blair (2009) explain how to extend the famous Leontief model to deal with energy flows or any environmental factor measured in monetary or physical terms. It can be done in a single-country or multi-regional framework, with respect to the level of available information about emissions, inter-industry transactions and international trade (Hertwich and Peters (2009), Moran and Wood (2014), Wiebe and Yamano (2016), Wu et al. (2020)). A good starting point for Seychelles would consist in developing a single environmentally-extended input–output (EE-IO) model taking into consideration the import content of emissions. This would further serve for other types of footprint (water, energy, raw materials and waste) that could be helpful to minimise the impact of the economy on the natural environment.

3. The environmentally-extended input–output approach

In an environmentally-extended input–output model (EE-IO), the indirect emissions resulting from inter-industry linkages along supply chains are considered in addition to the direct emissions produced by each industry and by end users (households, government, investors and the rest of the world). A symmetric input–output table is therefore needed to calculate the input coefficients and the multipliers. Starting from the classical Leontief model:

$$X = (I - A)^{-1}.F \qquad (1)$$

where X is a column vector of output, A is the matrix of technical (or input) coefficients (the industry's requirements in every input to produce one unit of output in monetary terms), I is the identity matrix and F is a column vector of final uses (internal and external, see below).

The impact factors need to be expressed as intensity rates in physical terms (for example, gigagrams of CO_2) per monetary unit of output $e_j = E_j / X_j$, where E_j denotes the industry j's CO_2 emissions and e_j the intensity (or direct impact) coefficient, in other words the amount of pollutant type per unit of industry j's output value. The industry j's CO_2 emissions are therefore $E_j = e_j.X_j$. Now substituting X by its value in (1) gives the level of emissions directly and indirectly resulting from industry j's activity:

$$E = e_j.(I - A)^{-1}.F \qquad (2)$$

The interpretation is easy: any change by one unit of final demand for commodity j will result in a $e_j.(I - A)^{-1}$ shift of direct (the industry and its first suppliers) and indirect emissions (the suppliers' suppliers in a chain of cascading effects). What matters then is to separate the emissions caused by domestic production from those linked with imported inputs used by industries and those associated with imports of final goods and services. To do so, we followed the stepwise methodology to calculate the CO_2 footprint in France and in the rest of

Europe or OECD countries (Pasquier (2018), Wiebe and Yamano (2016), Brown et al. (2021)). Firstly we try to measure domestic production-based emissions:

$$E_j^d = \widehat{e_j^d}.\left(I - A^d\right)^{-1}.\widehat{F^d} \qquad (3)$$

The capital letters denote the column-vectors, the hat symbol stands for an operator transforming a column-vector into a diagonal square matrix, the superscript *d* means domestic.

The import vector of the country must be split into the matrix of imported inputs (A^m) used by the domestic industries and the vector of imported commodities and services for final uses (F^m):

$$M = A^m X + F^m \qquad (4)$$

Substituting X by its value in (1), we obtain:

$$M = A^m.\left(I - A^d\right)^{-1}.F^d + F^m \qquad (5)$$

The CO_2 emissions embodied in imports from a country *c* will depend both on the share this exporting country holds in the domestic imports, on its own emission intensity coefficients by industry, but also on the technology (combination of inputs) used to produce a commodity. For instance, producing electricity through renewable energy or fossil-based inputs will not result in the same level of CO_2 emissions. Consequently, the emissions embodied in imports can be written as:

$$E^{m,c} = \widehat{e^c}.\left(I - A^c\right)^{-1}.\widehat{M} \qquad (6)$$

We can replace $\widehat{M}$ in Eq. (6) by its value in (5):

$$E^{m,c} = \widehat{e^c}.\left(I - A^c\right)^{-1}.\left[A^m.\left(I - A^d\right)^{-1}.\widehat{F^d} + \widehat{F^m}\right] \qquad (7)$$

By doing so, we can isolate the emissions embodied in imports of intermediate inputs by domestic industries $E_{IC}^{m,c} = \widehat{e^c}.\left(I - A^c\right)^{-1}.\left[A^m.\left(I - A^d\right)^{-1}.\widehat{F^d}\right]$, and the emissions embodied in imports of commodities for final uses, $E_F^{m,c} = \widehat{e^c}.\left(I - A^c\right)^{-1}.\widehat{F^m}$

By assuming a certain stability of input coefficients throughout time, both for domestic or imported input requirements of industries, we can estimate the current level of CO_2 emissions for the year of reference, but also calculate the percentage change of emissions after an economic shock like the COVID-19 pandemic, by substituting $\left(\widehat{\Delta F^d} + \widehat{\Delta F^m}\right)$ for $\left(\widehat{F^d} + \widehat{F^m}\right)$.

Eq. (7) represents the footprint which is consumption-based, in other words including the domestic demand in $\widehat{F^d}$ but excluding the foreign demand (exports) of domestically-

produced goods and services. It can be distinguished from a national inventory of production-based emissions, where the column-vector of exports will be re-integrated into $\widehat{F^d}$ but where also $\widehat{F^m}$ will not be considered in Eq. (7).

One further objective to improve the estimation is to use a multi-regional input–output (MRIO) model (Hertwich and Peters (2010)). Although foreign trade data in Seychelles are poorly detailed by commodity, origin and destination, it remains possible to use a simple MRIO model such as the one introduced by Miller and Blair (2009, pp. 264), where two countries would be considered (for example, Seychelles and EU):

$$E = \hat{e}.\left(I - CA\right)^{-1}.CF \qquad (8)$$

where E represents the vector of emissions resulting from the final demand, irrespective of where the goods are produced, $\hat{e}$ denotes a diagonal vector of emission intensity per unit of

output in the domestic and trade partner countries, the two matrices A and C are, respectively:

$$A = \begin{bmatrix} A^r & 0 \\ 0 & A^s \end{bmatrix} \qquad C = \begin{bmatrix} \widehat{c^{rr}} & \widehat{c^{rs}} \\ \widehat{c^{sr}} & \widehat{c^{ss}} \end{bmatrix} \qquad (9)$$

A is a block diagonal matrix whose submatrices represent regional technology structures (technical coefficient matrices). Matrix C represents trade flows within and between regions as a proportion (in other words, market share) of total trade for every commodity, including the domestic region which is considered (in other words, the sum in column is equal to 1). Finally, F is the demand for exogenous sectors in the domestic country and trade partners. The multipliers obtained by $\left[\hat{e}.\left(I - CA\right)^{-1}.C\right]$ would give not only the direct and indirect emissions due to a level or a change of exogenous final demand in the country, but would distribute the emission effects across supplying regions according to the percentages embodied in the components of block matrix C (Blair and Miller (2009)).

4. Application to the Seychelles case

4.1. Data

The application of the EE-IO model requires different types of data: input–output techniques, CO_2 emissions by industry, final uses and so on. Not all data are available yet for Seychelles. However, in 2020 the National Bureau of Statistics (NBS) published a supply and use table for the year 2014 for the first time, with a selection of 23 key industries for the domestic economy (NBS (2021)). On that basis, an input–output table was constructed but with no distinction between domestic and imported inputs. Consequently, we had to estimate first the import (inter-industry) matrix (A^m) by allocating the vector of imports *M* proportionately to the distribution of intermediate and final output (see Miller and Blair (2009), pp. 151, for an explanation of the method). The domestic IOT is shown in the Appendix (Table A1).

From that point, we were in a position to calculate both A^d and A^m matrices, the sum of which represents the total technical coefficient matrix $\left(A = A^d + A^m\right)$. The A-matrix was used as a proxy of the foreign country technology structure, assuming that both national and foreign technologies were identical. This is not unrealistic because the biggest domestic industries in Seychelles (such as the fish cannery, Indian Ocean Ltd) are foreign capital-owned, compete internationally and export most of their output to EU Member States (Germany, France, Italy, and so on), hence having the highest technology standards to produce and export commodities.

When it comes to emission intensity coefficients, we used the EU CO_2 emissions, adjusted for African countries ([7]). The IEA suggests to apply coefficients of deviation to the EU (air emission accounts) database at Eurostat of air pollutant emissions, with a different coefficient for electricity and non-electricity industries (Pasquier et al. (2018)). The emission coefficients e_j are expressed in 1 000 tonnes of CO_2 per EUR million, and thus need to be converted by the exchange rate in 1 000 tonnes per SCR million (the Central Bank rate was SCR 16.96 per euro in 2014). The coefficients were then averaged for some industries to be adjusted from a 65-row vector to a 23-row vector. Note that a single CO_2 emission coefficient of the manufacture of food, fishery, beverage and tobacco products from the EU classification in 65 industries was used for the three distinct industrial categories found in the Seychelles industrial classification. The table of emission coefficients according to the Seychelles industry classification (SIC), corresponding to a selection drawn from the ISIC (UN international standard industrial classification of all economic activities), is shown in the Appendix (Table A2).

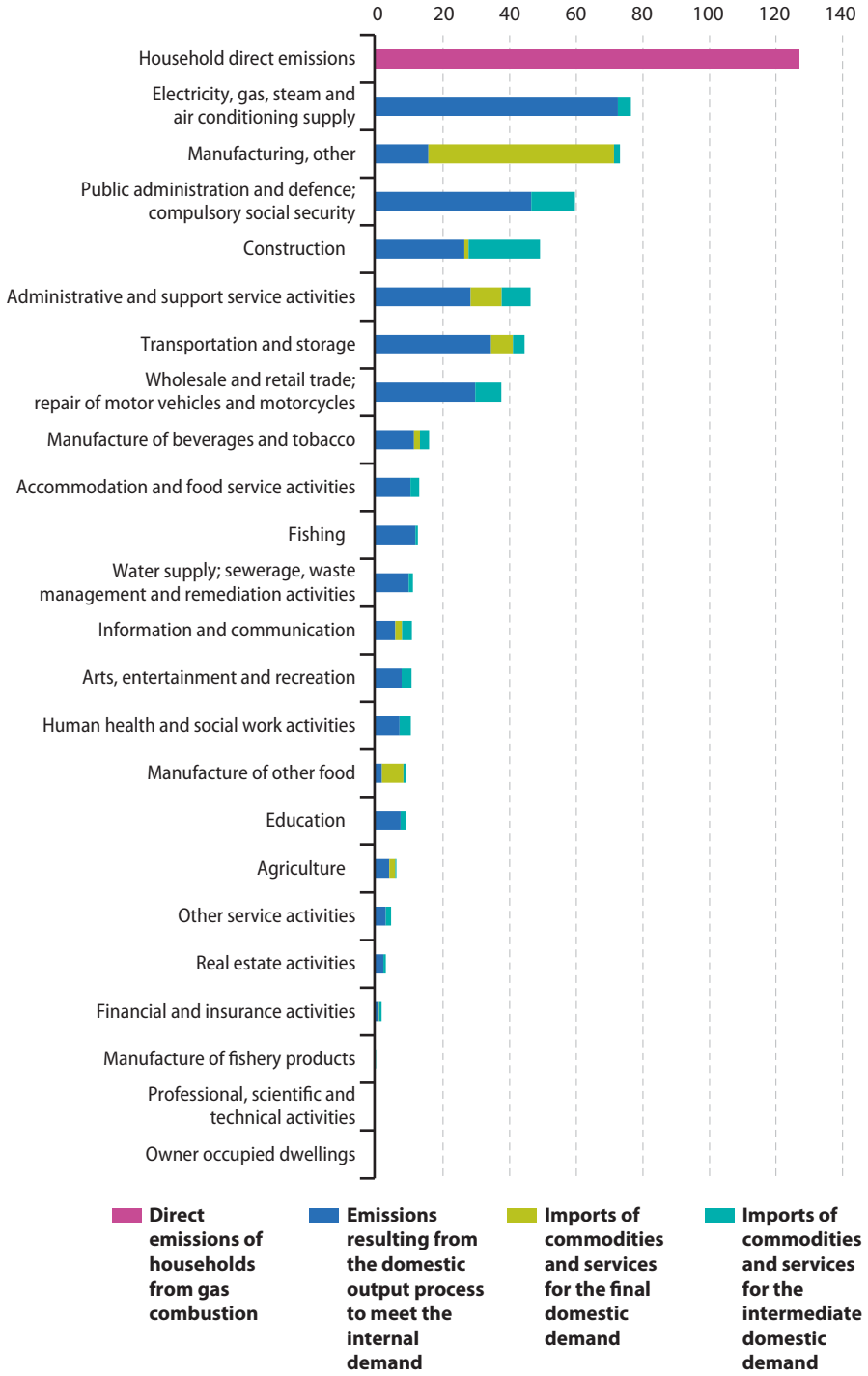
The last missing information concerned the direct emissions released by domestic households: CO_2 emissions resulting from the use of personal vehicles, air-conditioning, cookers and other devices. They are available for the EU Member States, such as France (1.76 tonnes of CO_2-equivalent per inhabitant in 2014) or the whole EU (1.59 tonnes of CO_2-equivalent per inhabitant in 2014). At the worldwide level, the CDIAC provides a figure of 1.35 tonnes of CO_2-equivalent per inhabitant, which may be used as a proxy value for the country (Boden et al. (2017)).

4.2. Results

Beyond the direct emissions of households from combustion (personal vehicles and other equipment) representing 127 000 tonnes, the indirect emission content of final demand resulting from domestic production was calculated with equation (3). The CO_2 footprint of Seychelles (direct + indirect emissions) reached 640 000 tonnes of CO_2 in 2014, in other words 3.67 tonnes per inhabitant. Such a figure may look quite high if we consider that imports represent 25 % of final domestic consumption, but local industry relies mostly on fossil fuel energy which is highly CO_2-emitting.

([7]) Available from the Eurostat website: https://ec.europa.eu/eurostat/, file of air emission accounts for 65 industries + direct emissions [env_ac_ainah_r2]. The coefficient for Africa in 2014 was 2.47 for non-electrical industries, and 2.00 for the electricity industry.

Figure 2: CO_2 **emissions resulting from domestic demand by industry and direct combustion, 2014**
(1 000 tonnes of CO_2)

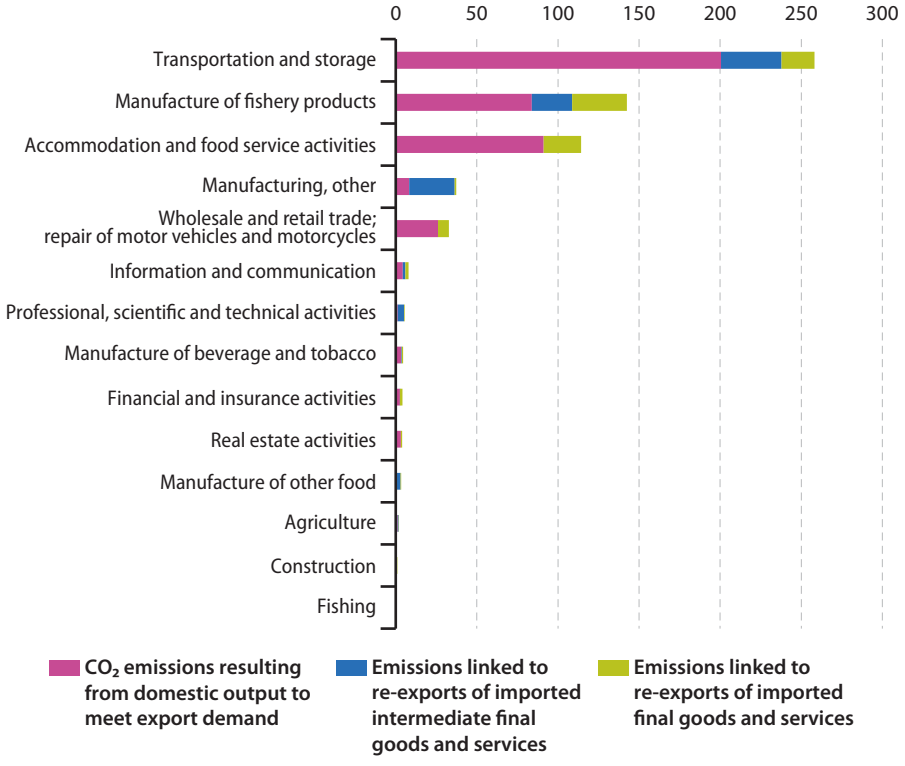


Source: own calculations

We can identify the key industries responsible for the highest level of CO_2 emissions with regard to domestic or foreign origin (Figure 2). As far as the domestic GHG emissions resulting just from domestic demand (households' consumption + enterprises' investment + government expenditure) are concerned, domestic output generates two thirds of the CO_2 footprint, and another third is from imports of intermediate and final commodities. A large proportion of territorial emissions (21 %) originate from the electricity and gas sector because of the fossil fuel origin of energy, but the public administration and defence industry is the second largest (14 %), followed by transportation and storage, wholesale and retail, administrative and support services, and construction with very close shares (10 %, 9 %, 8 % and 8 %, respectively).

The picture is rather different when looking at the import content of emissions associated with domestic demand (Figure 2). First, the 'other manufacturing' industry produces two thirds of the emissions from imports of final goods (cars, electric and electronic equipment, and so on), the remaining share resulting mostly from three industries (administrative and support services, transportation and storage, and the manufacture of other food products). As far as the emissions from imported inputs (intermediate consumption) are concerned, CO_2 emissions stem from a broader variety of industries (construction, public administration and defence, administrative and support services, wholesale and retail trade, and so on).

Figure 3: Analysis by industry of CO_2 emissions resulting from exports, Seychelles
(1 000 tonnes of CO_2)



Source: own calculations

In the national inventory, only the emissions issued by the domestic output to meet the foreign demand for exports is included, for a total amount of 427 000 tonnes. However, exported commodities such as canned fish also need imports (for example, frozen fish) whose production process is CO_2-emitting. When adding the emissions embodied in imports for external demand served by the Seychellois industries, the cumulative amount of emissions would reach 617 000 tonnes. Three industries are particularly involved in CO_2 emissions for exports, reflecting the economic specialisation of the country. Transportation and storage is the first one, in particular to meet the external demand for tourism services. The second pillar of the economy, namely the manufacture of fishery products, comes in second position, and finally, accommodation and food services (still for tourism purposes) is the third most polluting industry.

In order to summarise the previous values, the total CO_2 footprint of Seychelles is displayed in Table 1.

Table 1: CO_2 footprint, Seychelles, 2014

	Total emissions (1 000 tonnes of CO_2)	Emissions per inhabitant (tonnes of CO_2)
Direct emissions of households ([1])	127	1.35
Emissions resulting from domestic output	346	3.67
Emissions embodied in imports for final use	85	0.90
Emissions embodied in imports for intermediate use	82	0.87
TOTAL CO_2 footprint (excluding exports)	**640**	**6.79**

([1]) The direct emissions per inhabitant were extrapolated from Boden et al. (2017). The size of the Seychelles population was 94 215 inhabitants in 2014 (NBS 2021).

This first assessment of a detailed CO_2 footprint for Seychelles is consumption-based, in other words not looking at the origin of commodities that are domestically consumed. This means that emissions related to exports are excluded. Re-assessing national emissions on the simple basis of domestic production, whether the output is consumed internally or in foreign countries, would give a totally different picture. When subtracting imported emissions for final use and including the CO_2 content of exports, total CO_2 emissions related to domestic production (in other words, the national inventory) would reach 900 000 tonnes (or 9.55 tonnes of CO_2 per inhabitant), far above the CO_2 footprint in Table 1.

It should also be noted that the total CO_2 footprint per inhabitant is estimated at 6.79 tonnes but this figure encompasses direct household emissions linked with energy consumption through personal vehicles, air conditioning and other devices estimated by total emissions per inhabitant at the worldwide level (Table 1). This latter amount may therefore include also industrial emissions and be counted twice. When excluding households' direct emissions, the footprint falls to 5.44 tonnes of CO_2, a level which is quite close to the one estimated by the IEA, 5.33 tonnes of CO_2 (worldometers.info). We try to figure out why the total footprint in Table 1 is perhaps over-estimated through a sensitivity analysis (Subsection 4.3 below).

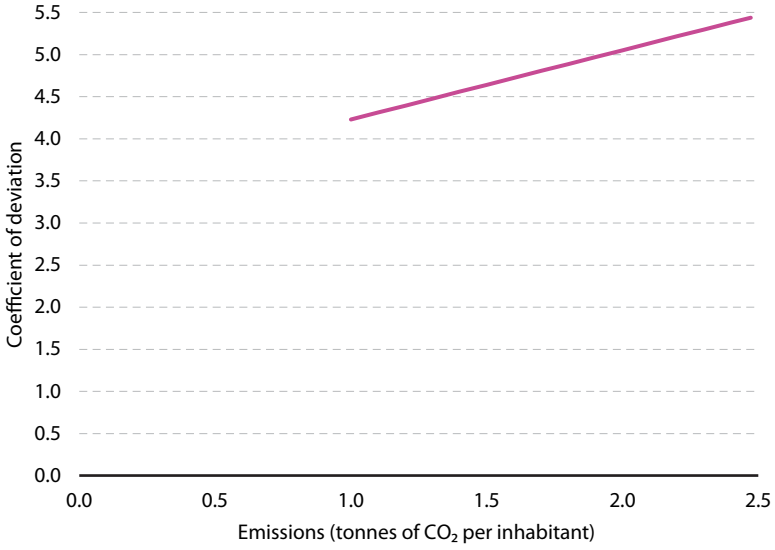
We can first compare these results with a different approach based on a MRIO model (equation 8 and equation 9 in the previous section). Because NBS does not provide any details about foreign trade combining commodities and origin or destination, it was not possible to distribute the regional effects between partner countries. We chose to integrate the trade between Seychelles and the EU for which we know the A-matrix of technical coefficients and the e-vector of emission intensity by sector. We therefore assumed that all Seychelles imports originate from the EU and that all Seychelles exports are directed to EU partners.

Such an assumption remains fairly realistic because EU Member States supplied 34.4 % of Seychelles imports and absorbed 88 % of Seychelles exports in 2020 for goods. The other major suppliers from which Seychelles imports goods are the United Arab Emirates (26.5 % in 2020), South Africa (6.5 %), India (5 %), China and Mauritius (3.5 % each) (NBS (2021)). EU visitors also represented 57 % of foreign tourism visits between January 2010 and March 2020 (source: Central Bank of Seychelles). In our estimation, just the domestic demand (excluding exports) was retained as the exogenous final demand vector. The results obtained are slightly lower than the results of Table 1: domestic CO_2 emissions resulting directly or indirectly from domestic output amounted to 307 000 tonnes (in other words, 3.26 tonnes per inhabitant). The emissions in other countries proxied by the EU and resulting from the Seychelles final demand reached 187 000 tonnes (or 1.98 tonnes per inhabitant), in other words 494 000 tonnes overall (5.24 tonnes per inhabitant), not including direct emissions by local households. Consequently, this other way of assessing CO_2 emissions gave reasonable results, only 4 % lower than the previous EE-IO model, though difficult to interpret at the industry-specific level.

4.3. Sensitivity analysis

The previous estimations of CO_2 emissions, resulting from the domestic production for internal final uses, or from CO_2 embodied in imported commodities for final or intermediate domestic uses, were based on EU intensity coefficients adjusted for Africa by the IEA coefficients of deviation (CD). We assume now that the technology used by Seychelles to produce goods and services is exactly identical to the EU technology, hence emission coefficients by industry equivalent to the EU ones in the Appendix (Table A2). The sensitivity of the CO_2 per inhabitant outcome as a function of the CD varying from 1 (equivalent to EU technology) and 2.47 (or 2.00 for the electricity and gas sector) is shown in Figure 4.

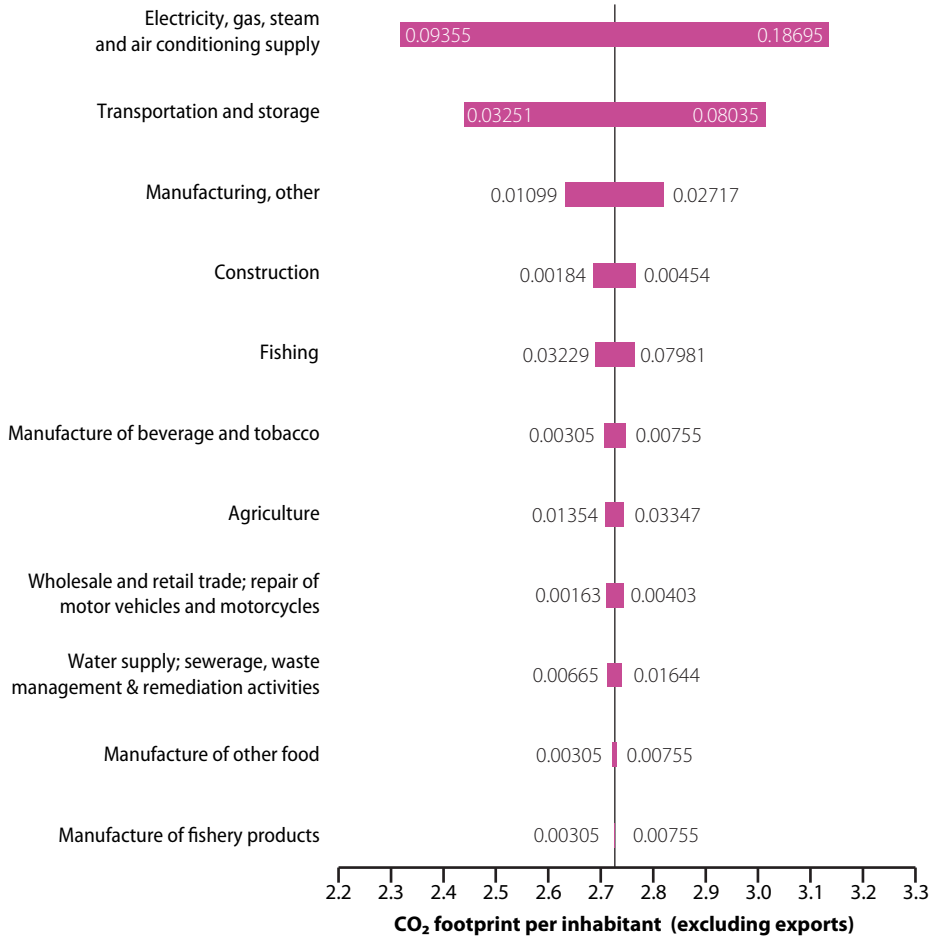
Figure 4: Sensitivity to the coefficient of deviation – CO_2 emissions per inhabitant, Seychelles



Source: own calculations with R software (R Core Team, 2021)

A perfect match between the EU and Seychelles emission coefficients (CD = 1) would result in 4.23 tonnes of CO_2 per inhabitant (emissions embodied in [domestic output + imports for final demand + imports for intermediate demand]). Adding this amount to the households' direct emissions of Table 1 would then give a total amount of 5.58 tonnes of CO_2, more in line with the overall IEA estimation of 5.33 tonnes of CO_2 in 2014. We now estimate the influence of the CD, industry by industry (Figure 5).

Figure 5: Sensitivity of CO_2 emissions per inhabitant to the coefficient of deviation analysed by industry, Seychelles, 2014



Source: own calculations with SensIt 1.53 software

In Figure 5, the individual effect of each industry is calculated by using values of the emissions coefficient (CO_2 per unit of output) between the EU (CD = 1) and Africa-adjusted emission coefficients (EU rates multiplied by a CD = 2.47 for non-electrical industries or 2.00 for the electricity and gas industry) centred on the mean between the lowest and highest values of the intensity ratio by industry. For instance, the electricity and gas CO_2 coefficient fluctuates between 0.094 and 0.187 with a mean value of 0.140. Consequently, the footprint per inhabitant would be between 2.32 and 3.14 tonnes of CO_2, other things being equal (in other words, other ratios remaining in their mid-value). Obviously, the energy sector has the most prominent effect on the CO_2 footprint, followed by the 'transportation and storage' and 'other manufacturing' industries to a lesser extent. The remaining industries have a much smaller influence on domestic emissions per inhabitant. The impact of each industry is not only explained by the intensity of emissions per unit of output value, but also by the level of final demand for the various commodities and the technology of the country in terms of inputs to produce one unit of output (Leontief matrix). In addition to the intensive use of fossil fuel-based energy, the transport and energy sectors cumulate a high level of demand from all industries and institutional end users, with strong backward and forward linkages across the economy. As a result, the footprint level is unsurprisingly linked with these two industries.

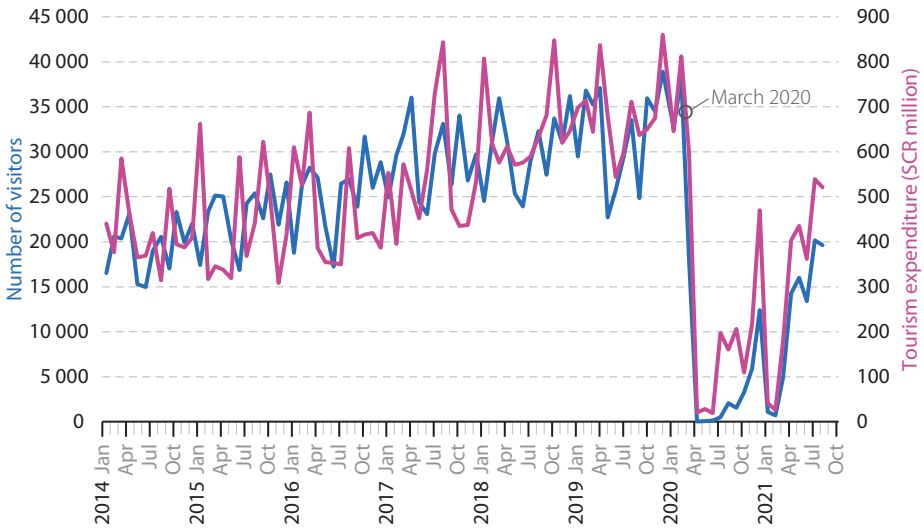
4.4. Impact of the COVID-19 pandemic

Like many other SIDS, Seychelles was particularly affected by the COVID-19 crisis after March 2020, because of trade restrictions and new priorities set for passenger or freight transport (Kontovas and Sooprayen (2020), Rassool et al. (2020), IMF (2021), AfDB (2021)). A ban on international travel was implemented by the State with effect from 23 March 2020 until 30 July 2021. Cruise ship visits were also suspended indefinitely from February 2020 and extended until 2021 (Rassool et al. (2020)). The second half of 2020 was not better than the first one because most foreign countries where tourists originate had implemented a lockdown and restricted travelling abroad. The UNDP report estimated the impact of decreasing earnings from tourism before and after the pandemic, taking 2019 as the reference (Rassool et al. (2020), pp. 12).

We assumed that the structure of exports to non-resident tourists followed the contribution of tourism to GDP published by NBS (average 2014–2019, NBS (2021)). Four exporting industries would therefore be impacted: wholesale and retail trade, transportation and storage, administrative and support service activities, and accommodation and food services. We used the NBS survey on the number of visitors and the CBS survey on the estimated earnings from tourism ([8]). The number of visitors fell by 70 % in 2020 (114 858) compared with 2019 (384 204), with a corresponding 58 % decrease of foreign currency revenues (Figure 6). Assuming that the shock had exclusively affected the level of exports of the four above-mentioned industries, proportionately to their initial value, the new vector of final uses was introduced to simulate the new levels of CO_2 emissions.

([8]) On a monthly basis, the Central Bank of Seychelles collects accurate and comprehensive information about transactions captured from credit card systems in hotels, online bookings, restaurants, tourism-related transactions, destination management companies, ferries, and so on.

Figure 6: Number of visitors and estimated tourism expenditure per month, Seychelles, January 2014 to August 2021



Source: NBS (number of visitors); Central Bank of Seychelles (expenditure)

Total exports fell by 24 %, a little less than the IMF expectation which considered other affected industries. Obviously, the consumption-based CO_2 footprint did not change because it was assumed that none of the internal institutions had modified their consumption level. The emissions of domestic output directed to exports declined by 35 %. Overall, CO_2 emissions found in the national inventory fell by 16 %, from 900 000 tonnes to 752 000 tonnes. As expected, nearly two thirds of the 148 000 tonnes of CO_2 reduction of emissions were due to lower transportation, and 30 % to the decreasing use of accommodation and food services. It is important to remember that the external shock concerned only the tourism industry in this simulation, not other sectors affected by the pandemic. However, when looking at the actual figures for 2020, it appears that a few other key industries such as the fish processing industry have been weakly affected by the pandemic, exports even increasing in 2020 both in quantity and value.

5. Discussion of the results

5.1. Why is this CO_2 emission assessment useful for Seychelles?

Like many SIDS in the world, Seychelles is particularly vulnerable to the effects of global warming and very concerned by the international commitments of reduction taken after the Kyoto Protocol in 1997 and the 2007 Bali Action Plan (UNDP (2008), Burns and Vishan (2010), Nath and Madhoo (2021)). Considering the long-term effects of climate change as equivalent to an ENSO (El Niño Southern Oscillation) episode, global warming would cost several percentage points of GDP in the long run (Robinson et al. (2010)). Despite a very small contribution to global CO_2 emissions, Seychelles has to find pathways to reduce its ecological footprint by adapting its own patterns of production and consumption. First of all, this is the only means for the country to shift away from fossil fuel energy and transition to a more sustainable economy. Secondly, SIDS depend to a large extent on foreign trade: exports on the one hand for their foreign exchange income, and imports on the other for their intermediate and final consumption.

However, the comparative advantages of developing countries tend to concentrate locally the carbon emissions while developed countries can specialise in less polluting activities (Sannassee and Seetanah (2016)). Trade openness might be wealth-creating and provide foreign currency resources to a SIDS, but often at the expense of higher environmental costs. For example, it was shown econometrically for Mauritius that 'a 1 % increase in trade openness is accompanied by an upshot of 0.60 % in CO_2 emission' (Sannassee and Seetanah (2016), pp. 175). What is the need of exporting processed food products if the spillover effects are few for the country because of foreign shareholders, profits transferred to offshore companies, massive imports of inputs, and employment of foreign workers spending their income overseas? Why should final consumption of domestic households be based on imported processed products rather than local production? Even the steady growth of tourism, a pillar of economic development for the Seychelles, is questionable in terms of sustainability (Pratt (2015)). The increasing number of visitors (+120 % between 2010 and 2019, in other words an annual average growth rate of +9 %) results in greater air traffic and emissions, deforestation to build new resorts and accommodation capacity, privatisation of land and restricted access to beaches for the local population, foreign investment resulting in outflows of capital income, imports of many intermediate and final goods, more income inequalities, and so on. The assessment of carbon emissions may send the right signals to re-direct the country's international specialisation (Sannassee and Seetanah (2016), Roth et al. (2019), Republic of Seychelles (2018)).

5.2. Which methodology for a replicable carbon assessment on a routine basis?

Two strands of methodology are usually distinguished to calculate CO_2 emissions from human activities. The first one is of microeconomic nature, with detailed information on household consumption and emission factors by type of commodity (Pasquier (2018)). The second one is more macroeconomic and combines inter-industrial data with national accounts on air

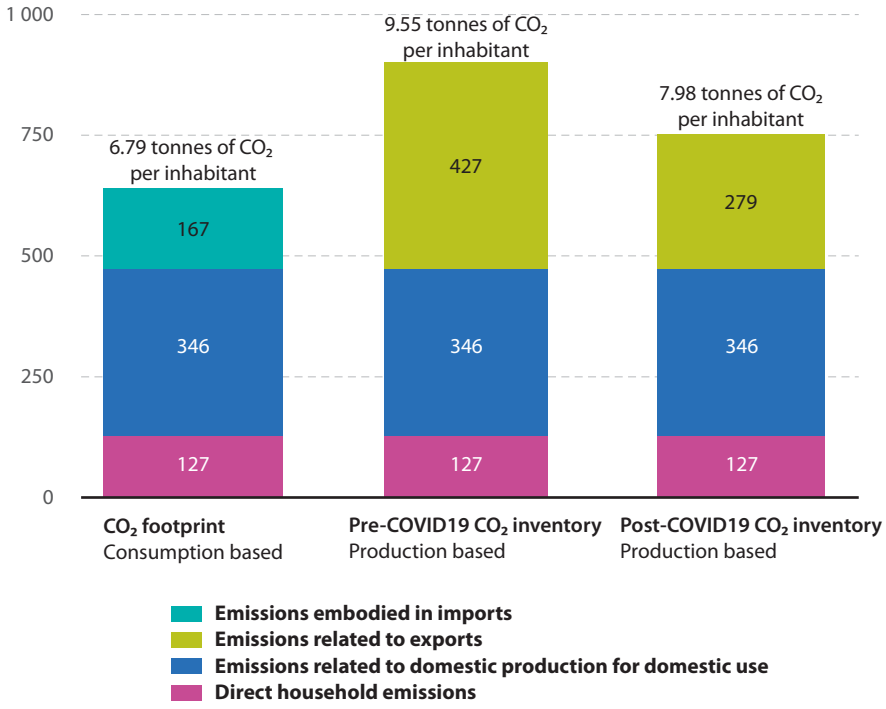
pollutant emissions (Suh (2009), Hertwich and Peters (2009), Boden et al. (2017)). The latter are rather based on a multi-regional framework, but can also be developed in a single-country framework (Miller and Blair (2009), Pasquier (2018), Boutaud and Gondrand (2018)). Differences of methodology and the level of detail may explain the divergence between the two types of approaches. For instance, the World Bank, using the CDIAC approach based on the multiregional GTAP model, found a CO_2 footprint per inhabitant of 6.32 tonnes for Seychelles in 2016 (data.worldbank.org), quite different from the value estimated the same year by the IEA with 5.43 tonnes (worldometers.com). Moreover, the first source provides a time series of CO_2 emissions with a very irregular pattern since 1971, following the booms and busts of the world economy, whereas the second one shows a more regular and increasing trend (see Figure 1). There is no absolute truth when it comes to the estimation of CO_2 emissions, but the least is to know how the calculation is made in order to simulate the effects resulting from major shocks affecting the economy, such as the COVID-19 pandemic for instance, or trade policy changes, and to reduce the overall level of air emissions.

In that respect, through the present contribution, we suggest to apply a widespread and transparent EE-IO methodology to the CO_2 footprint of Seychelles to serve as a reference basis for the coming years. Because there is no national account of air pollutant emissions yet, we used the EU air emission accounts database, which has the twofold advantage of being published online on a yearly basis and to cover the wide variety of EU Member States across different levels of industrial development and technology. Moreover, the EU is a major trade partner of the country, accounting for one third of imports and nearly 80 % of exports of goods, meaning that the technology structure materialised by the Leontief matrix and the air emission intensity could be fairly similar because the same environmental quality standards must be fulfilled by both partners.

5.3. Details about CO_2 emissions by origin and industry

The results show a CO_2 footprint of 513 000 tonnes of CO_2, not including the direct emissions of households' vehicles and air conditioning personal systems for which we have no specific data yet (640 000 tonnes otherwise). This would represent an average amount of 5.44 tonnes of CO_2 per inhabitant (or 6.79 tonnes of CO_2 including direct emissions – left-hand column of Figure 7). These amounts are quite close to the IEA estimation of 502 000 tonnes (in other words, 5.33 tonnes of CO_2 per inhabitant), showing the reliability of the estimated outcome. They are also well above the worldwide average figure of 1.35 tonnes of CO_2 per inhabitant, a difference which is consistent with the economic status of Seychelles as a high-income country, with a GDP per inhabitant of USD 14 700 in 2014 (IMF (2021)). However, the national inventory, which includes the emission content of exports and excludes that embodied in imports, was 900 000 tonnes of CO_2 (in other words, 9.55 tonnes of CO_2 per inhabitant – middle column of Figure 7), exceeding the domestic footprint. As a comparison, the respective levels of national footprint and inventory in France are the opposite, showing a footprint greater than the inventory: 10.6 compared with 7.3 tonnes of CO_2 per inhabitant respectively (Boutaud and Gondran (2018)). Proportionately, France exports relatively less and imports relatively more goods than Seychelles.

Figure 7: CO_2 footprint and inventory, Seychelles, 2019 (pre-COVID-19) and 2020 (post-COVID-19
(1 000 tonnes of CO_2)



Note: the emissions related to exports (green layer) do not include the import content of production; only the territorial emissions matter in the national inventory. The Seychelles population was 94 215 inhabitants in 2014 (Source: NBS 2021).

Source: own calculations

Another interest of the study is to disentangle the content of emissions by origin, either from imports or domestic production. This is important to show the gap between a production-based national inventory of CO_2 emissions and a consumption-based footprint where the responsibility of the country extends to the foreign nations where the commodities are produced (Wiebe and Yamano (2016), Boden et al. (2017), Wu et al. (2020)). The middle column of Figure 7 shows a great deal of CO_2 emissions related to exports, explaining that the level of emissions of the national inventory (900 000 tonnes of CO_2, production-based) exceeds by far the footprint level (640 000 tonnes of CO_2, consumption-based). Seychelles imports raw materials (for example, frozen tuna) that are further processed to be re-exported as final goods (canned tuna). The carbon emissions released by the fishing industry are imported but those included in the domestic output of canned fish products are exported, explaining why this important industry for Seychelles, representing 8 % of private jobs and 84 % of merchandise exports (NBS (2021)), does not appear among the most prominent industries captured by our estimated footprint in Section 4. Conversely, other industries like electricity and gas, public administration and defence, transportation and storage, wholesale and retail, administrative and support services are responsible for the national CO_2 footprint to a much greater extent because they reveal a pattern of domestic consumption.

6. Conclusion: towards a CO_2 abatement policy

On the basis of this first CO_2 footprint assessment, the government can take actions to reduce its footprint, mostly by substituting the fossil fuel origin of power used by inhabitants and local industries. It has started to do so, although at a slow pace, with an investment in renewable energy over the past decade. A 6 MW wind farm along with a 5.8 MW grid-tied roof top photovoltaic system supplied nearly 6 % of total electricity produced in 2020, the rest being provided by fossil fuels, mostly heavy fuel oil (PUC (2021)). The use of electric cars would be of little effect on direct household emissions as long as the electricity is carbon-based. A significant proportion of emissions related to domestic supply also comes from imports, through the transportation of goods (for example, food and beverage products) and the emissions embodied in foreign production. One type of abatement would stimulate the primary sectors of agriculture and fisheries, or promote other domestic sources of supply such as aquaculture to cover the local food demand of the population. Once again, the government has launched several actions to promote the 'blue' economy, developing coastal fisheries and aquaculture, or investing in blue bonds and marine renewable energy (Republic of Seychelles (2018)).

Another issue to deal with concerns the important content of emissions related to exports, whether they concern the tourism or the fish processing industries. We have shown that the national inventory (in other words, domestic emissions including the demand for exports) is greater than the national footprint. This is the case of many open economies like SIDS attempting to attract foreign exchange revenues, thus creating a livelihood for the population. Seychelles has been quite successful over the past decades to create an endogenous development of its economy through tourism (accommodation and food services, air traffic, support services such as tour operators, banking, arts and entertainment activities, and so on). However, the environmental cost could be important for Seychelles because this luxury industry relies to a great extent on imports and foreign investment, and the 2020 pandemic has also demonstrated the vulnerability of islanders with a strong decline (−70 % in 2020 compared with 2019) in the number of visitors (Rassool et al. (2020)). In this research, we have attempted to estimate the post-COVID impact on CO_2 emissions through the simulation of a 58 % decrease of expenditure from tourism that has been observed by the Central Bank of Seychelles in 2020. This would be equivalent to a 24 % reduction of total exports of goods and services for the country, resulting in a 16 % reduction of CO_2 emissions (right-hand column of Figure 7). Two thirds of this reduction of emissions would be obtained by the lower use of transportation services, and one third by the decreasing foreign demand for accommodation and food services.

This first attempt to estimate the CO_2 footprint of Seychelles by using a standard EE-IO approach has also several limitations, such as the lack of air emissions data monitored by the country, or the incomplete input–output table with regard to the distinction between domestic and imported intermediate consumption. Many efforts are under way to improve the data collection scheme, and a first supply and use table is now available and can be used to develop IO-based modelling and planning models (NBS (2021)). Further efforts are still needed prior to achieving a bigger MRIO framework, a social accounting matrix, a material flow analysis or a computable general equilibrium model, in order to trace more accurately the sinks and sources of carbon emissions, to assess other types of ecological footprints (for example, plastics) and find effective pathways of reducing outflows. At least this first estimation will serve as a transparent and replicable basis to follow the evolution of the CO_2 footprint and develop some mitigating projects for the country in a near future.

7. Acknowledgements

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8. Appendix

Table A1: Domestic input–output table for 23 industries, Seychelles, 2014
(SCR million)

SPC	Intermediate uses											
	AA	AB	CA	CB	CC	CD	D	E	F	G	H	I
AA	16	0	2	23	6	0	0	0	4	5	2	152
AB	0	0	180	0	0	0	0	0	0	0	0	25
CA	0	0	1 513	0	0	0	0	0	0	1	1	77
CB	1	0	27	14	3	0	0	0	2	8	2	114
CC	0	0	0	1	29	0	0	0	0	8	1	121
CD	3	14	98	3	25	48	121	11	212	39	153	51
D	3	4	24	8	24	6	3	65	25	95	51	300
E	0	0	1	0	1	0	1	2	1	17	4	12
F	1	1	25	1	5	7	4	4	81	26	39	47
G	0	0	0	0	0	0	0	0	0	0	0	0
H	2	3	241	4	16	12	0	8	49	170	571	78
I	1	1	7	0	7	2	0	4	2	17	124	53
J	1	1	18	1	5	6	0	3	12	36	50	60
K	19	4	20	1	3	5	0	4	42	68	53	115
LA	5	9	6	6	5	15	1	2	32	259	112	114
LB	0	0	0	0	0	0	0	0	0	0	0	0
M	0	0	41	1	5	2	0	1	7	19	12	74
N	2	3	23	1	1	2	3	8	5	40	221	38
O	2	4	33	1	2	3	0	2	7	15	13	54
P	1	2	15	0	1	1	0	1	3	9	6	25
Q	0	1	6	0	0	0	0	0	1	3	2	10
R	0	0	3	0	0	0	0	0	1	3	1	18
S	0	0	0	0	0	0	0	0	0	0	0	0
Total domestic intermediate consumption	59	47	2 286	66	137	110	135	117	486	838	1 417	1 538
Imports	44	98	1 570	100	215	336	811	86	1 476	465	1 402	1 312
Taxes on products	33	11	6	148	598	1 152	0	0	20	0	17	718
Gross value added	220	192	811	30	270	174	344	84	1 076	1 119	1 200	2 037
Output	356	349	4 673	344	1 220	1 772	1 289	286	3 058	2 422	4 035	5 605

Table A1 (cont.): Domestic input–output table for 23 industries, Seychelles, 2014
(SCR million)

SPC	Intermediate uses										
	J	K	LA	LB	M	N	O	P	Q	R	S
AA	0	0	0	0	0	0	0	0	0	0	0
AB	0	0	0	0	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	0	0	0	0	0
CB	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	3	0	0	0	0	0	0	1	0
CD	36	8	22	0	3	15	35	4	25	18	10
D	37	7	86	0	3	10	91	25	14	18	7
E	1	0	3	0	0	0	78	4	2	4	0
F	22	28	17	0	9	10	109	18	1	17	5
G	0	0	0	0	0	0	0	0	0	0	0
H	10	5	26	0	9	456	45	3	5	14	4
I	23	4	3	0	3	2	57	18	31	4	0
J	7	23	26	0	6	17	49	11	6	8	6
K	13	136	142	0	5	30	30	5	19	18	4
LA	67	64	33	0	25	31	86	1	45	21	22
LB	0	0	0	0	0	0	0	0	0	0	0
M	42	59	12	0	26	9	39	4	2	3	1
N	7	32	32	0	3	4	169	19	2	8	1
O	9	17	10	0	5	6	5	3	2	5	2
P	5	8	5	0	2	3	12	5	1	3	1
Q	2	3	2	0	1	1	1	1	21	1	0
R	1	2	1	0	0	1	8	0	0	1	0
S	0	0	0	0	0	0	0	0	0	0	0
Total domestic intermediate consumption	280	396	423	0	100	594	816	121	178	143	64
Imports	401	301	236	0	123	310	489	53	179	144	74
Taxes on products	175	6	30	0	0	36	0	0	2	55	10
Gross value added	596	733	581	1 562	317	421	1 656	552	369	199	125
Output	1 452	1 436	1 271	1 562	540	1 361	2 961	726	728	542	273

Table A1 (cont.): Domestic input–output table for 23 industries, Seychelles, 2014
(SCR million)

SPC	Final uses				
	Household	Government	Investment	Exports	Total uses
AA	116	0	0	30	356
AB	143	0	0	0	349
CA	9	0	0	3 072	4 673
CB	127	0	0	44	344
CC	827	0	0	230	1 220
CD	205	0	338	275	1 772
D	382	0	0	0	1 289
E	154	0	0	0	286
F	89	0	2 444	48	3 058
G	1 300	0	0	1 123	2 422
H	342	0	0	1 964	4 035
I	551	0	0	4 690	5 605
J	602	44	0	453	1 452
K	157	83	0	459	1 436
LA	143	0	0	167	1 271
LB	1 562	0	0	0	1 562
M	0	0	0	180	540
N	735	0	0	0	1 361
O	18	2 743	0	0	2 961
P	186	430	0	0	726
Q	194	477	0	0	728
R	430	71	0	0	542
S	273	0	0	0	273
Total domestic intermediate consumption					
Imports	2 844	21	2 343	4 766	
Taxes on products					
Gross value added					
Output	11 389	3 869	5 125	17 504	

Table A1 (cont.): Domestic input–output table for 23 industries, Seychelles, 2014
(SCR million)

SPC	
AA	Agriculture
AB	Fishing
CA	Manufacture of fishery products
CB	Manufacture of other food
CC	Manufacture of beverage and tobacco
CD	Manufacturing, other
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage, waste management
F	Construction
G	Wholesale and retail trade; repair of motor vehicles
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
LA	Real estate activities
LB	Owner occupied dwellings
M	Professional, scientific and technical activities
N	Administrative and support service activities
O	Public administration and defence
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation
S	Other service activities

Table A2: CO_2 emission coefficients for 23 industries, Seychelles, 2014
(1 000 tonnes of CO_2 per SCR million of output)

	e^c_j EU-27	e^d_j Seychelles
Agriculture	0.0135	0.0335
Fishing	0.0323	0.0798
Manufacture of fishery products	0.0031	0.0075
Manufacture of other food	0.0031	0.0075
Manufacture of beverage and tobacco	0.0031	0.0075
Manufacturing, other	0.0110	0.0272
Electricity, gas, steam and air conditioning supply	0.0936	0.1870
Water supply; sewerage, waste management	0.0067	0.0164
Construction	0.0018	0.0045
Wholesale and retail trade; repair of motor vehicles	0.0016	0.0040
Transportation and storage	0.0325	0.0803
Accommodation and food service activities	0.0014	0.0035
Information and communication	0.0005	0.0013
Financial and insurance activities	0.0003	0.0007
Real estate activities	0.0002	0.0004
Owner occupied dwellings	0.0000	0.0000
Professional, scientific and technical activities	0.0006	0.0015
Administrative and support service activities	0.0009	0.0022
Public administration and defence	0.0014	0.0035
Education	0.0013	0.0031
Human health and social work activities	0.0011	0.0028
Arts, entertainment and recreation	0.0013	0.0033
Other service activities	0.0012	0.0029

Note: the EU-27 values are the intensity coefficients of CO_2 emissions per unit of output value, expressed in 1 000 tonnes of CO_2 per € million (from Eurostat NAMEA data, https://ec.europa.eu/eurostat/) and converted in 1 000 tonnes of CO_2 per million Seychelles rupees with an exchange rate of 16.96 (CBS rate in 2014). The Seychelles emission rate is the EU-27 coefficient adjusted for Africa with regard to the IEA deviation coefficients of 2.47 for non-electrical industries and 2.00 for the electricity sector.

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4 Consistency of property income

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Abstract: This article aims at presenting a tool to identify issues to improve the consistency of the financial and non-financial accounts by institutional sectors. The international statistical standards clearly relate property income and financial assets categories. It is thus possible to derive implicit rates of return, in other words property income in relation to the respective financial position. Implicit returns are calculated to compare the data across institutional sectors and EU Member States with a metric that is intuitive to compilers and users of sector accounts.

For Member States, three broad categories of property income are analysed: (i) interest, (ii) return on equity (dividends, withdrawals …) (iii) other property income (from insurance, pensions investment funds…) and the related financial positions. Implicit rates of return were compiled using the most detailed national data of the October 2020 vintage. Most of the observed variations across sectors and Member States are assessed as largely plausible. However, some observed differences necessitate further analysis for specific resident sectors, as well as for the positions in relation to the rest of the world.

Summarising, the results are fairly plausible for implicit interest rates and implicit rate of returns for other property income, and Member State differences are limited. For the implicit return on equity, large cross-Member State differences still exist. The outliers are particularly large for non-financial corporations liabilities and for household assets. Equity issued by non-financial corporations and held by households is largely in the form of unlisted shares and other equity, which makes the recording of the financial positions as well as the respective property income more difficult than for listed shares.

Another important result is that the data show no major differences between annual and quarterly rates for implicit interest, return on equity and return on other property income. Structural and repetitive significant inconsistencies across different income type variables and sectors were only observed for few Member States.

JEL codes: C82, E01, G20

Keywords: national accounts, sector accounts, statistical practices

([1]) European Central Bank (ECB), DG-Statistics – External statistics and sector accounts.
([2]) Eurostat, Unit C2 – National accounts production.

1. Introduction

The relationship between financial assets and liabilities and the related property income is an important issue to improve consistency between financial and non-financial transactions (in other words, vertical consistency).

In April 2020, 14 EU Member States ([3]) indicated that they regularly review the consistency of property income and financial assets. In three of those cases (Germany, Hungary and Italy), consistency is achieved through a fully integrated approach, meaning that financial assets and liabilities are used when compiling property income in the non-financial accounts. In some other Member States (Belgium, Spain, Cyprus, Austria, Finland and Sweden), an integrated approach of compiling property income and financial positions is applied only to some types of property income (for example, only to interest or to reinvested earnings).

This note presents an overview of the consistency of property income and the related financial positions. Section 2 provides an overview of the methodological background. Sections 3, 4 and 5 are devoted to a detailed analysis of each of the elements of property income: interest rates, return on equity and other property income. Section 6 presents a detailed analysis of the consistency between annual and quarterly data. Finally, Section 7 includes concluding remarks.

The following analysis focuses on the comparison of implicit rates of return for assets and liabilities across Member States. Overall, the assumption that implicit return rates for assets and liabilities as well as implicit return rates across Member States should be closely related is not so straightforward. However, the presence of outliers can indicate that for some instruments the assets/liabilities are underestimated when implicit rates of return are high (or overestimated when implicit rates of return are low) and/or the relevant property income categories are overestimated (or underestimated). In other words, outliers can indicate a possible cause of discrepancy between financial and non-financial transactions as errors in the estimation of property income have a direct effect on non-financial net lending/net borrowing. For errors in the estimation of financial stocks, the link to financial net lending / net borrowing is not straightforward; however, detecting such errors may help in finding related issues that do affect the vertical discrepancy such as incomplete coverage or delimitation issues.

2. Methodological background

Property income (D.4) accrues when the owners of financial assets and natural resources put them at the disposal of other institutional units.

This paper compares the consistency of financial assets and liabilities and their related property income flows by sector ([4]) across the Member States for 2018. Due to a lack of data

([3]) Information available as of April 2020 and collected in the framework of the stocktaking exercise on national reconciliation practices for the financial and non-financial accounts by institutional sector.
([4]) For Sections 3, 4 and 5, quarterly data were used when available both for financial and non-financial sectoral accounts. In case of the unavailability of quarterly data (for at least one of the two domains), an annual frequency was chosen for both.

availability for 2018, 2017 data are used for Bulgaria. The analysis is based on the October 2020 vintage. The focus of the analysis is on households and on financial and non-financial corporations (the results for general government, for which vertical discrepancies are generally much smaller, are shown in the annex).

Annual data are used for Greece in this article because, in October 2020, Greece transmitted revised annual non-financial sector accounts that incorporated the results of the benchmark revision from 2010 onwards but are still pending for the quarterly data. This means that, temporarily, the quarterly non-financial accounts for Greece are not fully aligned with the annual non-financial accounts.

According to ESA 2010 paragraph 4.41, property income (D.4) is defined as '… the sum of investment income and rent.' The only property income component which is not covered in this analysis is D.45 (rent) as it relates to non-financial assets only.

ESA 2010 paragraph 4.41 classifies investment income as follows:

- Interest (D.41)
- Distributed income of corporations (D.42)
  - Dividends (D.421)
  - Withdrawals from income of quasi-corporations (D.422)
- Reinvested earnings on foreign direct investment (D.43)
- Other investment income (D.44)
  - Investment income attributable to insurance policyholders (D.441)
  - Investment income payable on pension entitlements (D.442)
  - Investment income attributable to collective investment funds shareholders (D.443)

And the corresponding financial assets and liabilities are:

- Stock of deposits (F.2M)
- Debt securities (F.3)
  - Short-term debt securities (F.3S)
  - Long-term debt securities (F.3L)
- Loans (F.4)
  - Short-term loans (F.4S)
  - Long-term loans (F.4L)
- Equity (F.51): listed and unlisted shares, and other equity
- Investment fund shares/units (F.52)
- Insurance, pension and standardised guarantees (F.6)
- Other accounts payable/receivable (F.8)

For this analysis, three main categories of property income have been identified and each of them was divided by the corresponding financial instruments ([5]) (Table 1) with the aim of computing their implicit rates of return. Resources have been related to assets and uses have been related to liabilities.

([5]) Financial transactions can be classified by the type of income they generate. Reinvested earnings on foreign direct investment (D.43) are generated by corporations with listed shares (F.511) as well as by corporations with unlisted shares (F.512) and other equity (F.519). Thus, only the sum of D.42 (generated by listed shares) and D.43 can be related to equity (F.511 + F.512 + F.519). The transmission of these detailed (3-digit) breakdowns of D.44 is voluntary for quarterly data. In this document D.44 is used to have the possibility of including the largest number of Member States.

Table 1: Overview

	Assets	Liabilities
Implicit interest rate	receivable: D.41G / assets: F.2M + F.3 + F.4	payable: D.41G / liabilities: F.2M + F.3 + F.4
Implicit return on equity	receivable: D.42+D.43 / assets: F.51	payable: D.42+D.43 / liabilities: F.51
Implicit return on other property income	receivable: D.44 / assets: F.52 + F.6	payable: D.44 / liabilities: F.52 + F.6

The implicit rates of return have been calculated as the relation between the (four quarter cumulated or annual) property income (receivable/payable) and the average stock (assets/liabilities) of the period. The average stock has been calculated as an average of the stock at the beginning of the period (end of previous period) and the stock at the end of the period.

3. Implicit interest rates ([6])

Interest is a form of income that is receivable by the owners of certain kinds of financial assets, namely deposits, debt securities, loans and other accounts receivable for putting the financial asset at the disposal of another institutional unit ([7]).

In order to compute implicit interest rates for each Member State, the stocks of deposits (F.2M), debt securities (F.3), and loans (F.4) (and other accounts payable/receivable (F.8)) have been compared with paid/received interest before the correction for FISIM (financial intermediation services indirectly measured), in other words gross interest (D.41G). Gross interest was divided by the respective financial position as this ratio is comparable to the interest rates observable in financial markets. Gross interest should thus be more comparable across Member States and sectors. As a result, the analysis is not affected by different estimation methods for the implicit service fees on loans and deposits.

3.1. Comparing implicit interest rates for assets and liabilities: resident sector

Figure 1 shows, on the left-hand side, the resident sector (S.1) implicit interest rate for assets and liabilities for the Member States and for the euro area aggregate. The values considered for the euro area aggregate are those published by Eurostat and the ECB and do not necessarily equal the sum of Member State data due to the integration of additional data sources (such as the euro area balance of payments) and balancing adjustments.

For the resident sector, it can be considered that most assets are matched by resident liabilities, thus assets and liabilities should have the same risk and maturity structure. In other

([6]) The analysis was performed excluding other accounts receivable (F.8). While ESA specifies that interest income may accrue on F.8, data availability for this instrument and for the related interest income may not be comparable across Member States. The charts including the instrument F.8 → (D.41G)/(F.2M+F.3+F.4+(F.8)) are available in an Annex but are not commented, as the main results presented here are not affected be the inclusion or exclusion of F.8.

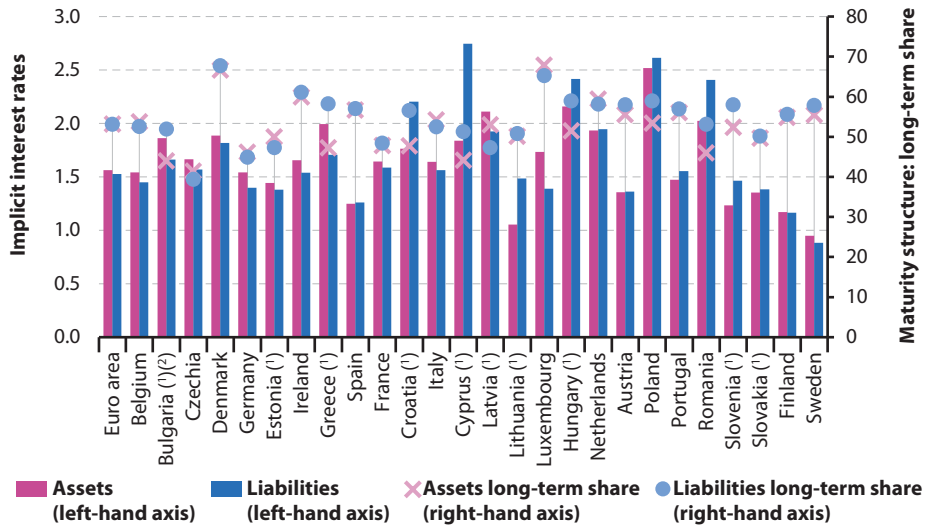
([7]) *Handbook of National Accounting: Financial Production, Flows and Stocks in the System of National Accounts*. ESA 2010 (paragraph 4.42) specifies that – in addition to these four instruments – income on SDR holdings and allocations and income on unallocated gold accounts are also treated as interest; however, these amounts are not included in the calculations as they are relatively small.

words, financial instruments issued and held by resident sectors should result in equal implicit interest rates of assets and liabilities. For most of the Member States, the resident sector implicit interest rates are similar for assets and liabilities; however, in four Member States (Croatia, Cyprus, Lithuania and Romania) the implicit interest rates are relatively higher on the liability side, and in two Member States (Greece and Luxembourg) they are significantly higher on the asset side. These exceptions may be due to higher risk and/or compositional effects (such as the longer maturity) on assets and liabilities with non-resident counterparts ([8]).

On the right-hand scale it is possible to observe the share of long-term assets/liabilities over the total stocks generating interest in the resident sector ([9]). In general, one would expect to observe higher interest rates when the share of long-term stocks is higher, and this positive correlation could be used as a proxy to explain differences in the level of implicit interest rates among Member States. For some small Member States, due to the high share of cross-border assets and liabilities, the maturity structure is indeed different between assets and liabilities (for example, Croatia and Cyprus) and it is possible to observe a larger spread among implicit interest rates.

For the individual resident sectors, differences in risk and maturity structure between assets and liabilities may play a larger role; this issue will be further investigated in Section 3.3.

Figure 1: Implicit interest rates and maturity structure for the total economy (S.1), 2018
(%)



Note: Malta, not available.

(1) Based on annual data rather than annualised quarterly data.
(2) 2017.

Implicit interest rates are generally between 1.0 % and 2.0 % with some exceptions including: Sweden, where rates are slightly below 1.0 %, Lithuania, with lower rates on the assets sides; Cyprus, where the rates from the liability side are above 2.0 %.

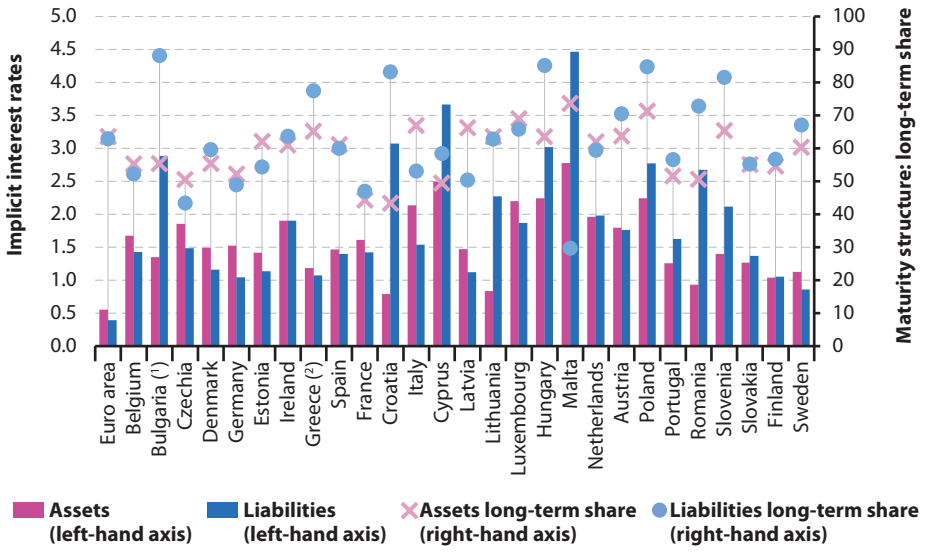
([8]) The consistency of the accounts ensures that S.1 + S.2 must be equal for both assets and liabilities. This means that if we observe a higher (lower) interest rate on the asset side of the resident sector, then we must observe a higher (lower) interest rate on the asset side for the resident position in relation to the rest of the world. Please see Section 3.2 for further information.
([9]) The share of long-term is defined as: (F.3L+F.4L)/(F.2M+F.3+F.4)

3.2. Comparing implicit interest rates for assets and liabilities: resident sector in relation to the rest of the world

As mentioned, the differences between the implicit interest rates for assets and liabilities for the resident sector in relation to the rest of the world (Figure 2) drive the differences for assets and liabilities for the resident sector in relation to all counterparts (Figure 1). Bulgaria is the only Member State that does not fit this expected pattern. The observed differences between asset and liabilities implicit interest rates (Figure 2) may be explained by different maturity risk structures of the position in relation to the rest of the world, for example a higher implicit interest rate on the asset side may be due to a longer maturity structure of assets compared with liabilities for Czechia, Estonia, Italy, Latvia and Malta. This may explain the lower values as well for the asset implicit interest rates in Bulgaria, Croatia, Cyprus, Hungary, Poland, Portugal, Slovenia, Slovakia and Finland. The lower interest rate on liabilities – despite equal long-term shares for example for Belgium, Denmark, Germany and Luxembourg – is likely due to the perceived lower risk in these Member States. Lower interest rates on liabilities for example in Greece despite the long-term maturity are possibly due to some liabilities granted at preferential, low interest rates. Not easily explainable are the differences in Lithuania which exhibits much lower implicit interest rates on assets, despite a similar share of long-term assets and liabilities.

Figure 2: Implicit interest rates and maturity structure for the total economy positions in relation to the rest of the world (S.2), 2018

(%)



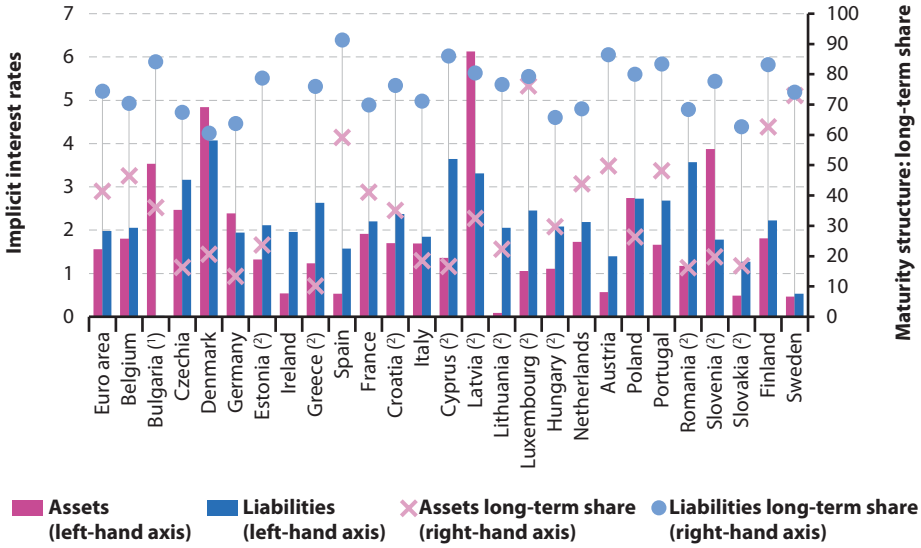
(1) 2017.
(2) Based on annual data rather than annualised quarterly data.

3.3. Comparing implicit interest rates for assets and liabilities: resident sector breakdown

NON-FINANCIAL CORPORATIONS

Figure 3 shows that there is considerable variation in the implicit interest rates of **non-financial corporations (NFCs)** across Member States. In general, implicit interest rates are higher on the liability side which is in line with the usually longer maturity of liabilities. In addition, given that gross interest of a FISIM consumer is compared here, this is to be expected as gross interest includes the service charge (FISIM) on the liability side, whereas FISIM leads to a lower interest paid to the asset holder ([10]). There are some exceptions in which NFCs receive significantly higher implicit rates on assets (Bulgaria, Denmark, Germany, Latvia and Slovenia), even though the maturity structure for assets and liabilities is similar to most Member States.

Figure 3: Implicit interest rates and maturity structure for non-financial corporations (S.11), 2018
(%)



Note: Malta, not available. Ireland: long-term shares not available.

(1) 2017.
(2) Based on annual data rather than annualised quarterly data.

Values are considerably higher in Denmark ([11]) and Latvia (4.9 % for assets and 4.0 % for liabilities) and for Cyprus and Romania (3.7 % for liabilities) than in other Member States. The case of Denmark appears strange when one considers the proportion of long-term stocks held by NFCs. In all other cases, the implicit rates on the asset side are generally low, below 1.5 %; in a few Member States, the rates are close to or below 0.5 % (Ireland, Spain, Cyprus, Lithuania, Austria ([12]), Romania, Slovakia and Sweden). In Lithuania, Romania or Slovakia,

([10]) For details on FISIM see the dedicated Chapter 14 in ESA 2010.
([11]) A full implementation of new source data is being carried out in Denmark; such an adjustment will be undertaken with the next benchmark revision and is expected to affect the interest levels dramatically.
([12]) Austrian NFCs usually do not have high volumes of debt securities on the asset side. They hold 10 times more deposits than debt securities. This could provide an explanation.

this could be explained by the high share of short-term stocks while for the rest there is no evident reason for the very low interest rate on assets; it could be related to different instrument composition across Member States in other words deposits with close to zero (or possibly negative) interest rates, while debt securities may have higher returns.

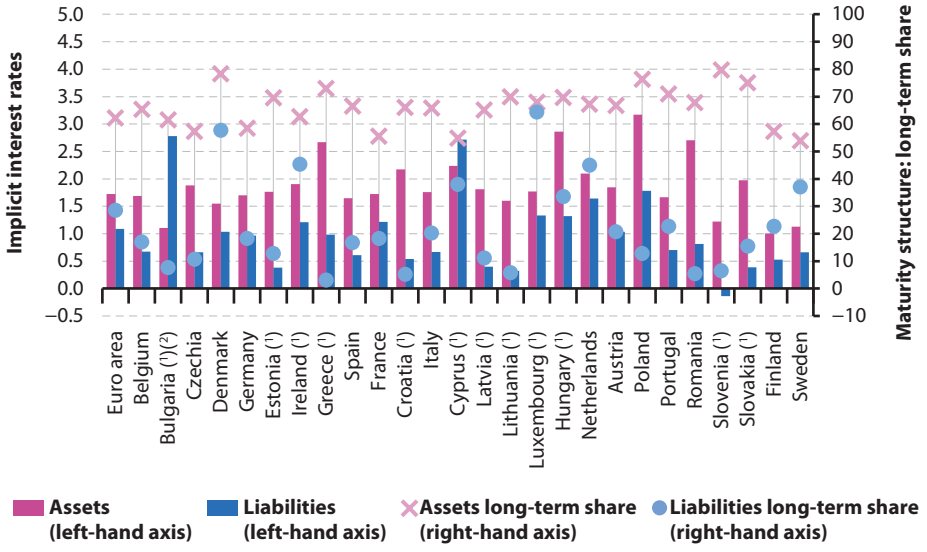
FINANCIAL CORPORATIONS

For **financial corporations,** implicit interest rates (Figure 4) are generally much higher for assets than for liabilities which reflects the maturity transformation of financial intermediaries. Financial corporations generally hold a high share of long-term instruments on the asset side and a high share of short-term instruments on the liability side (for example, deposits). In addition, for financial corporations as FISIM providers, FISIM is added to net interest on the asset side and deducted on the liability side. Implicit interest rates are always higher on the asset side except in Bulgaria and Cyprus.

Overall, interest rates are consistent across Member States in the euro area (slightly higher in Estonia, Greece, Cyprus and Slovakia). The slightly negative implicit interest rate on liabilities in Slovenia may be explained by monetary financial institutions charging depositors for the acceptance of deposits. In non-euro area Member States, interest rates differ substantially; they are high in Bulgaria, Hungary, Poland and Romania and low in Sweden. Considering the maturity structure, we observe a very low long-term share (3 %) on the liability side for Greece but a high implicit interest rate, and a similar situation for Czechia (9 %) and Romania (5 %). The opposite is observed for Sweden (35 %), where one would expect higher interest rates for the liability side.

Figure 4: Implicit interest rates and maturity structure for financial corporations (S.12), 2018

(%)



Note: Malta, not available.

(1) Based on annual data rather than annualised quarterly data.
(2) 2017.

HOUSEHOLDS

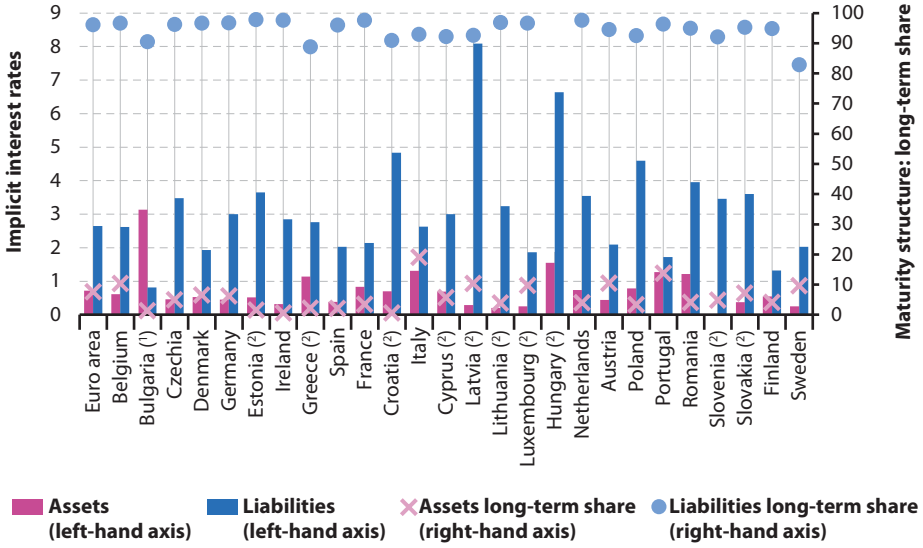
Implicit interest rates in the **households sector** (Figure 5) are, as expected, higher on the liability side as households are FISIM consumers (see explanation in NFC section). Household sector liabilities mainly consist of loans. In the euro area, interest rates on the liability side are relatively high in Latvia (8 %) while they are below 4 % in other euro area Member States. Non-euro area Member States show high liability side interest rates in the case of Croatia, Hungary and Poland; in the other non-euro area Member States interest rates on liabilities are below 4 % and therefore generally in line with the observed values for the euro area Member States.

On the asset side, implicit interest rates are generally low, below 1 % in most Member States. The highest values are observed in Italy (1.2 %), Greece and Portugal (1.1 %) for the euro area Member States and Bulgaria (2.5 %) for the non-euro area Member States.

It should be noted that an important part of assets and property income for households stems from the claims on insurance and pension schemes and these are shown in Section 5.

Figure 5: Implicit interest rates and maturity structure for households and NPISH (S.1M), 2018

(%)



Note: Malta, not available. Hungary: long-term shares not available.

(1) 2017.

(2) Based on annual data rather than annualised quarterly data.

4. Implicit return on equity

Implicit rates of distributed income on equity – for simplicity called return on equity – have been calculated comparing the sum of distributed income of corporations (D.42) ([13]) and reinvested income on foreign direct investment (D.43) with equity (F.51). Equity (F.51) comprises listed and unlisted shares and other equity. A more specific matching of property income with the respective financial instrument is not possible as both D.42 and D.43 may accrue to all subcategories of equity. The analysis has been carried out for all relevant positions of the resident sectors of the economy. Market values for assets and liabilities of unlisted shares and other equity are generally difficult to obtain or estimate. This is why abnormal yields could flag difficulties in non-financial and – in particular – financial accounts.

4.1. Comparing implicit return on equity for assets and liabilities: resident sector

Comparing the return on equity for the resident sector across Member States (Figure 6), the implicit rate of return is generally between 2 % and 7 %. Among the euro area Member States, Luxembourg shows particularly low implicit return on equity, below 1.5 %; a similar situation can be observed for Croatia among the non-euro area Member States.

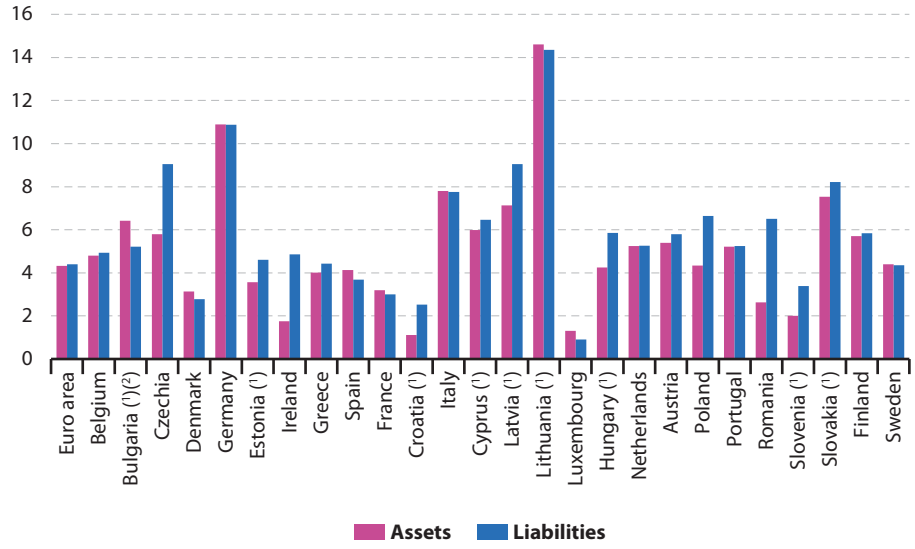
Six Member States present notably higher rates of return, both on the asset and on the liability side: Czechia (5.8 % and 9.0 %), Germany (both 10.9 %), Italy (both 7.8 %), Latvia (7.1 % and 9.0 %), Lithuania (14.6 % and 14.3 %) and Slovakia (7.5 % and 8.2 %), and some of them are more than double the euro area average whose implicit return on equity is close to 4.5 % on both sides. In general, the spread between assets and liabilities is small, with some exceptions. For instance, in Czechia, Ireland and Romania the spread is higher than 2.5 percentage points.

4.2. Comparing implicit return on equity for assets and liabilities: resident sector in relation to the rest of the world

As shown in Figure 7, the non-resident sector generally presents rates of returns between 4 % and 6 % on the asset side. The liability side is slightly more heterogeneous. Czechia, Latvia, Lithuania, Poland and Romania show rates above 10 % and are also the Member States with the largest spread between assets and liabilities. It is also worth noting the low yields for Luxembourg (less than 2 %) which may be related to the high outstanding amounts of unlisted shares and other equity.

([13]) D.42 covers dividends (D.421) and withdrawals from income of quasi-corporations (D.422).

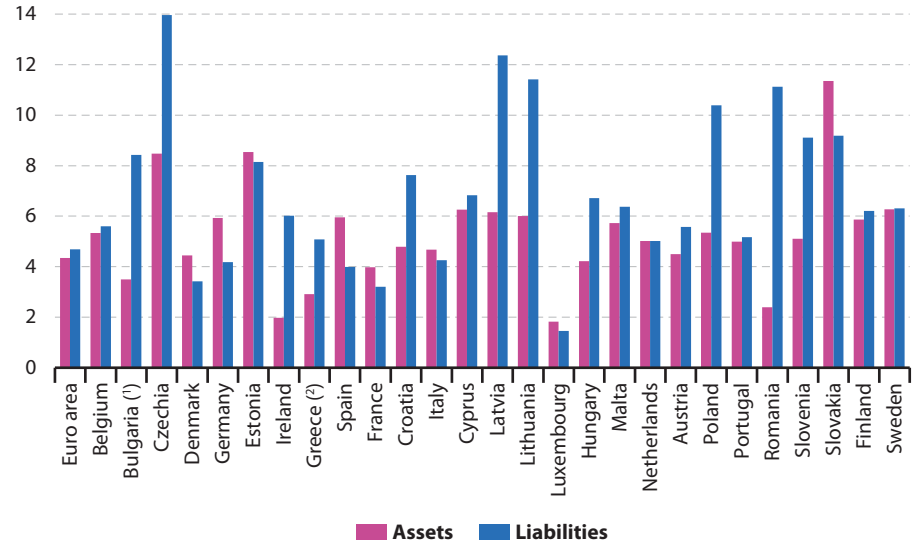
Figure 6: Implicit return on equity for the total economy (S.1), 2018
(%)



Note: Malta, not available.

(1) Based on annual data rather than annualised quarterly data.
(2) 2017.

Figure 7: Implicit return on equity for the total economy positions in relation to the rest of the world (S.2), 2018
(%)



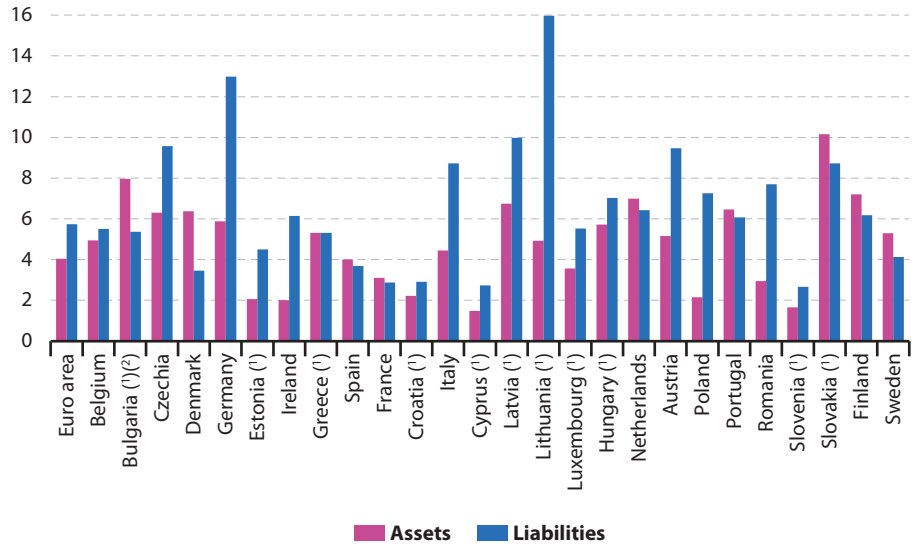
(1) 2017.
(2) Based on annual data rather than annualised quarterly data.

4.3. Comparing implicit return on equity for assets and liabilities: resident sector breakdown

NON-FINANCIAL CORPORATIONS

Figure 8 shows the implicit rates of returns of the NFCs. On the liability side, yields are notably high in Czechia, Germany, Ireland, Italy, Latvia, Lithuania, Austria and Slovakia. The contrast among implicit returns on equity on the asset side and on the liability side is particularly notable in Germany, Italy, Latvia, Lithuania, Poland and Slovakia. Cyprus and Slovenia show the lowest yields.

Figure 8: Implicit return on equity for non-financial corporations (S.11), 2018
(%)



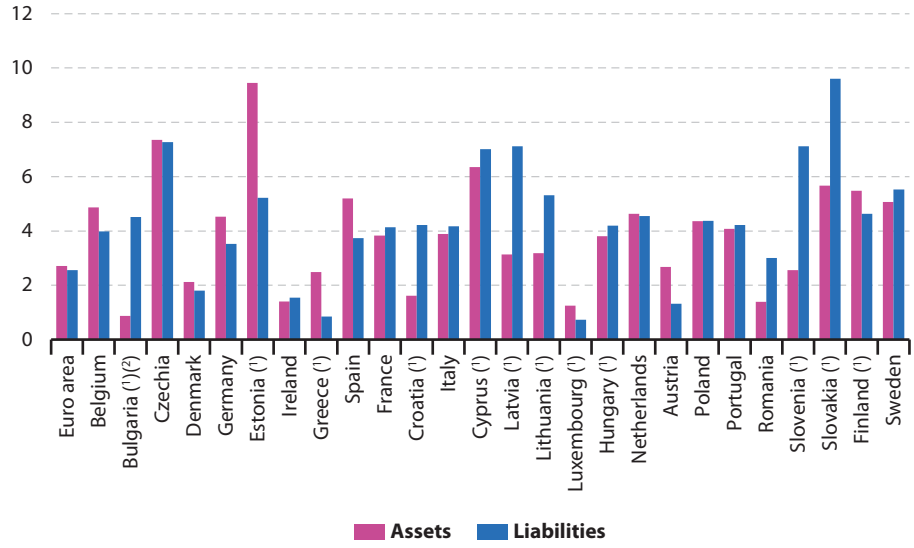
Note: Malta, not available.

(1) Based on annual data rather than annualised quarterly data.
(2) 2017.

FINANCIAL CORPORATIONS

As it is the case for implicit interest rates, for returns on equity there is also evidence of a relatively lower variability of rates of return in the financial corporations sector among Member States (Figure 9). Considerably higher yields are observed in Slovakia (above 10 % on the liability side).

Figure 9: Implicit return on equity for financial corporations (S.12), 2018
(%)



Note: Malta, not available.

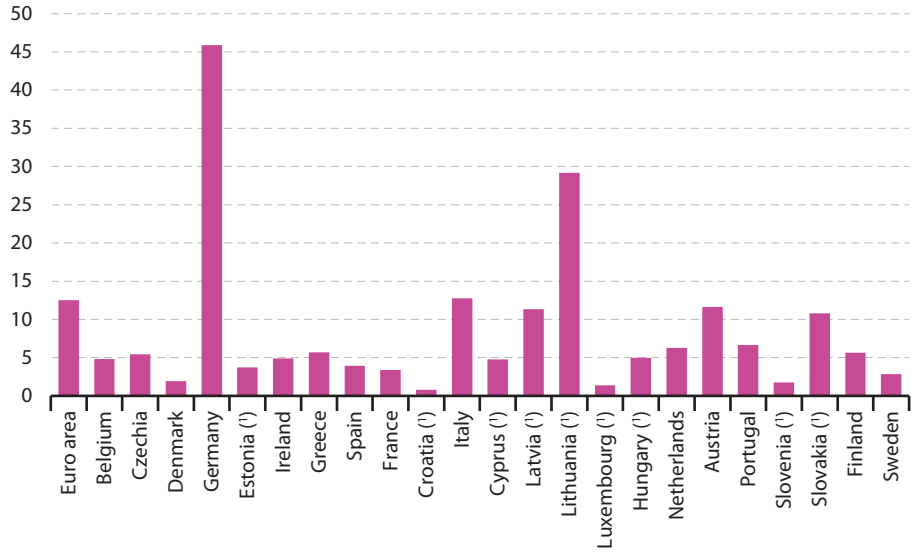
(1) Based on annual data rather than annualised quarterly data.
(2) 2017.

HOUSEHOLDS

Figure 10 shows the implicit return on equity for the household sector. As this sector does not issue equity, only the asset side is analysed. Germany and Lithuania show particularly high (above 25 %) rates of return, followed by Italy, Latvia and Austria with returns slightly above 10 %. The euro area also presents high returns, about 12 %. The rest of the Member States generally present rates of return of around 4 % to 6 %. Croatia (0.8 %) Luxembourg (1.3 %) and Slovenia (1.8 %) stand out for their low returns. Compositional effects, such as higher proportions of unlisted shares and other equity, may help explain some cross-Member State differences. The proportion of companies issuing other equity is much higher in some Member States and it is mostly held by households ([14]). The valuation of other equity is difficult as generally no market prices are available. While the valuation of listed shares is closely linked to stock market indices, the valuation changes of unlisted shares and other equity are less dynamic in most Member States. Estimation methods for other equity may yield values which do not fully reflect the profitability of a corporation ([15]). Overall, differences of rates of return across Member States appear to be very high and should be further investigated. In a first step, rates of return for the total of shares and other equity significantly exceeding 10 % should be examined, as it seems either property income may be overestimated ([16]) and/or the financial positions are underestimated ([17]).

([14]) Member State comparisons are, however, difficult as the outstanding amounts are affected by different valuation methods. For example, in Germany the outstanding amount of other equity is lower than in France, despite the large number of limited liability companies (with a form such as a GmbH) issuing other equity in Germany. Something similar happens in Austria, where the vast majority of NFCs (also GmbH) issue other equity.
([15]) For the valuation of other equity in quasi-corporations (such as limited liability and other partnerships) ESA 2010 prescribes the own funds method. This method tends to yield relatively low values with regard to profitability as the profits of the enterprise are also driven by assets such as human capital which are not fully reflected in the accounts.
([16]) A possible explanation to property income data overestimation is that is not always possible to separate the labour income received by owners working in their own enterprise from their return on capital. See Information Note on the Recording of Self-employment and Related Income Flows in Sector Accounts, Eurostat July 2019.
([17]) The ECB established in 2020 a virtual Expert Group on Unlisted Equity, and the valuation of outstanding amounts is one main topic of its work.

Figure 10: Implicit return on equity for households and NPISH (S.1M), 2018
(%)



Note: Bulgaria, Malta, Poland and Romania, not available.

(1) Based on annual data rather than annualised quarterly data.

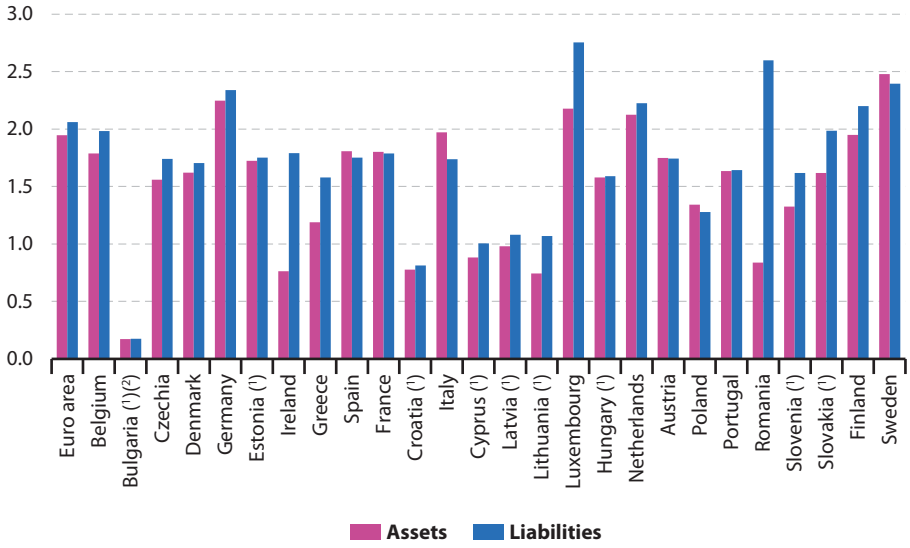
5. Implicit return on other property income

Other property income (D.44) covers income attributable to insurance policyholders (D.441), investment income payable/receivable on pension entitlements (D.442) and investment income attributable to collective investment funds shareholders (D.443). As this detailed level (3- digits) of breakdown is not mandatory for quarterly data and thus not available for several Member States, D.44 was compared to the sum of investment fund shares (F.52) and insurance, pension and standardised guarantees (F.6). Given that the available financial and non-financial accounts under the ECB and the ESA 2010 transmission programmes do not enable an identification of the underlying financial instruments to which insurance, pension and investment funds allocate their financial investment, the analysis of the results for other property income is particularly difficult.

5.1. Comparing implicit rates of return for assets and liabilities: resident sector

Figure 11 shows the other property income implicit rates of return on the assets and liability sides for the resident sector. Rates are generally consistent across Member States (between 1 % and 2.5 %) and are very similar on the assets and on the liability sides; this is in line with what is expected as most life insurance corporations pass the returns to their investors. Only a few Member States (Ireland, Luxembourg and Romania) stand out as the rates of return are significantly higher on the liability side. For Member States acting as an international financial centre for investment funds, in particular Ireland and Luxembourg in the EU, it should be taken into account that assets held by resident sectors are only a small fraction of the liabilities of resident funds as they are mostly held by foreign investors (see next section).

Figure 11: Other property income for the total economy (S.1), 2018
(%)



Note: Malta, not available.

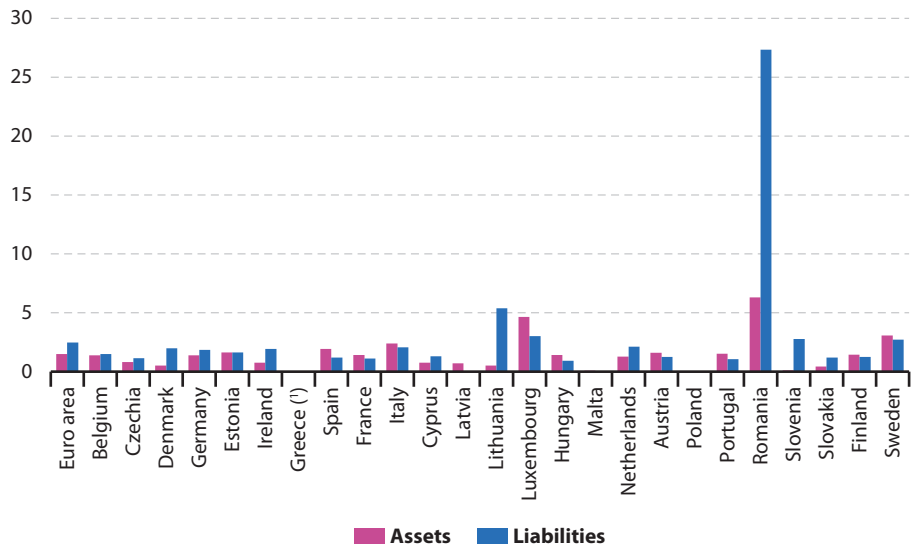
(1) Based on annual data rather than annualised quarterly data.
(2) 2017.

5.2. Comparing implicit rates of return for assets and liabilities: resident sector in relation to the rest of the world

Other property income implicit rates of return in relation to the non-resident sector (rest of the world; Figure 12) are similar to the resident sector, close to 1.5 % in most cases with some exceptions. Romania has a rate of return of 27.3 % on the liability side. The rates of return of the two Member States which act as international financial centre for investment funds (Ireland and Luxembourg) differ substantially on the asset side; the rate is particularly high in Luxembourg (4.6 %), while it is rather low in Ireland (0.8 %).

Figure 12: Other property income for the total economy position in relation to the rest of the world (S.2), 2018

(%)



Note: Bulgaria and Croatia, not available. Greece financial values do show positive values, but the correspondent rate of return is zero due to reported zero income data.

(1) Based on annual data rather than annualised quarterly data.

5.3. Comparing implicit rates of return for assets and liabilities: by resident sector breakdown

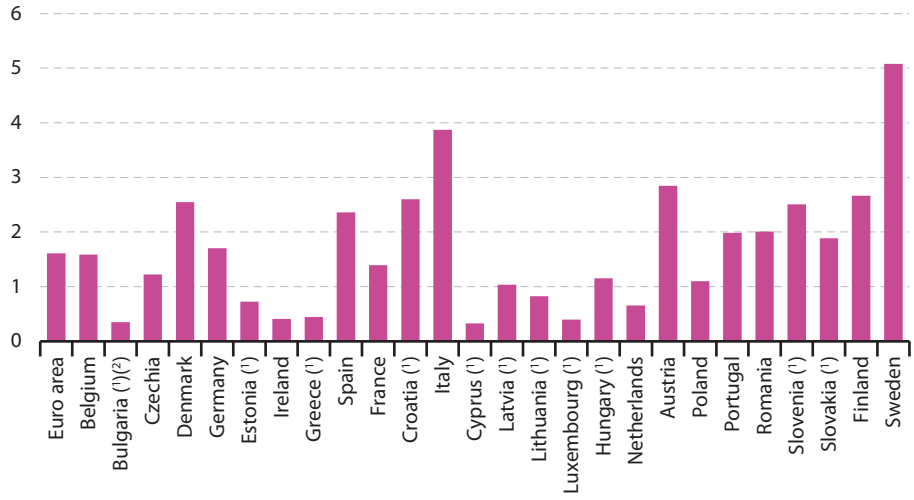
Non-financial corporations (S.11) and households and NPISH (S.1M) do not generally issue liabilities on which other property income payable accrues (the exception being non-autonomous pension fund liabilities which exist only in a few Member States). Thus, only the complete analysis for financial corporations (S.12) is presented. For S.11 and S.1M, the asset side is shown as well, but it cannot be compared with the liabilities.

NON-FINANCIAL CORPORATIONS

Other income receivable in non-financial corporations is mostly derived from the holdings of investment fund shares (F.52), while the holdings of insurance, pensions and standardised guarantee schemes (F.6) are much smaller, and the rates of returns are likely also lower on F.5 than on F.52. Rates of return (Figure 13) are below 4 % in most cases, the exception being Sweden with a rate of above 5 %.

Figure 13: Other property income for non-financial corporations (S.11), 2018

(%)



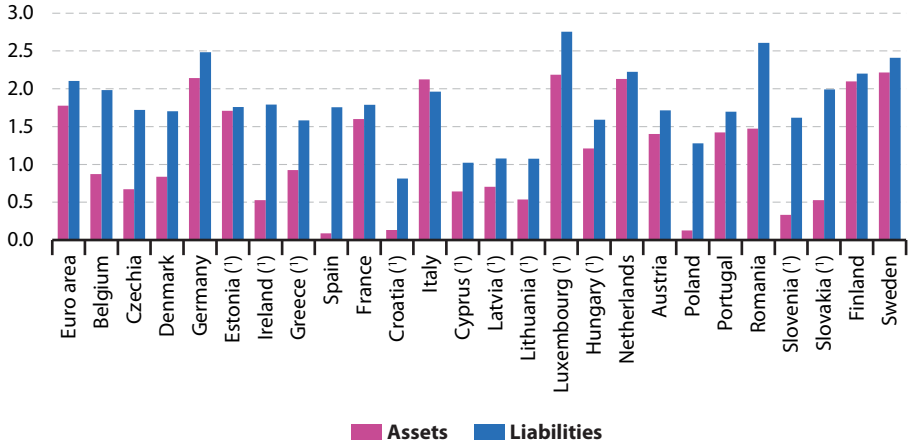
Note: Malta, not available.

(1) Based on annual data rather than annualised quarterly data.
(2) 2017.

FINANCIAL CORPORATIONS

Rates are in general higher on the liability side (see for example Spain or Poland). However, rates are generally between 0.5 % and 2.5 %.

Figure 14: Other property income for financial corporations (S.12), 2018
(%)



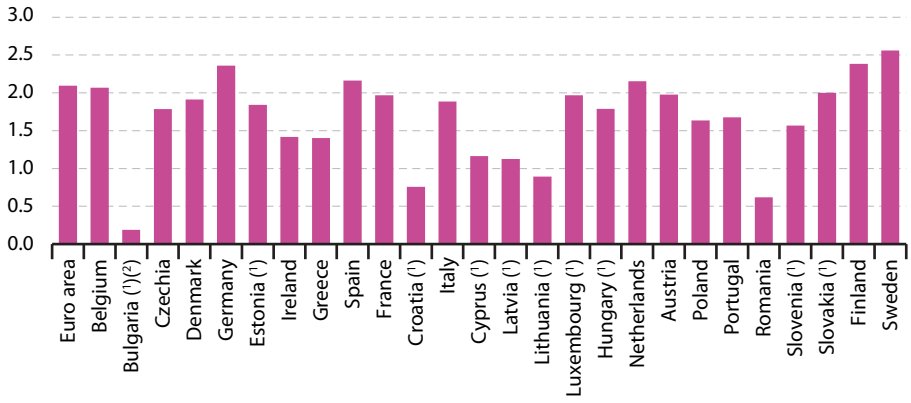
Note: Bulgaria and Malta, not available.

(1) Based on annual data rather than annualised quarterly data.

HOUSEHOLD SECTOR

As shown in Figure 15, rates of return on the asset side of the household sector in most Member States are between 1.0 % and 2.5 %. Bulgaria, Croatia and Romania had the lowest rates with 0.2 %, 0.7 % and 0.6 % respectively.

Figure 15: Other property income for households and NPISH (S.1M), 2018
(%)



Note: Malta, not available.

(1) Based on annual data rather than annualised quarterly data.
(2) 2017.

6. Consistency between the quarterly and annually derived income rates

6.1. Introduction and methodology

As a general concept within this article, the annual sum of quarterly data is preferred over the annual data if fully available for both financial and non-financial accounts, as users often prefer quarterly and more timely data. Only if the quarterly data are not available, annual data are used to calculate the income rates ([18]). This section aims to test the impact of this choice of frequency, as the consistency of quarterly and annual data is also of interest to users. Therefore, the different income rates have been recalculated based on the annual data ([19]) and then compared with the rates resulting from the annual sum of quarterly data for the year of 2018 ([20]).

This analysis was conducted for 15 Member States that regularly record both quarterly and annual data. Because some Member States compile quarterly data for some but not all sectors or variables, the analysis is done in two steps. The first step included the comparison of the quarterly income rates with the annual rates (quarterly to annual differences of up to 0.05 percentage points are deemed negligible and thus ignored for the analysis).

In the second step, the underlying non-financial accounts and financial accounts variables were compared. Checking their quarterly to annual consistency may help explaining where the differences in the income rates have their origins. As the different instruments (for example D.43, F.2M) differ largely in their size, a simple difference between quarterly and annual data will not indicate the magnitude of the quarter to annual discrepancy. To better gauge their extent, the quarterly data was divided by the annual data and then expressed as a percentage. A result of '100 %' means that the data are equal and no inconsistencies exist.

6.2. Implicit interest rate

The implicit interest rate is calculated based on four variables (see also Section 2). On the side of the non-financial accounts, D.41G – the total interest before FISIM allocation – can be found in the numerator of the equation. The three variables in the denominator are all from the financial accounts: deposits (F.2M), debt securities (F.3) and loans (F.4). Figure 16 shows those Member States (Bulgaria, Czechia, Ireland, Hungary and Poland) that have significant differences (>0.05 percentage points between the quarterly and annually derived implicit interest rates for the listed sectors ([21]).

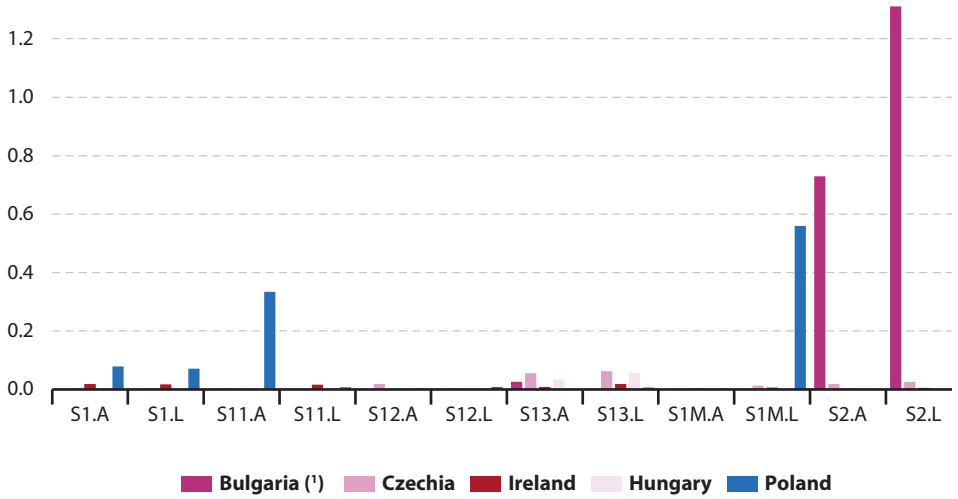
([18]) Except for Greece, where the annual data is used for calculating the ratios. In October 2020, Greece transmitted revised annual non-financial sector accounts that incorporated the results of the benchmark revision from 2010 onwards but are still pending for the quarterly data. On these grounds, Greece has been excluded from the analysis of consistency between the quarterly and annually derived income rates.

([19]) See in Table 1 of this article the formulas used to calculate the different implicit interest rates for each property income category. For the numerator the annual non-financial accounts were taken directly. For the financial accounts in the denominator the average stock has been calculated as an average of the stock at the beginning of the period (end of 2017) and the stock at the end of the period (end of 2018).

([20]) Due to limited availability of data, for Bulgaria, the use of 2017 data is selected.

([21]) Member States that show differences that are deemed insignificant (below 0.05 %) for any sector, include Germany, Italy, Cyprus and Luxembourg.

Figure 16: Implicit interest rate: absolute difference quarterly to annual data, 2018
(percentage points)



(1) 2017.

Poland is the only Member State that has slight differences between the quarterly and annual implicit interest rates for the **resident sector (S.1)**. They are based on small inconsistencies between the annual and quarterly data in non-financial variable D.41.

For **non-financial corporations (S.11)**, the analysis shows that differences between the quarterly and annual non-financial variables are only relevant for Poland. Table 2 provides an overview of the components of the implicit interest rate and the source of discrepancy between annual and quarterly values.

For **financial corporations (S.12)**, the differences between quarterly and annual data are not relevant.

Regarding the **general government sector (S.13)**, the largest difference between quarterly and annual rates both on the asset and liability sides is for Czechia (0.06 percentage points).

Within the **households and NPISH sector (S.1M)**, there were some large discrepancies for Poland, reaching up to 0.57 percentage points due to the instrument D.41G.

Lastly, for the **rest of the world (S.2)** Bulgaria shows massive discrepancies on both the assets (0.73 percentage points) and liabilities (1.31 percentage points) sides.

Table 2: Instruments that compose the implicit interest rate for quarterly data as a percentage of annual data, 2018

(%)

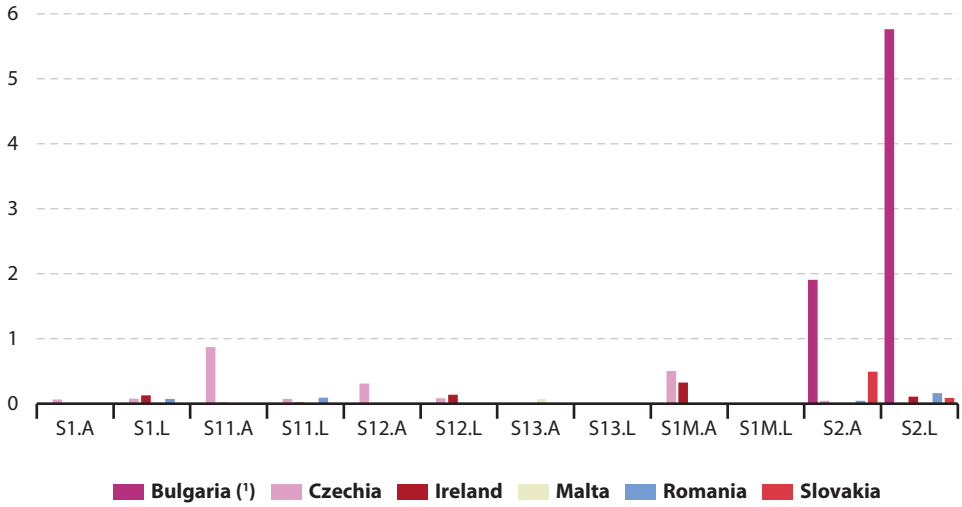
D41G			F2M			F3			F4		
Bulgaria											
D41G	**A**	**L**	**F2M**	**A**	**L**	**F3**	**A**	**L**	**F4**	**A**	**L**
S1	NA	NA	**S1**	100	100	**S1**	100	100	**S1**	100	100
S11	NA	NA	**S11**	100	NA	**S11**	100	100	**S11**	100	100
S12	NA	NA	**S12**	100	100	**S12**	100	100	**S12**	100	100
S13	97	103	**S13**	100	NA	**S13**	100	100	**S13**	100	100
S1M	NA	NA	**S1M**	100	NA	**S1M**	100	NA	**S1M**	100	100
S2	62	205	**S2**	100	100	**S2**	100	100	**S2**	100	100
Czechia											
D41G	**A**	**L**	**F2M**	**A**	**L**	**F3**	**A**	**L**	**F4**	**A**	**L**
S1	100	100	**S1**	98	98	**S1**	100	100	**S1**	103	103
S11	100	100	**S11**	99	NA	**S11**	91	100	**S11**	99	100
S12	100	100	**S12**	101	100	**S12**	101	105	**S12**	101	97
S13	100	100	**S13**	74	0	**S13**	36	97	**S13**	209	200
S1M	100	100	**S1M**	100	NA	**S1M**	100	112	**S1M**	90	99
S2	100	100	**S2**	100	100	**S2**	100	100	**S2**	100	100
Poland											
D41G	**A**	**L**	**F2M**	**A**	**L**	**F3**	**A**	**L**	**F4**	**A**	**L**
S1	104	104	**S1**	100	100	**S1**	100	100	**S1**	100	100
S11	149	100	**S11**	100	NA	**S11**	100	100	**S11**	100	100
S12	100	100	**S12**	100	100	**S12**	100	100	**S12**	100	100
S13	100	100	**S13**	100	100	**S13**	100	100	**S13**	100	100
S1M	100	114	**S1M**	100	NA	**S1M**	100	NA	**S1M**	100	100
S2	100	100	**S2**	100	100	**S2**	100	100	**S2**	100	100

In summary, it can be stated that the vast majority of the Member States showed no differences between annual and quarterly implicit interest rates. The heat map indicates that, on average, the non-financial instrument D.41G more frequently shows differences between quarterly and annual data. Moreover, even though some Member States (like Czechia) present relevant differences in financial instruments (in other words, F.2M, F.3 and F.4), the impact on the implicit interest rate is rather limited, as can be seen in Figure 16. Overall, preferring quarterly data over annual data for the analysis, or the other way around, does not have an impact on the results of this article.

6.3. Implicit return on equity

To calculate the return on equity, three different instruments are used. Two are from the non-financial accounts: distributed income of corporations (D.42) and reinvested earnings on foreign direct investment (D.43). The remaining variable is equity (F.51), sourced from financial accounts. Figure 17 shows the Member States for which significant differences (above 0.05 percentage points) are observed.

Figure 17: Implicit return on equity: absolute difference quarterly minus annual data, 2018
(percentage points)



(1) 2017.

For the **resident sector (S.1)**, the differences are very limited and always below 0.15 percentage points. Ireland on the liabilities side shows the largest discrepancies. Table 3 provides an overview of the components of the implicit return on equity, and the source of discrepancy between the annual and the quarterly values.

For **non-financial corporations (S.11)**, the discrepancies are relevant on the assets side, where Czechia presents differences above 0.85 percentage points. Differences of this magnitude, might distort the analysis depending on which frequency is used. According to the heat map, these differences for Czechia are mainly driven by F.51.

The **financial corporations sector (S.12)** differences are not relevant (below 0.3 percentage points).

The **general government sector (S.13)** shows small inconsistencies between quarterly and annual data. Due to data unavailability, the comparison of annual and quarterly data could not be conducted for the liability side of the S.13 sector.

For the **households and NPISH sector (S.1M)**, Czechia and Ireland present significant differences that can be up to 0.5 percentage points coming from the financial instrument F.51. As regards the liability side, there are no data to be analysed, as the household sector does not issue equity.

The **rest of the world (S.2)** revealed the highest difference between the quarterly and annual return on equity. Bulgaria, whose 2017 data are used due to the unavailability of 2018 data, records on the liabilities side a return on equity based on quarterly values of 8.4 % and a rate of 2.7 % based on annual values, leading to a difference of 5.8 percentage points. On the assets side, the difference for Bulgaria is not as large but still very substantial (1.9 percentage

points). These discrepancies are based entirely on inconsistencies in the non-financial variables D.42 and D.43. Whether these differences would also have appeared in the other sectors is not clear, as Bulgaria has not recorded sufficient quarterly data to do this analysis. Furthermore, Ireland and Slovakia recorded significant differences between the quarterly and annual returns on equity.

Table 3: Instruments that compose the implicit return on equity for quarterly data as a percentage of annual data, 2018

(%)

D42			D43			F51		
Bulgaria								
D42	**A**	**L**	**D43**	**A**	**L**	**F51**	**A**	**L**
S1	NA	NA	**S1**	NA	NA	**S1**	100	100
S11	NA	NA	**S11**	NA	NA	**S11**	100	100
S12	NA	NA	**S12**	NA	NA	**S12**	100	100
S13	100	NA	**S13**	NA	NA	**S13**	100	105
S1M	NA	NA	**S1M**	NA	NA	**S1M**	100	100
S2	295	255	**S2**	123	668	**S2**	100	100
Czechia								
D42	**A**	**L**	**D43**	**A**	**L**	**F51**	**A**	**L**
S1	100	100	**S1**	100	100	**S1**	101	101
S11	100	100	**S11**	100	100	**S11**	114	101
S12	100	100	**S12**	100	100	**S12**	104	101
S13	100	NA	**S13**	NA	NA	**S13**	103	0
S1M	100	NA	**S1M**	100	NA	**S1M**	91	NA
S2	100	100	**S2**	100	100	**S2**	99	100
Ireland								
D42	**A**	**L**	**D43**	**A**	**L**	**F51**	**A**	**L**
S1	100	100	**S1**	100	100	**S1**	101	103
S11	100	100	**S11**	100	100	**S11**	101	100
S12	100	100	**S12**	100	100	**S12**	101	109
S13	100	NA	**S13**	NA	NA	**S13**	100	207
S1M	100	NA	**S1M**	NA	NA	**S1M**	93	NA
S2	100	100	**S2**	100	100	**S2**	100	102
Slovakia								
D42	**A**	**L**	**D43**	**A**	**L**	**F51**	**A**	**L**
S1	NA	NA	**S1**	100	100	**S1**	98	99
S11	NA	NA	**S11**	NA	NA	**S11**	222	101
S12	NA	NA	**S12**	NA	NA	**S12**	100	90
S13	100	NA	**S13**	NA	NA	**S13**	100	95
S1M	NA	NA	**S1M**	NA	NA	**S1M**	4	233
S2	100	100	**S2**	100	100	**S2**	96	99

To conclude, the comparison of quarterly and annual returns on equity revealed inconsistencies across more Member States, sectors and variables than was the case for implicit interest rates. The origin of the inconsistencies is mixed as for some Member States it lies in the non-financial instruments, while for others only the financial instruments

present differences. The strong outlier for Bulgaria in S.2 needs to be examined through an individual Member State analysis. Excluding the exceptional cases of Bulgaria and Czechia, the preference of quarterly data over annual data has a rather negligible effect on the analysis for the majority of the Member States and sectors.

6.4. Implicit return on other property income

The implicit return on property income is calculated from other investment income (D.44) on the non-financial side, and investment fund shares or units (F.52) and insurance, pensions and standardised guarantees (F.6) on the financial side. For three sectors (S.11, S.13, S.1M), no data were available on the liability side.

Due to the small number of inconsistencies (Figure 18), it is not necessary to conduct a sector-by-sector analysis. Only four Member States reported substantial quarter to annual differences. Difference above 0.5 percentage points can be observed on the assets side for Czechia, Slovakia and Romania. On the liabilities side, Romania reported a large outlier for the external sector, almost 10 percentage points (27 % using quarterly data and 17 % using annual data). However, the vast majority of Member States showed highly consistent quarterly and annual data.

Figure 18: Other property income: absolute difference quarterly minus annual data, 2018
(percentage points)

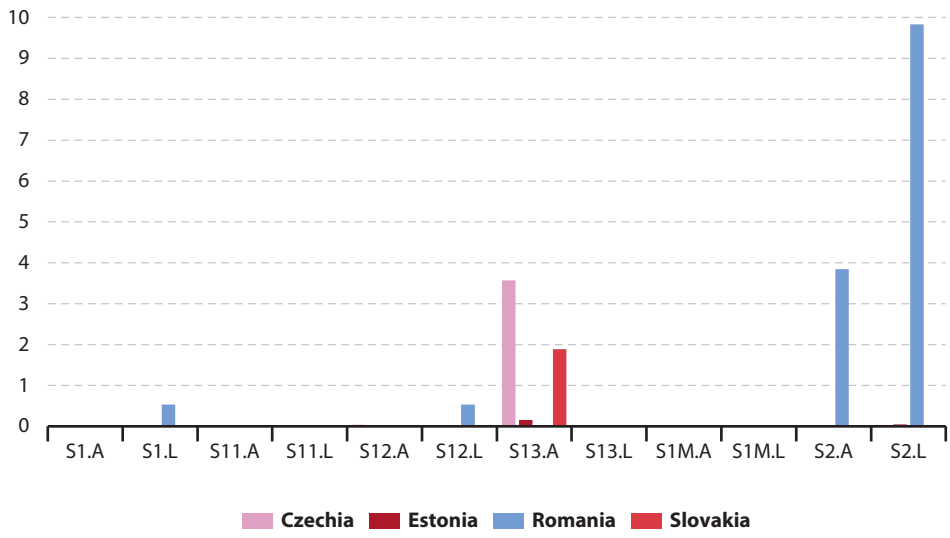


Table 4 presents the heat map for other property income. It is important to note that positions of the F.6 variable are, by comparison with F.52, so minor that even the large relative discrepancies for this variable will not significantly impact the calculation of the implicit

returns on other property income. Nevertheless, the F.6 discrepancies might deserve further investigation for individual Member States.

The discrepancies observed for Czechia come mainly from the financial instrument F.6 and to a smaller extent from instrument F.52 for the case of general government.

In Romania, the discrepancies are only present from the non-financial transaction D.44. However, in some cases the differences can be very large and might require further investigation.

To summarise the observations of the other property income rates, it can be stated that most Member States show highly consistent rates without any differences between quarterly and annual data. There are still some significant outliers for Romania and some negligible to moderate differences for at most one sector in just a few Member States.

Table 4: Instruments that compose other property income for quarterly data as a percentage of annual data, 2018

(%)

D44			F52			F6		
Czechia								
D44	**A**	**L**	**F52**	**A**	**L**	**F6**	**A**	**L**
S1	100	100	**S1**	100	100	**S1**	100	100
S11	100	NA	**S11**	100	NA	**S11**	101	NA
S12	100	100	**S12**	100	100	**S12**	131	103
S13	100	NA	**S13**	64	NA	**S13**	16	NA
S1M	100	NA	**S1M**	100	NA	**S1M**	100	NA
S2	100	100	**S2**	100	100	**S2**	99	100
Romania								
D44	**A**	**L**	**F52**	**A**	**L**	**F6**	**A**	**L**
S1	100	126	**S1**	100	100	**S1**	100	100
S11	100	NA	**S11**	100	NA	**S11**	100	NA
S12	100	126	**S12**	100	100	**S12**	100	100
S13	NA	NA	**S13**	100	NA	**S13**	100	100
S1M	100	NA	**S1M**	100	NA	**S1M**	100	NA
S2	256	156	**S2**	100	100	**S2**	100	100

6.5. Summary of comparison of quarterly and annual data

It can be concluded that the majority of Member States show consistent quarter to annual data and thus no relevant differences between annual and quarterly rates for implicit interest, return on equity and other property income. Structural and repetitive inconsistencies between quarterly and annual implicit income rates across different income types and sectors are only observed for a few Member States. For Czechia, the national statistical office indicated that most of the discrepancies can be explained by the different sector classification (between S.12 and S.13) of some units in the quarterly and annual financial accounts. Bulgaria showed significant discrepancies for the implicit interest rate and the return on equity rate mainly for S.2.

7. Conclusions

This paper includes an overview of implicit rates of returns by creditor and debtor sectors across the Member States. It is meant to provide data compilers an indication for which sectors the relations between assets and liabilities and the correspondent property income deviate from other Member States. National data compilers may use these results as a starting point for further investigations. Member States' experts are best placed to assess whether the observed differences compared to other Member States are due to economic differences and/or at least partially to due statistical sources and methods which could potentially be improved. Reducing differences due to statistical issues would also be a contribution to improve the vertical consistency of the accounts.

The analysis shows that for the implicit rates of return of the three components of property income (interest, distributed income on equity and other property income) the relation between assets and liabilities is generally plausible for the resident sector, although some questions for specific Member States remain. More differences and need for clarification are present in the resident sector breakdown as well as for the positions in relation to the rest of the world.

Secondly, the presence of specific outliers for some Member States can indicate that some instruments assets/liabilities are underestimated when implicit rates of return are high (or overestimated when implicit rates of return are low) and/or the relevant property income categories are overestimated in the non-financial accounts. This analysis across Member States can indicate a possible cause of vertical discrepancy.

In terms of property income categories and related financial positions, most outliers are observed for implicit returns on equity, followed by the implicit return of other income on insurance and investment fund positions. Some of the largest implicit returns on equity concern large economies (for example, Germany and Italy); this therefore impacts euro area and EU aggregates.

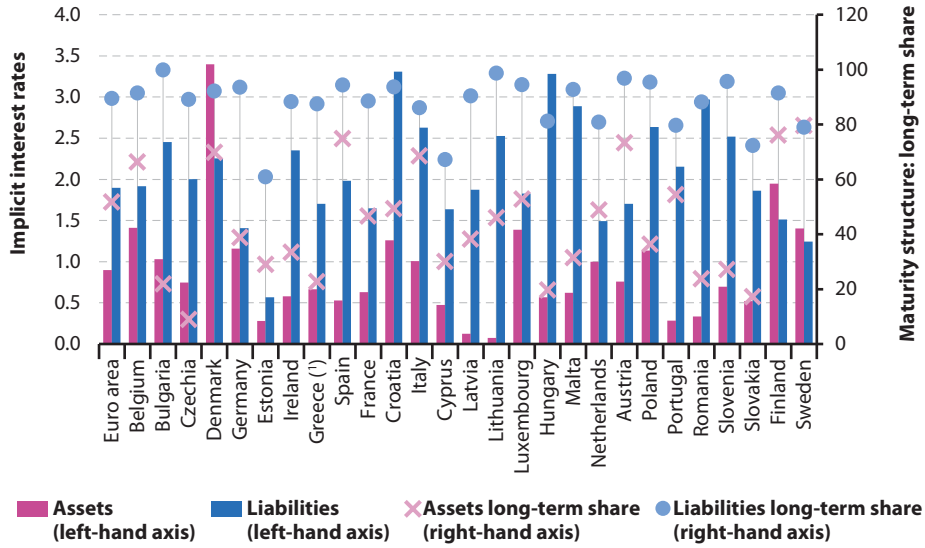
A series of checks on consistency between quarterly and annual data have also been presented. They show that there are no differences between them for the majority of Member States. Thus, the choice of using quarterly data over annual data has no major impact on the analysis. Nevertheless, some (unexplored) structural inconsistencies between the two frequencies are observed for Bulgaria, especially for the implicit return on equity, and for Romania for the implicit return on other property income. They should be investigated further.

8. Acknowledgements

The authors would like to thank Henning Ahnert (ECB, DG-Statistics – External statistics and sector accounts) for his valuable comments.

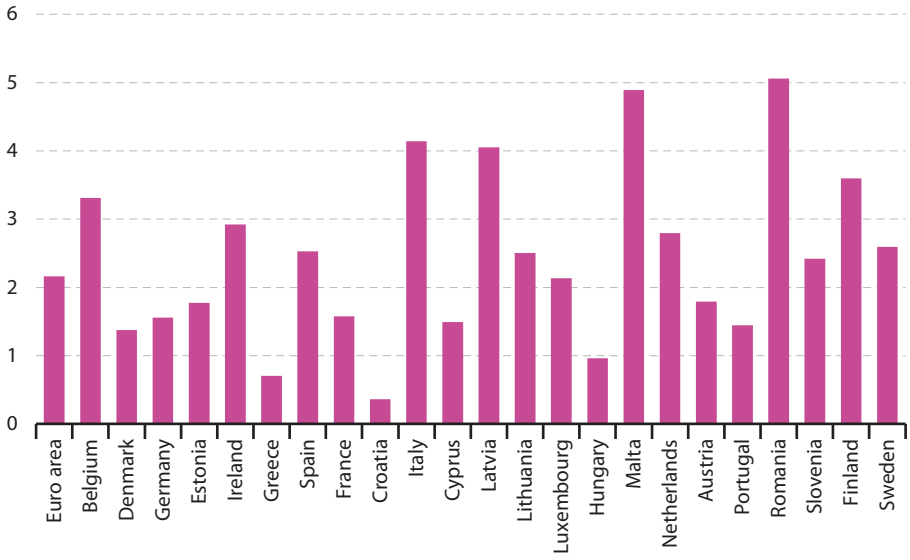
Annex 1: General government (S.13)

Figure A1.1: Implicit interest rates and maturity structure, 2018
(%)



(1) Based on annual data rather than annualised quarterly data.

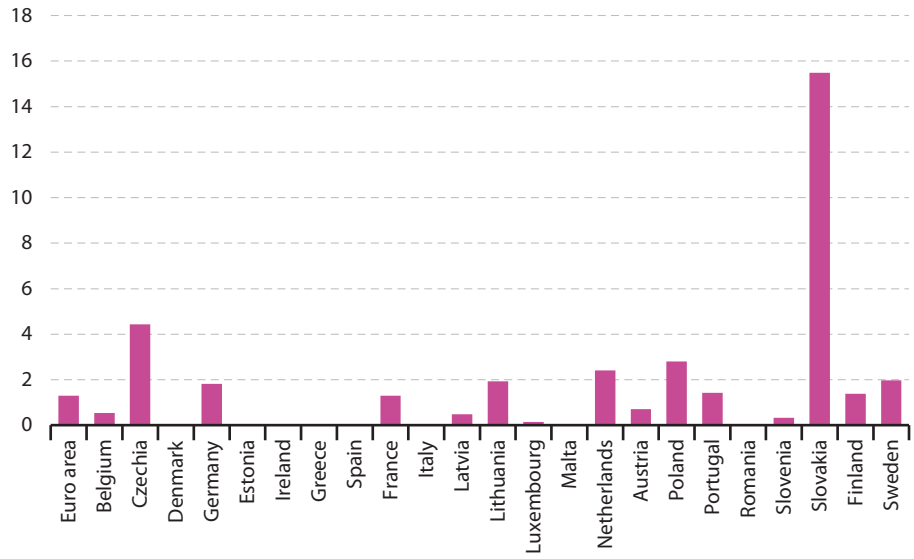
Figure A1.2: Implicit return on equity, 2018
(%)



Note: Bulgaria, Czechia, Poland and Slovakia, not available.

Figure A1.3: Implicit return on other property income, 2018

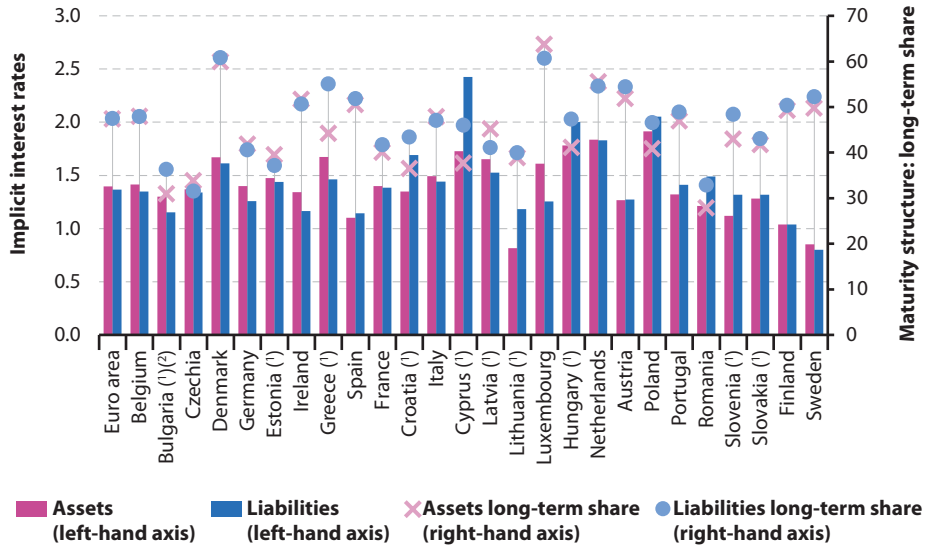
(%)



Note: Bulgaria, Croatia, Cyprus and Hungary, not available.

Annex 2: Implicit interest rate and maturity structure (including other accounts receivable F.8)

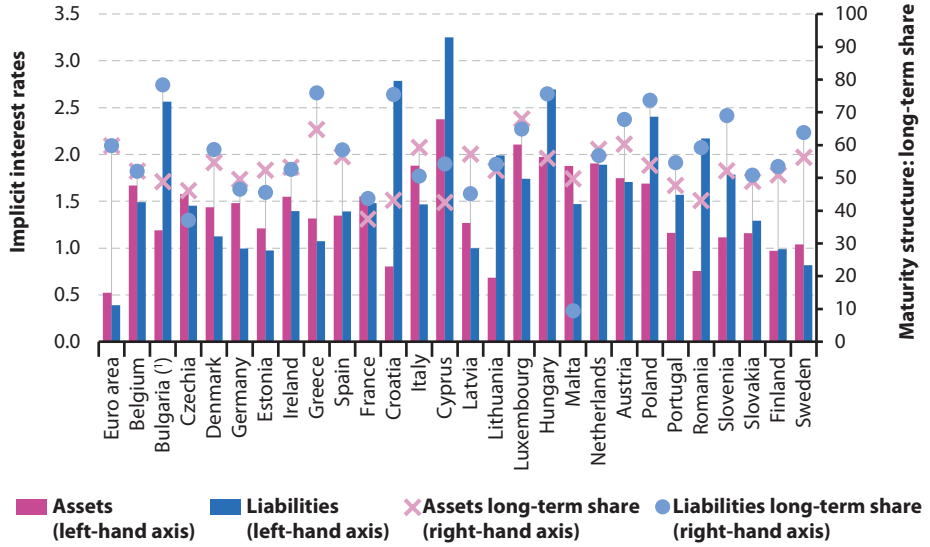
Figure A2.1: Total economy (S.1), 2018
(%)



Note: Malta, not available.

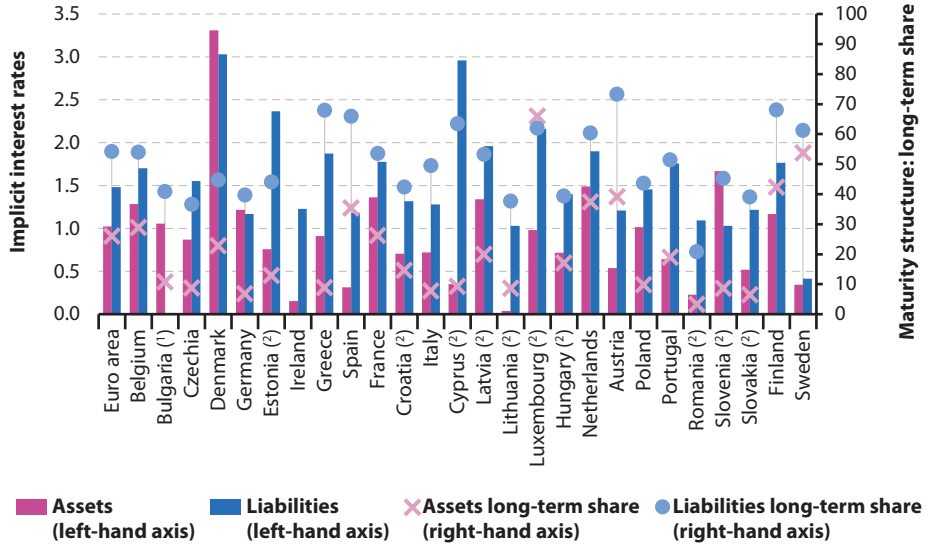
(1) Based on annual data rather than annualised quarterly data.
(2) 2017.

Figure A2.2: Total economy positions in relation to the rest of the world (S.2), 2018
(%)



(1) 2017.

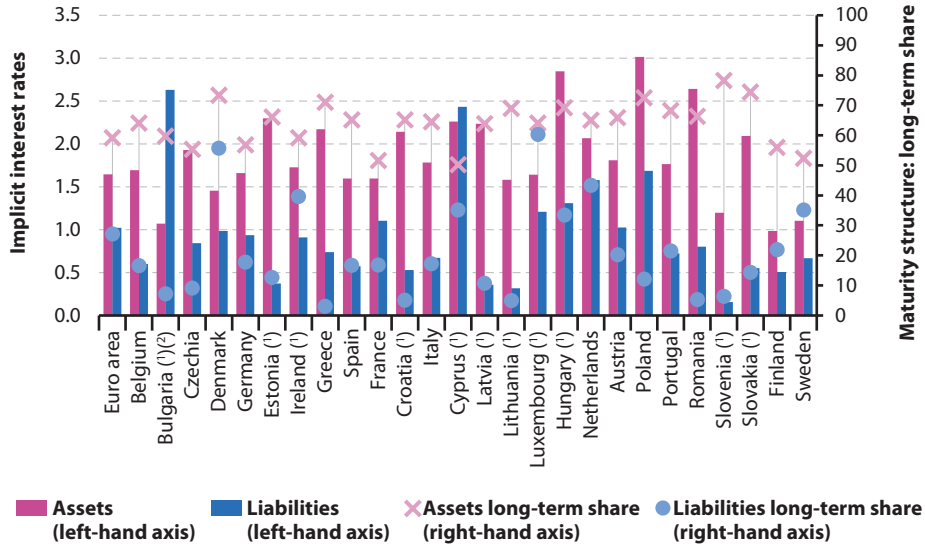
Figure A2.3: Non-financial corporations (S.11), 2018
(%)



Note: Malta, not available. Ireland: long-term shares not available.

(1) 2017.
(2) Based on annual data rather than annualised quarterly data.

Figure A2.4: Financial corporations (S.12), 2018
(%)



Note: Malta, not available.

(1) 2017.
(2) Based on annual data rather than annualised quarterly data.

Figure A2.5: General government (S.13), 2018
(%)

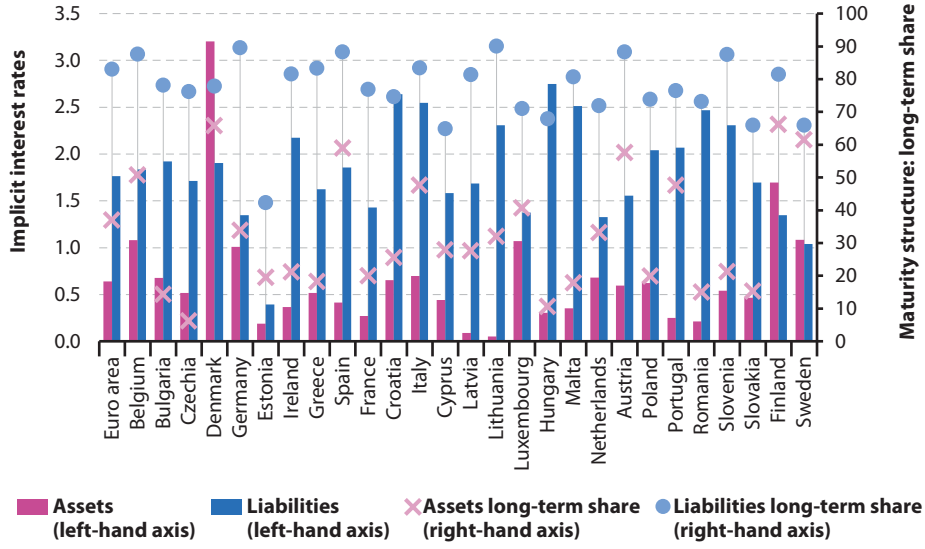
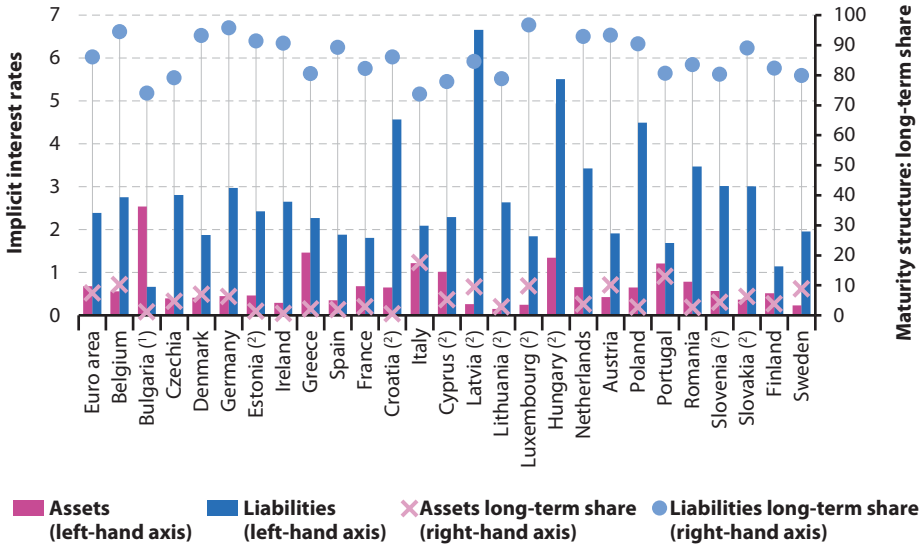


Figure A2.6: Households and NPISH (S.1M), 2018
(%)



Note: Malta, not available. Hungary: long-term shares not available.

(1) 2017.
(2) Based on annual data rather than annualised quarterly data.

5 Measuring beneficiaries in satellite accounts on social protection

DUNCAN COUGHTRIE, ANDY FULLER, PAOLO PASSERINI AND CORRADO PEPERONI ([1])

Abstract: Satellite accounts on social protection combine monetary and non-monetary data on social protection interventions. In the EU, the European system of integrated social protection statistics (ESSPROS) has been developed progressively since the late 1970s. Demand for data on social benefit recipients is longstanding but has intensified with the emergence of efforts to examine the impact of ageing populations and, more recently, the COVID-19 pandemic. The collection of data on social benefit recipients is, however, beset with methodological obstacles. Consideration of possible approaches to the collection of recipient data, and their relevance when applied across benefits with different characteristics (for example, different durations), demonstrates that there is no 'one-size fits all' solution. Consequently, some flexibility is needed to establish an overarching approach to the collection of data on recipients across the full spectrum of social benefits. Accordingly, the most pragmatic option appears to be to pursue a modular approach whereby sub-sets of benefits to which a single approach can be applied are grouped into modules, and a limited variation in approach is permitted between modules.

JEL codes: H55 Social Security and Public Pensions

Keywords: ESSPROS, social protection, satellite accounts, pension beneficiaries, social benefit recipients

([1]) Duncan Coughtrie and Andy Fuller: Alphametrics Ltd. Paolo Passerini and Corrado Peperoni: Eurostat – Education, health and social protection statistics. This paper represents the authors' personal opinion and does not necessarily reflect the views of Eurostat or Alphametrics Ltd.

1. Introduction

Satellite accounts on social protection are described in Chapter 22 of ESA 2010 (§22.110–§22.122). They provide a multidimensional overview of social protection, drawing on concepts defined by Eurostat's European system of integrated **social protection statistics** (ESSPROS) ([2]) and implemented in EU official statistics since 1990. The accounts describe the size and composition of social protection benefits, their financing and the administrative costs involved. Social protection benefits are classified by function (in other words, the purpose for which they are granted), by type (for example, in cash or in kind), and whether they are means tested. Eight functions of social protection intervention are considered: sickness/health care, disability, old age, survivors, family/children, unemployment, housing, and social exclusion not elsewhere classified. The main definitions and accounting principles applied in ESSPROS are consistent with those of national accounts, particularly as regards expenditure on social benefits and receipts from social contributions ([3]).

A distinguishing characteristic of many satellite accounts is the inclusion of **non-monetary data**, such as data on CO_2 emissions by industry in the environmental accounts or number of treatments by type of health care in the health accounts. The linkage of such non-monetary data with monetary data can provide key indicators, such as CO_2 emissions per value added or the costs per treatment, providing further insight complementing that already available from monetary variables. Table 22.7 of ESA 2010 provides several examples of non-monetary data and of potential key ratios with monetary variables.

In the case of satellite accounts on social protection, non-monetary data can readily provide information on the number of benefit payments received by protected persons. However, the same person may receive more than one benefit. Accordingly, analysis of social protection systems also requires knowledge of the number of persons receiving at least one benefit to inform on the extent to which persons in need are assisted. This leads, for example, to the ESSPROS collection on the number of pension beneficiaries ([4]), which takes account of persons receiving more than one pension, providing numbers that exclude double counting of pension beneficiaries ([5]).

The complexity (for analysis purposes) created by individuals (or households) receiving multiple benefits is not limited to pensions but is inherent across most national social protection systems. For example, a person receiving an unemployment benefit might also get a family allowance, a housing benefit, or both.

However, even in the most favourable case of no individual receiving more than one benefit, there are a number of **measurement issues** linked to the characteristics of benefits. For example, in ESSPROS the number of pensioners is measured as the number of pension

([2]) See https://ec.europa.eu/eurostat/web/social-protection/methodology. An overview of the ESSPROS system is provided in Section 2 of this paper.
([3]) Eurostat recently published a Statistical working paper comparing ESSPROS and national accounts methodologies, describing the correspondences and differences between the respective definitions and classifications and setting out a series of standardised bridge tables. See Links and differences between social protection statistics (ESSPROS) and national accounts — Methodological aspects and conceptual bridge tables – 2021 edition.
([4]) See data on pension beneficiaries: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=spr_pns_ben&lang.
([5]) See Appendix III of the ESSPROS manual and user guidelines: https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/ks-gq-19-014.

recipients at the end of a reference year. Such data provide a reasonable representation of the number of pensioners having received pensions during the reference year, although the two numbers generally differ. But what about, for example, the number of unemployment benefit recipients? Could one look at the number of recipients existing at the end of a reference year and consider it representative of the situation during the year? Common sense suggests not as the number of unemployed persons, and therefore of potential beneficiaries, tends to fluctuate over the year much more than the number of retired persons. A snapshot of their stock at the end of the year in this case may not be representative of the phenomenon the data seek to represent.

Other examples are the distinction between i**ndividuals and households as benefit recipients** and statistical units, the measurement of their socio-demographic characteristics, and the measurement of the number of beneficiaries for certain benefits in kind. These examples, the considerable variability in the nature of social benefits across countries, and the purposes for which they are granted, indicate that measuring non-monetary variables in satellite accounts on social protection is not a straightforward undertaking and that a number of prominent issues have to be considered.

Nevertheless, the advantage of having this kind of data collected within the ESSPROS framework resides in their quality, which results from rigorous compilation and validation processes, and in their international comparability, ensured by the harmonised classifications and methodology covering all data of the domain (monetary and non-monetary). This results in a high degree of consistency between data on expenditure and data on recipients.

From an informative standpoint, policy makers need detailed and timely official statistics to monitor the state and perspectives of social protection systems, for example to assess potential needs to reallocate resources to fill emerging gaps in the social protection safety net. ESSPROS data on social benefit recipients complement those on expenditure and can offer insights as to the effectiveness and responsiveness of social policies and their capacity to sustain those most in need. ESSPROS data on pensioners and pension expenditure are already used as an input to the Organisation for Economic Co-operation and Development's (OECD) social benefit recipients (SOCR) database, included in the OECD *Pension at a glance report*, in the European Commission's *Ageing Report* and *Pension Adequacy Report,* and are regularly used by the Indicators sub-group of the EU's Social Protection Committee.

Data on unemployment benefit recipients (UBR, see Section 5.2) are particularly useful, for example, to assess the reactiveness of social protection parachutes to negative phases of the economic cycle. Other Eurostat domains already collect relevant labour market data (for example through the EU labour force survey), and an analysis in combination with UBR data would increase the possibility to assess the coherence and adequacy of social safety nets to the changing conditions of national and European labour markets.

Finally, the combination of non-monetary and monetary data makes possible the calculation of average benefit amounts. In the case of ESSPROS data on pension beneficiaries and pension expenditure, figures on average amounts are already disseminated by Eurostat in dedicated *Statistics Explained* articles ([6]). More generally, average amounts could be calculated

([6]) See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Social_protection_statistics_-_pension_expenditure_and_pension_beneficiaries.

for all the benefits for which both expenditure and recipients' data are available. Nevertheless, the results should be interpreted with caution for several reasons. First, the combinations of social protection schemes in each country will have considerable influence on the figures recorded at an aggregate level. In other words, if average amounts are calculated from aggregates of benefits granted under different circumstances and serving different purposes, the results might not have any real meaning in terms of comparability between countries. Whenever possible, therefore, average amounts should be calculated only for detailed benefit classifications. In addition, data based on gross expenditure do not take into account the effect of taxes and social contributions payable on the benefits received, which varies both between and within countries. For example, while in one country a specific benefit may be tax free, in another, taxes (and/or social contributions) may be applied. For all these reasons, data on social benefit expenditure per beneficiary do not necessarily reflect the level or adequacy of the benefits granted in different countries.

All this considered, this article analyses measurement issues related to non-monetary variables related to social protection. These relate to the various **characteristics of the underlying benefits and of the underlying population of potential beneficiaries**, as well as to the objectives of the analysis. Which are the options available in terms of measurement variables for the number of social benefit recipients? Are there characteristics of social protection interventions that are relevant to define an effective approach to measurement? How are the various approaches to be used in relation to the different possible purposes of the analysis, including calculation of key indicators or ratios? While work in this area has focused mainly on the case of pension beneficiaries, in this article we consider the measurement of social benefit recipients more generally, with some specific focus on unemployment benefit recipients.

After a brief overview of ESSPROS key concepts in Section 2, these and other related questions are addressed in Section 3. Section 4 then covers more detailed aspects of non-monetary measures in satellite accounts on social protection, including possible types of **double counting of beneficiaries**, ways to deal with them and their implications for producing aggregations of social benefit recipients. The case of pension beneficiaries is dealt with in more detail in Section 5, based on the actual experience of the EU data collection run by Eurostat since 2006, alongside the possible extension to other types of social benefit recipients, specifically those receiving periodic cash unemployment benefits.

2. Overview of ESSPROS concepts

While the concepts, definitions, accounting and classification rules used by ESSPROS are in general harmonised with those used in national accounts, it offers an accounting framework that provides a more detailed multidimensional overview of social protection describing the size and composition of social protection benefits, their financing and the administrative costs associated with them. There is therefore a significant overlap in the scope of social protection covered by national accounts and by ESSPROS.

The scope of ESSPROS is delimited by its definition of social protection: *Social protection encompasses all interventions from public or private bodies intended to relieve households and individuals of the burden of a defined set of risks or needs, provided that there is neither a*

simultaneous reciprocal nor an individual arrangement involved. The list of risks or needs that may give rise to social protection is, by convention, as follows:

1. *Sickness/Health care*
2. *Disability*
3. *Old age*
4. *Survivors*
5. *Family/children*
6. *Unemployment*
7. *Housing*
8. *Social exclusion not elsewhere classified.*

The statistical unit used is the *social protection scheme* which *is a distinct body of rules, supported by one or more institutional units, governing the provision of social protection benefits and their financing* for which it is *possible to draw up a separate account of receipts and expenditures*. While this is not comparable with the statistical unit of national accounts – the institutional unit – it is usually possible to identify the sector of institutions operating schemes in ESSPROS to find some correspondence with the breakdown by institutional sector in national accounts.

ESSPROS is composed of a **core system**, collecting core information on the provision of social benefits and its financing, and a series of **modules** which collect supplementary information on specific aspects of social protection. More specifically, the core system collects quantitative data on social protection expenditure and the receipts of social protection schemes, accompanied by detailed qualitative information (see Section 5.2.3). Expenditure and receipts are broken down into a series of different sub-categories corresponding to the different types of transactions associated with these.

The key sub-category of expenditure is that on social benefits. These are transfers, in cash or kind, by resident schemes to households/individuals to relieve them of the burden of a defined set of risks/needs (the eight functions listed above). A unique feature of ESSPROS is that it implements a detailed classification system which categorises social benefits sequentially as follows.

1. **Characteristic**: social benefits are broken down by whether they are means-tested or not. Means-tested social benefits are those for which entitlement is explicitly or implicitly conditional on the beneficiary's income and/or wealth being below a specified level. This excludes benefits where the amount (but not the basic entitlement) is determined by income/wealth being below a specified level.
2. **Type**: social benefits are broken down by type according to how they are provided.
   - **Cash benefits** are benefits paid in cash with no evidence of actual expenditure required by beneficiaries. These are further sub-divided into periodic cash benefits paid at regular intervals (for example, weekly or monthly), and lump-sum cash benefits paid on a single occasion or as a lump-sum.
   - **Benefits in kind** are benefits granted in the form of goods and services. These may be provided directly by the social protection scheme or via reimbursement of certified expenditures.

3. **Function and detailed benefit classification**: social benefits are broken down by the function they serve – in other words the risk/need which they seek to address (listed in the definition of social protection given above) – and by detailed benefit type according to the specific purpose for which they are provided. ESSPROS defines a specific set of detailed benefit classifications for each function which broadly correspond to the most common benefits serving it.

This classification system is used in ESSPROS to produce detailed breakdowns of expenditure on social benefits that are unavailable in more aggregate data such as national accounts, and thus provide a platform for collecting other more detailed data – for example, data on recipients of social benefits.

3. Producing data on recipients of social benefits

The broad goal of producing data on social benefit recipients is to measure the **number of people** that are supported by all or part of the social protection system within a given reference period. Social benefits are designed to mitigate a wide range of social risks and are delivered in a variety of ways. Establishing processes for producing good quality and comparable data to meet the varying needs of users requires consideration of a number of key issues. Firstly, to define the concept of a recipient across diverse types of benefit, secondly to determine how these recipients should be measured, and, thirdly, how to aggregate data meaningfully when some recipients may receive more than one type of benefit.

Only once these are addressed can countries develop robust methods for deriving data on social benefit recipients from available national data sources. Indeed, in most cases, national sources are expected to include administrative microdata from national benefit registers, which typically include a raft of detailed information about each benefit recipient (for example, their characteristics) and each benefit they received (for example, type of benefit, amounts or dates of claims), structured in vastly different ways. The level of detail available in these sources goes well beyond that available from harmonised EU level micro-data such as from the European Union statistics on income and living conditions (EU-SILC) used in projects such as EUROMOD, a tax-benefit microsimulation model used to evaluate the effects of taxes and benefits in the EU ([7]). It is this level of detail and the fact that such registers cover all recipients of the benefits concerned, rather than a sample, which makes them a potent resource for deriving a range of data on benefit recipients at the level of individual benefits provided by individual social protection schemes. This cannot be achieved using existing harmonised EU level microdata. However, clear definitions are vital to enable consistent and comparable data on recipients to be derived from such complex data sources.

([7]) See https://euromod-web.jrc.ec.europa.eu/overview/what-is-euromod.

This section considers options for the definition and measurement of recipients, how the resulting data can serve the needs of data analysts and policy makers, and the extent to which these approaches can be applied across the full range of social benefits covered by ESSPROS. The issue of how to aggregate data without double counting is treated in the next section.

3.1. Beneficiaries, recipient units and the concept of a recipient

A recipient can broadly be interpreted as a beneficiary of the social protection system. However, a more precise definition is required to ensure a harmonious interpretation of the concept and facilitate the production of comparable data.

Typically, social benefits provide support either to individuals (whether or not they belong to a larger household) or to households composed of one or more members ([8]). In the former case, the concept of a beneficiary clearly relates to the individuals in receipt of benefits. However, when benefits support households, eligibility and the amounts payable may be determined by the household composition and/or situation and the needs of all or only selected members of the household. In this case, multiple household members can be considered beneficiaries even though the direct recipient may be a single individual within the household. Key examples of this are child allowances and housing benefits which are often determined based on household composition (in other words, the number of children and/or adults) but paid to one individual within that household.

Accordingly, possible approaches to the collection of data on social benefit recipients covering benefits granted to both individuals and households include the following.

- Collect data on **grantees** – in other words the number of persons who are administratively registered as recipients of the benefits. For individual benefits this corresponds to individual claimants while for household benefits this corresponds to household members designated as lead claimant, usually the head of household.
- Collect data on individual **beneficiaries** – in other words the number of individuals benefiting from the benefits provided. For individual benefits this corresponds to individual claimants while for household benefits this corresponds to the number of members of claimant households.

The approach based on **grantees** results in data on recipients which include both persons who represent only themselves and persons who represent their households. In some ways their numbers are equivalent to collecting data using two observation units for recipients – individuals and households. However, the approach based on **beneficiaries** may be difficult to implement in practice because it requires, as a minimum, access to data on the number of household members and, ideally, data that describe these individuals (for example, by sex or age). Such data may not be readily available in cases where these details are not a key part of determining eligibility for benefits.

([8]) ESSPROS defines social protection in §16 of Part I of the ESSPROS manual and user guidelines as being 'intended to relieve households and individuals of the burden of a defined set of risks or needs'. For example, benefits in the family/children function include benefits to households for bringing up children and for supporting relatives other than children.

3.2. Benefit characteristics and measuring the number of recipients

The varying nature of social benefits and how they are delivered impacts on how recipients can be measured using different observations.

In principle, all social benefits can be separated into two groups depending on whether they have a duration or not. Duration in this respect refers to the duration of each individual claim or benefit spell. Benefits that have no duration start and end at the same point in time. This is the case, for example, when claiming a one-off lump sum cash benefit ([9]).

The classification system used by ESSPROS already supports a distinction between cash benefits with and without duration by having separate classifications for periodic and lump-sum benefits ([10]). A similar distinction is, in theory, possible for benefits in kind but is not part of the ESSPROS classification system. For example, the provision of a carer to help carry out daily tasks has duration, while the provision of specialised equipment (for example, custom vehicles) to disabled persons does not. Both are considered in ESSPROS simply as benefits in kind.

Social benefits with duration can be further broken down based on their **typical duration** relative to the reference period (the calendar year), resulting into three categories:

1. **Long duration**: Benefits typically lasting the whole year. For example, old age pensions and survivors' pensions.
2. **Medium duration**: Benefits typically lasting one or more months. For example, unemployment benefits.
3. **Short duration**: Benefits typically lasting at least a day but no more than a month. For example, paid sick leave benefits.

Benefit duration is connected to two other characteristics with implications for the measurement of recipients. First, benefit receipt is more likely to be continuous (a single spell during the reference year) in the case of benefits with longer duration and intermittent (split across several spells during a reference year) in the case of those with shorter or no duration. Second, the number of benefit recipients is more likely to demonstrate variation over the course of the reference year (seasonal or otherwise) in the case of benefits with medium, short or no duration. For example, paid sick leave is typically short in duration, with claims rising during the winter and reoccurring among individuals in poor health or susceptible to illness.

([9]) Note that the benefit spell does not necessarily correspond to the period for which a benefit is potentially payable, though these may in some circumstances be the same. For example, in the case of a monthly cash benefit, benefit spells can start or end at any point during the month, but the payments (full or partial) will always occur at the end of the month.

([10]) It can be argued that certain lump-sum payments are provided with the intent to provide support over a fixed period. For example, lump-sum benefits provided to the unemployed to help them start a company or become self-employed may be designed to support activity over a start-up period and, in some cases, be repayable if the business is not still active at the end of this period. However, for practical purposes, lump-sum benefits have to be treated as benefits without duration.

Based on the following definitions, four possible approaches are available for measuring the number of recipients.

- **Recipients over the year (ROY)** is the total number of different recipient units that receive a benefit at any point during the reference year.
- **One-off stock** is a single point-in-time observation of the number of recipient units in receipt of a benefit at a given moment, for example, start-year, end-year or on another specific date.
- **Annual average stock (AAS)** is an average of multiple point-in-time observations taken across the reference year. AAS describes the average number of recipient units in receipt of a benefit at any point during the reference year and can be interpreted as the volume of recipient-years – in other words the number of recipient-years completed during the reference year.
  Average stocks serve to smooth out variations during the year to produce a more accurate estimate across the reference period. The observations used to derive the average can be of any frequency (for example, daily, weekly or monthly), and accuracy of the data will increase with the frequency of the underlying observations. The extent of accuracy gains deriving from higher frequency data depends, however, on the duration of the benefit concerned. For example, in the case of benefits with long duration (for example, pensions) recipient numbers tend to remain relatively stable during the year, thus reducing the need to smooth out fluctuations.
- **Flows** include **inflows** and **outflows**. Inflows refer to the number of benefit spells starting during the reference year and outflows to the number of ending spells ([11]).
  A single recipient unit can potentially experience multiple distinct benefit spells within the reference period in association with a single type of benefit and thus contribute multiple inflows/outflows to the flow data for the benefit. Conceptually, therefore, it can be considered a measure of the initiation and termination of recipient units within the process of claiming benefits rather than a measure of recipients.

Not all these approaches can be applied to all benefits (see Table 1). Stock (both one-off and annual average) can only be calculated for benefits with duration because benefits with no duration are essentially instantaneous: at any point in time there is effectively a stock of zero. Further, one-off stock may not be reliable for benefits which have a variable number of recipients over the course of the year. For this reason, this approach can only be reliably applied to benefits of long duration unaffected by such factors – for example, pensions and long-term care benefits. For benefits potentially subject to periodic variation, accurate representation of recipient numbers requires the use of AAS to smooth out peaks and troughs.

([11]) Inflows are alternatively referred to as successful claims, caseloads or entrants while outflows are sometimes referred to as exits. Note that flows can also be measured as unique recipients that started/ended at least one successful claim during the reference year. However, flows based on benefit spells are typically preferred to those based on unique recipients for three reasons: (1) coherence with annual average stock data (both account for all spells of receipt), (2) the data are more informative when trying to understand changes in the demand for benefits and (3) they enable a more straightforward breakdown by characteristics of recipients (in other words, based on characteristics at the start/end of the benefit spell).

Both ROY and flows are applicable to all benefits, with or without duration. This is because their calculation does not consider the time and duration of a benefit claim but only if a claim took place or started/ended during the reference year ([12]).

Table 1: Applicability of measurement approaches to benefits of different durations

Approach	Duration of benefit			
	Long	Medium	Short	None
One-off stock	✓	×	×	×
Annual average stock (AAS)	✓	✓	✓	×
Recipients over the year (ROY)	✓	✓	✓	✓
Flows (inflows/outflows)	✓	✓	✓	✓

3.3. Implication for use in data analysis and policy making

The extent to which a particular measurement approach is applicable is not the only significant consideration, it is equally important that the resulting data are relevant for users. Indeed, relevance is one of the guiding principles of the quality assurance framework of the European Statistical System ([13]). In this respect, it is important to consider the potential uses of data on social benefit recipients and how these can be fulfilled by the different approaches to measurement.

There are three main policy related needs:

1. **Trends:** time-series data on the number of recipients provide policy makers with an indication of relative changes through time in the demand for benefits and these, in conjunction with relevant contextual data, can be used to make projections of anticipated demand and corresponding funding needs.
2. **Adequacy**: combining data on the number of recipients with the related expenditure can provide indications of the adequacy of the level of support provided in relation to relevant socio-economic indicators (for example, poverty thresholds or level of previous income from work). This requires coherence between data on recipients and corresponding data on expenditure (in other words, data should be collected using common statistical principles).
3. **Coverage**: comparing data on the number of recipients with the size of a corresponding target population can provide policy makers with an indication of coverage and whether a benefit is effective in reaching its intended target population. This requires coherence between data on recipients and data for the relevant target population(s).

([12]) Note that in the case of benefits without duration, there is no distinction between inflows and outflows because both will count the number of benefit claims during the year.
([13]) See https://ec.europa.eu/eurostat/documents/64157/4392716/ESS-QAF-V1-2final.pdf/bbf5970c-1adf-46c8-afc3-58ce177a0646.

3.3.1. TRENDS

All approaches to the concept of a recipient and to measurement can be used to provide information on trends in the number of recipients (of benefits to which they can be applied). The key issue is the extent to which they are consistent with trends in expenditure.

Table 2: Ability to assess trends by measurement approach and duration of benefi

Approach	Duration of benefit			
	Long	Medium	Short	None
One-off stock	✓	×	×	×
Annual average stock (AAS)	✓	✓	✓	×
Recipients over the year (ROY)	✓	✓	✓	✓
Flows (inflows/outflows)	×	×	✓	✓

The extent to which different measurement approaches can produce data on trends in the number of recipients that are consistent with those of expenditure varies for benefits with or without duration (see Table 2):

- **One-off stock** is a reliable measure of recipients only for benefits with long duration and this follows through to the analysis of trends. For relevant benefits (for example, pensions), one-off stock can serve as a proxy for AAS and be interpreted in the same way.
- **AAS** accounts for the volume of recipient-years (in other words, accounts for both the number of recipients and the duration of their benefit spells within the reference year) and, as such, is an approach (for benefits with duration) that is fully consistent with expenditure recorded on an accrual basis. In a stable situation, trends in AAS should be directly in line with trends in expenditure and any divergences will reflect factors such as changes in the structure/characteristics of recipients or rates of benefit payable.
- **ROY** and **flows** are the only approaches that can be used to measure recipients of benefits without duration and, therefore, trends in their numbers. In such cases, both provide a useful but different perspective, but trends in flows will more closely align with those in expenditure. However, in the case of benefits with duration, trends for ROY and for flows can deviate dramatically from trends in expenditure when the average duration of benefit spells changes over time. This may occur, for example, in the case of unemployment benefits in response to changing labour market conditions. This can lead to counterintuitive and potentially confusing results for data users (for example, trends in recipients and in expenditure moving in opposite directions).

3.3.2. ADEQUACY

Assessment of adequacy requires a combination of data on expenditure and recipients to produce indicators that make it possible for the value of social benefits received to be compared with baseline indicators such as poverty thresholds, the level of the minimum or average wage, and so on. Ideally, such data would also support comparison across different benefits and across countries.

Comparable expenditure data are readily available from the ESSPROS core system. These data are reported on an accrual basis for each reference year – in other words expenditure for a given reference year is an aggregation of all expenditures deriving from claims and liabilities created in relation to events taking place during the reference year. To illustrate this, consider the situation where a person is granted a benefit in relation to circumstances in November of year *t* but the benefit is not disbursed until January of year *t+1*. In this case, the amounts disbursed will be reported in the expenditure for year *t* and not *t+1*. Accordingly, combining this with data on recipients to measure adequacy requires the data of recipients to represent an aggregation of all individuals in receipt of benefits during the reference year.

It is important to recognise that the concept of adequacy has a different meaning (at least in terms of the amounts needed) when considering social benefits that support individuals and households. In general (but certainly not exclusively), the interest in adequacy will be at the same level as the recipient unit of a benefit – for example, the adequacy of a housing benefit would normally be considered in relation to the needs of the household. However, the overall needs of a household are not necessarily a simple linear function of the number of its members (in other words, the characteristics of different members and overall composition matter). Consequently, the concept of individual beneficiaries may not be sufficient to assess reliably the adequacy of benefits providing support to households. However, data on grantees (for benefits delivered to the respective units) should always be relevant, provided the nature of the benefit is considered.

Table 3: Ability to assess adequacy by measurement approach and duration of benefit

Approach	Duration of benefit			
	Long	Medium	Short	None
One-off stock	✓	×	×	×
Annual average stock (AAS)	✓	✓	✓	×
Recipients over the year (ROY)	×	×	×	✓
Flows (inflows/outflows)	×	×	✓	✓

The extent to which different measurements of recipients can produce meaningful indicators on adequacy when combined with data on expenditure varies (see Table 3):

- **Expenditure / one-off stock**: as mentioned above, one-off stock is applicable only for benefits with long durations, for which it can serve as a proxy for AAS and be interpreted in the same way. For this reason, the ratio expenditure / one-off stock may represent a reliable estimation only for the average amount granted to those receiving this kind of benefit (for example, pensioners).
- **Expenditure / AAS** represents the average expenditure per recipient-year – in other words the average cost of a benefit paid to one recipient for a whole year. This approach – by

definition – removes the impact of benefit duration, so results can always be compared in a meaningful way between benefits of different durations. However, this approach can only be used for benefits with duration. Moreover, there is a risk that users of the data interpret results to be expenditure per recipient and not expenditure per recipient-year. In the case of an unemployment benefit payable for a maximum of six months, for example, the observation of expenditure / AAS would show the average amount paid to one recipient if the benefit was received for a whole year, a figure that could potentially be up to twice the maximum that can legally be received in a single spell. Expenditure / AAS is undoubtedly a valuable tool for comparison of the relative costs of different benefits, but users need to be appropriately informed of how the values should be interpreted.

- **Expenditure / ROY** represents the average amount of benefit received per recipient within the year. Since ROY takes no account of the duration of benefits, the value of the ratio will be affected by changes in the average duration of benefit receipt during the year and may vary without any change in the value of the benefits paid out per recipient/period. For example, an unemployment benefit payable for up to a maximum of six months is liable to show a lower value than an unemployment benefit payable for a year, even if the level of the monthly payment is equal. This can therefore convey a misleading message to users in the case of benefits with duration. However, it can provide a useful measure of adequacy in the case of benefits without duration as the source of non-comparability does not apply.
- **Expenditure / inflow** of recipients may give an indication of the cost incurred within the reference year per new successful claim (in other words, claims started during the reference period). The expenditure in the numerator will, however, include amounts related to spells that started prior to the reference year but continued within it, which will not be considered in the denominator. This indicator is thus liable to be unreliable for benefits with medium or long duration and, especially those for which flows are not reasonably constant over time. The observation can provide a useful measure of adequacy only for benefits of short or no duration.

3.3.3. COVERAGE

Assessment of coverage requires the combination of data on recipients and data on a corresponding target population to produce indicators that provide information on the extent to which social benefits are provided to those potentially in need. To provide meaningful results, both sets of data need to be measured in the same way.

Data on reference populations typically derive from demographic statistics, which can provide information on total population by age/sex/nationality, or surveys such as the EU labour force survey (EU-LFS) and EU statistics on income and living conditions (EU-SILC), which can provide information on potential target populations such as the number of unemployed (EU-LFS) or the number of people at risk of poverty or social exclusion (EU-SILC). Such sources generally provide data based on point-in-time observations – either one-off stock or AAS depending on the methodology. For the EU-LFS, for example, Eurostat publishes both quarterly (one-off stock) and annual data (AAS, based on the average of four quarters). Accordingly, only recipient data based on stocks can be used to support a meaningful assessment of coverage using such sources. For example, stock data on the number of recipients of full unemployment benefits can be combined with EU-LFS data on the number of unemployed

according to the International Labour Organization's definition ([14]) to derive coverage rates for full unemployment benefits. Indeed, such rates have already been produced and published by the OECD using data from their SOCR database ([15]).

Indeed, to use data on ROY, the reference population would theoretically have to be the number of different individuals who were part of the target population at any point during the year. For example, to assess coverage of unemployment benefits the observation of ROY would have to be compared to the total number of people who were unemployed at any point during the reference year. Typically, such data are not readily available. However, in cases where the composition of the underlying target population changes very slowly over the reference year, an average stock of the reference population could be used as a proxy denominator (see Table 4).

Table 4: Ability to assess coverage by measurement approach and duration of benefit

Approach	Duration of benefit			
	Long	Medium	Short	None
One-off stock	✓	×	×	×
Annual average stock (AAS)	✓	✓	✓	×
Recipients over the year (ROY) ([1])	×	×	×	×
Flows (inflows/outflows)	×	×	✓	✓

([1]) This approach can be applied only in cases where the composition of the reference population is stable over the year.

To use data on flows, the reference population would have to be the flows into the target population during the year. Such data are also not readily available but there are a few exceptions. For example, data on the number of births and deaths each year are readily available and could be used to assess coverage of birth grants and death grants.

The limited availability of reliable observations of target populations that are compatible with observations of ROY or flows means that these approaches are generally not suitable for the assessment of coverage, although there can be exceptions.

3.4. Measurement of the characteristics of benefit recipients

While the primary aim of developing a collection of data on social benefit recipients is to quantify the total number of recipients of social benefits, a further important objective is to provide information on their characteristics, providing an additional layer of information for data analysts and policy makers. In this regard there are two key concerns – what characteristics to measure and how to measure them.

The different concepts of a recipient give rise to issues in selecting characteristics to measure. Both concepts of a recipient imply the measurement of individual characteristics. However, household characteristics are likely more pertinent for understanding the recipients of household benefits. Indeed, certain important characteristics cannot be applied to both individuals and households. This could include, for example, total household size or the number of dependants. Further, the relevance of different breakdowns varies across benefits.

([14]) Persons who are without work, currently available for work and seeking work. See https://stats.oecd.org/glossary/detail.asp?ID=2791.
([15]) See https://www.oecd.org/els/soc/recipients-socr-by-country.htm#coverage.

For example, an appropriate set of age groups for benefits targeted at persons of working-age (for example, 15–24, 25–54 and 55–64 years) is not appropriate for benefits targeted at retirees.

Accordingly, two possible approaches may be considered. The first is to collect a limited set of harmonised breakdowns across all benefits. This ensures that breakdowns can be aggregated across different types of benefits, even if some are not applicable for some benefits. The number of breakdowns must be constrained to avoid excessive burden being placed on data production (Principle 9 of the European Statistical System's quality assurance framework). The second is to collect different breakdowns for different types of benefits. This would maximise the relevance of data for analysis of specific types of benefit but restrict possibilities to aggregate and conduct analysis spanning different types of benefit.

The fact that the characteristics of specific recipients may change during the reference period (for example, age) gives rise to complications when using certain approaches to the measurement of recipients related to when characteristics should be measured. Generally, there are three possible methods.

1. **Point of observation**: this can be applied to all measurement approaches except ROY. One-off stock is an observation at a point in time and inflows and outflows occur at a point in time so that the characteristics of the recipients can be recorded at this point. AAS is simply an average of multiple one-off observations. In this case, for example, if age is measured at each of the observation points contributing to the average, an individual recipient may contribute to the stock in two age breakdowns within a single reference year (as proportionate parts of a recipient-year). By contrast, observations of ROY are not connected to a specific point in time.
2. **Single point in time during the reference year** (for example, start/middle/end of the year): theoretically, this can be applied to all measurement approaches, but there will be cases where the characteristics at the single point in time do not reflect the characteristics at the time of benefit receipt. For example, some recipients whose benefit spell did not encompass the selected point of observation may have been one year younger/older at the time they actually received the benefit, resulting in a minor loss of accuracy.
3. **Start of the benefit spell for benefits with duration** and the **time of receipt for benefits without duration**. Theoretically, this can be applied to all measurement approaches, but is liable to significant accuracy issues for both stock (one-off or annual average) and ROY in the case of benefits with medium/long duration (in other words, in the case that benefit spells started a long time before the start of the reference year). This can, however, be used for flow data which refer only to the start/end of benefit spells during the reference year. In the case of ROY there is the additional risk that one recipient claims multiple times in the reference year thereby requiring a choice to be made in terms of which spell to use for observing their characteristics.

3.5. A single common approach or a modular approach

There are clearly advantages and disadvantages to each of the available approaches to both key building blocks:

1. **Concept of a recipient:** collecting data on individual beneficiaries may be impractical. Accordingly, the only viable approach is to simply collect data on grantees – in other words individual claimants for individual benefits and lead claimants for household benefits. This, however, does not provide a full picture of those who benefit from social benefits and limits the relevance of any information on the characteristics of recipients in the case of benefits provided to households.
2. **Measurement of the number of recipients**: no single approach is applicable to all ESSPROS benefits or provides data meeting all user needs. Annual average stock (including, as a proxy, end-year stock for benefits with long duration) is the best option for providing useful data on benefits with duration but cannot be used for benefits without duration. Recipients over the year and flows can be used for benefits with and without duration but are less relevant in the case of the former. Accordingly, a combination of approaches is needed to provide useful data for all forms of social benefits.

Given that there is no 'one-size fits all' solution, some flexibility is needed in the design of an overarching approach to the collection of data on social benefit recipients. The most pragmatic option is to pursue a modular approach whereby sub-sets of benefits to which a single approach can be applied are grouped into modules, and a limited variation in approach is permitted for different modules (in other words, allowing the use of different, possibly multiple, measurement approaches). In such an approach, the flexibility available in the design of specific modules should be clearly defined with clear restrictions on what elements are allowed to vary and to what extent these may vary, to ensure harmonisation where possible. It is equally important that the impact of such flexibility is made clear in terms of the use of resulting data (for example, aggregation of data of different modules).

4. Aggregating data on recipients of social benefits and treatment of double counting

Establishing a process for the production of data on social benefit recipients is not limited to setting out how to quantify recipients at the level of individual benefits. It is also important to determine how data on recipients of individual benefits can be combined to produce aggregates that provide information on the number of recipients for groups of benefits.

To provide meaningful results, any data on social benefit recipients that are to be aggregated need to not only be measured in the same way but also treated for potential double counting. In this section, the issue of double counting and its implications for producing aggregates are explained.

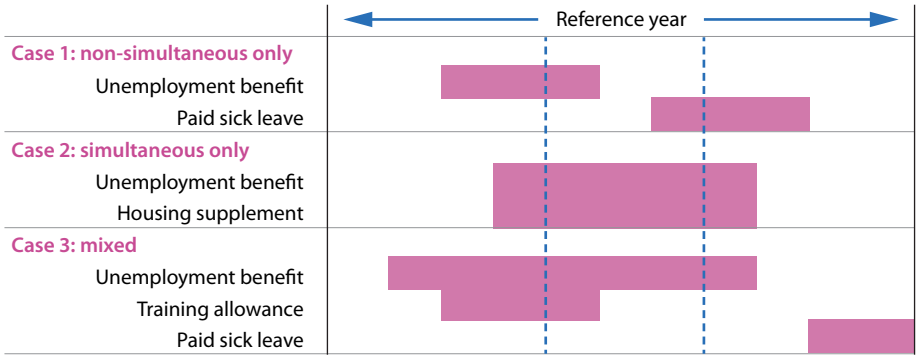
4.1. Double counting of social benefit recipients

Social protection systems address a wide range of risks and needs. As a result, an individual or household may claim multiple social benefits within a reference year. Quantifying the number of **unique recipients** of a group of benefits thus entails a risk of double counting when one recipient receives more than one of the benefits covered in the relevant reference period. In this regard, two scenarios need to be distinguished:

1. **Non-simultaneous receipt**: a recipient receives only one benefit at a given point in time, or over a given part of the reference period. For example, in one year, an individual might receive unemployment benefit for some months and then later, once in work, receive paid sick leave but is only ever in receipt of one of the benefits at any given point in time.
2. **Simultaneous receipt**: a recipient receives multiple benefits at a given point in time, or over a given part of the reference period. For example, an individual might receive both an unemployment benefit and a housing supplement at the same time.

These situations are further illustrated through example cases presented in Figure 1.

Figure 1: Simultaneous and non-simultaneous receipt of benefits



Magenta: spells of benefit receipt. Dashed blue lines: example point-in-time observations.
This figure presents three example cases.
Case 1: individual receives unemployment benefit and paid sick leave non-simultaneously.
Case 2: individual receives unemployment benefit and a housing supplement simultaneously.
Case 3: individual receives unemployment benefit and a training allowance simultaneously and paid sick leave non-simultaneously.

4.2. Risk of double counting and approach to measurement

The risk of double counting when quantifying the number of unique recipients of a group of benefits depends on the measurement approach and, more specifically, the type of observation used.

- **ROY** is based on observations over the reference period. A recipient is counted as one unit irrespective of when, or for how long, they receive the benefit during the year. Measurement of ROY across a group of benefits can thus be affected by double counting arising from both simultaneous and non-simultaneous receipt.
- **One-off stock** and **AAS** are based on point-in-time observations. In the case of non-simultaneous receipt, a point-in-time observation can only ever count a recipient in relation to one of the group of benefits (see Figure 1). This means that double counting can occur only in case of simultaneous receipt.
- **Flows (inflows and outflows)** are based on observations of benefit spells starting or ending during the reference year and are largely unaffected by double counting ([16]). Indeed, a recipient with multiple spells starting/ending during the year is expected to contribute more than once to the number of inflows/outflows.

The potential for double counting associated with each measurement approach is summarised in Table 5. In general, the risk of double counting is reduced when using approaches based on point-in-time observations (in other words, AAS or one-off stock) compared with those that use observations over the reference period (in other words, ROY) because they remove the risk arising from benefits received non-simultaneously.

Table 5: Potential for double counting by measurement approach

Approach	Benefits received simultaneously during the year	Benefits received non-simultaneously during the year
One-off stock	✓	×
Annual average stock (AAS)	✓	×
Recipients over the year (ROY)	✓	✓
Flows (inflows/outflows)	×	×

4.3. Implications of double counting for data production

A key preparatory step in measuring the total number of unique recipients for a group of benefits is to assess the risk of double counting between each possible pair of social benefits within the group to identify where it can arise in practice. In a group covering *n* benefits there are $n!/(2*(n-2)!)$ possible combinations. For example, if 4 benefits are covered, 6 pairs of benefits need to be assessed, while if 8 benefits are covered, the number rises to 28 pairs, and so on. This underlines the importance of the issue of double counting in selecting aggregates to be produced and the potential scope of its impact on data production.

([16]) Note that there is an exception to this in ESSPROS. A risk of double counting can arise due to reporting conventions related to the treatment of multifunction benefits. If a multifunction benefit is split into components which are reported separately, then the same inflow/outflow for that recipient will be recorded in the data for each component and double-counted if these are aggregated.

The extent of this issue for each country depends not only on the aggregates requested (universal to all countries) but also on the characteristics of their national social protection systems (country specific).

National systems will differ in terms of the number of benefits made available in association with a chosen aggregate. Indeed, social protection addressing a particular risk or need may be delivered via a relatively small number of benefits in some systems, while in others it may be provided through a wider range of separate benefits (for example, separate benefits for specific target groups.). The number of pairs of social benefits to be assessed for double counting will thus vary from country to country.

Another key aspect is the rules governing access to social benefits (in other words, eligibility rules/criteria), which are the main source of information for assessing the potential for double counting. While such rules are unlikely to rule out non-simultaneous receipt of different benefits within a reference year (though there could be some exceptions), they can often rule out the simultaneous receipt of certain combinations of benefits. This is achieved via two types of rules.

- **Rules explicitly preventing simultaneous receipt**: the eligibility criteria for a benefit explicitly exclude persons in receipt of another benefit (or group of benefits). This is the case, for example, when unemployment insurance is granted to the unemployed with a sufficient social contribution record for a temporary period whereas unemployment assistance is granted to the unemployed not eligible for unemployment insurance or whose entitlement has expired.
- **Rules implicitly preventing simultaneous receipt**: the eligibility criteria do not specifically mention other benefits in the group of interest but effectively create two mutually exclusive groups of recipients. This is the case, for example, when paid sick leave is only available to people in employment while full unemployment benefit is only available to people who are full-time unemployed (in other words, without work but available for and actively seeking work).

Furthermore, the broad organisation of the social protection system and its applicable rules may sometimes exclude the possibility of simultaneous receipt between large groups of benefits. This applies, for example, when there is a clear split between benefits provided to distinct segments of the population, such as between benefits for people of working age and non-working age, between benefits for people with and without work, or between benefits for people with and without disabilities.

Simultaneous receipt is, therefore, typically much less of an issue in practice than non-simultaneous receipt. This further underlines the advantage of using measurement approaches based on point-in-time observations (in other words, AAS or one-off stock) which are only affected by double counting arising from simultaneous receipt. Consequently, the extent of the need to treat double counting during the production of aggregates is anticipated to be vastly reduced for such approaches relative to those affected also by non-simultaneous receipt (in other words, ROY).

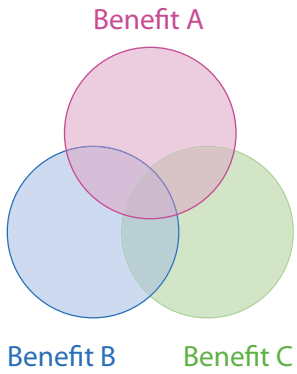
4.4. Aggregation and treatment of double counting

In practice, there are two methods for treating double counting when deriving the total number of unique recipients of a group of benefits. The first is to calculate the extent of double counting between all benefits covered and deduct it from the sum of the recipients of each constituent benefit (in other words, calculate and apply an adjustment for double counting). The second is to directly calculate the total number of unique recipients without double counting. The most desirable method will depend on the data collection requirements (in other words, whether the extent of double counting needs to be identified) and on the nature of the source data used.

It is important to recognise an important pitfall to be avoided. Quantifying double counting for a group of benefits is not as simple as quantifying the number of shared recipients for every pair of benefits within the group and then summing these together. This may overstate the extent of double counting because recipients may receive more than two benefits within the group (see Figure 2).

This further implies that a separate quantification of double counting, or of the unique number of recipients, is required for each aggregate compiled even when a high-level aggregate is based on aggregations at a lower-level (see Section 5.1.3, Figure 3). For example, in the case of ESSPROS, when producing a function level aggregate, the aggregates for means-tested and non means tested benefits within the function could be used but a specific calculation of the double counting between the two groups of benefits would still be needed. The only exception to this is if it is already known that double counting of recipients of the groups of benefits covered by the two lower-level aggregates is not possible. Nevertheless, this underlines the need for careful selection of aggregates to avoid an excessive work burden for data producers.

Figure 2: Overlaps in recipients of three benefits and quantifying double counting and unique recipients



Benefit(s)	Total unique recipients
A	A
B	B
C	C
A&B	$A+B-A\cap B$
A&C	$A+C-A\cap C$
B&C	$B+C-B\cap C$
A&B&C	$A+B+C-A\cap B-A\cap C-B\cap C-A\cap B\cap C$

Note: adjustment for double counting is shown in red.

Accordingly, the availability of suitable source data is a key constraint in practice. To make possible the identification of the unique recipients of a selected group of benefits, source data need to (i) cover the sub-set of benefits within that group that are potentially affected by double counting (in other words, those for which overlaps in recipients cannot be ruled out based on the eligibility rules) and (ii) provide information on the claims of each recipient of each benefit in a way that makes possible the construction of the observations used in the measurement approach adopted. A consequence of this is that deriving broader aggregates requires source data covering a larger selection of benefits.

In practice, the different parts of a country's social protection system are often spread across different institutions and providers, each maintaining their own monitoring systems with tailored approaches to measurement and observation and thus potentially limiting possibilities to combine data. In recent years, however, significant progress has been made in terms of initiatives to combine multiple sources of data for different benefits using personal identifiers (for example, personal ID number, or social insurance number) – in other words to construct linked benefit registers. The presence of compatible personal identifiers in datasets covering recipients of different benefits is key to the identification of individuals appearing in more than one dataset and the treatment of any double counting that arises.

5. Approach in ESSPROS modules on pension beneficiaries and unemployment benefit recipients

The considerations presented in the previous sections have been tested empirically in the longstanding ESSPROS module on pension beneficiaries (PB) and, more recently, in the experimental module on unemployment benefit recipients (UBR). These modules collect data on different sub-sets of social benefits and present different methodological issues related to the concept of a recipient, the measurement of the number of recipients, and the treatment of double counting ([17]).

5.1. Pension beneficiaries module

The aim of the module on pension beneficiaries ([18]), is to calculate the total number of unique beneficiaries (in other words, without double counting) in each of seven categories of pensions and then in each of the four functions to which they belong, in one inter-function aggregate (old age and survivors pension beneficiaries) and an overall aggregate covering all pensions. Table 6 illustrates the structure of the ESSPROS pension beneficiaries module.

([17]) The double counting described in this section stems directly from the organisation of the ESSPROS classification system and associated questionnaires, notably the types of aggregates which are requested, which were originally formulated to collect data on expenditure (for which there is no issue of double counting).

([18]) See Annex II of Regulation (EC) No 458/2007 of the European Parliament and of the Council on the European system of integrated social protection statistics (ESSPROS), available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32007R0458.

Table 6: Categories of pension and aggregates thereof

Category of pension	Aggregates		
	Function	Inter-function aggregation	Total
Disability pension	Disability		All pensions
Early retirement in case of reduced ability to work			
Old age pension	Old age	Old age and survivors	
Anticipated old age pension			
Partial retirement pension			
Survivors' pension	Survivors		
Early retirement for labour market reasons	Unemployment		

Note: at the most detailed level, ESSPROS also includes separate classifications for means-tested and non means-tested variants of each category of pension.

Data on beneficiaries are collected only for pensions for which non-zero expenditure has been reported in the ESSPROS core system. These data are collected at both the level of individual schemes and the level of all schemes. Breakdowns by sex are required at the level of all schemes but are optional for individual schemes.

5.1.1. THE CONCEPT OF A RECIPIENT AND MEASURE USED

Pensions are benefits typically targeted to individuals, mainly to protect them from risks related to old age, disability, early retirement for labour market reasons or loss of a spouse (or family member). Accordingly, associated eligibility criteria tend to be limited to conditions to be met by the individual recipient (for example, age and contribution history for old age pensions) ([19]). With this in mind, the concept of recipient adopted by the pension beneficiaries module is **the beneficiary**, as defined above in Section 3.1. However, it could equally be interpreted as **the grantee**, as they are interchangeable in the case of benefits provided to individuals.

Pensions are periodic cash benefits that are granted for extended periods, usually spanning several years. For example, old age and survivors' pensions are lifelong benefits, typically paid until death. Accordingly, the volatility in the number of recipients during the reference year is expected to be minimal. This characteristic differentiates pensions from other social benefits covered by ESSPROS and enables the use of **end-year stock** as a reliable low-cost solution to collecting data on the number of pensioners (in other words, minimises the work burden placed on data producers). This approach does not account for persons who received a pension during part of the year but not at the end of it and is therefore liable to understate the total number of beneficiaries during the reference year (ROY). However, such a situation is only likely to arise for pensions characterised by relatively higher turnover (for example, early

([19]) One exception is survivors' pensions which may include conditions to be met by a departed person (for example, contribution history) in addition to conditions to be met by the survivor (for example, degree of kinship, personal income). Furthermore, multiple survivors may derive rights to a survivors' pension from a single departed person, albeit the amounts granted may be affected by such a situation. For example, a surviving spouse, divorced spouse, and children may derive a right from a single departed person. Regardless, even in the case of survivors' pensions, the benefits are granted to and intended to assist individuals.

retirement for labour market reason) and 89 % of EU pension beneficiaries in 2018 received old age and/or survivors' pensions, for which this does not tend to be the case. Accordingly, the marginal gains in data accuracy that would be obtained from using other approaches (AAS or ROY) would be limited and therefore would not justify the additional costs (in terms of data production complexity) of their adoption.

5.1.2. DOUBLE COUNTING: TYPES AND TREATMENT

In this point, some more detailed aspects of double counting in pension beneficiaries statistics are illustrated with the example of the results of the 2020 data collection (reference year 2018). These demonstrate that pensioners may receive more than one pension in almost all countries (32 out of 35 taking part). The extent of this varies depending on national rules.

The methodology for pension beneficiaries describes six different types of potential double counting (pensioners receiving more than one pension) requiring consideration during the production of data.

- **Type 1. At detailed benefit classification level inside a single scheme**: beneficiaries may receive multiple pensions belonging to the same category of pension (in other words, the same detailed benefit classification) from a single scheme. This type of double counting is recorded in several countries where, according to the national legislation, an individual may receive two or more pensions of the same category, paid by the same scheme. Those involved are generally, but not exclusively, schemes paying old age pensions.
- **Type 2. At detailed benefit classification level between schemes**: beneficiaries may receive multiple pensions belonging to the same category of pension (the same detailed benefit classification) from different schemes. This double counting must be removed when reporting beneficiaries at the level of all schemes, so that those pensioners who receive a specific category of pension from two or more schemes are only counted once. This is the case, for example, in Denmark, where different subsets of retirees receive old age pensions from three different, mutually exclusive, schemes, but all receive a supplementary pension belonging to the same category, paid by a separate pension scheme (Arbejdsmarkedets Tillægspension, ATP).
- **Type 3. At detailed benefit classification level between non means-tested and means-tested sub-categories**: beneficiaries may receive both non means-tested and means-tested variants of the same category of pension. This double counting must be removed when reporting the aggregation of non means-tested and means-tested pensions at the level of all schemes. This is the case, for example, in Austria, where those receiving basic old age, disability and survivors' pensions, also receive, subject to a means-test, a supplementary pension.
- **Type 4. At intra-function level**: beneficiaries may receive pensions belonging to different detailed benefit classifications within a single function. This type of double counting may arise in either the disability function (type 4.1) or the old age function (type 4.2).
  - **Type 4.1**: beneficiaries may receive multiple pensions belonging to different pension categories within the disability function. Such beneficiaries should only be counted once in the total beneficiaries reported for the function as a whole.

  - **Type 4.2**: beneficiaries may receive multiple pensions belonging to different pension categories within the old age function. Such beneficiaries should only be counted once in the total beneficiaries reported for the function as a whole.

  This type of double counting is reported, for example, in Denmark, for pensions recorded in the disability function. More specifically, according to national legislation and eligibility criteria applied, it is estimated that 50 % of the beneficiaries of a private disability pension also receive an early retirement pension due to a reduced capacity to work.
- **Type 5. At inter-function level**: the total number of beneficiaries receiving at least one pension belonging to either the old age function or the survivors function has to be reported (total beneficiaries in old age and survivors functions). Beneficiaries who simultaneously receive pensions belonging to both functions should only be counted once.
- **Type 6. At total level**: the total number of beneficiaries receiving at least one pension belonging to any function has to be reported. Beneficiaries who simultaneously receive pensions belonging to different functions should only be counted once.

Calculating the number of beneficiaries for the different aggregates while accounting for the double counting described above entails a gradual, step by step, aggregation process. The different double counting types are thus numbered and ordered according to the step in this process at which they are treated (as summarised in Figure 3). This starts with the elimination of the double counting at detailed benefit level inside a single scheme (in other words, type 1), and ends with the elimination of double counting associated with deriving the total number of beneficiaries at the level of all schemes (in other words, type 6).

Figure 3: Multi-step aggregation process and adjustment for double counting

(1) This refers to the treatment of double counting when aggregating data on recipients of two or more functions. In the case of the PB data collection, it refers both to the aggregation of old age and survivors functions (double counting type 5) and to the aggregation of old age, survivors, disability and unemployment functions (double counting type 6). Theoretically, the combination of functions might also refer to the aggregation of all eight functions covered by the ESSPROS domain if a data collection covering recipients associated with all functions is ever implemented.

Table 7 illustrates how the six types of double counting are treated in the questionnaire used to collect data on pension beneficiaries.

Table 7: Pension beneficiaries module questionnaire and the treatment of double counting

		All schemes			Scheme 1			Scheme 2 … N		
		F+M	F	M	F+M	F	M	F+M	F	M
	Total pension beneficiaries	=A+B+C+D (DC type 6)			DC type 1			DC type 1		
A	**Total pension beneficiaries in disability function**	=A.1+A.2 (DC type 4)			DC type 1			DC type 1		
A.1	Disability pension beneficiaries	=A.1.1+A.1.2 (DC type 3)								
A.1.1	*Disability pension beneficiaries, NMT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
A.1.2	*Disability pension beneficiaries, MT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
A.2	Beneficiaries receiving early retirement benefits due to reduced capacity to work	=A.2.1+A.2.2 (DC type 3)								
A.2.1	*Beneficiaries receiving early retirement benefits due to reduced capacity to work, NMT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
A.2.2	*Beneficiaries receiving early retirement benefits due to reduced capacity to work, MT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
B	**Total pension beneficiaries in old age function**	=B.1+B.2+B.3 (DC type 4)						DC type 1		
B.1	Old-age pension beneficiaries	=B.1.1+B.1.2 (DC type 3)								
B.1.1	*Old-age pension beneficiaries, NMT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
B.1.2	*Old-age pension beneficiaries, MT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
B.2	Anticipated old age pension beneficiaries	=B.2.1+B.2.2 (DC type 3)								
B.2.1	*Anticipated old age pension beneficiaries, NMT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
B.2.1	*Anticipated old age pension beneficiaries, MT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
B.3	Partial pension beneficiaries	=B.3.1+B.3.2 (DC type 3)								
B.3.1	*Partial pension beneficiaries, NMT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
B.3.2	*Partial pension beneficiaries, MT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		

Note: NMT = non means-tested; MT = means-tested; F = female; M = male; DC = double counting.

Table 7 (cont.): Pension beneficiaries module questionnaire and the treatment of double counting

		All schemes			Scheme 1			Scheme 2 … N		
		F+M	F	M	F+M	F	M	F+M	F	M
C	**Total pension beneficiaries in survivors function**									
C.1	Survivors' pension beneficiaries	=C.1.1+C.1.2 (DC type 3)								
C.1.1	*Survivors' pension beneficiaries, NMT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
C.1.2	*Survivors' pension beneficiaries, MT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
D	**Total pension beneficiaries in unemployment function**									
D.1	Beneficiaries receiving early retirement benefits for labour market reasons	=D.1.1+D.1.2 (DC type 3)								
D.1.1	*Beneficiaries receiving early retirement benefits for labour market reasons, NMT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
D.1.2	*Beneficiaries receiving early retirement benefits for labour market reasons, MT*	*=Σ scheme 1 … n (DC type 2)*			DC type 1			DC type 1		
E	**Total beneficiaries in old-age and survivors functions**	=B+C (DC type 5)								

Note: NMT = non means-tested; MT = means-tested; F = female; M = male; DC = double counting.

Table 8 summarises the occurrence of the six types of double counting in the data reported by the 35 countries participating in the 2020 data collection according to the information provided in quality reports submitted alongside the data ([20]).

Table 8: Number of countries reporting double counting by type and treatment adopted, 2018

	Type of double counting					
	1	2	3	4	5	6
Countries with cases of double counting	17	28	14	6	22	22
Treatment based on qualitative information	9	19	5	3	13	13
Treatment based on PIN	8	9	9	3	9	9

Note: PIN = personal identification number.

The most common type of double counting (arising in 28 out of 35 countries) is type 2 double counting, involving beneficiaries receiving two (or more) pensions belonging to the same category (for example, two old-age pensions) paid by different schemes. This can be explained by pensioners having accumulated contributions with different schemes during different phases of their professional life.

However, the most common type of double counting, in terms of the number of beneficiaries affected, is type 5 double counting, involving beneficiaries receiving a pension serving the old age function and a pension serving the survivors function. This can be explained by three key factors. First, beneficiaries of old age pensions represent by far the highest share of pensioners (79 %), followed by those of survivors' pensions (22 %). Second, persons eligible for survivors' pensions tend to be elderly persons and are thus likely to receive an old age pension

([20]) Such reports are crucial to correct interpretation of the data and understanding the data sources and method used to treat double counting. Available at: https://ec.europa.eu/eurostat/web/social-protection/quality.

already. Third, most national pension systems do not rule out simultaneous receipt of old age and survivors' pensions. On this basis, double counting of pension beneficiaries is not just a methodological issue but also a characteristic of the phenomenon being analysed. The total number of persons receiving old age and/or survivors' pension (without double counting) is specifically requested and can be used to derive the number of those receiving both categories of pension, which can be quite significant in some countries. For example, these represented 16.2 % of pensioners in Italy (2.5 million pensioners), 16.8 % in France (3.3 million) and 18.5 % in Germany (4.3 million).

A more general approximation of the share of pensioners receiving two or more of the seven categories of pension covered by the module (in other words, double counting types 4, 5 or 6) is shown in Table 9. According to national quality reports, there are no such cases in 13 countries. By contrast, more than 15 % of pensioners receive two or more different categories of pensions in 11 countries.

Table 9: Share of pension beneficiaries receiving more than on category of pension, 2018
(%)

	Countries
0 (no double counting at all)	Estonia, Ireland, Croatia, the Netherlands (1), Poland, Romania, Iceland, Norway, the United Kingdom (1), Montenegro, North Macedonia (1), Serbia, and Bosnia and Herzegovina
>0 to <5	Bulgaria, Denmark, Latvia and Turkey
5 to <10	Greece, Spain, Luxembourg, Slovenia and Sweden
10 to <15	Cyprus and Austria
15 to <20	Belgium, Germany (1), France, Italy, Portugal, Finland and Switzerland
20 to <25	Czechia, Lithuania and Slovakia
≥25	Hungary

Note: the table considers only double counting between the seven categories of pension identified in ESSPROS (types 4, 5 or 6) but does not account for double counting that may occur within a pension category (types 1, 2 or 3).

(1) 2017.

In practice, treatment of double counting may not be straightforward. The methods applied (see Table 8) to detect and eliminate double counting can be roughly classified into two groups: (i) **methods based on qualitative information**, making possible the deduction and/or estimation of the extent of double counting, and (ii) **methods based on personal identification numbers (PINs) and processing of administrative data**.

A typical example of the first group is the above-mentioned type 3 double counting in Austria. According to Austrian legislation, recipients of basic non means-tested old age, survivors and disability pensions are granted, subject to a means-test, a supplementary pension of the same category. In other words, each pensioner receiving a means-tested supplementary pension is also in receipt of a basic pension of the same category. Consequently, the total number of pensioners for each category of pension (covering both means-tested and non means-tested variants) without double counting is simply the number of pensioners receiving the basic pension. No additional data processing is therefore needed to treat double counting.

An example of the second group is that of Italy, one of several countries adopting PIN based methods (see Table 8). Italian ESSPROS data on pension beneficiaries are based on administrative data. The source dataset includes microdata on each pension paid by national

pension schemes at the end of the reference year. In other words, each record in the dataset represents a pension and includes a PIN identifying the beneficiary. PINs appearing in multiple records enable the identification of pensioners in receipt of multiple pensions.

A schematic representation of the process adopted by the Italian national statistical office is shown in Figure 4. The source dataset where each record represents a pension is shown on the left-hand side of this figure. Data that are transmitted for the module refer to pensioners so this dataset has to be treated to eliminate recurrences of the same PIN by combining the corresponding records into a single record corresponding to that PIN. As part of this process a derived variable is added to identify the pensions received by each person represented by a PIN. The resulting output dataset is shown on the right-hand side of Figure 4. In this figure, the derived variable is labelled 'pensions received' and is composed of seven characters, each referring to a specific category of pension with the characters 'Y' and 'N' indicating that the person in question did or did not receive the given category of pension at the end of the year. This facilitates the quantification of persons in receipt of specific combinations of pensions. For example, counting those receiving both an old-age and a survivors' pension (irrespective of any other pension category received), simply requires the number of records where the first and fourth characters of the derived variable are set to 'Y'.

Where applicable, methods based on qualitative information may lead to satisfactory results in uncomplicated cases, but PIN based methods are likely to be necessary in most situations,

Figure 4: Double counting treatment based on PIN — simplified schematic of the method adopted by Italy

Input dataset = pensions

PIN	Type of pension	Amount
DMTMRC24111965	2	1 150
DTNGMR29011946	1	1 450
DTNGMR29011946	4	650
GRSLRA09231951	4	1 350
MRCMNL26041966	5	1 250
NNNMCL15091948	1	1 250
NNNRCD09011949	1	1 650
ONTBND09011950	4	1 250
PPRCRD06121945	1	1 250
PPRCRD06121945	4	700
PPRSTF11181949	4	1 150
PPRSTF11181949	6	500
ZNLCRD12031947	1	1250

Output dataset = pensioners

PIN	Pensions received	Cumulated amount
DMTMRC24111965	NYNNNNN	1 150
DTNGMR29011946	YNNYNNN	2 100
GRSLRA09231951	NNNYNNN	1 350
MRCMNL26041966	NNNNYNN	1 250
NNNMCL15091948	YNNNNNN	1 250
NNNRCD09011949	YNNNNNN	1 650
ONTBND09011950	NNNYNNN	1 250
PPRCRD06121945	YNNYNNN	1 950
PPRSTF11181949	NNNYNYN	1 650
ZNLCRD12031947	YNNNNNN	1 250

Type of pension
1 = old age
2 = anticipated old age
3 = partial retirement
4 = survivors
5 = early retirement for labour market reasons
6 = disability
7 = early retirement in case of reduced ability to work

being the only way to accurately eliminate all types of double counting. Despite this, methods based on qualitative information tend to be used the most frequently (see Table 8).

This situation possibly arises from the nature of data sources used at national level. While administrative data sources are the most common, the data needed to elaborate statistics on beneficiaries of different pensions are often split across different datasets, owned by different institutions (other than the national statistical office). For example, Belgium produces its data using 13 diverse administrative data sources. Further, the data sources available are not necessarily of the same type. For example, Switzerland uses five different types of data source: administrative data (four sources), register based data (two sources), censuses (two sources), surveys (two sources) and national accounts statistics.

Overall, 30 of the 35 countries participating in the 2020 data collection used two or more data sources, nine of which used data sources of different types.

5.2. Unemployment benefit recipients module

The module on UBR is a relatively recent development. It represents a first effort to extend the data collected on benefit recipients in ESSPROS, arising from a need to balance user needs with the feasibility of collecting data. It focuses specifically on recipients of **periodic cash benefits** serving the unemployment function ([21]).

The UBR data collection is still in an initial phase. Participation is currently voluntary, and six countries (Czechia, Denmark, Ireland, Latvia, Lithuania and Malta) took part in the data collection covering reference years 2018 and 2019. This somewhat limits the findings available from the work completed so far. However, several distinctive aspects related to the national implementation of the UBR data collection have already been identified and can be discussed. Combined data of the PB and UBR modules would provide data on recipients of benefits accounting for about 50 % of total expenditure on social benefits (of which about 90 % by the PB module and 10 % by the UBR module).

The aim of the module on unemployment benefit recipients is to calculate the total number of unique recipients (in other words, without double counting) of benefits associated with five detailed benefit classifications belonging to the unemployment function and an overall function level aggregate covering these (see Table 10).

Table 10: Detailed benefit classifications and aggregates thereof

Detailed benefit classifications	Aggregates		
	Function	Inter-function aggregation	Total
Full unemployment benefit	Unemployment		
Partial unemployment benefit			
Early retirement benefit for labour market reasons			
Vocational training allowance			
Other cash periodic benefits			

Note: at the most detailed level, ESSPROS includes separate classifications for means-tested and non means-tested variants of detailed benefit classifications.

([21]) The unemployment function also includes cash lump-sum social benefits and social benefits in kind.

Annual ([22]) data on recipients are collected only for benefit classifications for which non-zero expenditure has been reported in the ESSPROS core system. These data are collected at both the level of individual schemes and the level of all schemes. Breakdowns by sex and age group (15–24, 25–54, 55–64, 65+ years) are required in both cases ([23]).

5.2.1. THE CONCEPT OF A RECIPIENT AND MEASURE USED

All five periodic cash benefits covered by the UBR data collection serve to protect individuals from risks related to unemployment. Accordingly, associated eligibility criteria tend to be limited to conditions to be met by the individual recipient (for example, registration as unemployed, risk of losing occupation, contribution history or age). With this in mind, the concept of recipient adopted by the UBR module is **the grantee**, as defined above in Section 3.1. However, it could also equally be interpreted as the beneficiary, as is used in the PB module, as they are interchangeable in the case of benefits provided to individuals benefits.

There are several crucial differences between benefits covered in the UBR module and those covered by the PB module. Firstly, they tend to be granted for relatively shorter durations. For example, full unemployment benefits are intended to be provided for relatively limited periods of time, which can be measured in months, and often have time limits fixed in national legislation ([24]); by contrast, vocational training allowances may be granted for very short periods – in other words less than a month. Further, some countries, provide benefits lasting only a few days. Secondly, a single individual can often receive a particular benefit during multiple distinct spells within the same reference year. For example, unemployment benefit being granted during several separate short spells of unemployment. Lastly, unemployment can be seasonal and cyclical which results in variance in the use of unemployment related benefits during the year. For example, higher unemployment may be expected in touristic maritime areas during winter periods. Further, there is considerable variability in the benefits covered in the UBR module with respect to their duration, the possibility for multiple spells of receipt during the year and the extent to which they are affected by seasonal and cyclical patterns in unemployment ([25]).

All this considered, the number of recipients recorded by the UBR data collection is likely to vary significantly during the year. UBR data, therefore, cannot be derived using one-off stock, such as that used in the PB module, as this is liable to yield unreliable results. **Annual average stock** (AAS, based on monthly data) and **recipients over the year** (ROY), as described in Section 3.2, are more appropriate for measuring recipients of benefits of varying durations (long, medium or short).

([22]) The collection of quarterly data for indicators on unemployment benefit recipients could be conceived and would respond to some identified user needs. However, this would go beyond the scope of ESSPROS as a satellite account on social protection and, in addition, would be inconsistent with the periodicity (annual) of the other data covered by the domain, and can thus be seen as a further potential development in a broader context.

([23]) The breakdown by age group is not requested at the most detailed level for means-tested and non means-tested variants of detailed benefit classifications.

([24]) For example, in Latvia unemployment benefits are paid for a maximum of 9 months, while in Ireland the maximum duration may vary (from 9 to 12 months) on the basis of the recipient's contribution history.

([25]) For all these reasons, the aggregate number of recipients of unemployment related periodic cash benefits refers to a range of benefits with diverse characteristics in terms of duration, volatility in recipients during the reference year and amounts granted. This diversity impacts the interpretation and significance of aggregate data and should always be accounted for when disseminating data, giving priority, whenever possible, to the dissemination of data related to specific benefits.

An additional advantage of using both AAS and ROY is that, during data validation, data deriving from the two approaches can be compared to evaluate consistency – in other words to check that ROY exceeds AAS for all benefits and that the magnitude of the difference between them is consistent with the nature of the benefit. As a general principle, based on their definitions, it is expected that the difference between ROY and AAS should increase as the duration of the benefit decreases and this is confirmed in the preliminary results of the UBR collection. For example, in Latvia the data show a large difference between ROY and AAS (with ROY/AAS≈100) for recipients of other cash benefits. This derives from the inclusion of the above-mentioned services for the long-term unemployed, which mostly cover interventions with very short duration, resulting in a very low value for AAS relative to ROY. More generally, for all countries, the ratio between ROY and AAS is lower (in other words, the difference is smaller) for recipients of full unemployment benefits than for vocational training allowance or other periodic cash benefits, which tend to be paid for shorter periods.

Data on recipients of benefits related to early retirement for labour market reasons are collected in both the UBR and PB modules using different approaches. This makes it possible for the data of the two modules to be compared to further evaluate consistency in two ways. Firstly, that ROY (UBR module) is greater or equal to end-year stock (PB module). Secondly, that AAS (UBR module) is more or less equal to end-year stock (PB module). This second check will provide confirmation of whether end-year stock serves as a good proxy for AAS – in other words that end-year stock is not adversely affected by any volatility in recipients of the benefit during the reference year.

5.2.2. DOUBLE COUNTING: TYPES AND TREATMENT

Four of the six types of double counting that apply in the PB module also apply in the UBR module.

- Type 1. At detailed benefit classification level inside a single scheme
- Type 2. At detailed benefit classification level between schemes
- Type 3. At detailed benefit classification level between non means-tested and means-tested sub-categories
- Type 4. At intra-function level

As explained in Section 4.1, the use of ROY complicates the treatment of double counting by making it (theoretically) possible to have double counting of recipients between all benefits. This arises because persons may be in receipt of the different benefits during different periods of the reference year (in other words, non-simultaneous receipt). This additional difficulty has been confirmed to arise in practice in two countries (Denmark and Ireland).

While all six countries participating in the latest data collection used administrative data sources, four used multiple data sources (Denmark, Latvia and Lithuania used two while Malta used three), introducing, where relevant, an additional layer of complexity to the treatment of double counting. Indeed, both Latvia and Malta detected and treated multiple types of double counting using PIN based methods, all types of double counting in the case of Malta and just types 2 and 4 in the case of Latvia.

A key characteristic of the UBR data compared with that of the PB module is that the benefits covered are less dispersed across schemes. In 22 countries unemployment related expenditure is associated with three schemes or less ([26]) and in most cases the different schemes pay different types of unemployment benefits and/or protect different subsets of the active population. This leads to a lower risk of type 2 double counting – in other words between schemes.

Finally, the UBR module collects data broken down by sex and by age group (15–24, 25–54, 55–64, 65+ years). Five countries calculated breakdowns by age using method 2 – in other words based on single point in time during the reference year (see Section 3.4). Only Latvia used three different methods for different variables/benefits. Theoretically this could result in recipients receiving multiple benefits contributing to different age groups in the data for different variables/benefits.

5.2.3. RELEVANCE OF QUALITATIVE INFORMATION

Qualitative Information (QI) is collected annually to accompany the quantitative data collected within the ESSPROS framework, primarily that of the core system. This QI describes national social protection systems, providing detailed information on the schemes and the detailed benefits they provide in each country. The specifications for this are set out in Appendix II of the ESSPROS manual, which describes the purpose of the QI as providing:

1. in-depth information on social protection schemes;
2. the means to evaluate the classification of schemes and benefits applied;
3. a clear basis for footnotes in publications and for the ESSPROS database;
4. a means to respond to questions from users on the data by scheme;
5. a support for the validation of ESSPROS data.

Work undertaken during the initial phase of the implementation of the UBR data collection has re-emphasised the central role of the QI for ensuring effective validation of ESSPROS quantitative data and their correct use and interpretation. The benefit descriptions reported in the QI are fundamental to understanding the UBR data, including how they vary over time and the distribution of recipients by sex and age. The rules/criteria defining the amounts disbursed, usually reported in the QI, help to better understand the possible causes of changes in both the number of recipients and expenditure between years. The QI also facilitates the detection of double counting, particularly type 1 double counting arising from non-mutually exclusive benefits being recorded (and thus described) under the same detailed benefit classification of a single scheme. Furthermore, the QI is also fundamental to a better understanding of the content of other periodic unemployment related cash benefits, which often include benefits that vary considerably in nature, complicating the interpretation of the data.

([26]) In the PB module, recipients are dispersed across five or more schemes in the majority of participating countries. For example, they are dispersed across 22 schemes in Belgium, 20 in the Netherlands, 19 in Italy, 16 in France, 14 in Poland, 11 in Spain and 10 in Germany.

6. Conclusions

There is a longstanding demand from institutional and other users of Eurostat statistics for data on social benefit recipients. This has grown stronger over time with the emergence of efforts to examine issues associated with aging populations (for example, provision of pensions and long-term care) and, more recently, the need to assess the impact of and response of social protection systems to the COVID-19 pandemic. It is thus realistic to expect an expansion in the coverage of data on recipients in the ESSPROS framework in the coming years to provide such data for more benefits.

Clarifying the methodological obstacles to the collection of data on recipients of different types of benefits is thus a vital starting point for understanding the challenges that will need to be overcome. With this in mind, this article has outlined possible approaches to the key building blocks of a collection of data on social benefit recipients – the concept of a recipient, the method for measuring this and the indicators that can be derived – and examined their relevance when applied across benefits with different characteristics, in particular in terms of time-profile and duration.

The main conclusion is that **there is no 'one-size fits all' solution** and some flexibility is needed in the design of an overarching approach to the collection of data on social benefit recipients across the full spectrum of social benefits. The most pragmatic option is therefore to pursue a **modular approach** whereby sub-sets of benefits to which a single approach can be applied are grouped into modules, and a limited variation in approach is permitted between modules (in other words, allowing the use of different, possibly multiple, measurement approaches). The flexibility available in the design of specific modules should, however, be clearly defined, setting out which elements are allowed to vary and to what extent, to ensure that harmonisation is achieved where possible. It is equally important that the impact of such flexibility is made clear to users of the resulting data (in particular for aggregation of data from different modules).

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