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Filling the gap: the geographical allocation of euro area portfolio investment liabilities and related income

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Contents

Abstract

This paper presents the estimation method used to break down the euro area portfolio investment liabilities in the international investment position (i.i.p.) and their corresponding income debits in the balance of payments (b.o.p.), by main geographical counterpart. Identifying non-resident investors in euro area portfolio investment liabilities (i.e. equity and debt securities issued by euro area residents) is a complex task, as securities are regularly traded in secondary markets and held via custodians and other financial intermediaries. Consequently, identifying the actual holders of euro area securities may be hampered by so-called “first-known counterparty” and/or “custodial” biases if statisticians cannot look through the chain of intermediaries. Owing to these difficulties, the geographical counterpart allocation of euro area portfolio investment liabilities cannot generally be directly collected from reporting agents (i.e. the issuers of euro area securities) but instead needs to be estimated. The estimation method presented in this document relies on a comprehensive set of so-called “mirror” datasets (i.e. information on the holders of euro area securities) supported by temporal disaggregation and econometric techniques. The results provide robust estimates of portfolio investment liabilities and income debits by geographical counterpart.

Keywords: Balance of payments, time series, temporal disaggregation, portfolio investment, security-by-security data, data integration

JEL codes: C22, C82.

Non-technical summary

This paper explains the statistical compilation method used to estimate the geographical counterpart dimension of euro area securities held by non-residents and classified under the portfolio investment category in the euro area international investment position (i.i.p.) statistics. This estimation method also allocates the geographical counterpart dimension to the corresponding income flows included in the balance of payments (b.o.p.) statistics. Identifying the actual holders of euro area securities is a rather complex task as the issuers (custodians) of those securities cannot identify (or cannot *accurately* identify in the case of custodians) the actual final holders. This is related to the so-called "first-known counterparty" bias and/or "custodial" bias and is linked to the complexity of securities trading in financial markets.

The traditional approach followed to estimate the geographical dimension of the portfolio investment category in b.o.p./i.i.p. statistics relies on the use of "mirror" data. These data refer to information on the holders of securities issued abroad (e.g. euro area securities held by residents in Canada), collected by the statistical compiler of the holder's country. The most relevant mirror dataset for portfolio investment securities is the Coordinated Portfolio Investment Survey (CPIS) of the International Monetary Fund (IMF). However, a dataset of this type has certain timeliness (semi-annual or annual data) and coverage limitations.

The estimation method presented in this paper shows significant improvements on the above-mentioned traditional approach – these improvements may be summarised in two main categories. First, the estimation process enhances the available "mirror" data sources, covering not only the CPIS but also selected national b.o.p./i.i.p. statistics, data on reserve assets, additional surveys and security-by-security information compiled by the European System of Central Banks (ESCB). Second, the timeliness limitations relating to CPIS data are overcome by using sophisticated temporal disaggregation and econometric techniques.

The results provide robust estimates of the geographical dimension of euro area portfolio investment securities in b.o.p./i.i.p. statistics, covering information on stocks and income flows. However, like any other statistical method, a number of assumptions need to be made to remedy the lack of information, implying that a certain degree of caution should be applied when using and interpreting the results.

Further enhancements will follow in the medium term to improve the current estimation process. This will cover, among other things, the search for new data sources and the provision of estimates on transactions and other flows.

1 Introduction

Identifying foreign investors in euro area portfolio investment liabilities (i.e. equity[1] and debt securities issued by euro area residents) is a complex task. This reflects the fact that issuers do not have accurate information on the actual final holders of their securities because securities are regularly traded in secondary markets and held via custodians and other financial intermediaries. The main financial intermediaries for euro area securities are located within the euro area (most prominently in Belgium or Luxembourg). Therefore, a first-known counterparty[2] and/or custodial bias may arise if statisticians cannot look through these intermediaries to identify the actual holders of euro area securities. Importantly, such bias results in the flawed geographical allocation of investors in euro area securities.[3]

Bias of this type reflects three main limitations relating to the data collected through custodians. First, although custodians collect information on their direct customers, they do not know whether these customers are the final holders of the securities or whether they are acting as custodians on behalf of an unknown customer (referred to as a "third party"). This is especially the case when a custodian's customer is a financial institution. This missing information can lead to the allocation of large amounts of securities to countries in which custodians are located instead of to the countries of the actual final holders. Second, statistical compilers may mistakenly categorise the country in which the securities are held through a custodian as the country in which the securities were originally issued. Third, statistical compilers cannot usually access data on residents of their own country from custodians residing abroad (i.e. data on third-party holdings for custodians residing abroad). This usually leads to domestic holdings being underestimated.[4]

The situation mentioned above highlights the need to implement a statistical procedure to fill the gap regarding the geographical details of euro area portfolio investment liabilities and corresponding income. This paper outlines the procedure followed to estimate the geographical breakdown of euro area portfolio investment liabilities for "debt securities" and "equity and investment fund shares/units" (henceforth referred to as "equity"). To obtain such information, the standard data collection used to compile euro area i.i.p. and b.o.p. statistics is complemented by alternative data sources and estimation methods. These data sources refer to a comprehensive set of "mirror" datasets: information on the holders of euro area securities such as the IMF's Coordinated Portfolio Investment Survey (CPIS) or US

1 Portfolio investment equity covers listed shares, unlisted shares and investment fund shares/units, as defined in the sixth edition of the IMF's Balance of Payments and International Investment Position Manual (BPM6) (IMF, 2009).

2 Further details on first-known counterparty bias can be found in Section 2.5 of the ECB's "B.o.p. and i.i.p. book" (ECB, 2016).

3 Securities issued by euro area residents may also be held by non-euro area companies that belong to the same group (i.e. institutions under a foreign direct investment (FDI) relationship). Within FDI, national compilers are usually able to obtain accurate information regarding the identification of non-resident intra-group holders.

4 Further information on custodial bias and custodian chains can be found in Chan et al. (2007), while Warnock and Cleaver (2003) assess the impact of these biases and the role played by financial centres in the US data.

Treasury International Capital (TIC) survey data. This information is supported by statistical (e.g. linear interpolation) and temporal disaggregation techniques to fill existing gaps either in the time span or frequency of the data.

The derived estimates for euro area portfolio investment liabilities (i.i.p. stocks) by detailed geographical counterpart are available in the ECB Data Portal from the reference period Q1 2013, also including the associated investment income debit flows. These data also enable – for the first time according to BPM6 standards – an analysis to be conducted of the geographical breakdown of the euro area current account balance. Hence, these estimates provide data of great value to analysis and research. There is extensive demand for such data for economic policy purposes within the ESCB as well as by external data users (see, for example, Felbermayr and Braml, 2018 and Hobza and Zeugner, 2014). In another example (see ECB, 2018), the main geographical counterparts driving changes in the overall euro area current account and its components (e.g. goods and primary income) are analysed. This is relevant, for instance, in the context of trade frictions as well as in analyses of shifts in trading and financial patterns. These include those caused by the COVID-19 pandemic, as shown in ECB (2023). Another example, linked to the effects of Russia's aggression in Ukraine, is the analysis included in ECB (2022), which analyses the trade and financial linkages between euro area residents and Russia in detail. All in all, these new data estimates provide policymakers and researchers with access to a complete geographical perspective of the euro area current account and the i.i.p. This is useful for analysis related to trade, monetary policy, financial stability or capital flows.

The paper is structured as follows. Section 2 provides a brief methodological and compilation practices review of portfolio investment in the BPM6 standard. Section 3 follows with a description of the data sources and statistical procedures used to estimate the geographical allocation of euro area portfolio investment liabilities (stocks) by main geographical counterpart (non-euro area residents). Section 4 then includes a brief overview of the approach followed to estimate the associated income flows and the robustness check implemented. Finally, Section 5 concludes and highlights outstanding challenges.

2 Methodological and compilation background: portfolio investment and reserve assets functional categories

2.1 Main methodological concepts in BPM6

BPM6 defines the functional category "portfolio investment" in §6.54 as "*cross-border transactions and positions involving equity and debt securities, other than those included in direct investment or reserve assets"*. On the other hand, "direct investment" functional category covers those investments in securities where a control – or a significant degree of influence – exists between the parties. In addition, those securities denominated in foreign (non-euro) currency and readily available to and controlled by monetary authorities should be included in the "reserve assets" category as defined in BPM6 §6.64. The remaining functional categories ("other investment" and "financial derivatives") do not include financial instruments classified as securities.

Securities are defined in BPM6 §5.15 as "*debt and equity instruments that have the characteristic feature of negotiability*". The characteristic of negotiability is hence the key element of the above definition and implies that:

- securities can be (easily) bought and sold either on organised markets or over the counter (OTC);
- legal ownership can be transferred from one entity to another by delivery or endorsement.

As mentioned above, securities include two main instrument types. Equities and investment fund shares/units are defined in BPM6 §5.19-5.30. Equity securities comprise listed and unlisted shares and give the holder the right to the residual value of the issuing enterprise after the claims of all other creditors have been met. Investment fund shares/units are issued by investment funds and represent a share/unit in an investment portfolio that may cover both financial and non-financial assets. On the other hand, debt securities are defined in BPM6 §5.44-5.50 and require the payment of the principal as well as – usually – interest by the debtor at some point(s) in the future.

Regarding the valuation of these instruments, BPM6 stipulates that securities trading should be recorded at the market value (price) at which the transaction took place (excluding explicit and implicit fees), while stocks should be valued at the end-of-period market value. In particular, the so-called "dirty" price applies to both equity securities (BPM6 §7.26) and debt securities (BPM6 §7.27). This means that while equity prices[5] include dividends declared payable but not yet paid (until the ex-

[5] See Annex 8 of the Handbook on Securities Statistics for details on the methods used to estimate market prices for unlisted shares.

dividend date), for debt securities the accrued interest not yet paid is included in the price (considering the implicit or explicit coupon rate at inception).

With regard to securities, the criteria used to define the parties involved in a transaction are another important aspect of BPM6. BPM6 follows a *debtor-creditor* approach as opposed to a *transactor* approach (see BPM6 §A.3.4 and §A.3.72). This means that the final holder of a security (creditor), and not the financial intermediary (transactor), is considered to be the counterparty to the transaction. Finally, the corresponding income is compiled separately for equity dividends (BPM6 §11.24-11.32) based on the ex-dividend date, investment income attributable to investment fund shareholders[6] (BPM6 §11.37-11.39) and debt securities interest (BPM6 §11.48-11.76) following the accrual principle.

2.2 Compilation challenges and current practices

From a compilation perspective, there are three main aspects to consider: the level of reporting detail, the data collection channel and the data compilation model.[7]

For the level of reporting detail, compilers should decide whether to collect data on securities holdings and issues at the level of individual securities (i.e. security-by-security) or at aggregated level. The most significant benefits of security-by-security compilation systems are the following:

- Accuracy and consistency are preserved as statistical compilers are responsible for statistical classifications. In addition, the reporting burden is substantially lower for reporting agents who can simply provide information on the amount held/issued at the end of the reference period for those securities with an International Securities Identification Number (ISIN) code. This leads to an improvement in data quality.
- There is standardisation across statistical domains and the flexibility to compile new output requirements based on the higher granularity.

On the other hand, there are significant costs relating to setting up the collection system, the need to upgrade personnel skills, and IT resources. Data management is also complex as security-by-security databases usually involve the processing of large amounts of data (millions of observations) for which quality must be assured.

All in all, since the benefits are generally considered to outweigh the costs, the use of security-by-security databases is common practice in most developed countries. In this context, Annex VI of the ECB's Guideline on external statistics[8] lays down the obligation to compile at least 85% of the total portfolio investment stocks (assets or liabilities) on a security-by-security basis. This legal requirement is supported by the

6 This is recorded on an accrual basis when referring to the interest received on debt instruments and rents, and on ex-dividend date for equity related income.

7 See the final report of the ESCB's task force on portfolio investment collection systems for a detailed discussion of the three dimensions.

8 The ECB's Guideline ECB/2011/23 on external statistics as amended by Guideline ECB/2018/19.

availability, on the securities issuer side, of the ECB's Centralised Securities Database (CSDB).[9] On the holder side, the ESCB's Securities Holdings Statistics by Sector (SHSS), collected on the basis of the ECB's Regulation 2012/24, as amended, provide quarterly information on holdings of individual securities by euro area institutional sector.[10]

For the data collection channel, compilers face a dilemma over whether to obtain the necessary information from custodians or to approach end-investors directly. The main advantages of custodians' data collection models are the low reporting burden since the target population is relatively small, custodians are able to deliver high-frequency ISIN-level information in a timely manner and custodians can easily adapt their IT systems to security-by-security reporting. The disadvantages of the models include the risk of double counting (linked to custodial bias), potential misclassification of investor sector, limitations in terms of scope (e.g. national legal requirements do not apply to securities held in custody abroad) and difficulties in properly identifying certain types of transactions (e.g. repo agreements). In general, direct reporting applies to financial investors, while custodians report on behalf of non-financial investors.

Joining together the security-by-security information on securities issued (held) in (by) euro area countries, as available in the CSDB (SHSS), it is possible to define a **compilation model** that returns good quality data on the securities issued in the euro area and held by non-euro area residents (the so-called "residual approach"). According to this method, portfolio investment liabilities are calculated as the difference between the total amount outstanding of all securities issued by residents and the residents' holdings of such securities. In the case of euro area portfolio investment liabilities from an issuer perspective, this would translate into:

$$EA\ PI^{L,I}_{extra\ EA} = \sum National\ PI^{L,I}_{rest\ of\ the\ World} - \sum National\ PI^{A,I}_{intra\ EA}$$

Where EA stands for euro area, PI for portfolio investment, I for instrument type (i.e. debt securities and equity), L for liabilities and A for assets. Hence $\sum National\ PI^{L,I}_{rest\ of\ the\ World}$ corresponds to all securities issued by euro area residents and not held domestically,[11] while $\sum National\ PI^{A,I}_{intra\ EA}$ refers to euro area securities held cross-border by euro area countries.[12]

The compilation of reserve asset securities by central banks is simpler than it is for portfolio investment considering that (i) it refers to a single reporting entity, (ii) it covers only the asset side, and (iii) it relies on readily available internal security-by-security information. Further details on the compilation guidance and statistical requirements may be found in both IMF (2013) and ECB (2000).

9 See ECB (2010).

10 See ECB (2015).

11 For example, it refers to securities issued by France after deducting French domestic holdings.

12 For example, it refers to securities issued by France and held by German residents.

3 The estimation of the geographical allocation of euro area portfolio investment liabilities

From the perspective of foreign investors, securities issued by euro area residents – which are not part of a direct investment relationship – may be held either as portfolio investment or as reserve assets, depending on the purpose of the investment.

The following subsections detail the main characteristics of each data source used in this exercise, the statistical techniques used to overcome their limitations and the main corresponding results.

3.1 Data sources

3.1.1 IMF Coordinated Portfolio Investment Survey (CPIS)

The IMF's CPIS is the backbone of the estimation process explained in this paper. It is the most comprehensive publicly available database containing bilateral portfolio investment holdings. It is therefore used as much as possible as a proxy for the geographical allocation of euro area portfolio investment liabilities held by non-EU countries. However, it has limitations in terms of reporting countries, time span, frequency and timeliness.

Country holdings, broken down by instrument and counterpart area as reported in the CPIS, are used as mirror data for euro area portfolio investment liabilities. The coverage of the CPIS database varies from country to country with regard to the first reported period and frequency (i.e. usually annually until 2012 but semi-annually since 2013). Therefore, some estimations are needed to obtain a homogeneous dataset going back to 2013 at a quarterly frequency. The quarterly series are estimated using the Chow-Lin temporal disaggregation method (see subsection 3.2 and Annex 1 for further details).

3.1.2 IMF Currency Composition of Foreign Exchange Reserves (COFER)

For selected counterparts (i.e. Canada, Switzerland, the United Kingdom and the United States), the currency composition of reserve assets is available from their

national websites.[13] For the remaining major non-EU counterparts (i.e. Australia, Brazil, Hong Kong, India, Japan, Norway, Saudi Arabia, South Africa and South Korea (equity)) we rely on the IMF's Currency Composition of Foreign Exchange Reserves (COFER) survey data. From this dataset we calculate the share of euro-denominated reserve assets of total reserve assets based on all reporting countries.[14] This COFER ratio is used as a proxy for the share of securities issued in the euro area.

3.1.3 IMF SEFER and SSIO surveys

The IMF collects semi-annual information on the geographical breakdown of securities held as reserve assets and annual information on securities held by international organisations outside the EU (IOs). This is done through its Survey of Securities Held as Foreign Exchange Reserves (SEFER) and its Survey of Securities Held by International Organizations (SSIO) respectively.

These surveys reveal that up to 29% (12%) of short-term (long-term) debt securities holdings reported to the IMF and issued in the euro area are held abroad as reserve assets. As the IMF only publishes aggregated amounts, it is crucial to estimate the geographical breakdown for countries holding euro area securities as reserve assets.

First, the reserve assets of the main euro area counterparts[15] (except for Argentina, China, Indonesia, Mexico, Russia, South Korea (debt securities) and Turkey) and the holdings of IOs other than EU institutions are subtracted from the total euro area securities held as reserve assets by IOs. After that, the portfolio investment holdings of the ECB, as an SSIO reporter, are also subtracted. The remaining amounts are considered to be reserve assets held by "Other countries" on aggregate and participating in the SEFER survey.

3.1.4 IMF BPM6: benchmark data for the temporal disaggregation

The IMF BPM6 dataset contains b.o.p. and i.i.p. data for individual countries, jurisdictions and other reporting entities, as well as regional and global totals for major components of the b.o.p. and i.i.p. statistics. The b.o.p. dataset covers 190 economies while i.i.p. data refer to more than 160 economies.

These quarterly data are used as benchmark time series. They make it possible to estimate higher frequencies (i.e. quarterly) of the currency/country composition based on lower frequencies (i.e. annual or semi-annual) (see Annex 1).

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13 Details may be found on the United States Treasury Department, Bank of England, Canadian Department of Finance and Swiss National Bank websites.

14 This share has remained quite stable at around 20% since Q1 2015.

15 Namely EU non-euro area countries, Australia, Brazil, Canada, Hong Kong, India, Japan, Norway, Saudi Arabia, South Africa, South Korea (equity), Switzerland, the United Kingdom and the United States.

3.1.5 Portfolio investment and reserve assets data collected by the ECB

Euro area liabilities held by residents in EU countries outside the euro area (i.e. Bulgaria, Czech Republic, Denmark, Hungary, Poland, Romania and Sweden)[16] are largely derived from the data on portfolio investment assets (i.i.p.) and reserve assets that national central banks from those countries provide to the ECB in the context of the b.o.p./i.i.p. statistics data collection. While euro area securities held by these countries as portfolio investment are reported directly and with the required level of granularity, securities held as reserve assets must be estimated owing to the unavailability of the geographical detail required. In this context, securities denominated in euro and reported as held as reserve assets are assumed to be issued in the euro area.[17]

3.1.6 ESCB securities holdings statistics

SHSS data compiled by the ESCB comprise, among other components, data on euro area securities held by euro area custodians on behalf of customers residing outside the euro area (third-party holdings).[18] It is generally difficult to compare or combine SHSS data with CPIS and SEFER/SSIO data because of differences in coverage and the custodial bias associated with the SHSS. Nevertheless, in six cases SHSS third-party holdings have been meaningfully integrated with CPIS data whilst minimising the risk of double counting and reflecting better coverage of SHSS.

The first case concerns IOs. As it may safely be assumed that IOs do not hold securities on behalf of other investors, SHSS data may be used to estimate holdings by IOs.

The second case relates to offshore financial centres. Only 18 out of 40 offshore financial centres are defined by the IMF report to CPIS,[19] but SHSS data provide third-party holdings for the missing 22 offshore centres.[20] Offshore centre data are potentially affected by custodial bias, independently of data source. While on the one hand it cannot be assumed that SHSS holdings correctly represent the geographical location of the final holders (possibility of overestimation), on the other hand it is likely that financial institutions in these centres use additional custodians located outside the euro area (possibility of underestimation). All in all, in the absence of

16 The EU non-euro area Member States aggregate also includes the data for EU non-euro area institutions.

17 This currency detail is only available for total securities. Therefore, the proportion of euro-denominated securities of total securities is applied indiscriminately to the two instrument types considered in this exercise: debt securities on the one hand, equity on the other.

18 The main component of the dataset regards holdings by euro area investors collected either directly from the final investors (for most financial sectors) or from custodians. See ECB (2015) for further details.

19 Aruba, Bahamas, Barbados, Bahrain, Bermuda, Curaçao, Guernsey, Gibraltar, Isle of Man, Jersey, Cayman Islands, Lebanon, Liberia, Mauritius, Panama, Philippines, Singapore and Vanuatu.

20 Andorra, Antigua and Barbuda, Anguilla, Belize, Cook Islands, Dominica, Grenada, Hong Kong, Saint Kitts and Nevis, Lucia, Liechtenstein, Marshall Islands, Montserrat, Nauru, Niue, Seychelles, Sint Maarten, Turks and Caicos Islands, Saint Vincent and the Grenadines, British Virgin Islands, US Virgin Islands and Samoa.

more robust data sources, SHSS data are used as a proxy for the portfolio investment holdings of offshore centres not reporting to CPIS.

The third case refers to China. Chinese portfolio investment holdings[21] are negligible in comparison with its reserve assets, so it may be plausibly assumed that China is the residence of the final holders of the securities reported to SHSS as third-party data.[22] This is also reflected by the fact that Chinese "public" holdings (i.e. holdings of the general government and the central bank) represent the bulk of euro area securities assets in SHSS third-party data. We may therefore plausibly assume that euro area securities held by Chinese investors are managed mostly through euro area custodians and are correctly reflected in the SHSS data.

The fourth case pertains to the United Kingdom and equity securities. A comparison between CPIS aggregates and SHSS third-party holdings data reveals a consistent positive discrepancy of approximately €400 billion. Recent research suggests that this gap stems from the under-coverage in CPIS data of British equity assets.[23] This is particularly the case for other financial corporations (excluding insurance companies, pension funds and money market funds) and non-financial corporations, where only 70% of total assets are captured. Additionally, household assets appear to be underestimated in the CPIS data. As a result, SHSS third-party holdings are considered to be more accurate and are incorporated into the compilation process.

The fifth case refers to Russia. Like China, Russian "public" holdings represent most of the euro area securities assets of Russian investors in SHSS third-party data. Finally, SHSS third-party holdings are also used to capture the assets of certain counterparts that hold relatively small amounts, whose coverage in the CPIS does not seem to be comprehensive and for which the temporal disaggregation does not provide reliable estimates. For both debt securities and for equities, this is the case for Argentina, Indonesia, South Korea (only debt securities), Mexico and Turkey.

3.1.7 US portfolio investment holdings: the TIC Survey

The US portfolio investment holdings of euro area securities relies extensively on the US Treasury International Capital (TIC) Survey data. This source provides monthly data on debt securities and equity held by US investors. The information is collected primarily from US-based custodians and brokers/dealers providing comprehensive and timely information on the monthly stocks of euro area securities held by US investors. Some limitations apply in terms of derogations (reporters' transactions must reach at least USD 50 million) and certain instrument types are excluded (e.g. swaps).[24] This data source is consistent with the IMF's CPIS (see Annex 1) but provides data at a higher frequency and in a more timely manner.

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21 As reported in the Chinese State Administration of Foreign Exchange (SAFE) b.o.p. and i.i.p. official data and in the IMF's CPIS.

22 It is very unlikely that the general government or the central bank will act as custodian for a third country.

23 See Milesi-Ferretti (2024).

24 Further details may be found in Bertaut and Judson (2014).

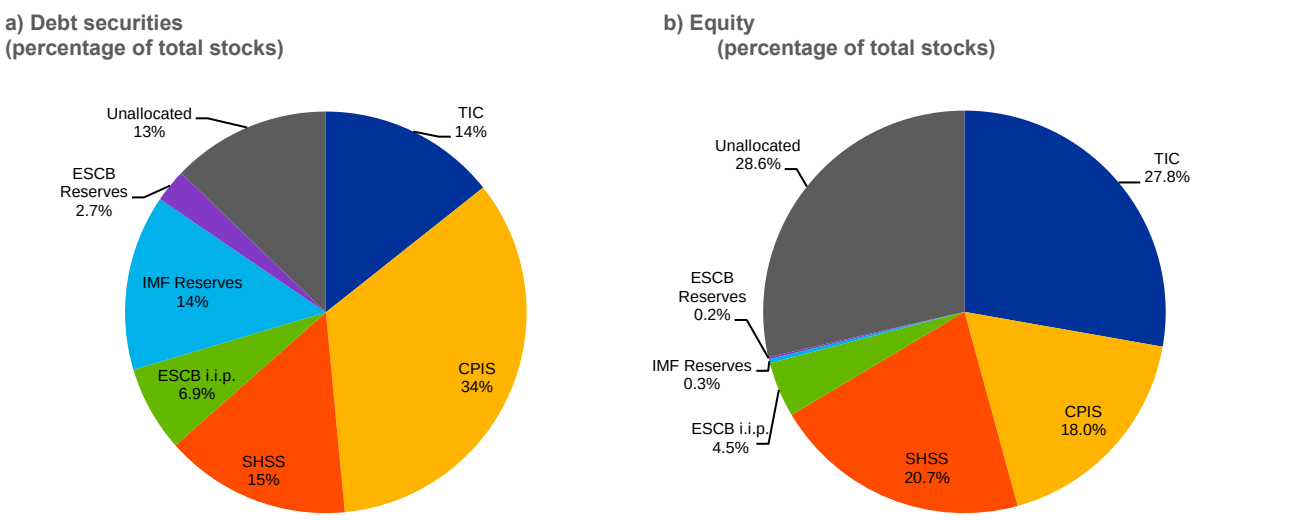
3.1.8 Summary overview of data sources

Chart 1 below summarises the approximate weights of each data source in the total, broken down by instrument type. The analysis reveals the following three main stylised facts.

- The CPIS dataset alone is not enough to provide high-quality estimates for the geographical allocation of euro area portfolio investment liabilities.
- Input data for reserve assets are, as expected, mostly relevant in the estimation of euro area debt securities, reflecting the preference of monetary authorities to hold fixed-income assets in their portfolio.
- The unallocated amounts are much larger for equity securities and are attributed to difficulties in identifying holdings in custody abroad, especially in the case of households. Section 3.2 below elaborates further on this phenomenon.

Chart 1

Data sources and their contributions to the estimates in the second quarter of 2024



Sources: Bureau of Economic Analysis (TIC survey), ECB (b.o.p./i.i.p, reserve assets and SHSS), IMF (b.o.p./i.i.p., COFER, CPIS and SEFER/SSIO) and authors' calculations.
Notes: "CPIS" includes data from the CPIS, SEFER and SSIO surveys (see sections 3.1.1 and 3.1.3).

3.2 Methodology

The starting point for the estimation of portfolio investment liabilities is the information available in the IMF's CPIS. As outlined in the previous section, the CPIS dataset has only annual and semi-annual frequencies. In order to meet the b.o.p/i.i.p. requirements, the same information must be estimated at a quarterly frequency. For this purpose, temporal disaggregation techniques are incorporated into the estimation method. In general, the objective of these techniques is to disaggregate low frequency time series (e.g. annual data) into higher frequency time series (e.g. quarterly data), keeping the sum, the average, the first or the last value of the

resulting high frequency series consistent with the low frequency series. To estimate the high frequency series, one or more high frequency indicators can be used as a benchmark.[25]

As a first step, the Chow-Lin (Maxlog) temporal disaggregation method is used (see Annex 1 for a comparison with other available models). This is one of the regression-based methods and assumes a linear relationship between the higher and the lower frequency series. In particular, the quarterly portfolio investment assets by instrument (e.g. total foreign equity assets held by Canadian investors) as published by the IMF (see Section 3.1.4) are used as an explanatory variable for estimating quarterly CPIS series (e.g. euro area equity assets held by Canadian investors).

As a second step, given that CPIS data for the latest reference period only become available at the end of the estimation exercise, a fourth order autoregressive model is used to forecast the most recent observation.

The main temporal disaggregation process is then run on the CPIS series. For the main counterparts, including China, both semi-annual and annual data are temporally disaggregated to a quarterly frequency. For the other counterparts only the annual CPIS figures are temporally disaggregated given the scarce and irregular availability of semi-annual data.

Once the temporal disaggregated CPIS series have been computed, the resulting portfolio investment assets of the various counterparts are complemented with information on securities held as reserve assets, as shown in the formula below:

$$EA\ PI\ liabilities\ stocks_t^{I,GEO} = GEO\ PI\ assets\ stocks_t^I + GEO\ RA\ assets\ stocks_t^I$$

Where EA stands for euro area, PI for portfolio investment, RA for reserve assets, I for instrument type (i.e. debt securities and equity) and GEO for the main geographical counterparts being estimated in this exercise. As was mentioned at the beginning of this chapter, the formula reflects the fact that from the perspective of foreign (non-euro area) investors, securities issued by euro area residents and classified under portfolio investment ($EA\ PI\ liabilities\ stocks_t^{I,GEO}$) may be held either as portfolio investment ($GEO\ PI\ assets\ stocks_t^I$) or as reserve assets ($GEO\ RA\ assets\ stocks_t^I$).

As the required breakdowns for reserve assets data are not readily available, different data sources, assumptions and estimation methods are implemented for various counterparts, as mentioned in Section 3.1. In addition, there are certain cases where the portfolio investment component is not directly sourced from the CPIS dataset. A brief overview is provided below.

- **Main counterparts outside the EU (excluding China and Russia)**: The global share of euro-denominated securities held as reserve assets is calculated by applying the COFER ratio to the IMF reserve assets data. The result is then multiplied by the share of debt and equity securities reported under SEFER and SSIO (see Section 3.1.3) to obtain the instrument split. This

[25] See Sax and Steiner (2013). See also Dagum and Cholette (2006) and Chow and Lin (1971).

approach applies to Australia, Brazil, Hong Kong, India, Japan, Norway, Saudi Arabia, South Africa and South Korea (equity), as mentioned in Section 3.1.2. For Canada, Switzerland, the United Kingdom and the United States, details of euro-denominated reserve assets are available from their national websites. The portfolio investment component is obtained from the CPIS (see Section 3.1.1), except in the case of the United States, where it is sourced from the TIC survey (see Section 3.1.7), and for UK equity securities which are retrieved from SHSS third-party holdings data (see Section 3.1.6).

- **EU countries outside the euro area**: See Section 3.1.5.
- **Argentina, China, Indonesia, Mexico, South Korea (debt securities), Russia and Turkey**: SHSS data are used to compute both the reserve assets and portfolio investment components.
- **Offshore centres**: For offshore countries not reporting to IMF's CPIS, SHSS data are used to estimate both portfolio investment and reserve assets components. Regarding the other offshore centres reporting to CPIS, these data are used for portfolio investment holdings, complemented by third-party holdings data from SHSS to estimate the reserve assets component.
- **International organisations**: 10% of SEFER-SSIO aggregate equity (except the ECB) is assigned to non-EU international organisations and is based on information provided bilaterally by the IMF, while holdings of debt securities are estimated using SHSS data. EU institutions holdings are approximated by the holdings of the European Investment Bank reported to the ECB in the context of the b.o.p./i.i.p. statistics data collection.
- **Other countries**: Both for debt securities and for equity, the unallocated amounts are entirely attributed to the residual "Other countries" breakdown. This then contains not only those geographical counterparts not included under the countries previously listed, but also strictly geographically unallocated amounts. In the latter subset, debt securities are considered to represent mainly euro area debt securities held as portfolio investment and/or reserve assets by countries not participating in the CPIS and SEFER surveys (e.g. some oil producers). This assumption is also reinforced by their relatively low share (13%) in the total shown in Chart 1. Therefore, the breakdown "Other countries" is calculated as the residual difference between total euro area portfolio investment liabilities and the sum of the above counterparts.[26] For equity, the magnitude of the unallocated amounts included under "Other countries" is quite large: around €3 trillion (29%) of total euro area portfolio investment equity liabilities in the second quarter of 2024, as shown in Chart 1. In this case it would not be reasonable to consider that such amounts correspond to not participating reporters in the CPIS and SEFER surveys. Unfortunately, the current available data sources and research[27] do not provide additional insights

[26] These are Argentina, Australia, Brazil, Canada, China, Hong Kong, India, Indonesia, Japan, Mexico, Norway, Russia, Saudi Arabia, South Korea, South Africa, Switzerland, Turkey, the United Kingdom, the United States, offshore centres, EU non-euro area countries and international organisations.

[27] See Milesi-Ferretti (2024).

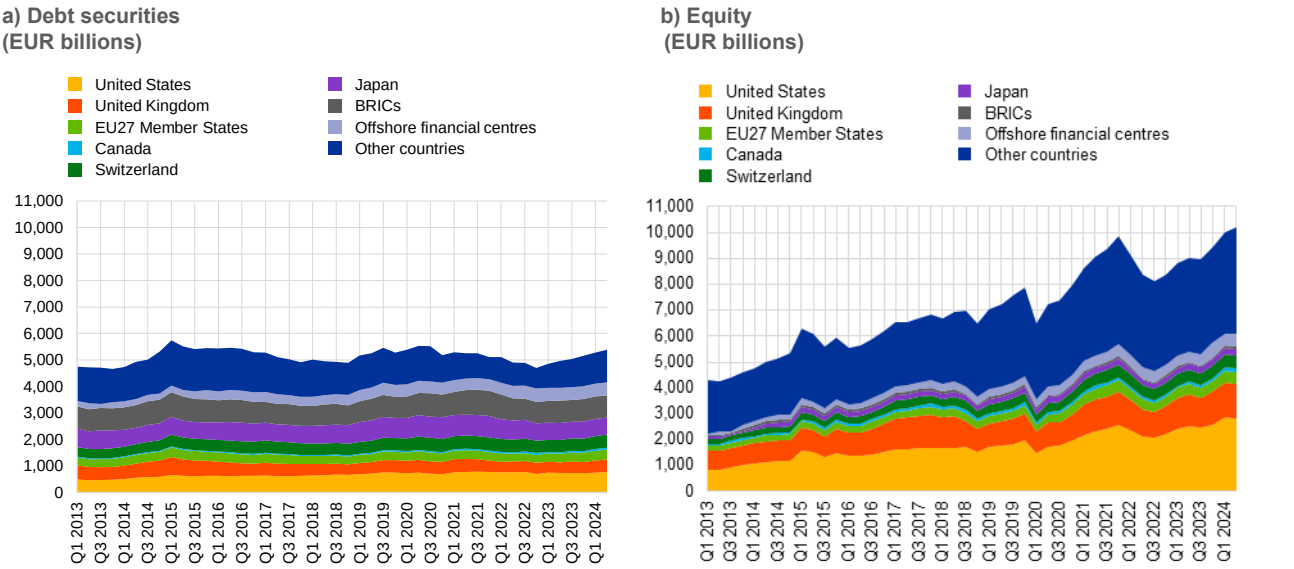
into the precise geographical allocation of such unallocated amounts, except for those considered to correspond to certain sectors in the United Kingdom and identified through SHSS third-party holding data, as previously mentioned.

3.3 Main results

An overview of the changes in stock estimates by instrument and by main geographical counterparts is presented in Chart 2. Additional series covering a more comprehensive geographical breakdown can be found in the ECB's Data Portal.[28]

Chart 2

Euro area stocks of portfolio investment liabilities: main geographical counterparts for the period Q1 2013 to Q1 2024



Sources: Bureau of Economic Analysis (TIC survey), ECB (b.o.p./i.i.p, reserve assets and SHSS), IMF (b.o.p./i.i.p., COFER, CPIS and SEFER/SSIO), and authors' calculations.

Regarding euro area debt securities, the major geographical counterparts in the second quarter of 2024 were Japan, Switzerland, the United States and the United Kingdom, holding around 45% of the total. This share remained fairly constant over time as the decreasing trend observed in the holdings of British investors offset other major geographical counterparts (see panel a of Chart 3 below). The higher weight for offshore centres should be also highlighted as reflecting their increasingly important role in the international financial system[29] and, to some extent, the enhanced coverage of the CPIS dataset since 2015. The remaining counterparts' shares remained fairly stable over the period analysed. The peak observed in the

[28] In particular, the geographical detail includes data regarding total EU non-euro area Member States including Denmark and Sweden as "of which" items, international organisations excluding EU institutions, Argentina, Australia, Canada, Switzerland, the United Kingdom, Japan, the BRIC countries and Russia as "of which" items, and the United States, Indonesia, South Korea, Mexico, Norway, South Africa, Saudi Arabia, Turkey and the off-shore centres aggregate, for which Hong Kong is also shown as an "of which" item. For the total stocks of portfolio investment liabilities further details are available (i.e. for Brazil, China and India). The former individual country data details are not disclosed by instrument type for reasons of confidentiality.

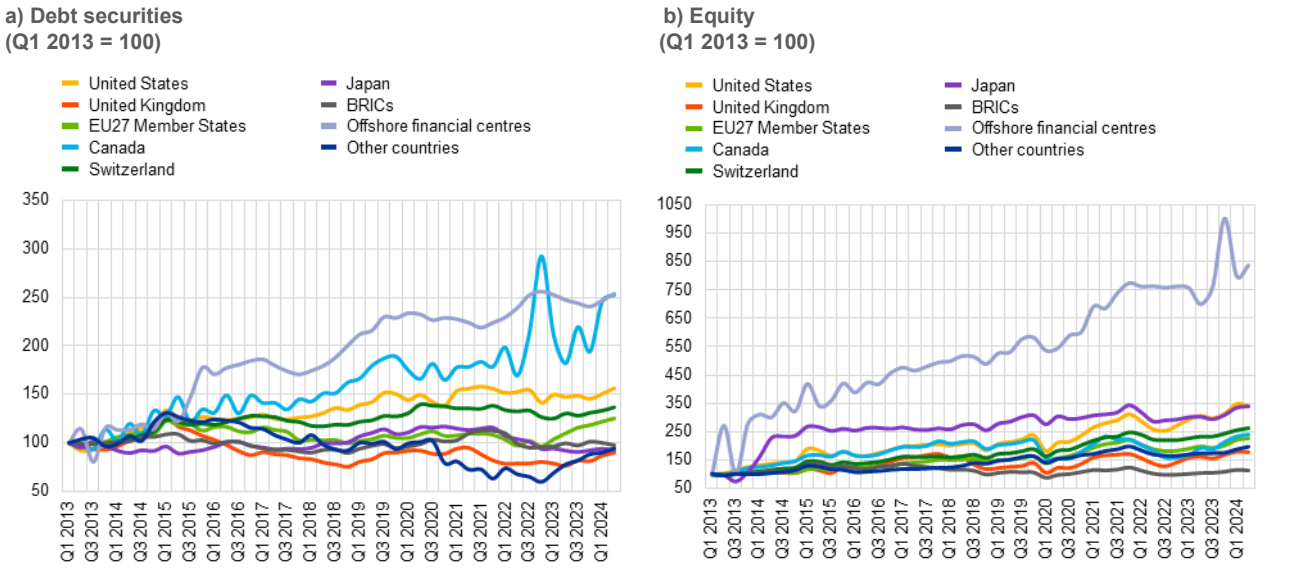
[29] See Lane and Milesi-Ferretti (2010).

first quarter of 2015 (also visible in panel b for equity securities) is linked to the start of the ECB's expanded asset purchase programme.[30]

With regard to euro area equity, the main investor counterparts were the United States, which accounted for 28% of the total, followed by the United Kingdom with a share of 13%. The contribution of other counterparts (excluding "Other countries") remained below 10% of the total. Compared to debt securities, offshore centres played an even more significant role, with their share steadily increasing relative to other counterparts. Additionally, the notable rise in Japanese investors' holdings in the first quarter of 2014 was largely due to more comprehensive data collection by the Bank of Japan, prompted by the BPM6 framework transition. The sharp decline observed in the first quarter of 2020 resulted from price movements reflecting the impact of the COVID-19 pandemic on financial markets, although this trend partially reversed in the second quarter of 2020. A similar sharp decrease in the first half of 2022 (excluding offshore centres) was primarily driven by market disruptions caused by the Russian invasion of Ukraine.

Chart 3

Change over time of euro area stocks of portfolio investment liabilities for the period Q1 2013 to Q1 2024



Sources: Bureau of Economic Analysis (TIC survey), ECB (b.o.p./i.i.p, reserve assets and SHSS), IMF (b.o.p./i.i.p., COFER, CPIS and SEFER/SSIO) and authors' calculations.

3.4 Main improvements and caveats of the new estimation method

The suggested estimation method presents two major improvements on traditional statistical practices that usually rely on the IMF's CPIS survey.

[30] See Andrade et al. (2016).

- First, the method relies on a very comprehensive set of data sources for both the portfolio investment and reserve assets functional categories, as detailed in Section 3.1.

- Second, the method overcomes the various limitations regarding the frequency of each data source (e.g. semi-annual or annual instead of quarterly for the CPIS).

The combined use of multiple data sources and the different estimation procedures represents a challenge and is not free from certain constraints and caveats that should be considered when interpreting the results shown in this section. The main challenges and caveats to bear in mind are as follows.

- Incomplete and imprecise coverage of the CPIS dataset

  - The number of participating countries is limited – 82 in the last survey referring to end-December 2023 – and many oil producers and a significant share of offshore centres do not participate. As previously shown in Chart 1, this is reflected in incomplete coverage for euro area securities: 34% for debt securities and 18% for equity.

  - Portfolio investment assets in custody outside the holder's domestic country and outside the euro area (e.g. US holdings of euro area securities held in custody in the United Kingdom or offshore financial centres) are frequently not fully included in the i.i.p.[31] These amounts usually remain unallocated, even when the final holder's country of residence participates in the CPIS. Looking at national data reported to the ECB versus CPIS, the CPIS data gap for equity is almost exclusively vis-à-vis investment fund shares/units issued in Ireland and Luxembourg, the two major investment fund issuers. Available research estimates that most of the investment fund shares issued in Ireland and Luxembourg are traded through repositories in the United Kingdom, the United States and Switzerland.[32]

  - Third-party holdings of securities held by custodians located in the euro area might be erroneously allocated to the country of the custodian instead to the issuer country, especially when a chain of custodians is in place (e.g. German or US securities held in custody in the UK allocated by CPIS reporters as if issued in the United Kingdom).

- For the purpose of this exercise and for reasons of confidentiality, it is assumed that China is not reporting to SEFER.[33]

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31 An exception to this is the euro area, within which ESCB third-party holdings information is collected and exchanged in the SHSS framework for non-financial investors.

32 See Milesi-Ferretti (2024).

33 This assumption is justified by the empirical observation that there is neither a break in the series in 2015, the year in which China started reporting COFER, nor a significant backward revision for the SEFER/SSIO aggregate.

- The i.i.p. data reported to the ECB are frequently revised and, as a consequence, the euro area aggregated liabilities are revised each quarter for a period of time based on an agreed revision policy at the European level.[34] CPIS data are revised semi-annually and only by a few of the participating countries. This asymmetry in revision practice makes the estimates of the residual geographical categories prone to some inconsistencies.

- Finally, the unallocated amounts for equity included under “Other countries” likely include certain amounts that have not been properly estimated for some of the identified counterparties. However, and as previously mentioned, the current available data sources and research do not provide insights into how to properly redistribute them.

Although the estimates are affected by the underlying hypotheses and data challenges, the robustness check conducted suggests that the quality of the estimates of euro area debt securities and equity holdings for the main euro area counterparts is fairly robust, especially for the former instrument type (see Section 4.2). In addition, several validation checks are implemented in the regular updates to verify the internal consistency of national euro area data transmissions to the ECB (e.g. breakdowns by instrument add up to total euro area portfolio investment liabilities) as well as how this varies with financial markets developments.

[34] In particular the Harmonised European Revision Policy for Macroeconomic Statistics.

4 The estimation of the geographical allocation of euro area portfolio investment income debits

4.1 Methodology and main results

As for stocks, so too the income flows generated by euro area portfolio investment liabilities (i.e. the portfolio investment income "debits" according to BPM6 terminology) cannot be collected directly from b.o.p./i.i.p. data reporters. The obstacles and difficulties around this were discussed in the Introduction. However, having estimated the geographical counterparts of euro area portfolio investment liabilities stocks, it is possible to derive the corresponding income flow in a second step.

The estimation approach assumes that the income generated by euro area securities follows the same geographical allocation as the underlying stocks. Taking account of BPM6 principles, interest on debt securities should be recorded on an accrual basis,[35] so the income calculation is based on the average outstanding amounts of the last two quarters prior to the period being calculated.[36] This approach is also followed for equity income for reasons of consistency.

$$EA\ PI\ income\ debits_t^{I,GEO} = \frac{average\left(EA\ PI\ stocks\ liabilities_{t-1,t-2}^{I,GEO}\right)}{average\left(EA\ PI\ stocks\ liabilities_{t-1,t-2}^{I,extraEA}\right)} \times EA\ PI\ income\ debits_t^{I,extraEA}$$

Where EA stands for euro area, PI for portfolio investment, I for instrument type (i.e. debt securities and equity), and GEO for the main geographical counterparts being estimated in this exercise. This implies that the average weights (distinguishing between debt securities and equity instruments) of the different geographical counterparts estimated for stocks are applied to total euro area portfolio investment income debits[37]. This estimation approach implies the following assumptions.

- Non-euro area investor countries invest in a "common basket" of euro area securities (i.e. those included in total euro area portfolio investment liabilities). This common basket implies that all non-euro area investor countries obtain the

35 See BPM6 §11.49.

36 For example, the compilation of Q1 2024 portfolio investment income debits considers the average stocks for the periods Q3 2023 and Q4 2023. A sensitivity analysis was also carried out which considered the average stocks of the previous four quarters, leading to consistent results. However, the estimates using the average of two quarters better capture changes in the underlying stocks.

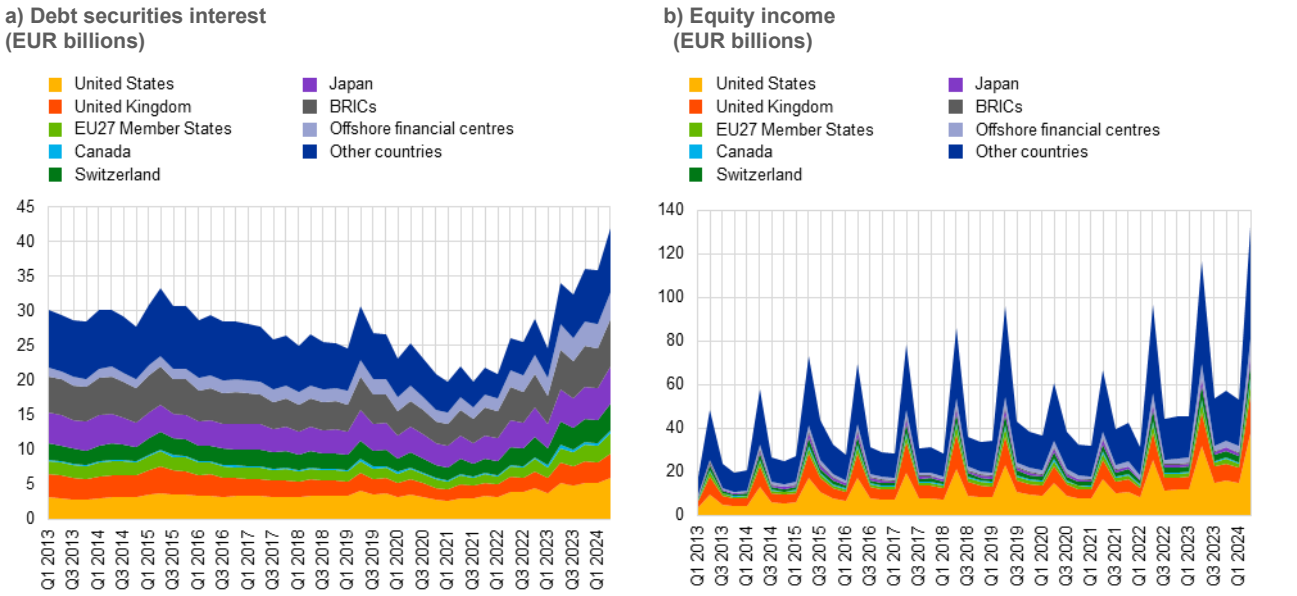
37 Total euro area portfolio investment income debits (i.e. $PI\ income\ debits_t^{I,extraEA}$ in the above formula) are obtained in a previous step of the compilation process, following the residual approach explained in Section 2.2. In this particular case, the amount is calculated as the difference between (1) the sum of euro area countries' national portfolio investment income debits vis-à-vis the rest of the world and (2) the sum of euro area countries' national portfolio investment income credits vis-à-vis other euro area countries.

same return (i.e. interest payments, dividends[38] and investment funds' income attributable to shareholders) by instrument type (debt securities and equity) and reference period. Therefore, factors like the country or sector of issuance do not play a role in the corresponding average return or yield.

- The potential impact of exchange rates developments on portfolio investment income debits is not explicitly addressed. This is consistent with the fact that the vast majority of the securities issued by euro area residents are denominated in euro and are therefore neutral to exchange rate changes[39].

Chart 4

Geographical details of euro area portfolio investment income debits for the period Q1 2013 to Q2 2024



Sources: Bureau of Economic Analysis (TIC survey), ECB (b.o.p./i.i.p, reserve assets and SHSS), IMF (b.o.p./i.i.p., COFER, CPIS and SEFER/SSIO) and authors' calculations.

Similar to the stocks' estimates, the results for the geographical breakdown of portfolio investment income debits are available in the ECB's Data Portal from reference period Q1 2013, distinguishing between debt securities interest and equity income[40]. Chart 4 above summarises the results for the main counterpart countries (areas), confirming the two main stylised facts also observed for the total portfolio investment debits.

- The decreasing trend until 2021 of the debt securities interest series was coherent with the context of low (or even negative) interest rates and the subsequent increase from 2022 onwards was in line with changes in the reference interest rates.

38 The dividends paid depend on the distribution policy of each company. This is therefore an additional source of differentiation not tackled by the method presented in this document.

39 Euro-denominated debt securities issued by euro area countries represented around 89% at the end of the second quarter of 2024 while the share was almost 92% for listed shares.

40 For income the scope of the geographical details is the same scope as for stocks. The only exception is the details for the counterpart area code "X88" (unallocated), which is not included.

- A strong seasonal component of the equity income series was triggered by the usual distribution of dividends in the second quarter of the year. A sharp decrease was observed in the period 2020-21 and was linked to the COVID-19 pandemic as well as the limitations placed on banks seeking to distribute dividends in the euro area during the period.[41]

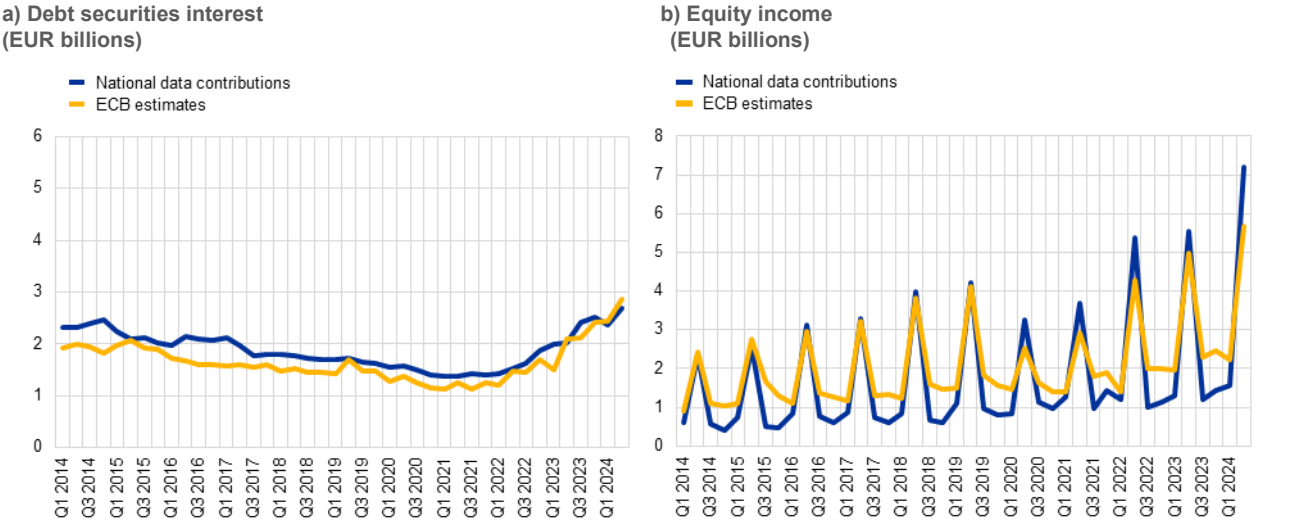
4.2 Robustness check

The results for the EU 27 member states not included in the euro area were compared with the national data contributions regularly transmitted to the ECB. These were the sum of two components:

- the portfolio investment income credits vis-à-vis euro area countries broken down by instrument type;
- exclusively for debt securities, the reserve assets interest credits generated by debt securities, considered in proportion to the corresponding stocks denominated in euro.

Chart 5

Consistency of income debits estimates with mirror data from the EU27 non-euro area Member States for the period Q1 2014 to Q2 2024



Sources: ECB (b.o.p./i.i.p and reserve assets), IMF (b.o.p./i.i.p., COFER, CPIS and SEFER/SSIO) and authors' calculations.

Chart 5 above shows the results for the EU27 aggregate for the period from the first quarter of 2014 to the second quarter of 2024. The aim of this robustness check is to assess whether the trend for estimated income is comparable with the income data reported to the ECB by national compilers.[42] The comparison confirms that the estimates provide a consistent trend both for debt securities interest and for equity

41 See ECB (2020), press release.

42 The reasons for using estimates and not national contributions is to ensure that a homogeneous approach is followed for all counterparties, as well to provide users with income results that are consistent with estimated euro area portfolio investment liabilities stocks.

income, although a difference in levels is observed, especially in the case of the latter instrument. In the case of debt securities, the gap is very small and is attributable to model assumptions (e.g. those on reserve assets stocks), while that for equity is also small and may be considered plausible. A similar picture is seen when drilling down to the level of individual countries.[43]

Summing up, the robustness check proves the validity of euro area portfolio investment liabilities income estimates for analytical purposes as the above gaps are not substantial. However, when interpreting the results users should bear in mind the caveats mentioned in Section 3.4.

[43] Country-level data are not shown owing to confidentiality constraints.

5 Conclusions

This paper provides details of the estimation method used to allocate euro area portfolio investment liabilities and the respective income debits by geographical counterpart. Identifying the actual holders of euro area securities is a rather complex task hampered by the first-known counterparty bias and/or by the custodial bias. The geographical distribution of euro area portfolio investment liabilities can therefore only be estimated. The estimation method presented in this paper provides several enhancements on the traditional approach relying mostly or even exclusively on the IMF's CPIS data.

These improvements may be summarised in two main categories. First, the estimation process uses a very rich set of "mirror" data sources covering national b.o.p./i.i.p. statistics, reserve assets data, surveys carried out by the IMF (e.g. CPIS and SEFER / SSIO) and security-by-security data (SHSS). Second, limitations as to the timeliness (e.g. semi-annual and annual IMF's CPIS data) of certain data sources are overcome by using sophisticated temporal disaggregation and econometric techniques.

As is the case for other statistical methods, certain assumptions need to be made to overcome the lack of information both when estimating the stocks (e.g. instrument allocation for reserve assets) and the related income (e.g. considering that non-euro area residents invest in a common basket of euro area securities). When using and interpreting the results it is necessary to consider the relative degree of certainty and accuracy of the estimates compared with the unknown actual values.

Nevertheless, the results seem to provide robust estimates of euro area portfolio investment liabilities stocks and related income by geographical counterpart, making it possible to compile total i.i.p. liabilities and euro area current account debits by geographical counterpart. These estimates fill a major analytical gap for euro area b.o.p./i.i.p. statistics.

Despite the substantial progress already achieved with the current version of the estimation method, additional efforts will be made to enhance it in the medium term. For instance, searching for new data sources and testing the validity of the assumptions made in this exercise are ongoing initiatives. In addition, the feasibility of extending the current scope to financial transactions and other flows is also being studied.

Annex 1: Temporal disaggregation sensitivity analysis

There are several ways of performing temporal disaggregation. These depend on various factors: the availability of reference indicators, the stationarity of the reference series and the need to obtain forecasted values. Mathematical methods such as the cubic spline or Denton are often simple alternatives when there are neither any optimal reference indicators nor any need to forecast the reference series. On the other hand, statistical methods can model more complex features of the target time series, also providing the usual statistical diagnostics tools such as goodness of fit measures.[44] Chow and Lin (1971), Fernández (1981) and Litterman (1983) describe some of the most common statistical regression methods used to perform temporal disaggregation. These models estimate the low frequency series based on one or more reference high frequency series, under the assumption that there is linear relationship between them. The above methods differ in the proposed models for the structure of the residuals. Chow and Lin (1971) extend the generalised least squares approach to temporal disaggregation, assuming that the residuals follow a first order autoregressive process, while Fernández (1981) and Litterman (1983) assume that the residuals follow a non-stationary process (a random walk and a random walk-Markov model respectively).[45]

The possibility of using the IMF BPM6 dataset to provide reference indicators and the need to forecast the CPIS data (for up to three reference periods) explain the choice of preferred statistical methods. Considering that most of the time series under study appear to be cointegrated, the method used in this document is the Chow and Lin (1971) model. However, in order to verify the soundness of our quarterly disaggregated estimates, in this annex we also apply the other statistical models listed above, using the same reference indicators. All the specifications exclude the use of a constant variable as this is not considered relevant in the literature.

The table below summarises the results for the different models, showing the different p-values and R-squared by instrument and geographical counterpart, and distinguishing the models disaggregating annual and semi-annual CPIS series. The Litterman (1983) approach has been omitted since it yields results that are too similar to those of the Fernández (1981) model.

44 See the ESS guidelines on temporal disaggregation, benchmarking and reconciliation, 2018 edition.

45 See Sax and Steiner (2013) for further details.

Table A1

Temporal disaggregation p-values and R-squared: accuracy of the disaggregated values

Instrument	Counterpart	Chow-Lin annual		Chow-Lin semi-annual		Fernández annual		Fernández semi-annual	
		p-value	R^2	*p-value*	R^2	*p-value*	*R2*	*p-value*	R^2
Debt securities	CA	0.00	0.84	0.00	0.81	0.00	0.52	0.00	0.54
	HK	0.00	0.65	0.00	0.83	0.00	0.60	0.00	0.73
	JP	0.00	-0.09	0.00	0.43	0.00	-0.58	0.00	0.46
	RU	0.00	0.98	0.00	0.92	0.00	0.91	0.00	0.44
	CH	0.00	-0.27	0.00	0.07	0.00	-0.11	0.00	0.10
	US	0.00	0.88	0.00	0.79	0.00	0.67	0.00	0.69
	C4	0.00	0.24	0.00	0.36	0.01	-0.04	0.61	-0.07
	GB	0.00	0.28	0.00	0.20	0.00	0.30	0.00	0.25
Equity	CA	0.00	0.92	0.00	0.90	0.00	0.71	0.00	0.78
	HK	0.00	0.75	0.00	0.43	0.00	0.44	0.00	0.26
	JP	0.00	0.90	0.00	0.82	0.00	0.83	0.00	0.82
	RU	0.00	0.22	0.00	0.17	0.04	0.19	0.00	0.00
	CH	0.00	0.99	0.00	0.98	0.00	0.95	0.00	0.94
	US	0.00	0.93	0.00	0.93	0.00	0.78	0.00	0.86
	C4	0.00	0.90	0.00	0.24	0.00	0.56	0.71	-0.03
	GB	0.00	0.83	0.00	0.72	0.00	0.81	0.00	0.72

Sources: Bureau of Economic Analysis (TIC survey), ECB (b.o.p./i.i.p, reserve assets and SHSS), IMF (b.o.p./i.i.p., COFER, CPIS and SEFER/SSIO) and authors' calculations.
Notes: "C4" stands for "Offshores financial centres".

Both the Chow and Lin (1971) and Fernández (1981) models perform well on the majority of series (i.e. low p-value and high R-squared), especially for CPIS semi-annual series and debt securities. The Chow and Lin (1971) model performs slightly better for CPIS annual and semi-annual scenarios observing a higher significance and smaller residuals than the Fernández (1981) model. The performance for selected counterparts could be further improved by modelling each series with a specific reference indicator. However, given the good overall fit and in order to keep the production system simple, this step was not deemed necessary.

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