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Where are the hidden securities in external statistics?[1]

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Abstract

Several studies on the international investment position and balance of payments statistics (external statistics) suggest that holdings of foreign financial assets are greatly underestimated ("hidden" or "missing") in official data. This is evidenced by a significant global discrepancy between external assets and liabilities that reached $4.2 trillion at the end of 2022.

The literature relates the gap to an effort to hide wealth for tax evasion purposes ("hidden") coupled with the difficulties faced by external statistics compilers to collect information on cross-border financial investments of non-financial corporations and households, notably if intermediated via custody accounts in foreign countries ("missing").

We take a deeper look on the "missing" hypothesis, i.e. data on foreign assets missing from external statistics data collections due to foreign custody. We are interested in further testing the "missing" hypothesis and estimate its magnitude by using a novel method based on the mechanics of international finance and the practices in external statistics recording. To this end we considered the inverse relationship between securities and deposits using a particular sub-set of non-financial corporations' and households' external statistics data, namely transactions in "third-party securities holdings" held in custody in euro area financial centres and the deposits held with foreign banks (collected by the Bank of International Settlements).

The results obtained for the euro area financial centres are extrapolated to other financial centres worldwide to estimate the global "missing" securities broken down by holding country. For the year 2021, about 50% of the "missing" securities globally are statistically attributed to the United States, the United Kingdom, Germany, the Netherlands, Cayman Islands, and Ireland. The "missing" securities represented about 1.4% of GDP for these countries. The results may complement and improve the interpretation of international statistics, as this method keeps the methodological consistency of macroeconomic external statistics based on the residency framework.

Keywords: international investment position, portfolio investment, data gaps, household assets

JEL classification: TBC

Contents

1 Introduction

Statisticians and economists have long puzzled over an abnormal global discrepancy in portfolio investments reported as foreign assets and liabilities in the international investment position and balance of payments statistics (external statistics) – that is, at the global level, cross-border liabilities are larger than cross-border holdings. The most recent estimates of this discrepancy, referred to as the global assets-liabilities gap, place this unaccounted figure at a level of $4.2 trillion as of end-2022, down from $6.1 trillion at end-2021. Such gap represents a substantial portion of overall global wealth and economists and statisticians are interested to ascertain the composition of the gap and how its spreads across countries.

Several authors suggest the assets-liabilities gap may be due to intentional actions to hide savings offshore and/or evade taxes, which constitutes the so-called "hidden" element of the gap. Gullo et al (2022) argue that money laundering takes advantage of less financially transparent countries, thereby increasing the probability of observing anomalous flows in global financial data. They also conclude that offshore secrecy is no longer a stronger determinant of anomalous flows than onshore secrecy.

We also support the offshore hypothesis as main driver for the assets-liabilities gap and we argue there is a sizable "missing" component attributable to limitations in cross-border data collection of official statistics. More recently, households and corporations increasingly allocate investments through globally active asset managers and online brokerages. This complicates the direct ties between investors in securities and (chains of) financial intermediaries, which effortlessly make use of the global financial infrastructure to manage their financial services in the most efficient manner.

International finance leverages on securities custodians dispersed worldwide. While this enhances the global capital mobility, the "fragmentation" of custody complicates the statistical data collection. Official external statistics are typically compiled only from resident custodians based on their legal mandate (Fache Rousová and Rodríguez Caloca, 2015). As households and non-financial corporations are not always required to directly report their portfolio investments, official statistics are pushed to collect indirect ownership information for the asset side. This creates the potential for underreporting of financial claims held in foreign custody – the so-called "third-party holdings" (TPH) – which is our analytical focus.

We propose that quantifying the scale of "missing" third-party holdings will help us understand the composition of the global assets-liabilities gap. To achieve this objective, we present an innovative methodological framework that estimates the dynamic link between third-party holdings and foreign-held deposits. This approach goes beyond previous level-based analyses (Zucman, 2013; Alstadsæter, Johannesen and Zucman, 2018).

We apply this flow-focused approach to granular and high-quality data on third-party holdings of euro area custodians (Fache Rousová and Rodríguez Caloca, 2015). We subset the data to investment fund shares as this segment is deemed to account for most of the assets-liabilities gap (Milesi-Ferretti, 2023). We then extrapolate the findings to gauge a global aggregate of "missing" securities that contribute to close the assets-liabilities gap. Furthermore, our results, when distributed by major holder

countries, shed light on global cross-border "missing" investment concentration. Our analysis reveals that among the top 20 countries in terms of portfolio asset holdings as of the end of 2021, 10 countries have missing assets amounting to more than 10% of their total assets. Notably, for countries like the Netherlands, Cayman Islands, Belgium, and the United Kingdom, this proportion reaches nearly 20%.

By maintaining consistency with the international statistical standards on external statistics, i.e. following the residency-based framework as opposed to the ultimate-owner or look-through approach, and further incorporating custody-based insights, our research design aims to improve the interpretation of global macroeconomic data and complement incrementally official statistics. Our contribution may help to advance our understanding of the assets-liabilities puzzle faced by policymakers and academics by examining its composition across borders through an enhanced approach.

Overall, our contribution provides valuable evidence for the ongoing efforts to understand unexplained movements in international portfolio investment positions, which are critical for economic performance and financial stability monitoring. In the following Sections, we further describe the motivation and theoretical context of cross-border investment intermediation structures that challenge conventional data collection frameworks for official statistics. We then detail our empirical approach (Section 3) and present key findings (Section 4). The conclusion reflects on implications, limitations, and avenues for future research.

2 Motivation and link to existing studies

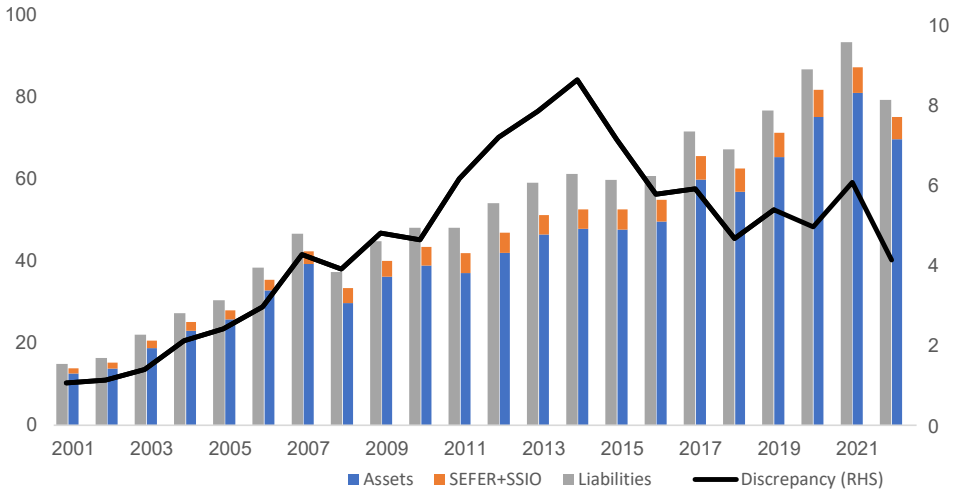
A key metric to measure the extent of global hidden/missing financial assets not fully captured in official statistics is the underestimate of net foreign asset positions of developed countries that Zucman (2013) mainly attributed to the portfolio investment assets held by households in offshore tax havens. In fact, there are several data collection challenges for statistics on securities, notably for securities held abroad, that lead to underreporting as indicated by Bui Quang & Gervais (2019). Several authors have advanced statistical methods that estimated higher levels of foreign assets compared to official figures, but also acknowledged limitations in the results (Pellegrini et al., 2016).

In the literature, it is widely assumed that official statistics capture to a considerable extent portfolio investment liabilities (issuances), portfolio investment assets held by direct reporters (legal entities with reporting obligations), and portfolio investment assets held by households in countries other than offshore financial centres. Under this assumption, the global discrepancy between portfolio liabilities and assets (including securities held as foreign exchange reserves and held by international organisations) corresponds broadly to the financial assets of households held via offshore financial centres.

Replicating this methodology and using the latest vintage of the External Wealth of Nations dataset by Lane and Milesi-Ferretti (2018) as well as IMF data shows a discrepancy of 4.2 trillion (tn) US dollar between global portfolio investment liabilities and assets in 2022 (see Figure 1). Notably, the global discrepancy has significantly declined from its peak of $8.7 tn in 2014, which may be attributed to better coverage

in the collection of securities, in particular for those held as reserve assets, but may also reflect more stringent efforts to combat tax evasion (Benetrix et al., 2021).

Figure 1: Global discrepancy between assets and liabilities in international security holdings



Source: Lane and Milesi-Ferretti (2018), IMF Securities Held as Foreign Exchange Reserves (SEFER) and Securities Held by International Organizations (SSIO).

While Zucman (2013) attributed the missing assets to the household sector, there may be additional factors at play: first, part of the global assets-liabilities discrepancy may be accounted for incomplete country coverage and under-reporting of assets by CPIS participants due to incomplete institutional coverage (i.e. missing reserve assets due to the still incomplete coverage in the IMF's SEFER.)[1] Second, misclassifications between portfolio equity investment and foreign direct investment (FDI) equity may account for part of the observed discrepancy between global assets and (portfolio) liabilities positions (Schmitz, 2021). Moreover, survey responses in some countries may be based on resident custodians and not directly reported by respondents making it difficult to account for securities held in custody abroad by non-financial corporations (NFCs) in addition to households, or even sometimes of institutional investors (Bui Quang and Gervais, 2019).

Milesi-Ferretti (2023) shows that the global discrepancy between portfolio investment assets and liabilities is mainly due to equity securities and in particular driven by investment fund shares issued in Ireland and Luxembourg for which information on the holders is missing to a great extent in the international financial statistics (Beck et al., 2023). Beck et al. (2023) use administrative data from the Central Bank of Ireland and the Commission de Surveillance du Secteur Financier (CSSF) for Luxembourg and find that the United Kingdom in particular plays a major role as an immediate counterpart to the investment fund shares issued in Ireland and Luxembourg. The

[1] A likely only minor part of the gap between global portfolio investment liabilities and assets may be accounted for by countries that do not report any international investment position data (Milesi-Ferretti, 2023).

authors provide evidence that this reflects both underreporting of holdings by UK residents and holdings by investors residing outside the euro area and the UK.

Zucman (2013) established that households' offshore wealth held in Switzerland in 2008 consisted to 25% of deposits and 75% of securities.[2] He applied these proportions to the global discrepancy in security holdings to compute households' total offshore assets (including deposits). By using an equivalent approach at annual frequency, Alstadsæter, Johannesen and Zucman (2018) find global offshore financial assets of $8.6 tn in 2015, $7.0 tn of which in securities and $1.6 tn in deposits. Bui Quang and Gervais (2019) also use the aggregate ratio of foreign securities held in custody in Switzerland to foreign deposits in Switzerland to estimate French missing securities assets.

In our work we focus on the securities held in custody abroad to capture underreporting. We make use of the link between cross-border deposits and security holdings abroad and take advantage from the fact that investors using a securities account abroad will typically have a deposit account in that country and/or transfer funds into that country as needed.

In this regard we establish a stronger connection between deposits and securities than other authors, refining previous approaches on the link between securities and deposits. We estimate the relationship between securities and deposits using a particular sub-set of non-financial corporations' and households' external statistics data, namely "third-party securities holdings" held in custody in euro area financial centres and the deposits held with foreign banks (collected by the Bank of International Settlements). The deposits provided by the BIS under the International Banking Statistics are consistent with international statistical standards for external statistics.

3 Empirical strategy

3.1 Hypotheses

One of the most relevant challenges faced in the compilation of the external statistics is to ensure the double-bookkeeping entry recording, and consequently a balanced recording of credits and debits (net acquisition of financial assets and/or net incurrence of liabilities) of the transactions. This principle is at the core of our approach to reconstruct hidden/missing assets, as developments in cross-border deposits can be indicative and used as a proxy to estimate the holdings of securities in portfolio investment that are missing from official data. To confirm this assumption, we test two hypotheses on the relationship of transactions in cross-border deposits with the assets-liabilities gap in securities and with third-party securities holdings.

We focus on the assets side of the portfolio investment (securities holdings), as the complete recording of securities liabilities is less of an issue for statistical compilers. Companies and sovereigns can easily report their securities issuances as well as the initial holders buying the issuances in the primary market or the domestic custodians

[2] Specifically Zucman (2013) used the *Securities holdings in bank custody accounts* and *fiduciary deposits* datasets published by the Swiss National Bank (SNB).

used in the primary market. The recording difficulties mostly arise with transactions in the secondary markets and/or if securities are held by foreign custodians. In these cases, missing information about the actual holders of securities can lead to mis-recordings in the balance of payments and in international investment position statistics. This may happen when the security is traded between a resident and a non-resident in the secondary market, and/or when it is held in a foreign custodian that is not required to report to the compilers located in the residency of the issuer.

Hypothesis 1: *Cross-border deposits (in/outflows) in country i (i.e. liabilities) are (negatively) correlated with the global assets-liabilities gap vis-à-vis country i.*

The first variable used is cross-border deposits (in/outflows) from the rest of the world vis-à-vis country *i*. The assets-liabilities gap is defined by the difference between the stocks of portfolio investment liabilities of country *i* in the form of equity and investment fund shares as reported in country *i*'s international investment position, and the total bilateral assets of portfolio investment in the form of equity and investment fund shares issued by residents of country *i* , as reported in the IMF's CPIS (i.e. derived from the creditor data).

The rationale for this hypothesis is the typical inverse relation between the flows of deposits and the holdings of securities as generally investors make use of deposit accounts to invest in securities. We anticipate a negative relation between the in/outflow of deposits and the flow of securities holdings. If changes in securities holdings are not accurately reflected in external statistics as signalled by the assets-liabilities gap, a reduction in deposits held by foreigners in country *i* may be associated with larger missing assets in terms of securities issued by country *i*.

Hypothesis 2: *Cross-border deposits (in/outflows) held in country i by country j are (negatively) correlated with the "third-party" holdings of securities held in country i by country j.*

Third-party holdings refer to the act of entrusting securities to a separate specialised entity (typically custodians) for safekeeping and management on behalf of another party. While various combinations of third-party holdings exist, our specific focus lies on the scenario where a custodian within a particular country offers custody services for securities issued within the same country to non-resident investors.

This hypothesis is a more granular version of hypothesis 1. We believe that foreign custodians have a significant impact on the assets-liabilities gap when they are not reporting the holdings (referred to as 'third-party holdings') to the external statistics compiler located in the country where the security holder resides. The underlying idea is that e.g. a household has a deposit account in a foreign country where the custodian is based and subsequently uses this deposit account to invest in securities.

3.2 Data sources

To test the hypotheses outlined in Section 3.1, we employ and combine different data sources, namely information on international banking statistics for deposits, third-party holdings of securities in European financial centres, Coordinated Portfolio Investment Survey (CPIS) and International Investment Position (IIP) for securities.

Data on third-party holdings are available in the Securities Holdings Statistics by Sector (SHSS) database maintained by the European System of Central Banks. We

focus on the investment fund shares held by non-financial investors (excluding general government) from all available countries that are reported by custodians located in Ireland, Luxembourg, and Belgium[3]. The data used include the following variables: (i) holder country, (ii) custodian country, (iii) total holdings and transactions of investment fund shares. We used quarterly data from 2013Q4 to 2022Q3.

The locational banking statistics (LBS) follow balance of payments concepts and tracks the claims and liabilities (including interoffice positions) of banks resident in a reporting country. It includes breakdowns by instrument (loans and deposits, debt securities, and "other"), currency, bank nationality, counterparty sector (e.g. intragroup, central banks, unrelated banks, and non-banks) and counterparty country. The LBS are divided into two data subsets, the LBS by residence (LBSR) and the LBS by nationality (LBSN). Broadly speaking, the datasets differ in that the LBSR are reported by bank located in a particular country and includes an instrument breakdown for banks' on-balance sheet claims/liabilities. The LBSN provide the same information based on a reporting bank's nationality regardless of where it is located.

In our analysis, we gathered data on LBSR by financial instrument and institutional sector across all countries, which were deposited with banks located in Ireland and Luxembourg. The data consists of (i) reporter country (i.e. where the bank is located), (ii) counterparty country (i.e. where investor is located), (iii) total value of deposits, (iv) counterparty sector. We considered three different sectors – households, non-financial corporations, non-bank financial institutions and quarterly data from 2013Q4 until 2022Q3.

The Coordinated Portfolio Investment Survey provides detailed bilateral cross-border portfolio investment holdings. The CPIS was first conducted as a pilot for 1997, but a more complete dataset is available annually from 2001 to 2012. From 2013 onwards, the CPIS was published semi-annually (end-June and end-December). According to the CPIS guidelines, a reporting economy provides data on its holdings of portfolio investment securities. Separate data are reported for equity, including investment fund shares. Both, the LBSR and CPIS data are consistent with the Balance of Payments methodology. We used semi-annual CPIS data between 2013Q4 to 2022Q2.

The data for balance of payments and international investment position are from the ECB database, available in link. It corresponds to the quarterly outstanding amounts of liabilities in the form of portfolio Investment equity and investment fund shares of Ireland and Luxembourg.

3.3 Testing Hypothesis 1

To test hypothesis 1, we examined the correlation between the assets-liabilities gap in equity, as defined previously and the changes in cross-border deposits (Table 1). Specifically, we analysed the data from 2014Q2 to 2021Q4 for Ireland and Luxembourg. The correlation was evaluated both contemporaneously and with a one-quarter lag (i.e. one period lag). At this stage, we want to capture the sign of the correlations between the asset-liabilities gap and the flows of the deposits, not necessarily to discuss the magnitude of its correlation. The results revealed a negative

[3] These countries account for a large share of the custody industry in the EU. Ireland and Luxembourg are the main countries of residence for investment funds in the EU.

relationship between the assets-liabilities gap and the amount of deposits in/outflows, which became more pronounced in the lagged specification, thereby providing evidence for hypothesis 1. For the contemporaneous specification there are negative correlations for Ireland (-0.358) and for Luxembourg (-0.259) (see Table 1). In addition, if we consider the one-period lag specification, the results show a stronger negative correlation: -0.511 for Ireland and -0.481 for Luxembourg.

Table 1: Correlations between the asset-liability gap in equity and in/outflows of cross-border deposits (2014Q1-2021Q4)

	Ireland	**Luxembourg**
Contemporaneous	-0.358	-0.259
One period lag	-0.511	-0.481

3.4 Testing Hypothesis 2

To test hypothesis 2, we estimated the correlation between changes in cross-border deposits (both current and lagged by one quarter) and developments in third-party holdings (either transactions or changes in positions). To do so, we run the following regression:

$$\Delta TPH_{ijt} = \alpha + \beta_1 \Delta LBS_{ijt} + \beta_2 \Delta LBS_{ijt-1} + \varepsilon_t \,, \qquad (1)$$

where ΔTPH_{ijt} refers to either transactions or changes in positions of third-party holdings by the non-financial sector (excluding general government) and ΔLBS_{ijt} refers to changes in the level of deposits by both households and non-financial corporations between t and $t-1$, α refers to relevant fixed effects (holder, custodian or period).

We expect, according to hypothesis 2, β_2 to be negative. β_1 may be either negative or null, depending on the time the deposits are used to invest. Specifically, if deposits are used in the same quarter to invest in securities, we expect β_1 to be negative. On the contrary, if deposits are used to invest in a different quarter, β_1 may not be statistically relevant.

We used bilateral data at the holder-country custodian-country pair, for which we have information on third-party-holdings (TPH) and deposits with no gaps in observations. This criterion results in 158 holder countries[4] and the three custodian countries Belgium, Ireland and Luxembourg. For each holder-custodian-quarter observation, we observe the positions in third-party holdings of investment fund shares (total euro area, or combined Ireland and Luxembourg issuances), the

[4] ISO-2 codes of included holders are: AD, AE, AM, AO, AR, AT, AU, AW, AZ, BA, BD, BF, BG, BH, BI, BJ, BM, BO, BQ, BR, BS, BW, BZ, CA, CD, CF, CG, CH, CI, CL, CM, CN, CO, CR, CV, CW, CY, CZ, DE, DK, DO, DZ, EC, EG, ET, FI, FR, GA, GB, GG, GH, GN, GR, GT, HK, HN, HR, HT, HU, ID, IL, IM, IN, IT, JE, JO, JP, KE, KH, KR, KW, LB, LI, LK, LR, LY, MA, MG, ML, MO, MU, MV, MW, MX, MY, MZ, NE, NG, NL, NO, NP, NZ, OM, PA, PE, PF, PH, PK, PL, PT, PY, QA, RO, RS, RU, RW, SC, SE, SG, SI, SK, SL, SN, SR, SX, TG, TH, TN, TR, TW, TZ, UA, UG, US, UY, VE, VN, VU, ZA, ZM, ZW, BE, FJ, KY, BB, BN, BY, DJ, EE, GI, IQ, IR, IS, JM, KZ, LC, LT, LV, NA, NC, NI, SA, SM, SV, TC, VA, VC, YE

transactions in third-party holdings (total euro area, or combined Ireland and Luxembourg issuances), as well as deposits of households and non-financial corporations of holding countries in banks in the three custodian countries.

We additionally excluded holdings by euro area countries to check whether results still hold for "worse quality" data, as data on third-party holdings are systematically collected and quality assured for euro area holder countries. The quality difference may arise from the fact that euro area custodians have better information on the actual holder of the securities held in custody if these are euro area residents.

Our main exercise is to estimate aggregate missing assets. In the baseline specifications we aggregate holdings of each country over all custodians, while controlling for holder and period fixed effects. In another specification, we also run regressions using bilateral data while controlling for holder, custodian and period fixed effects. Out method focus on flows and not levels.

Table 2 shows the results for the transactions in third-party holdings of investment fund shares issuances held by all (available) countries (and of which non-Euro Area countries) as a consequence of a change in foreign deposits. In addition, we also estimated the impact of a change in foreign deposits in the third-party holdings of investment fund issuances in Ireland and in Luxembourg and held by all (available) countries and non-Euro Area countries.

Table 2: In/outflows of deposits and transactions in third-party holdings - Regression results

	TPH: all issuances held by:		**THP: IE+LU issuances held by:**	
	all countries	**non-EA countries**	**all countries**	**non-EA countries**
change in deposits	0.58 *(1.84)*	1.30 *(3.46)*	0.54 *(1.90)*	1.30 *(3.60)*
change in deposits lagged	-2.54* *(1.36)*	-4.84** *(1.14)*	-2.49* *(1.34)*	-4.85** (1.07)
Holder FE	*yes*	*yes*	*yes*	*yes*
Period FE	*yes*	*yes*	*yes*	*yes*
Cluster S.E.	*Holder + Quarter*	*Holder + Quarter*	*Holder + Quarter*	*Holder + Quarter*
Observations	*5372*	*4862*	*5372*	*4862*
R^2	*0.05*	*0.05*	*0.09*	*0.10*

Significance levels * <0.01, ** <0.001

Note: Table shows results from regression model (1). Left-hand side contains aggregate quarterly transactions in third-party holdings of all available countries or non-euro area countries. Right-hand side contains quarterly changes in aggregate cross-border deposits of households and NFCs of the holding countries. In the specifications holder and period fixed effects are included. Standard errors are clustered over holder and quarter.

The estimations presented in Table 2 exhibit a statistically significant negative relationship between transactions in the TPH and changes in cross-border deposits lagged by one quarter, β_2. When we consider the impact for the same quarter, β_1, the estimations are not statistically significant.

The results indicate that a decrease in deposits in the previous period by $1 leads to positive transactions in third-party holdings of $2.5 (see results for all TPH issuances held by holders in all countries). We also check whether the effects hold if we consider only holders outside the euro area, for whom we assume worse data quality. Results in a column for all TPH issuances by non-EA countries also show a lagged negative correlation between TPH transactions and changes in deposits but of greater absolute value elasticity of -4.8. This can indicate that non-euro area households and NFCs place more frequently deposits in Belgian, Irish and Luxembourgish for their investment purposes. The results remain robust whether we include holdings of all investment fund shares or only those issued by funds in Ireland and Luxembourg. This is evident in the regression results for transactions in shares solely from investment funds in Ireland and Luxembourg.

As we aim estimating the missing holdings across all custodian destinations, we rely on baseline estimates derived from the regression results for all holders and all issuances. In our subsequent calculations, we use the results obtained from the specifications with all holdings. These results provide us with a multiplier of -2.5 and a standard error of 1.3, which we take to establish the lower and upper bounds of our estimates (2.5 ± 1.3).

4 Estimating missing portfolio investment assets by geography

4.1 Calculation approach

Using the results from Section 3.4, we provide an estimate of missing portfolio investment assets by holder country. The underlying idea is to make use of the existing relationship with in/outflows of deposits as a proxy to estimate the missing assets that we assume taking mostly the form of investment fund shares and via foreign custodians.

First, we establish a starting value for the initial period to estimate the missing assets. The starting value is chosen to be 2018Q4, motivated by the availability of deposits data. When determining the starting value, we consider the fact that the level of cross-border deposits represent a share of total wealth placed abroad. In line with existing studies (see e.g. Zucman, 2013, or Quang and Gervais, 2019), we multiply the deposits with this ratio to estimate the value of missing assets. However, we do this only for the initial period of 2018Q4. The following periods we use the multiplier obtained from the regression analysis and the changes in deposits, which is a novel approach in the literature.

The candidate for the starting value is calculated using a ratio between portfolio investment and other investment in the i.i.p of the euro area, assuming that we can extrapolate it to the rest of the world. The ratio in 2018Q4 as well as the average ratio in 2018 is equal to 2.8, which we use to calculate the starting value. This value is also quite close to what is reported in BIS LBS and in SNB data for Switzerland: specifically, the ratio between foreign equity securities held in custody by foreign private investors (i.e. households and NFCs) in banks in Switzerland to cross-border deposits by foreign households and NFCs held in Swiss bank equaled 2.3 in 2021. The reconstruction of

the missing assets stop in 2021Q4, which is the value we an estimate for missing assets.

In summary, we start by multiplying the position in cross-border deposits at end 2018Q4 by *γ=2.8*

$$\widehat{MA_{j0}} = \hat{\gamma} Deposits_{j0} \quad (2)$$

where $\widehat{MA_{j0}}$ corresponds to the estimated missing assets in the initial period (calculated for each country j). $Deposits_{j0}$ represent total cross-border deposits by households and NFCs of country j in the initial period, in all foreign banks. $\hat{\gamma} = 2.8$ stands for the ratio between the missing assets and deposits.

Secondly, using the starting value of missing assets and the in/outflows of cross-border deposits, we construct the series for missing assets for each holder country, using the following equation:

$$\widehat{MA_{jt}} = MA_{j0} + \sum_{\tau=0}^{\tau=t-1} \widehat{\beta_2} \Delta Deposits_{j\tau}, \quad (3)$$

where $\widehat{MA_{jt}}$ is the amount, for country j of the missing assets in period t, $\Delta Deposits_{j\tau}$ is the in/outflows of cross-border deposits between $t-2$ and $t-1$ (assuming that the lag between deposits and investment is one quarter)[5], and $\widehat{\beta_2} = -2.5$ according to the scenario considered from the regression results (Table 2). Equation (3) gives the aggregate value of the missing assets over time for each country.

Finally, the adjusted assets position is obtained by summing the CPIS position of country *j,* in period *t* with an estimate of missing assets:

$$\widehat{CPIS_{jt}} = CPIS_{jt} + \widehat{MA_{jt}} \quad (4)$$

Note that while we obtain the coefficient β_2 using investment fund share issuances only, we apply it later to adjust CPIS positions for equity and investment fund shares.

Lower and upper bounds are obtained in equation (3), while constructing 68% confidence bands, by modifying the multiplier as $\widehat{\beta_2} - \sigma = -2.5 - 1.3 = -3.8$ for a lower bound and as $\widehat{\beta_2} + \sigma = -2.5 + 1.3 = -1.2$ for an upper bound. When decomposing missing assets by destinations (e.g., intra-euro area vs. extra-euro area), we use the respective bilateral cross-border deposits and apply the procedure described in equations (2) and (3).

4.2 Estimates of missing assets

The results for the missing assets for end-2021, are presented in Table 3, at an aggregate level, for all the reporting CPIS countries and on an individual level for the top 20 holder countries in official CPIS data. It shows the reported CPIS assets, the results of our estimates for missing assets, and the CPIS assets plus the estimated missing assets that we call adjusted total assets. Moreover, it illustrates the relative value of missing assets as a percentage of the adjusted total assets and as a percentage of GDP.

The estimated aggregate value of the missing assets is $4.9 tn at end-2021, representing 9.7% of the adjusted total assets and 5.5% of aggregate GDP. For the

[5] Note, to avoid extreme changes in deposits, we calculate changes in deposits in percentage of positions, winsorize 10% tails of this distribution, and recover adjusted changes in deposits.

largest 20 CPIS holders the estimated amount of the missing assets is $3.9 tn at end-2021, 8.8% of the adjusted total assets and 5.6% of aggregate GDP.

According to the obtained results, the primary contributors to the aggregate amount of missing assets are : the United States ($662 billion (bn)), the United Kingdom ($548 bn), Germany ($391 bn), the Netherlands ($328 bn) and Cayman Islands ($316 bn).

These results are broadly consistent with Zucman (2013) that estimated around 8% of the global financial wealth of households is held in tax havens, three-quarters of which goes unrecorded. Available evidence suggests that offshore assets belong mainly to residents of richer countries, in particular to Europeans. Moreover, Pellegrini, V. and Tosti, E. (2012) show that the underestimate of global foreign portfolio assets remains steady at between 7 and 7.5 per cent of global GDP in the period from 2001 to 2010 (about $4.5 tn at the end of 2010).

The largest missing assets in proportion to the total adjusted assets, are estimated for the Netherlands (19.5%), Belgium (18.6%), Cayman Islands (18.3%) and United Kingdom (17.5%) and Switzerland (16.2%). Relevant proportion of missing assets (largest than 10%) are also estimated for Germany (15.4%), France (13.6%) and China (11.8%). Missing assets lower than 5% of the total adjusted assets are instead estimated for Norway (1.3%), South Korea (1.5%), Canada (3.3%), Japan (4%) and Honk Kong (4.7%) and Sweden (4.8%). Estimates for the United States, Luxembourg, and Ireland, which are among the largest CPIS holders, range between 5% and 10% of total assets.

The estimations of the missing assets as percentage of GDP show that Cayman Island and Luxembourg have the highest percentages. The results are highly influenced by the population and GDP amounts of these countries. Other countries with high missing assets as percent of GDP are: Ireland (51.0%), the Netherlands (31.8%), Switzerland (25.6%), Singapore (22.3%), Belgium (22.1%), Hong Kong (18.8%), and the United Kingdom 17.5%.

Our results are consistent with the literature. For example, according to Pellegrini, V. and Tosti, E. (2012) estimated for the period between 2001-2010, the share of the missing assets to be allocated to major euro area countries (France, Germany, Italy, the Netherlands, and Spain) on average around 9 per cent of national GDPs. According to our estimations the missing assets as percentage of GDP for these countries fiver countries we obtain a ratio of 9.1% of GDP.

Table 3. Reported, missing and adjusted total portfolio investment assets (equity and investment fund shares)

End-2021, USD bn

COUNTRY	REPORTED ASSETS	MISSING ASSETS	ADJUSTED TOTAL ASSETS	MISSING AS % OF TOTAL ASSETS	MISSING AS % OF GDP
UNITED STATES	12061	662	12724	5.2	2.8
LUXEMBOURG	3473	227	3700	6.1	264.6
UNITED KINGDOM	2575	548	3123	17.5	17.5
IRELAND	2306	262	2569	10.2	51.0
JAPAN	2215	92	2306	4.0	1.8
GERMANY	2153	391	2545	15.4	9.1
CANADA	2056	71	2127	3.3	3.5
HONG KONG	1416	69	1486	4.7	18.8
CAYMAN ISLANDS	1411	316	1726	18.3	5237.4
NETHERLANDS	1354	328	1682	19.5	31.8
ITALY	1343	105	1448	7.3	5.0
NORWAY	1208	16	1224	1.3	3.2
FRANCE	1176	186	1362	13.6	6.3
SWITZERLAND	1074	208	1282	16.2	25.6
SINGAPORE	968	95	1062	8.9	22.3
AUSTRALIA	878	30	908	3.3	1.8
SWEDEN	806	41	847	4.8	6.4
CHINA	648	87	735	11.8	0.5
SOUTH KOREA	592	9	601	1.5	0.5
BELGIUM	575	131	706	18.6	22.1
SUM OF TOP 20	*40290*	*3872*	*44162*	*8.8*	*5.6*
TOTAL CPIS	*45229*	*4885*	*50115*	*9.7*	*5.5*

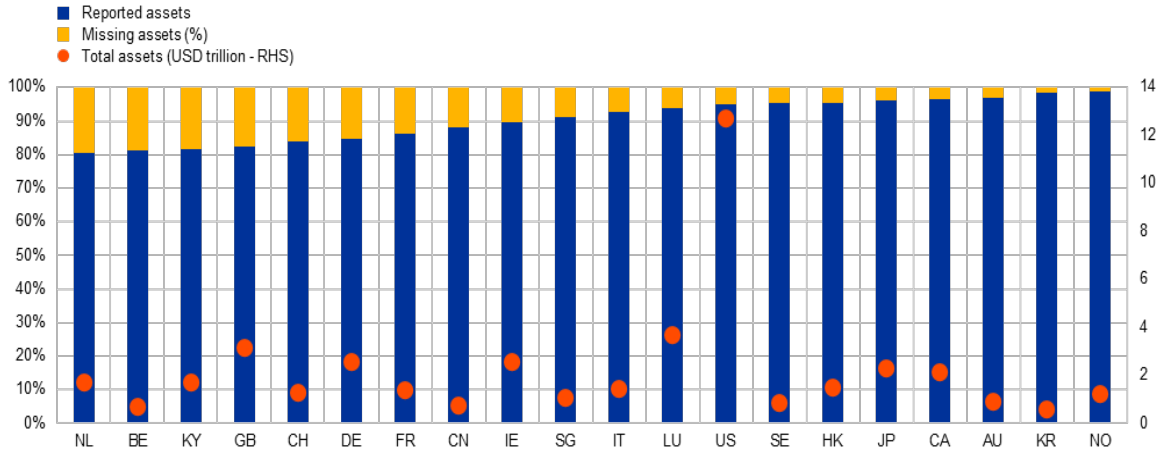
Sources: IMF CPIS, World Bank, authors' calculations.

Notes: Reported assets show the assets as reported by each country in the CPIS dataset. Missing assets show the missing assets as estimated in our model presented in Section 4.1. Adjusted total assets show the sum of reported and estimated missing assets.

We provide a graphical representation of the results (see Chart 1) to illustrate a ranking of the top-20 CPIS holders by the proportion of estimated missing assets in the total adjusted assets. The results are heterogeneous since there is no direct relationship between the total assets held by each country and the percentage of the missing assets.

Chart 1. Proportion of reported and estimated missing assets

End-2021, LHS: % in total assets; RHS: USD trillion



Sources: IMF CPIS, authors' calculations.

Notes: Reported assets show the assets as reported by each country in the CPIS dataset. Missing assets show the missing assets as estimated in our model presented in Section 4.1. Adjusted total assets show the sum of reported and estimated missing assets.

The heterogeneity across the top-20 countries with respect to the proportion of missing assets highlights the importance to assess other factors that explain the existence of the missing assets. This can include a variety of factors already advanced in the literature such as legislation, tax heavens regimes, financial transparency, among others.[6]

The results obtained in our study broadly align with the findings presented by Alstadsæter, Johannesen and Zucman (2018). These authors, using a different approach and methodology, focused on estimating the magnitude of missing household wealth kept off-shore in tax havens. In our study we do not restrict our estimates to holdings of the household's sector, but we focus only on estimating the missing gap for the portfolio securities most relevant in the global discrepancy, that is related to missing holding assets of equity and investment fund shares.

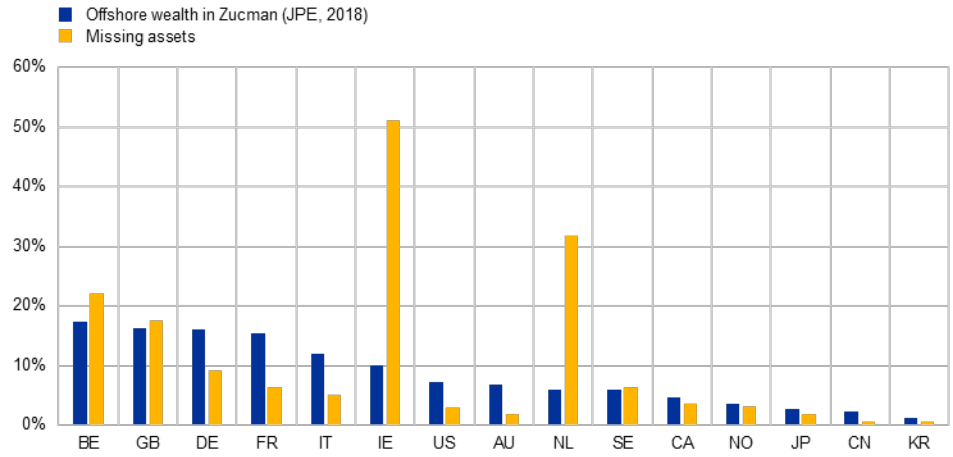
Our estimates also refer to missing assets held anywhere, while Zucman's work specifically focus on wealth held in offshore tax havens. Notwithstanding these differences in method, scope and reference period of the exercises, our results bring some similarities to Zucman (JPE, 2018).[7] Chart 2 shows the estimates of offshore wealth as in Zucman (JPE, 2018) compared to our estimates for missing assets, for the sample of countries presented in both studies.

[6] Between 2007 and 2021 overall size and composition of foreign holdings as percentage of GDP changed considerably for some countries (e.g. Ireland and Netherlands) and this needs to be taken into account in the comparative interpretation between the estimates of these two studies.

[7] Our estimates do not include, for example, holdings abroad of debt securities and deposits abroad.

Chart 2. Comparison of missing assets with results from Zucman (JPE, 2018)

% of GDP, 2017 and 2021



Sources: Zucman (JPE, 2018), authors' calculations.

Notes: Offshore wealth as % GDP refers to estimates of offshore household's wealth from Zucman (JPE, 2018) referring to end-2007. Missing assets as % of GDP refer to the estimates presented in this paper, referring to end-2021.

We associate this heterogeneity also to country economic size, competition in financial services, and the residency approach (and not ultimate owner) followed in statistics. In high developed countries, wealthy households and NFCs may seek innovative and fragmented financial services solutions for their investments, making use of global financial infrastructure to optimise returns. Some of their wealth will be placed with foreign custodian services (TPH) and may end up being underreported in official statistics. This explanation supports the fact that Zucman (JPE, 2018) estimates are higher than ours for Germany, France, Italy, United States, and Australia.

On the other extreme, the most striking differences are found for Ireland, the Netherlands, Belgium and, to a lesser extent, the United Kingdom, where our estimates have a larger share of GDP in missing assets. For countries where the missing assets as percentage of GDP is elevated there are additional factors to consider. Our methodology follows the residency approach as establish by the international statistical standards for external statistics and national accounts. Wealthy families or NFCs establish sometimes legal units abroad (e.g. family and other type of trusts, special purpose vehicles, conduits, etc) and transfer assets to them.

These legal units are generically called special purpose entities (SPEs) as they are just passive legal entities used as a tool (e.g. fiscal optimisation, confidentiality benefits, ring-fenced and protection of assets to certain events, etc) for their owners. However, following the statistical standards, these SPEs are resident in a country different from their owners.[8] The link between owner and SPEs is established by foreign direct investment and no longer by portfolio investment or other investment (deposits). In

[8] The residency of the SPEs was discussed in the ongoing review of the international statistical standards discussed (see https://unstats.un.org/unsd/nationalaccount/aeg/2022/M18/M18_8_G4.pdf). It was concluded to keep the current convention in the IMF's balance of payments manual sixth edition.

fact, statistics would report a global shift of wealth to countries where such SPEs are located and reside. This explains, following the residency approach, why countries such Cayman Island, Luxembourg, Ireland, the Netherlands, Switzerland, Singapore, Belgium, Hong Kong, and even the United Kingdom have high missing assets compared to their GDP.

Regarding the remaining countries, our findings could be interpreted as giving overall consistent results: a group of large foreign investors (South Korea, China, Japan, Norway and Canada) have a low share in GDP in missing foreign assets/wealth.

4.3 Official statistics and third-party holdings

Addressing the missing assets from third-party holdings in official statistics requires more than using the typical statistical data collection instruments at the disposal of country's statistical authorities. An enhanced CPIS report could be promising in improving transparency regarding cross-border security holdings. However, to fully unlock the potential of this valuable dataset, it is essential that regulatory and statistical measures promote comprehensive and detailed reporting of third-party holdings to the CPIS.

Without this statistical disaggregated dissemination of indirect holdings obtained from all foreign custodians a significant portion of countries' external assets will remain missing in official statistics. Implementing a mandate for global custodians to provide detailed third-party holdings would greatly contribute to reconciling global discrepancies with greater accuracy. It is crucial that global statistical compilation guides continue to evolve and require the inclusion of this custody-level data. A country granular third-party reporting, notably for households and NFCs, within the CPIS framework would be a vital step towards advancing our understanding of global investment portfolio investment.

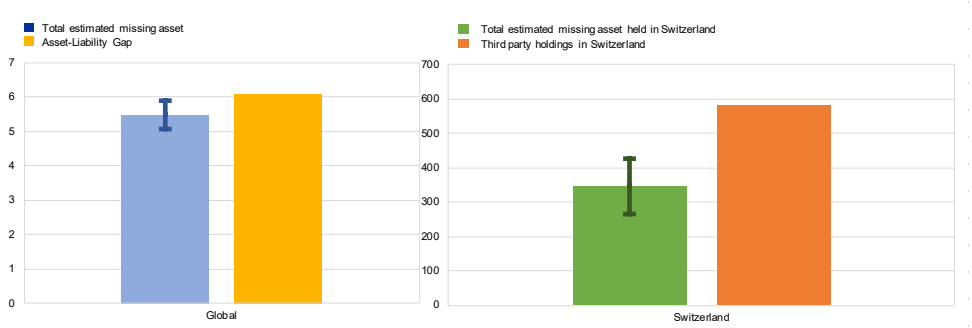
5 Robustness checks

To further benchmark our estimates of missing assets we compare the results for the total missing assets of all countries in the world to the global assets-liabilities gap as (presented in Figure 1). Notably, this comparison hinges on the assumption that the global discrepancy is mainly due to equity (and less driven by reserve assets and debt securities). Moreover, one has to consider that there are other sources that can potentially create discrepancies. Our main assumption underlying our estimates is that household and NFC missing assets are the main factor.

The results show that for end-2021 our estimates come quite close to the global-assets-liabilities gap (see Chart 3, left-hand-side panel). While the global assets-liabilities gap amounted to $6.1 tn, our mid-point estimate of missing assets reaches $5.5 tn. This is re-assuring for our methodological approach, as our global estimates do not take into account the global assets-liabilities gap itself but are based on the estimated link between deposits and securities held in custody.

Chart 3. Estimated missing equity securities, the global asset-liability gap and Swiss third-party holdings, 2021

USD trillion (lhs); USD billion (rhs)



Notes: Estimates of missing assets are obtained following equations (2) and (3) and shown with a 68% confidence band.

Secondly, we compare an estimate of the missing assets held in Switzerland, based on our methodology, with the data available on foreign equity securities held in custody by foreign private investors (i.e. households and NFCs) in banks in Switzerland.[9] Our results show that for end-2021 we estimate missing equity assets held in Switzerland which account for around 60% - if our mid-point estimate is considered – of the assets held in custody in Swiss banks as reported by the SNB (Figure 2, right-hand-side panel). As for globally missing assets, we take this result as supportive of our methodology, noting that we base our methodology in the residency approach. The fact that our estimates are somewhat lower than what is reported in SNB data, may be due to a larger ratio – between securities held in custody in Switzerland and deposits – for Switzerland than is observed in other countries.

6 Conclusion

This paper contributes to our comprehension of the global assets-liabilities gap in external statistics by estimating the extent of unreported third-party securities holdings in official data. We used reliable data on custody arrangements from financial centers in the euro area and implemented a dynamic flow-based model approach to cover globally missing asset. This method offers valuable insights that further refine the previous level-based model analyses.

Our estimates show that approximately $4.9 trillion (about 8% of total assets or 5.6% of world GDP) of portfolio equity and investment fund share securities held through third parties abroad are missing from official statistics as of the end-2021. This significant amount accounts for a significant portion of the $6.1 trillion of the global assets-liabilities gap and is primarily concentrated in a small number of major economies. The underestimation varies across countries but is particularly

[9] To calculate missing assets held in Switzerland, we perform the procedure described in equations (2) and (3) in section 4.2. but use bilateral cross-border deposits of all countries held in banks in Switzerland.

pronounced in key investment hubs like the Cayman Island, Luxembourg, Ireland, the Netherlands, Switzerland, Singapore, Belgium, Hong Kong, and the United Kingdom.

While this research makes progress in understanding discrepancies in cross-border portfolio positions, certain limitations persist. Data constraints hindered us from fully leveraging the potential of our methodological framework beyond the euro area. Greater granularity regarding custodial arrangements worldwide would enhance our understanding of the distribution of household and NFC wealth among advanced and emerging market economies.

Looking ahead, efforts to enhance transparency in reporting institutional investors' cross-border security holdings, as facilitated by ongoing enhancements to the IMF CPIS, are encouraging. But it would be ideal that regulatory and statistical initiatives would promote a comprehensive and granular reporting of third-party holdings to the CPIS, as this information would provide valuable insights and would complete countries' actual external assets and liabilities.

In conclusion, this study improves our understanding of the assets-liabilities gap in global portfolio investment positions. By quantifying a statistically significant portion of missing assets it contributes to economic and financial surveillance analyses. Ongoing methodological refinements coupled with expanding datasets will further enhance our ability to accurately account for international portfolio investment, which are crucial for policy assessment.

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Where are the missing securities in external statistics?

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Bank of Spain
12 February 2024

Introduction

- **Statistical Puzzle**: globally, external assets are smaller than external liabilities Figure
- Why?
  - difficult to capture in official statistics securities held via foreign custodians
  - hidden assets due to intentional actions to hide savings offshore and/or evade taxes
- What do we know?
  - HHs and NFCs hold securites in custody abroad (Zucman 13, Gervais/BuiQuang 19)
  - investment fund shares (IVFs) drive the global discrepancy in portfolio investment (Milesi-Ferretti 23, Beck et al. 23)
- **Research Question**: can securities held in custody abroad be considered the missing link to close the asset-liability gap in portfolio investment?
- **Our contribution**:
  - estimate a dynamic link between third-party holdings of investment fund shares and foreign-held deposits of HHs and NFcs
  - recover the missing securities using flow-focused approach

Hypothesis 1

- **Hypothesis 1**: *Cross-border deposits (in/outflows) in country **i** are (negatively) correlated with the global assets-liabilities gap vis-à-vis country **i**.*
- **Data**:
  - International Investment Position of the Euro Area
  - Coordinated Portfolio Investment Survey
  - Locational Business Statistics: bilateral cross-border deposits of HHs and NFCs
- Results:

Table: Correlation between asset-liability gap and flows of deposits

	Ireland	Luxembourg
Contemporaneous	-0.358	-0.259
One period lag	-0.511	-0.481

Hypothesis 2

- **Hypothesis 2**: *Cross-border deposits (in/outflows) held in country **i** by country **j** are (negatively) correlated with the "third-party" holdings of securities held in country **i** by country **j**.*
- **Data**:
  - Locational Business Statistics: bilateral cross-border deposits of HHs and NFCs
  - Third-party holdings of a private sector
- Run:

$$\Delta TPH_{ij,t} = \alpha + \beta_1 \Delta Deposits_{ij,t} + \beta_2 \Delta Deposits_{ij,t-1} + \varepsilon_{ij,t} \quad (1)$$

  - $\Delta TPH_{ij,t}$ - transactions in TPF by holders from ***j*** of issuances in ***i*** in ***t***
  - $\Delta Deposits_{ij,t}$ - deposits growth of HHs and NFCs from ***j*** in banks in ***i*** in ***t***
- We expect $\beta_2 < 0$

Hypothesis 2

- Aggregate results are:

	ΔTPH_t: all issuances, held by...		ΔTPH_t: IE+LU issuances, held by...	
	all countries	non-EA countries	all countries	non-EA countries
$\Delta Deposits_t$	0.58	1.30	0.54	1.30
	(1.84)	(3.46)	(1.90)	(3.60)
$\Delta Deposits_{t-1}$	-2.54*	-4.84**	-2.49*	-4.85**
	(1.36)	(1.14)	(1.34)	(1.07)
Holder FE	yes	yes	yes	yes
Period FE	yes	yes	yes	yes
Cluster S.E.	Holder + Quarter	Holder + Quarter	Holder + Quarter	Holder + Quarter
Observations	5372	4862	5372	4862
R2	0.05	0.05	0.09	0.10

Note: Results from regression model (1). LHS: aggregate quarterly transactions in TPH of (i) all available countries, or (ii) non-euro area countries. RHS: quarterly changes in aggregate cross-border deposits of households and NFCs of the holding countries. Holder and period fixed effects are included. Standard errors are clustered by holder and quarter.

- Correlation with lagged deposits is -2.5 with 68% confidence bands $(-3.8, -1.2)$.

Constructing Adjusted CPIS Position

- **Step 1**: set a starting value in 2018q4

$$\widehat{MA}_{j,0} = \hat{\gamma} \cdot Deposits_{j,0}$$

  $\hat{\gamma} = 2.8$ (ratio of portfolio assets to other investment liabilities in IIP of Euro Area)

- **Step 2**: construct a series of missing assets up to 2021q4:

$$\widehat{MA}_{j,t} = \widehat{MA}_{j,0} = \sum_{\tau=0}^{t-1} \hat{\beta}_2 \Delta Deposits_{j,\tau}$$

- **Step 3**: adjust CPIS position for 2021q4:

$$\widehat{CPIS}_{j,t} = CPIS_{j,t} + \widehat{MA}_{j,t}$$

- Bounds for estimates: 68% confidence bands $(\beta_2 - \sigma, \beta_2 + \sigma) = (-3.8, -1.2)$
- Bilateral estimates: the same procedure as for aggregate

Estimates of Missing Assets

Country	Assets			Missing assets as % of	
	Reported	Missing	Adjusted	Adjusted	GDP
United States	12061	662	12724	5.2	2.8
Luxembourg	3473	227	3700	6.1	264.6
United Kingdom	2575	548	3123	17.5	17.5
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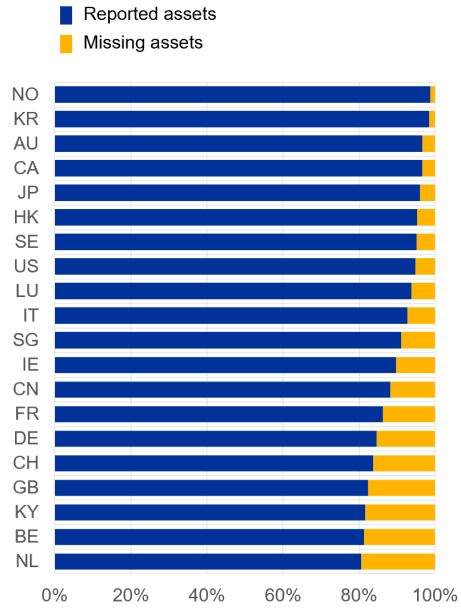
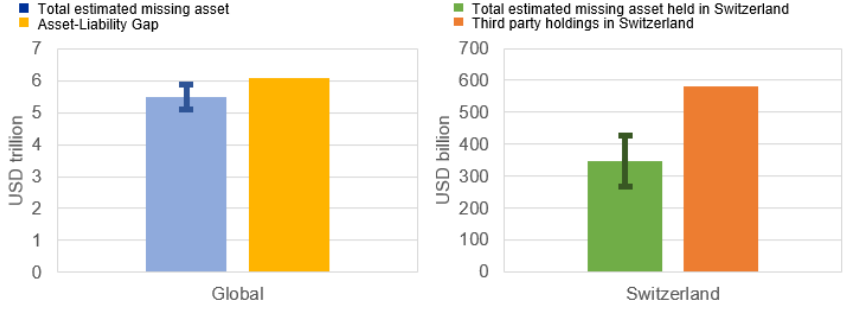
Sum of top 20	**40290**	**3872**	**44162**	**8.8**	**5.6**
Total CPIS	**45229**	**4885**	**50115**	**9.7**	**5.5**



Robustness

- Global:
  - Global discrepancy in 2021 is $6.1 tn
  - Our estimate is $5.5 tn [5.1,5.9] $\sim$ 90%
- Switzerland:
  - Reported amount of foreign securities in custody is $582 bn
  - Our estimate is $347 bn [266,428] $\sim$ 60%



Conclusions

- Our paper contributes to understanding the causes of global assets-liabilities gap
- We estimate holdings of missing assets due to unreported foreign custody securities in official data
- We find global missing assets of around 5.5% of global GDP, with a key role of investment hubs countries
- Missing assets account for around 15-20% of aggregate holdings in the countries with the largest share of unaccounted securities.

A way forward for global statistics on portfolio holdings?

- Statistical recording of residents' HH and NFC assets held via foreign custodians is challenging due to difficulty of obtaining direct reporting
- Possible solution is global sharing of data on third-party holdings (TPH) collected from resident custodians
  - Resident custodians to provide statistical compilers with granular information on holdings by foreign residents
  - Statistical compilers to publish aggregated data on these third-party holdings by holder country, sector, counterpart country and assets classes
- Within ESCB, granular TPH information is available (SHS), covering only euro area custodians
  - Enhancing IMF CPIS data collection to country-by-country information on TPH to cover custodial holdings at global level

Appendix

Global asset-liability discrepancy

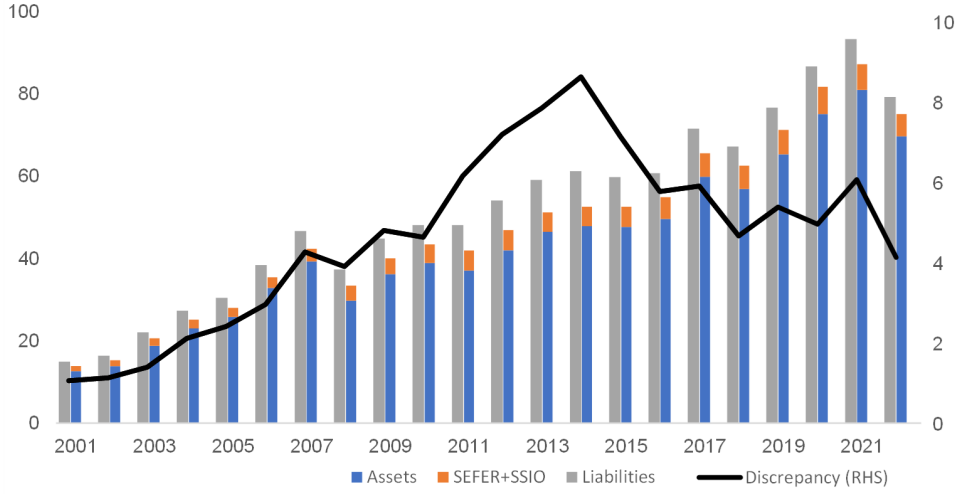


Figure: Global asset-liability discrepancy in international security holdings, $ trillion

Back