# Residency-to-Nationality Reallocation Matrices

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This README file provides documentation for the series of downloadable .DTA files containing reallocation matrices that can be used to restate residency-based data on a nationality basis, as outlined in Coppola et al. (2020). These matrices are estimated using data on the holdings of global mutual fund and ETF portfolios, obtained from Morningstar and use the algorithm to aggregate associated issuances across corporate subsidiaries developed in Coppola et al. (2020). We request that users of these data acknowledge their source and recommend inclusion of the following sentence:

> "These data are based on the work in Coppola, Maggiori, Neiman and Schreger (2020) and were obtained from: www.globalcapitalallocation.com".

The principal downloadable files include:

- Reallocation_Matrix_X_Y_Z.dta: Files containing the reallocation matrices,
- Country_Names.xls: File containing a mapping from country ISO3 codes (used to index matrices) to country names,

where "X" indexes investing countries, "Y" indexes asset classes, and "Z" indexes years. For example, the matrix used to restate U.S. holdings of corporate bonds from a residency basis to a nationality basis as of December 2017 is the file

"Reallocation_Matrix_USA_Corporate_Bonds_2017.dta".

We include data for the following investing countries: the U.S., the European Monetary Union (EMU), Great Britain, Canada, Switzerland, Australia, Sweden, Denmark, and Norway. We only

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consider the EMU as a block since mutual funds are concentrated in Luxembourg and Ireland, but collect investments from the rest of the countries in the European Union.

We include matrices estimated separately for holdings in the following asset classes: equities; all bonds; corporate bonds; sovereign, agency, and local government (muni) bonds; asset-backed securities.

This release of the data includes matrices estimated for the years 2007 to 2017. The matrices are always estimated using data as of the last reporting date of the year (December).

# 1 Methodology

For a given asset class, let $x_{i,j}^{\mathcal{R}}$ denote the dollar value of holdings in the Morningstar data of investor country $j$ in securities issued by country $i$ under a residency basis.[1] Let $x_{i,k,j}^{\mathcal{R}\to\mathcal{N}}$ denote the dollar value of these same holdings that, under nationality rather than residency, would be associated instead with issuer country $k$ rather than $i$, such that $x_{i,j}^{\mathcal{R}} = \sum_k x_{i,k,j}^{\mathcal{R}\to\mathcal{N}}$. We then define an entry $\omega_{i,k,j}$ in our reallocation matrix for country $j$ as:

$$\omega_{i,k,j} = \frac{x_{i,k,j}^{\mathcal{R}\to\mathcal{N}}}{x_{i,j}^{\mathcal{R}}}. \tag{1}$$

Collecting $\omega_{i,k,j}$ over all rows $i$ and columns $k$, we have country $j$'s reallocation matrix $\Omega_j$:

$$\Omega_j = \begin{bmatrix} \omega_{1,1,j} & \omega_{1,2,j} & \omega_{1,3,j} & \dots \\ \omega_{2,1,j} & \omega_{2,2,j} & \omega_{2,3,j} & \dots \\ \omega_{3,1,j} & \omega_{3,2,j} & \omega_{3,3,j} & \dots \\ \vdots & \vdots & \vdots & \ddots \end{bmatrix}, \tag{2}$$

where each row of $\Omega_j$ sums to one.

Equipped with these reallocation matrices, one can transform bilateral positions in other datasets from a residency to a nationality basis. Let $q_j^{\mathcal{R}} = \left[q_{1,j}^{\mathcal{R}}, q_{2,j}^{\mathcal{R}}, \dots\right]'$ denote the vector of positions of country $j$ in issuer country $i$, observed in a residency-based dataset. We use the superscript $'$ for the transpose operator of vectors and matrices. We can then transform these data to a nationality basis by pre-multiplying the residency-based vector by the transpose of the reallocation matrix:

$$q_j^{\mathcal{N}} = \Omega_j' q_j^{\mathcal{R}}, \tag{3}$$

where $q_j^{\mathcal{N}} = \left[q_{1,j}^{\mathcal{N}}, q_{2,j}^{\mathcal{N}}, \dots\right]'$ is the resulting estimate of nationality-based positions for that dataset.

[1] To save on notation, we do not index these values by asset class and time.

The reallocation matrix files follow the structure described in equation (2), so that each row sums to one. Rows and columns are identified using ISO3 country codes.

# References

**Coppola, Antonio, Matteo Maggiori, Brent Neiman, and Jesse Schreger**, "Redrawing the Map of Global Capital Flows: The Role of Cross-Border Financing and Tax Havens," *Working Paper*, 2020.