Compilation, Revision and Updating of the Global VAR (GVAR) Database, 1979Q2-2023Q3*

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Abstract

This is the latest version of the GVAR dataset—a global modelling framework for analyzing the international macroeconomic transmission of shocks while accounting for drivers of economic activity, interlinkages and spillovers between different countries, and the effects of unobserved or observed common factors. This dataset includes quarterly macroeconomic variables for 33 economies (log real GDP, y_{it}, the rate of inflation, dp_{it}, short-term interest rate, r_{it}, long-term interest rate, lr_{it}, the log deflated exchange rate, ep_{it}, and log real equity prices, eq_{it}), as well as quarterly data on commodity prices (oil prices, $poil_t$, agricultural raw material, $pmat_t$, and metals prices, $pmetal_t$), from 1979Q2 to 2023Q3. These 33 countries cover more than 90% of world GDP. The updated database can be download from the GVAR database website. It would be appreciated if use of the updated dataset could be acknowledged as: "Mohaddes and Raissi (2024). *Compilation, Revision and Updating of the Global VAR (GVAR) Database, 1979Q2-2023Q3*. University of Cambridge: Judge Business School (mimeo)".

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Introduction

This is the latest version of the Global VAR (GVAR) dataset. It extends up to 2023Q3 the last available GVAR dataset (the '2019 Vintage') prepared by Mohaddes and Raissi (2020) and available from the GVAR database website. This updated dataset (1979Q2-2023Q3) will be referred to as the '2023 Vintage', and was prepared by Kamiar Mohaddes (Judge Business School and King's College, University of Cambridge) and Mehdi Raissi (International Monetary Fund). The 2023 Vintage is largely obtained by extrapolating forward (using growth rates) the data of the 2016 Vintage (see Mohaddes and Raissi (2018)) from 2013Q2 to 2023Q3. The construction of the 2023 Vintage is based on data from Haver Analytics, the International Monetary Fund's International Financial Statistics (IFS) database, and Bloomberg.

Table 1: Countries in the GVAR Model

Asia and Pacific	**North America**	**Europe**
Australia	Canada	Austria
China	Mexico	Belgium
India	United States	Finland
Indonesia		France
Japan	**South America**	Germany
Korea	Argentina	Italy
Malaysia	Brazil	Netherlands
New Zealand	Chile	Norway
Philippines	Peru	Spain
Singapore		Sweden
Thailand	**Middle East and Africa**	Switzerland
	Saudi Arabia	Turkey
	South Africa	United Kingdom

The GVAR is a modelling framework of the world economy designed to explicitly model economic and financial interdependencies across markets and countries at national and international levels, and was originally proposed by Pesaran et al. (2004) and further developed by Dees et al. (2007). It links individual country-specific models in a coherent manner to a global modelling framework by using time series, panel data, and factor analysis techniques. It has been used extensively in policymaking, in bank stress testing, the analysis of China's growing importance for the rest of the world economy (Cesa-Bianchi et al. 2012 and Cashin et al. (2016, 2017b)), the international macroeconomic transmission of weather shocks (Cashin et al. 2017a), the impact of commodity price shocks (see Mohaddes and Pesaran (2016, 2017) for the global macroeconomic consequences of country-specific oil-supply

shocks and Cashin et al. 2014 and Mohaddes and Raissi 2019 for the differential effects of demand- and supply-driven commodity price shocks), the implications of global and domestic fiscal policy adjustments (see Mohaddes et al. (2022) and Alawadhi et al. (2018) for examples from the Middle East), and other real and financial shocks (see, for instance, the GVAR handbook edited by di Mauro and Pesaran 2013 for empirical applications from 27 contributors), as well as in forecasting (see Pesaran et al. 2009 and Bussière et al. 2012 for the earliest GVAR forecasting applications to the global economy). For an extensive survey of GVAR modelling, both the theoretical foundations of the approach and its numerous empirical applications, see Chudik and Pesaran (2016). See also Chudik et al. (2020) who contribute to the growing GVAR literature by showing how global and national shocks can be identified within a GVAR framework (with the usefulness of the proposed approach illustrated in an application to the analysis of the interactions between public debt and real output growth).

Note that more recently Chudik et al. (2021) develop a threshold-augmented GVAR (TGVAR) model to quantify the global macroeconomic effects of Covid-19 under uncertainty, and Chudik et al. (2021) investigate the macroeconomic effects of countries' discretionary fiscal actions in response to the Covid-19 pandemic and its fallout using the TGVAR model.

The GVAR dataset includes quarterly macroeconomic and financial variables for 33 economies (log real GDP, y_{it}, the rate of inflation, dp_{it}, short-term interest rate, r_{it}, long-term interest rate, lr_{it}, the log deflated exchange rate, ep_{it}, and log real equity prices, eq_{it}), as well as quarterly data on commodity prices (oil prices, $poil_t$, agricultural raw material, $pmat_t$, and metals prices, $pmetal_t$), over the 1979Q2 to 2023Q3 period. These 33 countries cover more than 90% of world GDP, see Table 1. You can download the data from the GVAR database website. This data can be used to estimate GVAR models using the GVAR Toolbox (see Smith and Galesi 2014 for details) or to estimate individual country VARX* models (as is done in Burney et al. 2018, Esfahani et al. (2013, 2014), Mohaddes and Pesaran 2014, and Mohaddes and Raissi 2013).

It would be appreciated if use of the updated dataset could be acknowledged as: Mohaddes, K. and M. Raissi (2024). *Compilation, Revision and Updating of the Global VAR (GVAR) Database, 1979Q2-2023Q3.* University of Cambridge: Judge Business School (mimeo).

Real GDP

For compiling the 2023 Vintage Real GDP series, seasonally-adjusted data were obtained from Haver Analytics and the International Monetary Fund's IFS (Concept: GDP Volume Index, Quarterly, 2010 = 100) for all countries with the exception of India. The quarterly

rate of change of the seasonally-adjusted IFS/Haver series was then used to extrapolate forward the 2016 Vintage GDP from 2013Q2 to 2023Q3.

For India, seasonally-adjusted data over 1996Q2-2023Q3 from the Central Statistics Office was used (Concept: GDP at 2010 Prices and Exchange Rates). The quarterly rate of change of the Industrial Production General Index (from the Ministry of Statistics and Program Implementation) over 1979Q1-1996Q1 was used to extrapolate backward the real GDP data.

Consumer price index

In order to create the 2023 Vintage CPI, IFS data (Concept: Consumer Prices, All items, Quarterly, 2010 = 100) were collected for all countries with the exception of Argentina. For Argentina seasonally-adjusted data from Haver Analytics (Concept: Buenos Aires Consumer Price Index, Jul.11–Jun.12=100) was utilized. The quarterly rate of change of the seasonally-adjusted IFS/Haver series was then used to extrapolate forward the 2016 Vintage CPI from 2013Q2 to 2023Q3.

Equity price index

Updated equity price series are sourced from Haver Analytics. Firstly, a quarterly MSCI share price index, excluding dividends, in local currency was collected for all countries. Secondly, the 2023 Vintage equity price index was obtained by forward extrapolation of the 2016 Vintage using the rate of change of the new series from 2013Q2 to 2023Q3.

Exchange rates

Exchange rate series are sourced from IFS. A quarterly average of the nominal bilateral exchange rates vis-a-vis the US dollar (units of foreign currency per US dollar) was obtained for each country. The 2023 Vintage exchange rate was obtained by forward extrapolation of the 2016 Vintage using the rate of change of the new series from 2013Q2 to 2023Q3.

Short-term interest rates

Haver Analytics and IFS data are used for Argentina, Austria, Chile, China, Malaysia, and Turkey (Concept: Interest Rates, Deposit Rate); for Peru (Concept: Interest Rates, Discount Rate); for Belgium, Canada, France, Germany, Italy, Mexico, Norway, Philippines, South Africa, UK and US (Concept: Interest Rates, Treasury Bill Rate); and for Australia, Brazil, Finland, India, Indonesia, Japan, Korea, Saudi Arabia, Singapore, Spain, Sweden, Switzerland, and Thailand (Concept: Interest Rates, Money Market Rate). For the Netherlands

and New Zealand, the 3-month government repo rate and the 30-days bank-bill yield were used, respectively. The 2023 Vintage short term interest rates are then extended with these series from 2013Q2 to 2023Q3. Note that for Germany, as the money market rate which was used in the earlier vintages was no longer available, we used the 3-month treasury bill from 2010Q1 onward and for Singapore the overnight rate average was used from 2005Q3 onward.

Long-term interest rates

Haver Analytics and IFS data (Concept: Interest Rates, Government Securities, Government Bonds) are used to extend the series for all countries, namely Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, Korea, Netherlands, New Zealand, Norway, South Africa, Spain, Sweden, Switzerland, United Kingdom, and United States. The 2023 Vintage long-term interest rates are extended with these series from 2013Q2 to 2023Q3.

Oil price index

For the oil price index a Brent crude oil price from Bloomberg was used (Series: Current pipeline export quality Brent blend. Ticker: CO1 Comdty). To construct the quarterly series, the average of daily closing prices was obtained for all trading days within the quarter. The quarterly rate of change of this new series was used to extrapolate forward the 2016 Vintage oil price index from 2013Q2 to 2023Q3.

Other commodities: Agricultural raw material and metals price indices

The agricultural raw material and metals price indices were both taken from the IMF's Primary Commodity Prices monthly data.[1] Monthly averages of the indices were taken for each quarter. The 2023 Vintage price indices were obtained by forward extrapolation of the 2016 Vintage using the rate of change of the new series from 2013Q2 to 2023Q3.

Construction of the variables

Log real GDP, y_{it}, the rate of inflation, dp_{it}, short-term interest rate, r_{it}, long-term interest rate, lr_{it}, the log deflated exchange rate, ep_{it}, and log real equity prices, eq_{it}, are six variables included in most of the GVAR applications in the literature. These six variables are included

[1] http://www.imf.org/external/np/res/commod/index.aspx.

in the dataset and are constructed as

$$\begin{aligned} y_{it} &= \ln(GDP_{it}), \quad dp_{it} = p_{it} - p_{it-1}, \quad p_{it} = \ln(CPI_{it}), \quad ep_{it} = \ln\left(E_{it}/CPI_{it}\right), \\ r_{it} &= 0.25\ln(1 + R^S_{it}/100), \quad lr_{it} = 0.25\ln(1 + R^L_{it}/100), \; eq_{it} = \ln\left(EQ_{it}/CPI_{it}\right), \end{aligned} \quad (1)$$

where GDP_{it} is the real Gross Domestic Product at time t for country i, CPI_{it} is the consumer price index, E_{it} is the nominal exchange rate in terms of US dollar, EQ_{it} is the nominal Equity Price Index, and R^S_{it} and R^L_{it} are short-term and long-term interest rates, respectively. In addition to the above variables the dataset also includes the log of oil prices, $poil_t$, the log of agricultural raw material prices, $pmat_t$, and the log of metals prices, $pmetal_t$.

Finally, for the convenience of VARX* modelling, we have also included the corresponding 'star' variables, $\mathbf{x}^*_{it} = (y^*_{it},\ dp^*_{it},\ eq^*_{it},\ r^*_{it},\ lr^*_{it})'$ for each country, constructed using country-specific trade shares, and defined by

$$\mathbf{x}^*_{it} = \sum_{j=1}^{N} w_{ij}\mathbf{x}_{jt}, \quad (2)$$

where w_{ij}, $i, j = 1, 2, ...N$, are bilateral trade weights, with $w_{ii} = 0$, and $\sum_{j=1}^{N} w_{ij} = 1$. In the dataset w_{ij} is computed as a three-year average to reduce the impact of individual yearly movements on the trade weights. More specifically, the trade weights are computed as

$$w_{ij} = \frac{T_{ij,2014} + T_{ij,2015} + T_{ij,2016}}{T_{i,2014} + T_{i,2015} + T_{i,2016}}, \quad (3)$$

where T_{ijt} is the bilateral trade of country i with country j during a given year t and is calculated as the average of exports and imports of country i with j, and $T_{it} = \sum_{j=1}^{N} T_{ijt}$ (the total trade of country i) for $t = 2014, 2015, 2016$. Note that the trade flows, T_{ijt}, are also provided in a separate excel file for the 33 countries over the 1980–2016 period.

PPP - GDP data

The source for construction of the country specific PPP-GDP weights is the World Development Indicator database of the World Bank. The GDP in Purchasing Power Parity terms in current international dollars (Ticker: NY.GDP.MKTP.PP.CD) was downloaded for all countries from 1990 to 2018.

Trade matrix

To construct the trade matrices, the IMF Direction of Trade statistics was used. For all the countries considered the matrix of Exports and Imports (c.i.f.) was downloaded at the annual frequency. The data for 2014–2016 average of Exports and Imports are appended to the trade matrices associated with the 2013 Vintage.

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