One Ring to Rule Them All? New Evidence on World Cycles*

Macro-financial dataset - Data Description

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1. Introduction

The appendix describes the long quarterly macro-financial dataset assembled for the paper "One Ring to Rule Them All? New Evidence on World Cycles", by Eric Monnet and Damien Puy (2019). For a complete discussion, we refer readers to the latest version of the paper on the authors' website. We encourage the users of the data to send us their feedback on the current version of the database, as well as suggestions for improvement. To do so, please contact the authors and copy Antoine Malfroy-Camine at macrofin.data@gmail.com. The database is updated and expanded regularly. Please cite the current version of the working paper when using the data: Monnet, Eric, and Damien Puy (2019), "One Ring to Rule Them All? New Evidence on World Cycles". International Monetary Fund Working Paper 19/202.

2. Methodology

We assemble a new "long" macro-financial dataset of output, credit and prices (assets and goods) covering (i) a wide range of advanced and emerging countries (ii) over the whole post-war period (since 1950-Q1) and (iii) at quarterly frequency. To do so, we make extensive use of the *International*

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Financial Statistics (IFS) archives, which contain the whole history of statistical information published by the IMF ever since its creation. Since 1944 and as part of the Bretton Woods agreement, the IMF requires that its members send standard macro-financial statistics at a high frequency, in particular price, trade, reserve and credit statistics. Over time, the IMF has therefore become the leader of data collection and dissemination among international organizations, and the main provider of macro-financial data to academic circles (through the IFS online database). However, for various institutional and historical reasons, only a small part of the information compiled in IFS has made it to the official "digital" version of the IFS database. Our main contribution is to tap directly into the IFS paper volumes, stored physically in the IMF archives, to recover missing statistical information over the last 70 years, for both advanced and emerging countries.

The database consists of five variables, available for a large cross section of countries: (i) real GDP, (ii) Credit, (iii) Consumer Prices, (iv) Stock Prices, and (v) Sovereign Bond Yields. Although specifics apply, we generally follow the same procedure for all series. We first collect official quarterly statistics currently provided online from by national statistical institutes (or international organizations) for each variable, and then use the IFS archives to extend all series in the past, after making sure definitions match. A companion excel file, also downloadable from the authors' website, reports the exact variable we extend, as well as the date at which we use IFS archives to extend official series in the past.

For consumer prices, stock prices and bond yields, this exercise is straightforward and generally amounts to collecting data directly from older (paper-based) vintages of IFS.[1] Consumer prices are reconstructed using the "cost of living" index (line 66 in IFS). Stock prices are based on the "share price index" collected (line 61 or above in IFS). When this index is not available, we use the "Industrial share price" as a proxy for the overall index. Bond yields refer to average yields to maturity on (central) government bonds issues with lives of at least 7 years (line 62 in IFS).

In line with most contributions on credit cycles, we use the IFS "claims on the private sector from domestic banks" (IFS line 32d) as our definition of domestic credit. This definition is equivalent to the *Bank credit to the Private Non-Financial Sector* assembled by the BIS, which is widely used in the literature, and excludes foreign credit and credit from other institutional sectors (e.g. the government or non-banks). Compared to other data, credit aggregates are subject

[1] Changes in definitions and collection methods over time have been minimal for these variables.

to a significant number of breaks throughout history, however. When they happen, those breaks are well-documented in paper volumes however and, for at least several quarters, values of the same data series are reported under both the old and the new definition in different IFS vintages. This allows us to chain different data series and create long series without breaks, in line with the BIS long credit dataset (Dembiermont, 2013), which is the most comprehensive dataset of (long) quarterly credit statistics to date.[2]

To construct long quarterly real GDP, we start by collecting quarterly historical Industrial Production (IP) data from *IFS* volumes, and combine them with official annual real GDP series from the *Penn World Tables* (Feenstra, Inklaar and Timmer (2015)). We then use temporal disaggregation methods to extend existing official quarterly GDP statistics in the past (Chow Lin, 1971). In spirit, a temporal disaggregation method allocates the annual GDP across quarters using the (quarterly) IP as a guide. Since the sum of quarters must match the annual GDP number however, annual growth rates can never deviate, on average over the year, from the "true" growth imposed by annual GDP series. Figure 1 compares our "synthetic" quarterly GDP to official quarterly GDP in the United States and France, the only two countries that publish these series since 1950. It shows that our GDP growth, based on our "synthetic" quarterly GDP series, is able to track the GDP growth based on official quarterly GDP statistics very accurately.[3] Those methods are widely applied in countries in which quarterly data (or surveys) are too expensive to conduct and the industrial production is the only reliable indicator of high-frequency output fluctuations.[4]

3. Coverage, definition and comparison with other datasets

Overall, our final dataset covers (i) 37 countries for real GDP (ii) 45 countries for credit (iii) 48 countries for consumer prices (iv) 26 countries for stock prices and (v) 18 countries for bond yields. All series are available at quarterly frequency, since the early 1950's until 2019 and follow standard definitions. Credit denotes the stock of domestic bank credit to the private non-financial sector, expressed in local currency. Prices refers to the Consumer Price Index (CPI). The stock price is an

[2]When breaks in definition were too substantial, credit series were not extended.

[3]Very similar results emerge for other countries, albeit on a shorter sample.

[4]Temporal disaggregation methods are actually recommended in the IMF *Quarterly National Accounts Manual*. It is also a standard tool used by international organizations (e.g. the OECD) to generate long quarterly GDP data when official quarterly data are missing. We come back to this point below.

Figure 1. Real GDP Growth - Synthetic vs. Official

Figure 1.A. United States

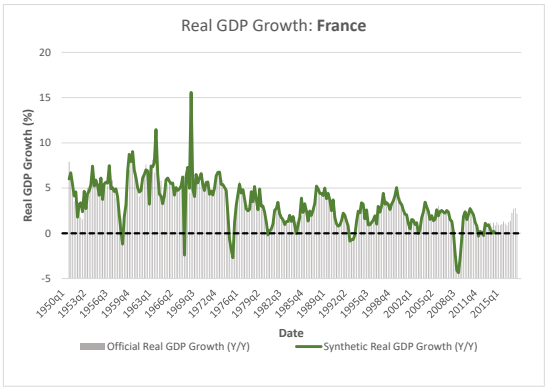


Figure 1.B. France

Notes: In both figures, grey bars report the year-on-year real GDP growth rates based on official quarterly GDP data. Data for the US is taken from the BEA. Data for France is taken from INSEE. The green (solid) lines report the growth we obtain using our synthetic quarterly GDP data, which combines annual GDP numbers from *Penn World Tables* and historical quarterly Industrial Production (IP) data from *IFS* volumes.

index tracking the prices of common shares traded on the main stock exchange. Long-term bond yield reports the yield observed on government bonds maturing in 7 to 10 years, depending on the country. Real GDP data is adjusted for seasonality.[5] We encourage readers to check the exact unit for all data series, which is reported in the companion excel file.

As a consistency check, we compare our data to other popular historical macro-financial datasets. In general, we find that our new series move in tandem with comparable variables available at annual frequency, implying that we are tracking the same data currently used in the literature, albeit at a higher frequency and for a much broader set of countries. For instance, Figure 2 reports the real credit and stock price growth based on our series to those derived using Jorda et al. (2017), which are only available at annual frequency and for a limited set of countries. For Norway and Denmark, we add thirty-five years of quarterly stock price data - between 1950 and 1985 - to what is currently available from official sources. Over that period, our data aligns very well with the stock price growth based on annual data from Jorda et al. (2017). A similar finding emerges for private credit growth in Spain and Italy.[6]

[5]The official real quarterly GDP data we collect from authorities is seasonally adjusted. We then extend those using seasonally adjusted IP data from *IFS* volumes.

[6]We also find a very close correlation when comparing our series to annual bond yields or inflation series from popular sources, when such a comparison is possible. The GDP growth calculated using our dataset is, by construction, aligned with annual GDP growth derived from official sources since they are based on those numbers.

Figure 2. Stock Price and Credit growth: Comparison with Jorda et al. (2017)

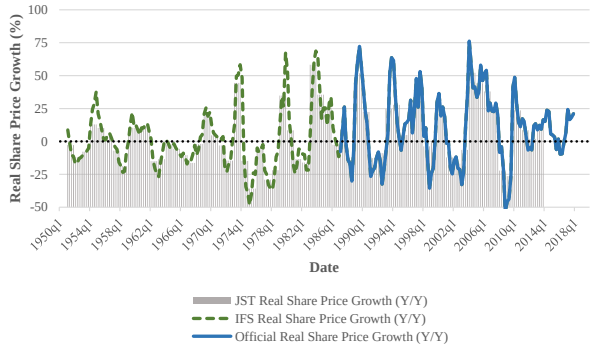


Figure 2.A. Stock Price - Norway

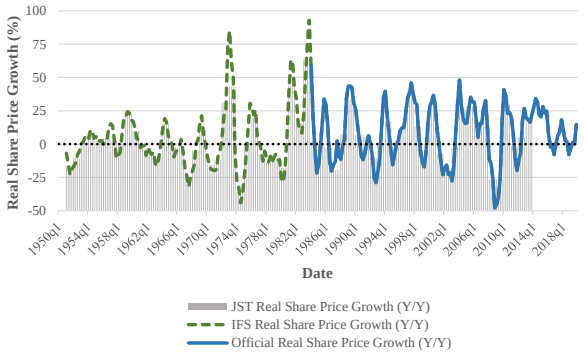


Figure 2.B. Stock Price - Denmark

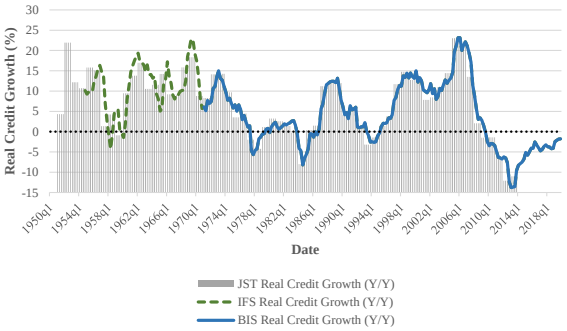


Figure 2.C. Credit growth - Spain

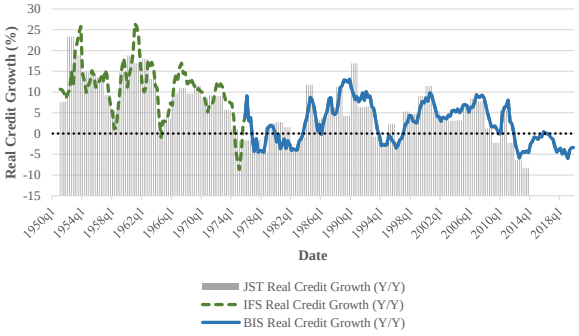


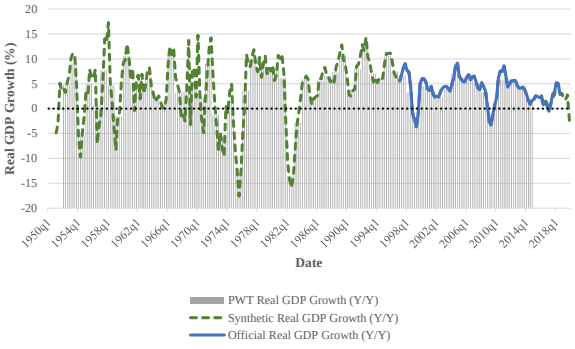
Figure 2.D. Credit growth - Italy

Notes: Grey bars report the year-on-year real stock price and real credit growth rates based on annual data from Jorda et al. (2107). Green (dashed) lines report the growth we obtain using our data. To illustrate how our data extends what is currently available in the literature, the blue (solid) lines report growth rates based on OECD data for stock prices and the BIS for credit.

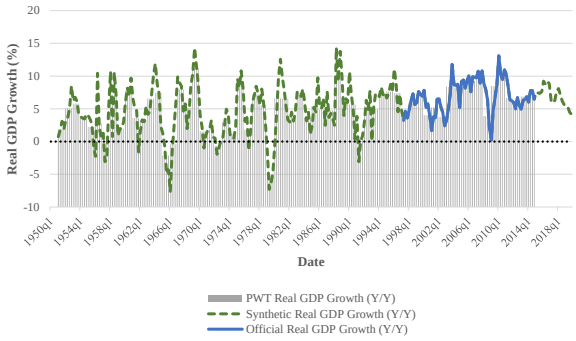
Compared to popular sources providing historical macro-financial data at quarterly frequency, in particular the OECD and the BIS, we increase the data coverage by around 20 to 30 percent for advanced economies, depending on the series. Gains in coverage, however, are generally much higher for emerging markets. We roughly double the amount of quarterly data available for both GDP and credit in EMs (compared to the OECD and the BIS data, respectively) and increase it by 50 percent for stock prices (compared to the OECD). With regards to GDP, our database is particularly useful for large EMs that are not part of the OECD, or for those that are part of the OECD but for which no historical data exist. For instance, we add roughly 45 years of quarterly GDP statistics for both Chile and India (Figure 3, Upper Panel). Similarly, we considerably expand the coverage of BIS

credit statistics in major EMs, which usually stops in the late 90's, or in countries that are not part of the BIS (Figure 3, lower panel). Finally, we also improve the overlap of across datasets, resulting in a more balanced panel than is currently available. For instance, long and high-quality credit statistics are available from the BIS for some large emerging markets (e.g. Argentina or Thailand since the 1950's), but prices or output data are not. Conversely, some countries with good coverage from the output side do not have any information on the financial side. Bringing them together allows us to characterize the whole cycle, both real and financial, for a large number of countries, especially developing countries. Figure 4 illustrates this on Argentina, a major emerging market historically but for which official quarterly output and price data starts only in 2004.

Figure 3. Gains in Coverage for Selected Economies: GDP and Credit



A. Figure 3.A. GDP Growth - Chile



B. Figure 3.B. GDP Growth - India

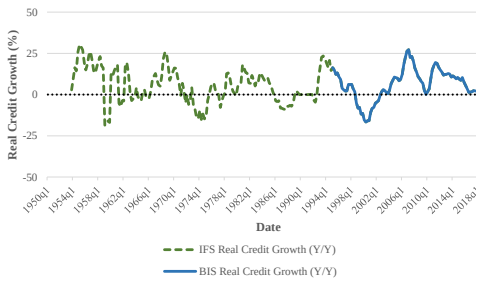


Figure 3.C. Credit growth - Colombia

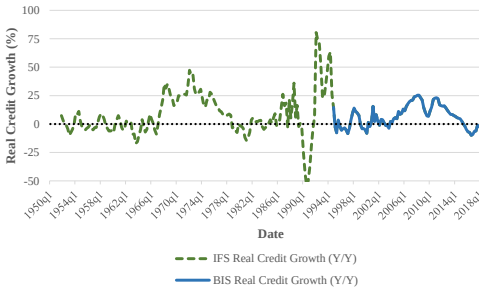


Figure 3.D. Credit growth - Brazil

Notes: In Panels A and B, grey bars report the year-on-year real GDP growth rates we obtain using annual data from the *Penn World Tables*. The blue (solid) lines report GDP growth using data currently available from official sources at quarterly frequency. In both panels, the green (dashed) lines report the growth rates we obtain using our data.

Besides extending the country and time coverage of existing datasets, our methodology also

improves the quality of historical GDP and credit series. To date, only seven OECD countries publish official quarterly GDP data before 1990. As a result, international organizations generally rely on interpolations to produce long quarterly GDP statistics, which are in turn used by researchers. However, such interpolations are not always based on actual output data (e.g. industrial or manufacturing production).[7] Using historical IP data directly sourced from the IFS archives therefore eliminates GDP series based on simple linear interpolations that are still present in widely used international macroeconomic databases.[8] Similarly, we solve issues related to the compilation of credit data. Historical breaks in credit series, in particular, often happen due to changes in the definition and scope of the banking sector or changes in accounting standards. These breaks are usually not corrected in popular datasets available.[9] As a result, credit data have generally received less attention, even though most of the credit received by the private sector in both AEs and EMs is provided by domestic banks. In line with the BIS long credit dataset (Dembiermont, 2013), we use different vintages of the same data to fix the breaks. The use of IMF paper archives therefore allows us to extend the BIS approach and fill the remaining gaps in historical credit statistics. Finally, using IFS as a single source also ensures that definitions of variables are consistent and continuous across time and countries, a potential issue that emerges when datasets from different organizations are merged.[10]

We finish by highlighting three important aspects of our database. First, although we collect historical data from IFS paper volumes to "extend" official data, the data contained in *IFS* volumes has also been produced by local country authorities, and is therefore also official data. We simply use IFS archives to retrieve it. In other words, it has not been produced by the IMF to fill up potential gaps in official statistics. Second, although relying on the IMF archives helps reconstructing the

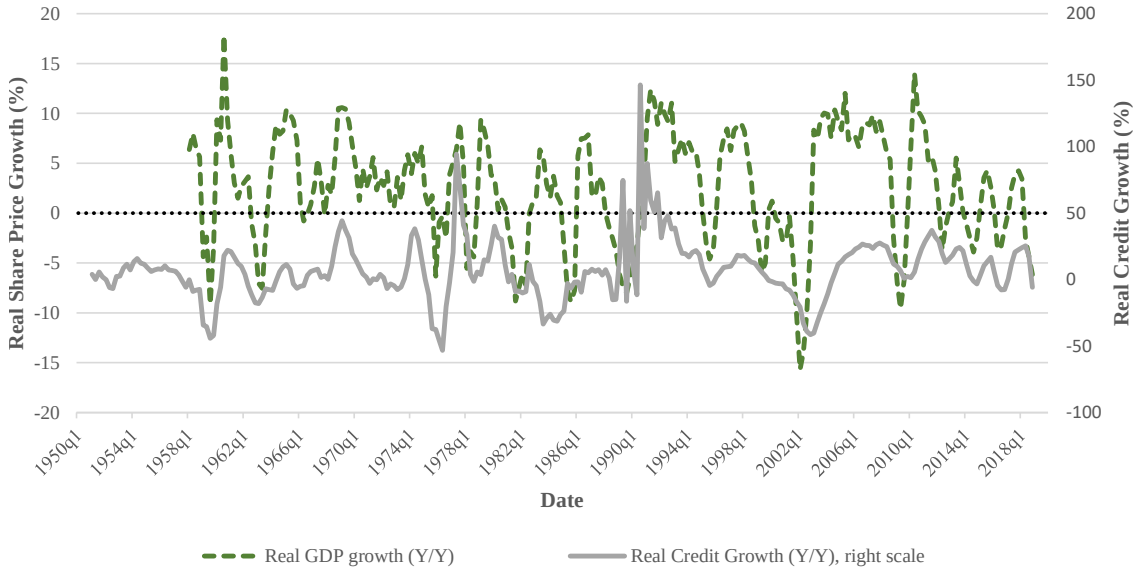
[7] The OECD produces real quarterly GDP data for 20 countries since 1960, but roughly half of them are based on linear or quadratic interpolations.

[8] The issue of the quality of long (quarterly) real GDP data has been raised in recent papers. For example, Romer and Romer (2017) use OECD quarterly real GDP data since 1967 but emphasize that such series are "less consistent in both quality and methodology across countries". For this reason, they use industrial production which is straightforward to measure and more reliable to assess the effect of crises on business cycles. The large and influential literature on the effects of US monetary policy often relies on industrial production series (Bernanke and Mihov 1998, Romer and Romer 2004, Barakchian and Crowe 2013). In our case, we combine annual GDP number, which are well established and quarterly IP data.

[9] For instance, credit series in Jorda et al. (2017) are not always corrected for breaks.

[10] This explains why the archives (or more generally the original publications) of the IMF have been used extensively by economic historians to study the history of exchange rate arrangements or financial liberalization (Calvo and Reinhart 2002, Reinhart and Rogoff 2004, Chinn and Ito 2006, Quinn and Toyoda 2008). The IMF Direction of Trade Statistics, which provides annual data since 1948, also forms the basis of the trade literature about trade and gravity models. To some extent, we extend this practice to macro and financial data.

Figure 4. Real GDP and Credit Growth - Argentina



Notes: The dashed line reports the year-on-year synthetic real GDP growth rates based on our synthetic GDP data. The grey (solid) lines reports real credit growth.

statistical history of advanced economies in the distant past (e.g the 50's and the 60's), a large part of the database pertains to the recent past, in particular the 80's, the 90's and even the early 00's, for both emerging and advanced countries. Finally, we emphasize that the methods we rely on are not new, especially when it comes to the construction of long GDP and credit statistics. We rely on the same techniques used by other major providers of long quarterly statistics (the OECD and the BIS), but apply them to a new set of data that was previously unavailable.

4. References

Barakchian, S. Mahdi, and C. Crowe, 2013. "Monetary policy matters: Evidence from new shocks data" *Journal of Monetary Economics* 60.8 : 950–966.

Bernanke, Ben S., and I. Mihov, 1998. "Measuring monetary policy." *The Quarterly Journal of Economics* 113.3 (1998): 869–902.

Calvo, Guillermo A., and C. M. Reinhart, 2002. "Fear of floating." *The Quarterly Journal of Economics* 117.2: 379–408.

Chinn, M.D., Ito, H., 2006. "What Matters for Financial Development? Capital Controls, Institutions, and Interactions". *Journal of Development Economics* 81(1), 163–192.

Chow, G., C., and Lin, A., 1971. "Best Linear Unbiased Interpolation, Distribution and Extrapolation of Time Series by Related Series," *The Review of Economics and Statistics*, 53, 372–375.

Dembiermont, Drehmann M, and Muksakunratana S, 2013. "How much does the private sector really borrow - a new database for total credit to the private non-financial sector," *BIS Quarterly Review*, Bank for International Settlements, March.

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer, 2015, "The Next Generation of the Penn World Table" emphAmerican Economic Review, 105 (10), 3150-3182, available for download at www.ggdc.net/pwt

Jordà, Oscar, M. Schularick, and A. M. Taylor, 2017. "Macrofinancial History and the New Business Cycle Facts." *NBER Macroeconomics Annual* 2016, volume 31, edited by Martin Eichenbaum and Jonathan A. Parker. Chicago: University of Chicago Press.

Quinn, Dennis P., and A. M. Toyoda, 2008. "Does capital account liberalization lead to growth?" *The Review of Financial Studies* 21.3: 1403–1449.

Reinhart, Carmen M., and Kenneth S. Rogoff, 2004. "The modern history of exchange rate arrangements: a reinterpretation." *The Quarterly Journal of Economics* 119.1 : 1–48.

Romer, Christina D., and D. H. Romer, 2004. "A new measure of monetary shocks: Derivation and implications." *American Economic Review* 94.4: 1055–1084.

Romer, Christina D., and D. H. Romer, 2017 "New evidence on the aftermath of financial crises in advanced countries." *American Economic Review* 107.10 (2017): 3072–3118.