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

Abstract

We estimate world cycles using a new quarterly macro-financial dataset assembled using IMF archives, covering a large set of countries since 1950. World cycles, real and financial, exist and US shocks drive them. But their strength is modest for GDP and credit. Global financial cycles are much weaker for credit than for asset prices. We also challenge the view that synchronization has increased with globalization. Although this is true for prices (goods and assets), it is not for quantities (output and credit). World business and credit cycles were as strong during Bretton Woods (1950-1972) as during the Globalization period (1982-2006). We investigate the economic and financial forces driving our results, connect them to the existing literature and discuss important policy implications.

JEL Classification: E32, F41, F42

Keywords: World Cycles, business cycles, financial cycles, Financial Integration, trade integration, Globalization, US Monetary Policy

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1. Introduction

Do world cycles really exist? And if so, how strong are they? Over the last two decades, empirical evidence on world cycles, both real and financial, has been increasing.[1] Although this issue has been approached from various angles, a consensus seems to have emerged around three facts. First, world cycles exist and are driven by the US, and in particular by US monetary policy.[2] Second, their effect is quantitatively strong.[3] They affect both real and financial variables, quantities and prices. Isolating your economy from them is, at best, a challenging task [Rey, 2015]. Third, their strength has increased over time, mainly because of the intense globalization process that started in the mid-80's.[4] Taken together, these facts have portrayed world cycles as a dominating force and weighed on some important policy debates. They have pushed the view that integration, both real and financial, comes at the cost of increased synchronization, even in normal times. They also suggest that the degree of control over domestic variables (or policy autonomy) is limited, especially in small open economies (SOEs) and emerging markets (EMs) that have chosen to integrate their economies into the global market.

We revisit this conventional wisdom using a new quarterly dataset of output, consumer prices (CPI), credit and asset prices (stock prices and bond yields) for a large sample of advanced and emerging countries since 1950 (1950Q1-2019Q4). Building on the unique history of the International Monetary Fund (IMF) as a hub for international statistics, we create new long macro-financial series using the paper archives of the IMF *International Financial Statistics* (IFS). Extracting information that was never previously digitized, we recreate the real and financial (statistical) profile of major emerging and advanced economies over the whole post-war period at a quarterly frequency. To our knowledge, we are the first to assemble a quarterly dataset with such a long and wide coverage. More importantly, we correct several issues related to the coverage, frequency and quality of existing macro-financial databases, which have ultimately biased the perception of world cycles.

Building on standard econometric tools used in the literature (i.e. dynamic factor models), we first confirm several findings. We find that world cycles, both real and financial, exist. We estimate very precise world cycles in all variables – output, credit, inflation and asset prices – over the whole post-war period. Those factors do not always correlate, implying that financial variables (domestic credit, equity prices and bond yields) respond to different global forces. We also confirm that the US seems to be the main driver of global dynamics, both real and financial. More precisely, we find

[1] See Kose et al. [2003a] on the existence of a world business cycle, Miranda-Agrippino and Rey [2020] on a global financial cycle and Ciccarelli and Mojon [2010], Fernández et al. [2017], Auer et al. [2019], Ha et al. [2019] on a world inflation cycle. In what follows, we use "global" or "world" interchangeably.

[2] Recent evidence on the effect of US monetary policy on real and financial variables around the world include Dedola et al. [2017], Kalemli-Ozcan [2019], Miranda-Agrippino and Rey [2020] and references therein.

[3] Although estimates for the post-war period vary across variables and studies, they all point to a sizeable impact. The share variance in domestic variables explained by a world factor usually ranges between 20 and 30% for output and asset prices, and climbs to 50 percent for inflation (Auer et al. [2019]).

[4] Evidence of a rise in global output co-movement include, inter alia, Lumsdaine and Prasad [2003], Kose et al. [2008]. On the financial side, see Cesa-Bianchi et al. [2019b], Jordà et al. [2019]. Ha et al. [2019] and references therein also report a rise in inflation synchronization.

that US shocks typically identified in the literature, such as monetary policy shocks, productivity shocks or policy uncertainty shocks, lead real and financial world cycles. Qualitatively, this confirms the role of the US hegemon [Miranda-Agrippino and Rey, 2020].

We also challenge important results, however. First, we qualify the quantitative importance of world cycles. World cycles have been an important source of volatility for domestic variables over the postwar period (1950–2019). Their strength, however, varies significantly with the sample used (time, country and variable). In general, the strength of world cycles – measured by the share of variance in domestic variables explained by the world dynamics – drops significantly when a few "extreme" observations are excluded from the sample (i.e. the oil shocks and the 2008/2009 financial crisis) and/or when looking at emerging markets (EM). We also find that world cycles are much stronger when looking at prices (consumer goods and assets) rather than quantities (output and credit). In normal times, the impact of the world business cycle on domestic output is relatively modest (around 15 percent for the median country). Finally, the strength of the global financial cycle depends heavily on the variable used: synchronization is three to four times higher when using stock and bond prices (around 50 percent) rather than credit (around 10–15 percent). Overall, world cycles disproportionately affect advanced economies and asset prices, and have a modest impact outside extreme events.

We also challenge the view that world synchronization has increased over time. Although the synchronization of asset (and goods) prices has increased steadily over the last seven decades, this is not true for output and credit. The world output and credit cycles were as "strong" during Bretton Woods (1950–1971), a low point of financial and trade integration, as during the Globalization period (1984-2006). World cycles explain roughly 15 percent of the variance in domestic credit and output for the median country, and below 10 percent for the median emerging market in both periods. After the Global Financial Crisis (GFC), both output and credit synchronization have reverted to relatively low historical levels. In contrast, the synchronization in prices (assets and goods) has roughly doubled since Bretton Woods (from 25 percent to 50 percent for the median country). In other words, although higher asset price synchronization seems to be a robust new feature of the international financial system, we do not find robust evidence of increased output and credit synchronization at the global level.

Finally, we explore the factors behind the stability of output synchronization over the last 70 years. We show that this is the result of two opposing forces – trade and financial integration – that have left the average level of output synchronization in the world roughly unchanged. Countries that have increased their trade integration more than others have synchronized their domestic output with the world business cycle. However, financial integration had the opposite effect. Countries that have deepened their financial linkages with the world have, in the long run, de-synchronized their output from the world cycle. This result is reversed only during the GFC, during which more financially open countries have actually experienced more output synchronization with the world. The flexibility of the exchange rate, however, has not affected the extent to which domestic

economies react to the global dynamics.

This paper makes several important contributions. The first is a significant increase in macro-financial data available to researchers. Although the academic (and policy) interest for global macro-financial dynamics has soared since the GFC, important data gaps remain. Broadly speaking, our data addresses three shortcomings. We first increase the frequency of long/historical macro-financial datasets, which are usually available at annual frequency [e.g. Jordà et al., 2017]. Besides washing out small and short-lived cycles, using annual data prevents time comparisons because the amount of data is not enough to re-estimate dynamic factor models on sub-samples. Second, we address a longstanding problem of country coverage. Because of data constraints, long evidence on world cycles is usually neither "long" (i.e. limited to post-1990's) nor about the "world" (i.e. limited to advanced countries).[5] We solve this issue by improving considerably the statistical coverage of both advanced and emerging markets before the early 1990's. This allows, for the first time, to compare the macro-financial behavior of most countries both before *and* after their integration into world markets. We are also able to identify truly "world" cycles, as opposed to "regional" cycles (or cycles affecting only advanced countries). The third contribution is the addition of long credit data, especially in EMs, which allows us to paint a much more accurate picture of the financial cycle.[6] Using a more complete statistical picture reveals that part of the conventional wisdom on world cycles comes from a measurement problem. Because of data constraints, the literature has focused its attention on (i) advanced economies (ii) the very recent past (post 1990's) and (iii) prices (especially asset prices) rather than quantities. This practice has given too much weight to specific groups of countries (e.g. G7), abnormal times (e.g. the GFC) and/or variables (e.g. equity prices), leading sometimes to an over-estimation of the strength (or increase in strength) of world cycles, both real and financial. Section 5. discusses where (and why) our results diverge from the existing literature, and exposes some of its biases.

Our results also provide evidence on the way financial and trade linkages connect domestic output to the world. The synchronizing effect of trade is in line with the literature documenting the positive impact of trade integration on bilateral output correlations (Duval et al. [2016]). Similarly, the negative (albeit asymmetric) impact of financial integration we identify echoes the recent literature investigating the impact of finance on bilateral co-movement. Kalemli-Ozcan et al. [2013b] also identify a strong negative effect of banking integration on output synchronization, conditional on global shocks and country-pair heterogeneity. Kalemli-Ozcan et al. [2013a] also find that in periods without financial crises, increases in bilateral banking linkages are associated with more divergent

[5]For instance, long historical comparisons based on quarterly data are exclusively focused on G7 countries [Kose et al., 2008, Doyle and Faust, 2005]. Studies with a broader geographical focus are constrained to the post 90's because of data constraints in emerging markets and smaller advanced economies. Our data alleviates this tradeoff.

[6]Existing credit series are usually annual and limited to advanced economies [Jordà et al., 2017]. Usually, those series are also not corrected for breaks. Long (quarterly) credit statistics with break adjustments are provided by the *Bank for International Settlements* (BIS), but their coverage is very uneven across country and time. The lack of clean and balanced credit series explains the scarcity of existing work on credit cycles (compared to asset prices). We extend the BIS approach to new archival data, which allows us to fill the remaining gaps in cross-country credit statistics.

output cycles. However, this relation is significantly weaker during financial turmoil periods, suggesting that financial crises induce co-movement among more financially integrated countries.[7] Our findings show that financial and trade integration affects not only country-pairs co-movement patterns, but more generally the way countries co-move with the rest of the world. The absence of a role for the exchange rate regime as a determinant of a country's output synchronization with the rest of the world is also in line with other contributions [Dedola et al., 2017, Miranda-Agrippino and Rey, 2020] and generally support the presence of a dilemma rather than a trilemma.[8]

Our findings also have important policy implications. A straightforward corollary of our results is that a lower level of financial integration does not imply, *per se*, a lower level of co-movement in the economic system. Contrary to conventional wisdom and previous studies [Williamson, 1985, Kose et al., 2008], the Bretton Woods period was also affected by world cycles, although capital controls were still the norm and financial systems were highly regulated. Conversely, a high level of international financial integration does not always imply stronger output co-movement. In fact, in the long run and absent major global financial crisis, we find that international financial integration has reduced global output co-movement.[9] Although contagion effects can dominate (as exemplified by the GFC), the focus on the last financial crisis has painted a biased picture and has ignored some of the de-synchronizing effects finance has had during the 20 years leading to the GFC.

The modest impact of the world cycles on domestic output and credit provides perspective on the degree of (or lack thereof) policy autonomy, especially in EM. Outside periods of extreme global (real or financial) shocks, world cycles have had a modest impact on key policy targets, i.e. output and credit. Looking at credit, in particular, clearly suggests that local credit conditions for the private sector are, at least quantitatively, still relatively isolated from the external environment. This conclusion is reinforced by the fact, in contrast to asset prices, the impact of US monetary policy shocks on the global credit cycle is small and not significant. As we discuss below, these results should not come as a surprise since local credit markets are far less integrated internationally, and under more direct control of the local policymakers, than local asset markets. Still, this result challenges the common wisdom on spillovers from US monetary policy. In particular, it suggests that if US monetary policy matters for the rest of the world, it is not so much because of its direct impact on credit supply, but rather because of its influence on global asset prices and risk aversion. Our results also qualify the macro relevance of some the effects previously identified in the literature (e.g. Bräuning and Ivashina [2020]), a point we discuss in the last section. Finally, the striking decoupling between the high (and rising) global synchronization of consumer prices on the one hand, and the low (and stable) synchronization of output and credit on the other, raises

[7] Duval et al. [2016], Cesa-Bianchi et al. [2019a] find similar results.

[8] Baxter and Stockman [1989] also found little evidence of systematic differences in the behavior of key macroeconomic aggregates, in particular output, under alternative exchange rate systems.

[9] Kalemli-Ozcan et al. [2013b] also present a model where the relation between integration and synchronization depends on the type of shocks hitting the world economy. Acemoglu et al. [2015] show that beyond a certain point, dense interconnections serve as a mechanism for the propagation of financial shocks, leading to a more fragile financial system.

difficult issues for central banks since, as suggested by Auer et al. [2017], the reaction function of central banks for both monetary and macro-prudential policies include variables with very different degrees of autonomy from world cycles.

The remainder of this paper is constructed as follows. Section 2. goes over the key features of the new macro-financial database. Section 3. presents the empirical framework. Section 4. presents key results. Section 5. discusses our key results, connects them to the existing literature and draws important policy implications. Section 6. performs robustness checks. The last section concludes.

2. Dataset

2.A. Construction

An important contribution of this paper is to 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 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 members to 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).[10] 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 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) domestic 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.[11] 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. Changes in definitions and collection methods over time have been

[10] The OECD is the only other institution with a similar mandate, but its country and data coverage is much more limited than the IMF and it does not really focus on international financial data. The OECD data also has a shorter coverage since it was created only in 1961.

[11] To be more precise, we check that definitions match *de jure* and that they report the same variations (i.e. IFS statistics and official statistics match *de facto* when both are available). A companion excel file, downloadable from the authors' website, reports the variables we extend and the date at which we start using IFS archives to extend official series in the past.

minimal for these variables. Consumer prices are reconstructed using the "cost of living" index (line 66 in IFS). Stock prices are based on the "share price index" (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 on (central) government bonds with at least 7 years of remaining maturity (line 62 in IFS).

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 also 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 series, credit aggregates are subject to a significant number of breaks throughout history, however. When they happen, those breaks are well-documented in IFS paper volumes and, at least for several quarters, values 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 et al., 2013], which is currently the most comprehensive dataset of (long) quarterly credit statistics. When breaks in definition were too important, credit series were not extended.

To construct long quarterly real GDP, we start by collecting quarterly historical Industrial Production (IP) data from *IFS* volumes (IFS line 67), and combine them with official annual real GDP series from the *Penn World Tables* [Feenstra et al., 2015]. We then use temporal disaggregation methods to extend existing official quarterly GDP statistics in the past [Chow and Lin, 1971]. A temporal disaggregation method allocates the annual GDP across quarters using the (quarterly) IP as a guide. But since the sum of quarters must match the annual GDP number, 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 series to official quarterly GDP series for the US and France, the only two countries that publish these series since 1950. We find that GDP growth based our synthetic quarterly GDP series track growth based on official quarterly GDP statistics very accurately. Very similar results emerge for other countries in our sample, albeit on a shorter sample. Temporal disaggregation methods are widely applied in countries where quarterly data (or surveys) are too expensive to conduct and the industrial production is the only reliable indicator of high-frequency output fluctuations.[12]

[12]Temporal disaggregation methods are actually recommended in the IMF *Quarterly National Accounts Manual*[URL:https://www.imf.org/external/pubs/ft/qna/]. 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 - Quarterly "Synthetic" vs. Quarterly Official

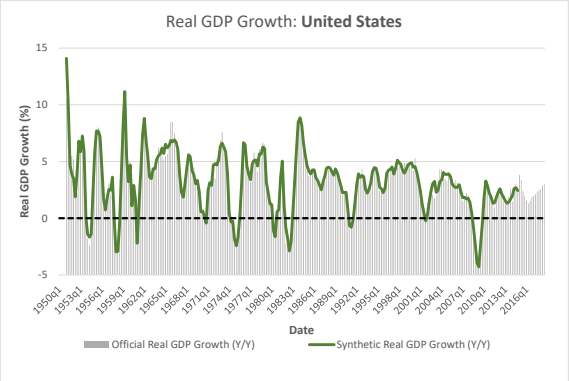


Figure 1.A. United States

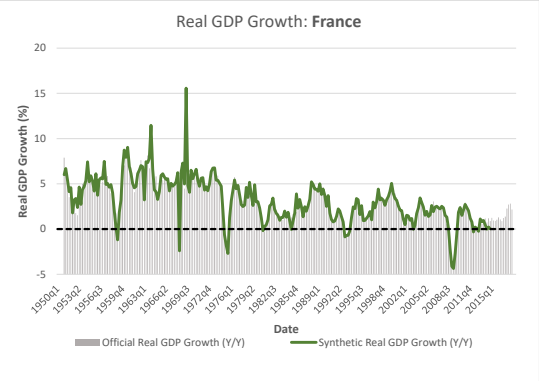


Figure 1.B. France

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.

2.B. Dataset: Key features

2.B.1. Coverage and Definitions

Our dataset covers (i) 37 countries for real GDP (ii) 45 countries for credit (iii) 48 countries for consumer prices (iv) 27 countries for stock prices and (v) 17 countries for bond yields. Table A1 in Appendix reports the countries covered. The country coverage only refers to countries with full coverage over the postwar period (1950-2019). The coverage of the database regularly expands due to updates, however. We refer readers to the companion online excel file for the most recent version. All series are available at quarterly frequency, since the early 1950's until 2019 and follow standard definitions. In line with the BIS and other major contributions on credit cycles [e.g. Claessens et al., 2012, Jordà et al., 2017], "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 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.[13]

2.B.2. Comparison with other datasets

As a consistency check, we compare our quarterly data to annual historical macro-financial datasets. We find that our new series move in tandem with comparable variables available at annual frequency, implying that we track the same concept currently used in the literature, albeit at a higher frequency

[13]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.

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 Jordà et al. [2017], which are only available at annual frequency and for a narrower 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 Jordà et al. [2017]. A similar finding emerges for private credit growth in Spain and Italy.[14]

Figure 2. Stock Price and Credit growth: Comparison with annual data from Jordà et al. [2017]

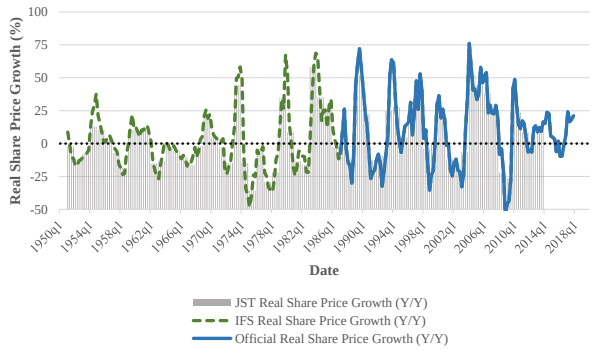


Figure 2.A. Stock Price - Norway

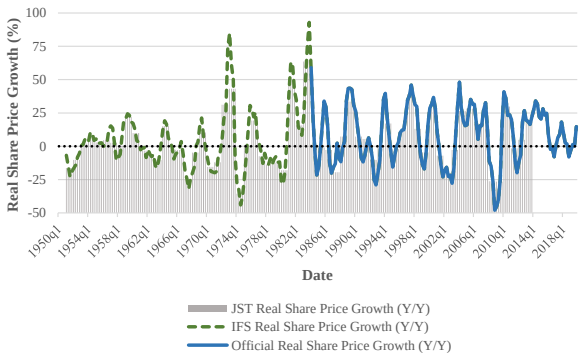


Figure 2.B. Stock Price - Denmark

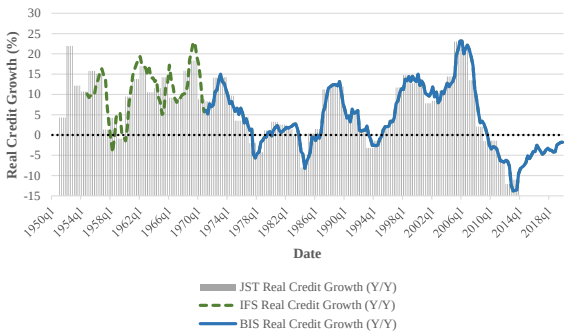


Figure 2.C. Credit growth - Spain

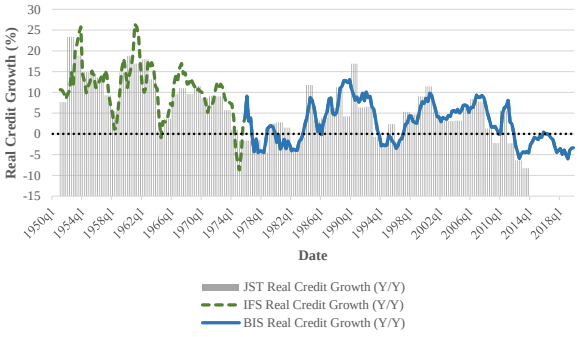


Figure 2.D. Credit growth - Italy

Notes: Bars report the year-on-year real stock price and real credit growth rates based on annual data from Jordà et al. [2017]. Green (dashed) lines, labeled "IFS data", report the growth we obtain using our quarterly data based on IFS archives. To illustrate how our data extends what is currently available in the literature, the blue (solid) lines also report growth rates based on OECD data for share prices and BIS data 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. Those gains, which are concentrated between

[14]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.

1950 and 1980, are essential to contrast the behavior of macro variables during decades of "low" integration (Bretton Woods) to the post-1980 "high" integration era. Quantitatively, gains in coverage are higher for emerging markets. We roughly double the amount of quarterly data available for both GDP and credit in EM compared to the OECD and the BIS datasets, respectively. We 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 panels). Similarly, we considerably expand the coverage of BIS credit statistics in major EM, which usually stops in the late 90s, or in countries that are not part of the BIS. We also illustrate this in Figure 3 for Colombia and Brazil.

Finally, we 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, but prices or output data are not. Conversely, some countries with good coverage on the real side have little information on the financial side. Bringing them together allows us to identify cycles, both real and financial, for a large number of countries. This is especially useful in developing countries where this information has been traditionally missing. Figure 4 illustrates this for Argentina, a major emerging market with very long nominal credit data available since 1958 (from BIS or national authorities), but for which official quarterly output and price data, which are necessary to adjust nominal credit data, start only in 2004. After reconstructing GDP and consumer prices in the past, both (real) credit and business cycles emerge very clearly over the whole post-war period.

2.B.3. Qualitative adjustments

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).[15] 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.[16]

[15]The OECD produces real quarterly GDP data for 20 countries since 1960, but roughly half of them are based on linear or quadratic interpolations. Some examples, along with the solutions offered by our database, are discussed in Appendix AB.

[16]The issue of the quality of long (quarterly) real GDP data has been raised in recent papers. For example, Romer and Romer [2004] discuss 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 [e.g. Romer and Romer,

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

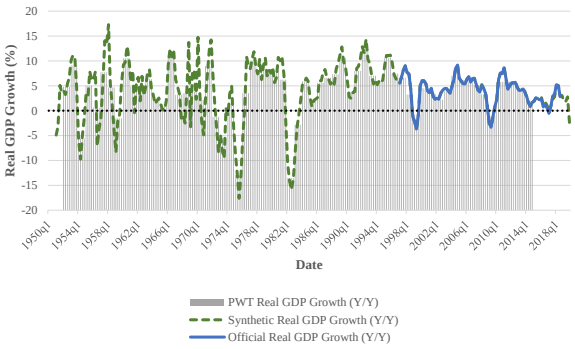


Figure 3.A. GDP Growth - Chile

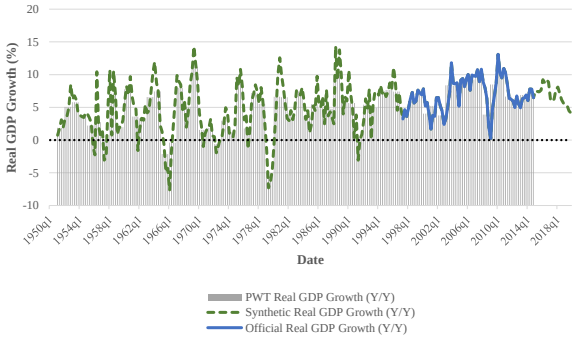


Figure 3.B. GDP Growth - India

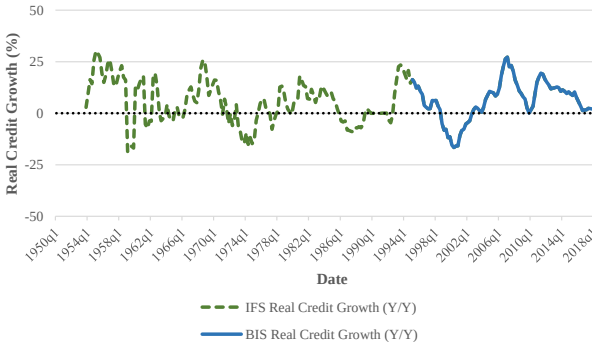


Figure 3.C. Credit growth - Colombia

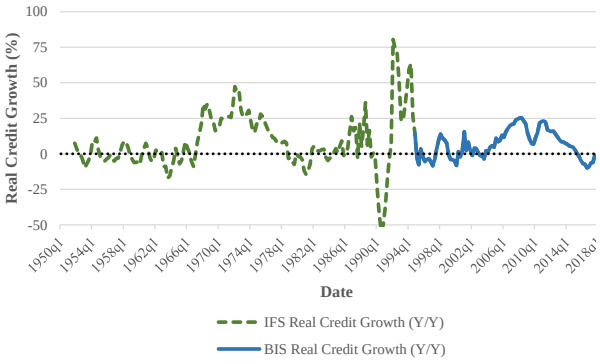
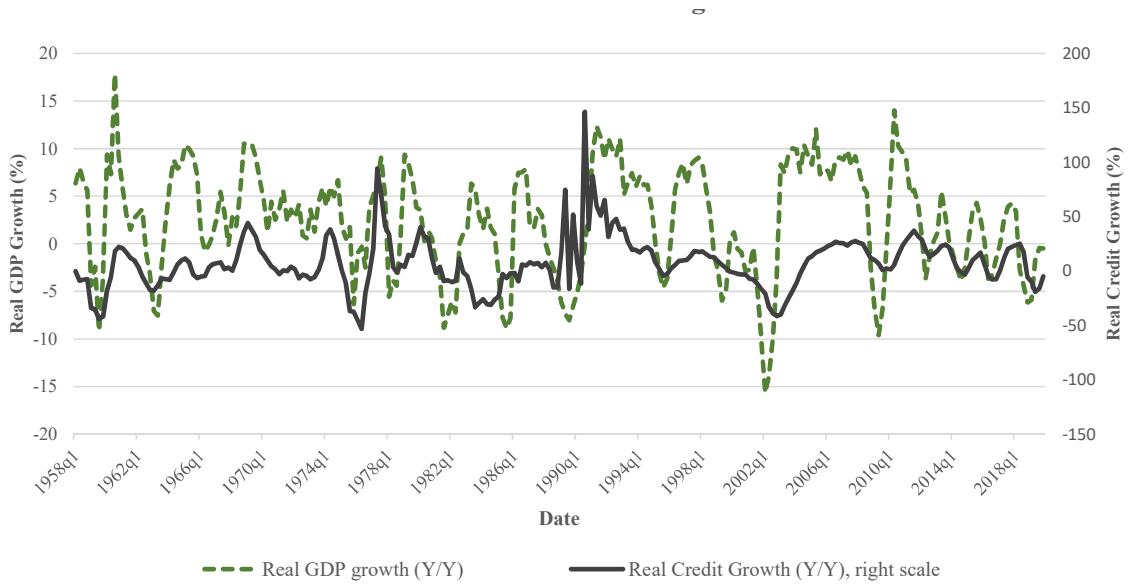


Figure 3.D. Credit growth - Brazil

Notes: Bars report the year-on-year real GDP growth rates we obtain using annual data from *Penn World Tables*. Blue (solid) lines report GDP growth using data currently available from official sources at quarterly frequency. Green (dashed) lines, labeled "IFS data" report the growth rates we obtain using our data based on IFS archives.

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.

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 and/or changes in accounting standards. These breaks are usually not corrected in popular datasets available. As a result, credit data have generally received less attention, even though most of the credit received by the private sector in most advanced and emerging markets is still provided by domestic banks (see Section 5.). In line with the BIS long credit dataset [Dembiermont et al., 2013], we use different vintages of the same data to fix the breaks. The use of IMF paper archives 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.[17]

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 statistical history of advanced economies in the distant past (e.g the 50's and the 60's), the database

2004]. In our case, we combine annual GDP number and quarterly IP data, both of which are well established and much less subject to quality issues.

[17]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 [Quinn and Toyoda, 2008, Ilzetzki et al., 2019]. 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.

also fills important gaps in 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.

3. Empirical Framework

In line with most of the empirical literature, we use a dynamic factor model to estimate world cycles and quantify their impact on the variance of individual series in each country. Since we focus exclusively on co-movement at the world level, we restrict attention to a single factor model as in Stock and Watson [1989, 2011]:

$$Y_{i,t} = P_i F_t + u_{i,t}$$
$$F_t = A_1 F_{t-1} + A_2 F_{t-2} + \cdots + v_t$$
$$u_{i,t} = C_1 u_{i,t-1} + C_2 u_{i,t-2} + \cdots + e_{i,t}$$

Where $Y_{i,t}$ designates the variable to be explained (e.g. output or credit) in country i in quarter t and F_t is the world factor at time t. In practice, we use an AR (1) in both the factor and the error term, and estimate the model using Maximum Likelihood. All variables are computed in yearly growth rates, except for bond yields, which are computed in yearly absolute difference (since they are already expressed basis points). Using year-on-year growth rates for both credit and prices allows us to control for potential seasonality in those series. Our real GDP data is already seasonally adjusted.

We rely on this empirical framework because of its simplicity and low computational cost. However, results are very robust to alternative approaches. Our findings are not sensitive to the number of lags in the AR processes. Results are also invariant to other factor extraction methods, such as estimations of the factors with Bayesian methods and/or with inclusion of additional factors (e.g. regional factors). For instance, using a model in the spirit of Kose et al. [2003a] yields identical results. The use of a single world factor is also very well supported by the data, with the first eigenvalue explaining a large share of the variance in all variables, and a marginal contribution of subsequent eigenvalues. Onatski [2009]'s test statistics also confirm the use of a single factor model for all variables (see table A2 in appendix).

Building on the longer coverage of the database, we first estimate the factor model and variance decompositions for each series separately (e.g. GDP) on the full sample. Factors and variance decompositions are then estimated on four different sub-periods: the Bretton Woods period (1951

Q1–1971 Q4), the oil shock period (1972 Q1–1983 Q4), the globalization period (1984 Q1– 2006 Q4), and the financial shock (or GFC) period (2007 Q1–2019 Q4).

We use this historical breakdown for several reasons. First, we isolate periods of global shocks to assess the sensitivity of results to outliers, or periods of extreme co-movement. Although these periods are important to consider, they also weigh heavily on the results and policy conclusions.The decade ranging from 1973 to 1983 features the demise of the Bretton Woods system, two inflationary oils shocks and, as a result, the widespread use of contractionary monetary policy in almost all advanced economies starting 1979. Similarly, the period from 2007 to 2014 was characterized by the GFC and its aftermath. Including these outliers in a sub-period rather than another can change findings drastically. For instance, including the oil shocks in the "globalization" period generally drives the result that output synchronization has increased over time; a point we discuss at length in Section 5.A..

Second, debates about the role of globalization (trade or financial) revolves around the comparison of world synchronization before and after the kink in the "hockey-stick" of globalization, which is usually dated around 1985 [Jordà et al., 2019]. For the first time, we are therefore able to compare the intensity of co-movement under "normal" macroeconomic fluctuations (i.e. without extreme shocks) under low integration (1951 to 1971) to its counterpart under deep integration (1985 to 2006). The Bretton Woods sample (1950-1971) is notable for its steady growth and stable business cycles dynamics, whereas the Globalization period (1984-2006) captures most of the Great Moderation. In addition, both periods are almost of equal length. This decomposition is also in line with Kose et al. [2008], which facilitates comparisons of our results with theirs (See Section 5.). Third and finally, isolating periods of global shocks allows us to test whether the effect of trade or financial integration varies with the type of shocks hitting the world economy (real shocks in the 1970s or financial shock in 2008-2009). We come back to this issue in the next section.

4. Results

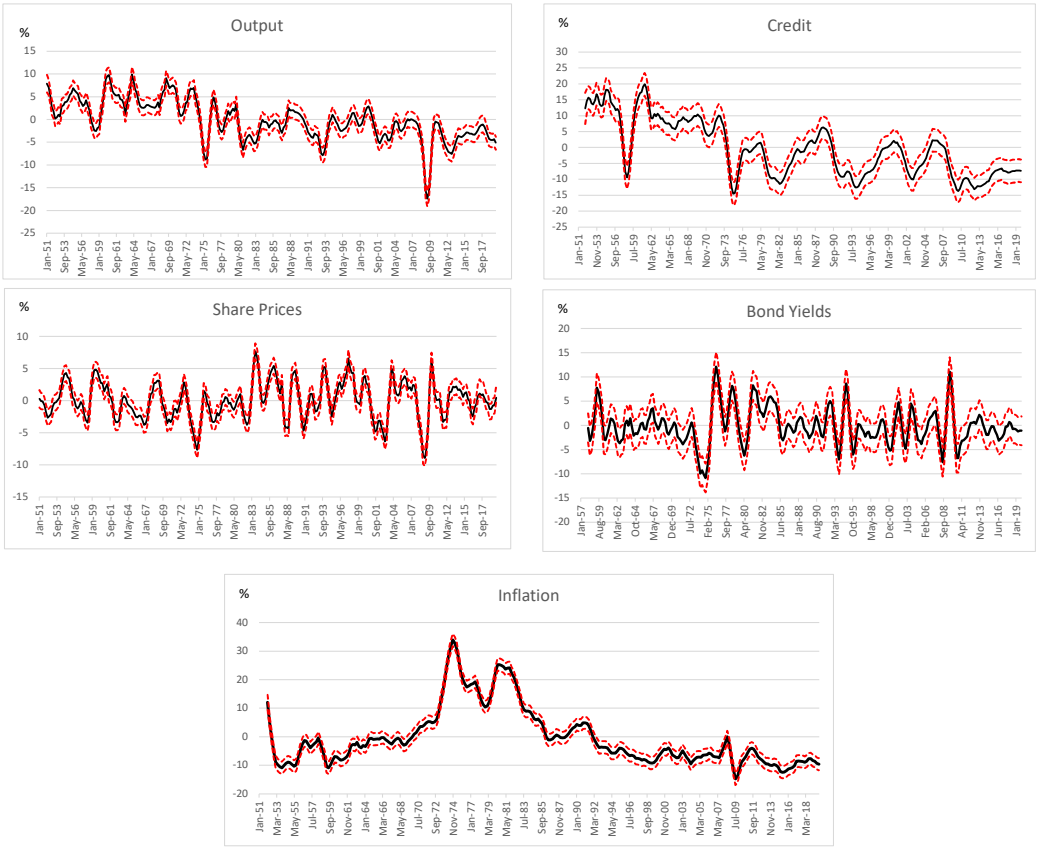
4.A. World Cycles

Figure 5 reports the world cycles extracted on each variable namely (i) real GDP (or output) (ii) credit (iii) stock prices (iv) bond yields and (v) inflation, along with confidence intervals (5 percent and 95 percent). All variables are expressed as yearly growth rates - with the exception bond yields which are expressed as yearly absolute changes - and expressed in real terms. Values are expressed in deviations from the (long run) sample mean and can therefore take negative values for a relatively long time. For instance, growth and inflation around the world were not negative (on average) in the post 90's. They were simply below the long run mean of the data.

Overall, we find that all factors are well estimated over the whole period. Peaks and troughs are also in line with major real and financial expansions (or crisis).[18] The factors are also in line

[18]In an older version of this paper dedicated only to output [Monnet and Puy, 2016], we conducted a narrative

Figure 5. World Cycles - Estimates



Notes: Figures plot the results of the factor estimations for each variable. Output refers to real GDP growth (in percent); credit to real credit growth (in percent); stock prices to real stock price growth (in percent); bond yields to change in real bond yields (in hundreds of basis point); Inflation to yearly CPI inflation (in percent).

with existing studies which have estimated them using yearly data [e.g. Kose et al., 2003a, Ha et al., 2019, Auer et al., 2019]. Two facts are worth mentioning however. First, the output and credit cycles are strongly correlated (Table 1). However, this correlation is much lower for all other pairs of cycles. Among other things this confirms that financial variables respond to different underlying global factors. Second, we find that variations in asset prices (bond yields and stock prices) are generally more frequent than movements in quantities. Credit cycles are, in particular, more protracted than asset prices cycles.

analysis of the world output cycle based on the IMF annual reports published between 1950 and 2014 and find that the world cycles described in IMF reports match almost exactly the turning points and phases identified by our estimation procedure.

Table 1. World Cycles - Correlations

	Output	Credit	Stocks Prices	Bond Yields	Inflation
Credit	0.82				
Stock Prices	0.21	0.11			
Bond Yields	-0.07	-0.04	0.17		
Inflation	-0.01	-0.13	0.29	-0.01	

4.B. The US and World Cycles

Is the US ruling over the world? To assess whether the US have been "driving" world cycles, both real and financial, over the post-war period, we perform an exercise similar to Miranda-Agrippino and Rey [2020] and check to what extent changes in US variables affect world cycles. Contrary to Miranda-Agrippino and Rey [2020] however, we go beyond US monetary policy shocks. In practice, we collect a set of externally identified US shocks and assess the response of our (estimated) world cycles to those shocks using Jorda's local projection framework [Jordà, 2005]. We estimate the following model:

$$\Delta F_{t,t+h} = \delta_h + \sum_{s=1}^{l} \alpha_s^h \Delta F_{t-s} + \sum_{s=1}^{l} \beta_s^h \Delta F_{t-s} USShock_{t-s} + \epsilon_h^t$$

where h denotes the horizon (quarter) of projection, $\Delta F_{t,t+h}$ reports the cumulative change in the world factor of interest (e.g. world output) between quarter t and $t+h$, and *US Shock* is the US shock of interest (see below). We use 4 lags for all variables (i.e. l=4), but results are not sensitive to changes in the number of lags. Since the error term in the local projection framework follows a moving average process by construction, standard errors are always corrected using a Newey and West [1987] estimator.

We restrict attention to four types of US shocks, which have attracted most of the literature on US spillovers and for which we have data over the whole post-war period at a quarterly frequency, namely: (i) US monetary policy shocks, (ii) US fiscal policy shocks, (iii) US policy uncertainty shocks, and (iv) US productivity shocks. Monetary policy shocks are taken from Coibion [2012].[19] We use Romer and Romer's exogenous tax shocks to measure unanticipated (or exogenous) US tax changes [Romer and Romer, 2010]. US policy uncertainty shocks are proxied by changes in the US Economic Policy Uncertainty Index, computed by Baker et al. [2016]. Finally, US productivity shocks are taken from Basu et al. [2006], Fernald [2014].[20] All variables are available at quarterly frequency since early 1950's.

[19] Since the data starts in 1969 however, we use quarterly changes in the Fed discount rate to proxy for changes in the US monetary policy stance between 1950 and 1968. Results are similar if we focus on the post-1968 sample however.

[20] We use changes in (utilization-adjusted) US TFP series.

After collecting these shocks, we first confirm that they imply a "textbook" response of US variables.[21] We then use them to see how they affect, individually, our estimated world cycles. Since many of those shocks happen at the same time, and in conjunction with other important global shocks (e.g. oil shocks), we also test the robustness of our results to (i) using all US shocks at the same time and (ii) the introduction of measure of exogenous oil supply shocks [Kilian, 2009]. Key results are broadly unchanged, however. We now turn to the main results, distinguishing between non-monetary policy shocks and monetary policy shocks.

4.B.1. Non-Monetary Policy Shocks

US (non-monetary) shocks all generate significant deviations in real and financial world cycles (Figure 6). Responses are also very much in line with the existing literature. We find that US productivity shocks are expansionary for the world, i.e. they are followed by expansions in output, asset prices, credit, and ultimately consumer prices globally.[22] The response is gradual and peaks after 8 quarters. The impact of US policy uncertainty is also very stark and in line with other recent contributions [Carrière-Swallow and Céspedes, 2013, Bloom, 2014]. An unanticipated rise in US policy uncertainty is quickly followed by drops in output, share prices and credit around the world, while the response of inflation and bond yields is more muted. Finally, we find that fiscal consolidations in the US also have a negative effect on the world business cycle, which is in line with many other contributions [IMF, 2013]. However, we do not find any effect of unexpected US fiscal consolidation on consumer prices or financial variables. Taken together, these results clearly support the view that the US is a driving force of the post-war world cycles.

4.B.2. Monetary Policy Shocks

Results are more mixed when it comes to the impact of US monetary policy shocks. We find that US monetary policy contractions are followed by a decline in the world inflation cycle, which becomes significant after two years. A similar picture emerges for the world business cycle, with a drop in output that peaks after seven to eight quarters. The response of asset prices is less clear cut. Although real equity and bond prices drop on impact following an unexpected monetary policy tightening, our estimates are slightly imprecise; a finding that might reflect the use quarterly data.[23] We also find that the effect of monetary shocks on domestic credit is small and not significant, suggesting that contrary to asset markets, domestic credit markets have been relatively isolated from exogenous changes in US policy rates. Importantly, this results is robust to the use of

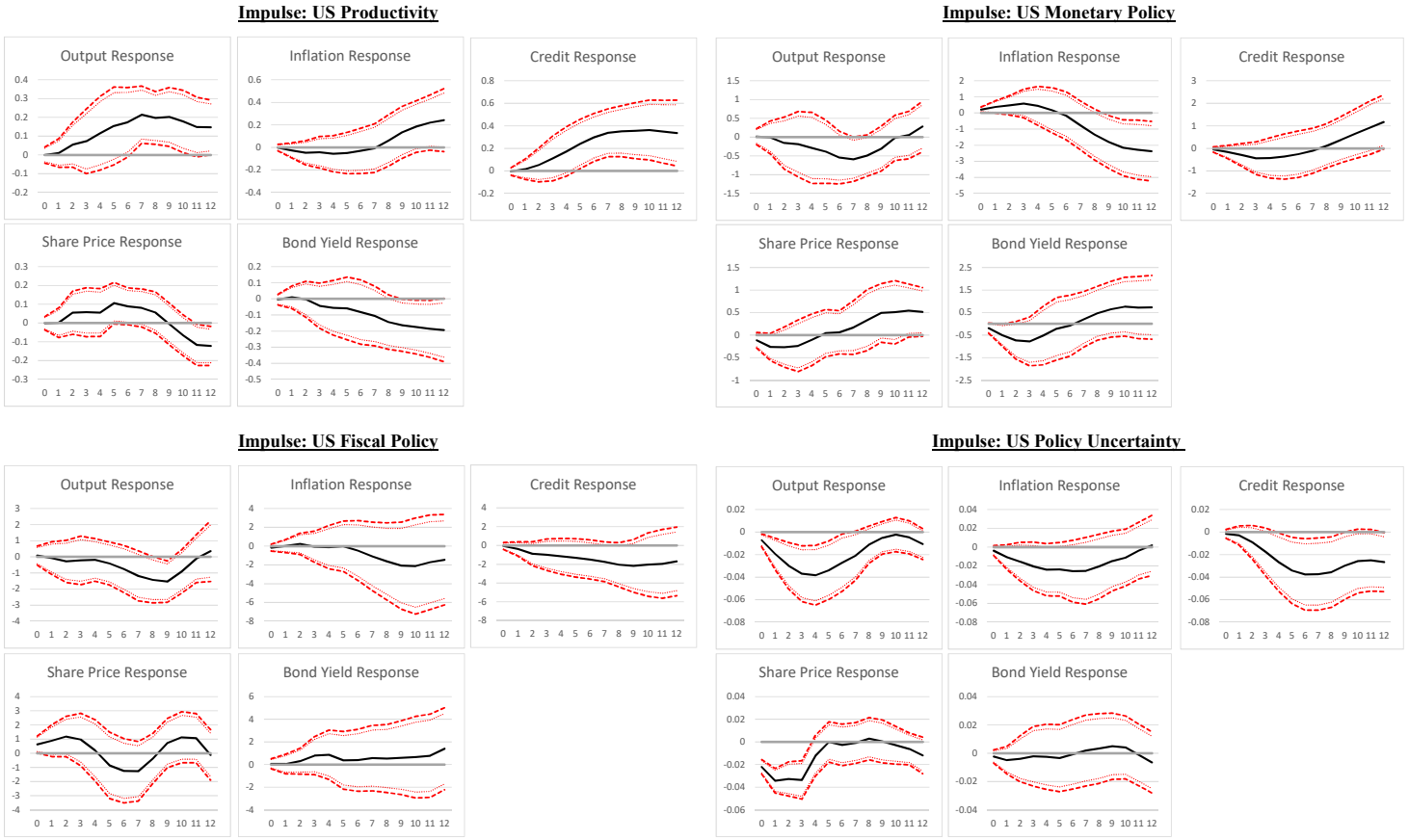
[21] We check that, in our sample (1950-2015), US specific variables (output, prices, credit etc.) have the expected response to US shocks. This is not always the case. For instance, we also used US fiscal spending shocks using Ramey's military news shocks [Ramey and Zubairy, 2018]. However, those shocks did not generate a positive response in US output using the post-war period. Therefore, we did not use them in the second stage.

[22] See IMF [2017] and references therein for similar results and a discussion of the channels through which US technology shocks affect other countries positively.

[23] the negative response of bond prices on impact is significant at the 10% level. It is right above the 10% threshold for the global equity cycle.

alternative instruments of US monetary policy shocks, and does not improve when looking at a the very recent sample (e.g. after 1980 or even 1990). Taken together, these results are qualitatively and quantitatively close to those in Dedola et al. [2017], who find that a surprise US monetary tightening leads to (i) a drop in industrial production, real GDP and Inflation in most countries (ii) a drop in equity prices in only some countries (iii) no significant response of domestic credit for most countries, in a relatively large panel of countries between 1990 and 2008. The potential decoupling between the effect of US monetary policy on credit and asset prices, in particular, is noteworthy since it also arises when looking at the strength of world cycles; a point we explore next section.

Figure 6. US Shocks and World Cycles: Local Projections



Notes: Productivity shocks are "expansionary", i.e. they refer to an increase in US productivity. Other shocks are defined as "contractionary". Monetary and Fiscal shocks refer to (unexpected) monetary policy contractions and increases in tax rates, respectively. A positive change in the policy uncertainty index also refers to an increase in uncertainty. The solid lines report cumulative effects on world cycles after a one percentage point increase in the impulse variable. Red dotted lines report confidence intervals (5% and 95%) respectively. Standard errors are corrected for heteroskedasticity and serial correlation. The x-axis reports for the horizon of projection (in quarters).

4.C. How strong are World Cycles? And has it really changed?

We now turn to the strength of world cycles, and its evolution over time. To start, Figure 7 reports the share of (historical) variance explained by each world cycle for the median country in our sample over the whole post-war period (1950-2019). The right panel reports the same statistics but distinguishes between advanced and emerging countries. In line with other important contributions working with annual data [e.g. Kose et al., 2003a, Ha et al., 2019, Auer et al., 2019], we find that world cycles account for a significant share of the variance in domestic variables. For instance, the world business cycle accounts for roughly 30 percent of domestic output fluctuations in the median country and 50 percent for inflation. However, we also highlight several important new findings.

First, world synchronization is much higher in prices (assets and goods) than in quantities (output and credit). Second, the importance of the Global Financial Cycle depends heavily on the variable one looks at. The contrast between asset prices and credit, in that respect, is stark: synchronization is three to four times higher in asset prices (bond yields and stock prices) than in credit. Third, separating AEs from EMs also reveals that advanced economies generally drive the result that synchronization, at the world level, is high. On average, the contributions of world cycles to the median EM economy has been small, around 10 percent across variables. Taken together, these results suggest that although world cycles exits, they affect disproportionately advanced economies and asset prices.

We also unearth new facts - and challenge important results - regarding the way synchronization at the world level has changed over the last 70 years. Figure 8 reports the median share of variance explained by each world cycle in our sample, distinguishing between the different sub-samples. Two key findings emerge. First, isolating "exceptional" periods of global real and financial shocks is important, since co-movement increases significantly. This is particularly true for the GFC period, during which co-movement in all variables was at record high. In normal times, the average co-movement in output and credit is relatively modest for most countries (between 10 and 20 percent). It is more substantial, however, for asset prices and inflation (between 30 and 50 percent).

Second, world synchronization has not increased uniformly: although synchronization in asset prices has been on a secular increase since Bretton Woods, the average (or median) impact of world cycles on domestic economies has not really changed for output or credit. The world output and credit cycles were as "strong" during Bretton Woods (1950–1971), a low point of financial and trade integration, as during the Globalization period (1984-2006). World cycles explain roughly 15 percent of the variance in domestic credit and output for the median country in both periods. Importantly, after the Global Financial Crisis (GFC), both output and credit synchronization have almost reverted to those relatively low historical levels. By contrast, we find that the synchronization in prices (assets and goods) has roughly doubled since Bretton Woods (from 25 percent to 50 percent for the median country) and has reverted to these high pre-crisis levels.[24].

[24] Fernández et al. [2017, 2020] show the importance of commodity prices in driving world inflation. Auer et al. [2017] investigate how the expansion of global value chains increases the international synchronization of prices.

Figure 7. World Cycles - Strength

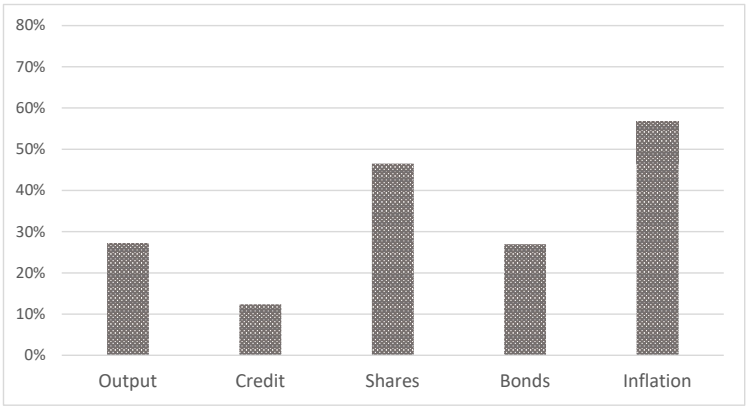


Figure 7.A. All countries

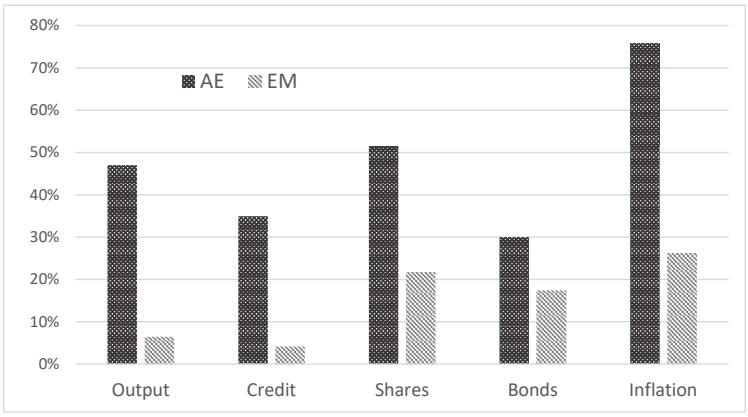


Figure 7.B. Advanced vs. Emerging

Notes: Figures plot the share of variance in domestic variables explained by each corresponding world cycle over the whole sample (1950-2019). Results are reported for the median country. AE (EM) refers to advanced (emerging) economies.

Overall, those results confirm the exceptional nature of the GFC when it comes to credit and output synchronization. They also highlight a strong decoupling between prices and quantities over the long run. Although higher asset price synchronization seems to be a robust new feature of the international financial system, we do not find robust evidence of increased output and credit synchronization at the global level. This, in turn, challenges a number of important results from the literature, and casts a new light on the strength of the global financial cycle. In particular, the latter appears much more modest through the lens of credit than asset prices. We postpone a discussion of our results, and their connection to the existing literature, to Section 5.

Figure 8. World Cycles - Strength over time

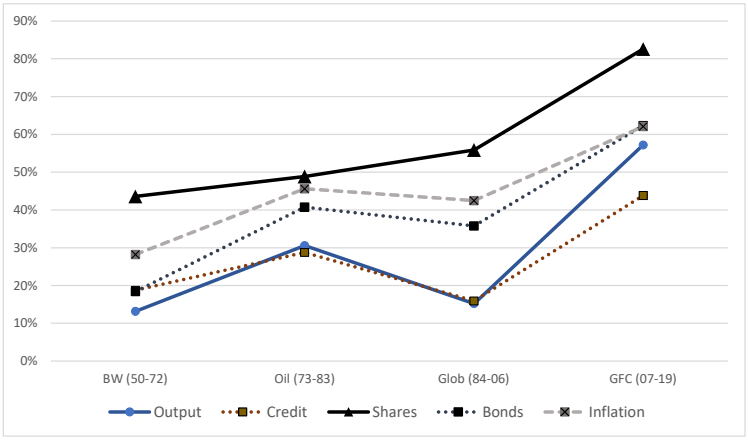


Figure 8.A. Sub-Samples

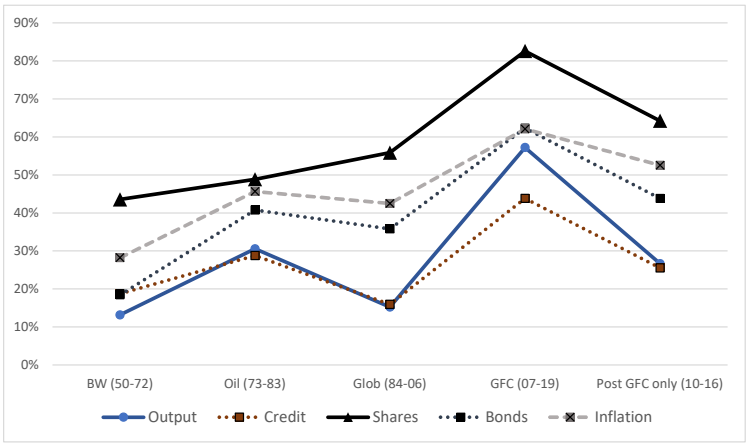


Figure 8.B. Sub-Samples - including post-GFC

Notes: The figures plot the share of variance in domestic variables explained by each corresponding world cycle over each sub-sample. Results are reported for the median country.

4.D. World output Synchronization: Why so stable?

We finish by exploring the reasons behind the relative stability of world output synchronization over the long run. We first highlight that although the average (or median) output co-movement has been left roughly unchanged between Bretton Woods and the globalization period, the countries that co-move with the rest of the world are not the same. Figure 9 illustrates which countries de-synchronized (or re-synchronized) with the world business cycle over the last 70 years. The share of variance explained by the world business cycle, for each country, during the globalization period is plotted against the same share of variance during Bretton Woods. The 45-degree line identifies countries that have not changed the way they co-move with the world.

A first striking finding is that the way countries' output co-move with the rest of the world has, for a lot of countries, changed little over the last 70 years. Some countries - such as Netherlands,

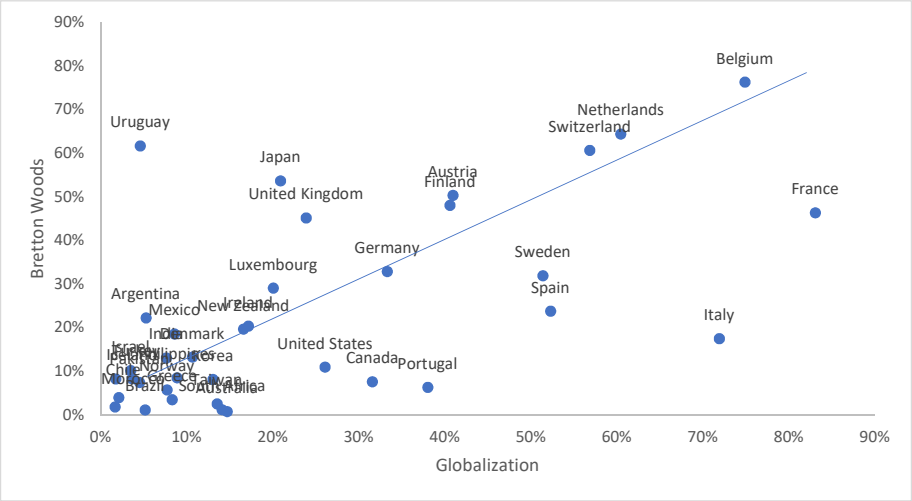
Finland or Belgium – have always been synchronized with the rest of the world, whereas other (e.g. Norway, Denmark, as well as most emerging markets) display relatively low co-movement with the rest of the world in both periods. Some countries, such as Uruguay, Japan or New-Zealand used to co-move more during Bretton Woods than they did 30 years later. In contrast, countries like France, Italy, Spain or to smaller extent the US have become more synchronized with the world business cycle.

We explore formally the role of trade integration, financial integration and foreign exchange flexibility in explaining these stylized facts. In practice we use the following panel regressions:

$$\theta_{i,t}^{W} = \beta_1.Trade_{i,t} + \beta_2.Finance_{i,t} + \beta_3.FXFlex_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t}$$
$$t = 1, 2$$
$$i = 1, ..., 37$$

Where $\theta_{i,t}^{W}$ designates the share of variance accounted for by the world business cycle for country i in period t; $Trade_{i,t}$ captures the level of trade integration; $Finance_{i,t}$ captures the level of financial integration of country; $FXFlex_{i,t}$ measures the degree of flexibility of the exchange rate; α_i captures country-fixed effects and δ_t are time dummies capturing period fixed effects. Period 1 designates the oil shock period, and period 2 the GFC period.

Figure 9. World Output Synchronization - Then and Now



Notes: The figure plots the share of variance in domestic output explained by the world cycle during the globalization period (1984-2006) against its counterpart during Bretton Woods (1950-1973).

We measure trade integration by computing the average ratio of exports plus imports to GDP over each sub-sample for each country. Similarly, we measure financial integration using the average ratio of foreign assets plus foreign liabilities to GDP over each sub-sample for each country. Data are taken from IMF Direction of Trade Statistics and Lane and Milesi-Ferretti [2007], respectively.[25] We control for the exchange rate regime using the (updated) exchange rate classification compiled by Ilzetzki et al. [2019]. In practice, for each country in our sample, we average the fine classification (ranging from 1 to 14) over each sub-period. By construction, a higher value of the index indicates greater exchange rate flexibility over that period.

The inclusion of both fixed effects helps us control for the presence of (i) common shocks scaling up all countries at the same time (ii) country fixed effects, since some countries always co-move less (or more) than others. Although this implies that we cannot say much about the between-variation in the panel, the within-variation is clearly the object of interest in our paper. More importantly, the inclusion of fixed effects allows us to assess, in a more rigorous way, the importance of trade and financial integration in affecting co-movement patterns. To date, important contributions (following Kose et al. [2003b]) have limited their analysis to cross-section analysis, or panel estimations without the inclusion of fixed effects, implying potentially a significant omitted variable bias in the results.

Table 2 reports the results. Standard errors are clustered by country in all estimations. Column 1 presents results for the baseline regression. Column 2 and 3 present results when financial integration and trade integration measures are interacted with time dummies to investigate the presence of potential asymmetries during periods of common shocks. This allows us to isolate the effect of financial integration in normal times from its effect in times of financial crisis.

Although the number of observations used for estimation is small (144), the panel regression yields striking results, some of which are well connected to recent empirical contributions. First, trade integration tends to increase co-movement with the rest of the world. Second, financial integration has, on average, a negative impact on the synchronization of domestic output to the world business cycle. However, this average effect conceals an asymmetric effect: when using interaction terms with the GFC period, the coefficient is positive, implying that more financially connected countries co-move more during financial crisis. However, the total (net) effect remains negative. Third, we do not find that FX flexibility has an impact on how domestic output connect with the world cycle.

[25] Given our focus on spillovers and co-movement and line with the empirical literature, we focus our attention on de facto measures of openness - expressed as percent GDP – rather than de jure measures. The latter have been shown to be at odds with actual capital flows. In addition, one they reach their maximum, de jure measures do not distinguish between different degrees of financial integration. In our context, this implies that all advanced countries in the last period display the same level of integration, although some advanced countries are two to three times more integrated than others (based on our de facto measure).

Table 2. Determinants of World Business Cycle Synchronization

	(1)	(2)	(3)
Trade Openness	0.13**	0.19***	0.153***
Financial Openness	-.07**	-.09**	-.07**
FX Flexibility	0.01	0.01	0.007
OIL	0.08**	0.08**	0.119
GFC	0.40***	0.07	0.371***
Interactions			
GFC x Financial Openness		0.06**	
GFC x Trade Openness		0.001	
Oil Shock x Financial Openness			0.01
Oil Shock x Trade Openness			-.002*
Country FE	Yes	Yes	Yes
N	144	144	144
R - squared	0.557	0.569	0.530

Notes: The dependent variable is the share of variance of domestic output accounted for by the world business cycle in each of the four periods. All estimations include country fixed effects. Standard errors are clustered at the country level. *, **, *** refer to significance at 10 percent, 5 percent and 1 percent, respectively.

5. Discussion of the results

This section discuses where (and why) our results diverge from the existing literature. We focus on two aspects that have attracted most of the attention, namely (i) the increase in business cycle synchronization over the post-war period and (ii) the strength of the global financial cycle and its connection to US monetary policy. We also raise the key policy implications of our findings.

5.A. Globalization and Business Cycle Synchronization

The most recent and robust empirical evidence on output synchronization pointed to an increase in global output co-movement since the demise of the Bretton Woods system. In an important paper, Kose et al. [2008] found that a common factor explained, on average, a larger fraction of output volatility in the globalization period (1986:3-2003:4) than it did in the Bretton Woods period (1960:1-1972:2) using quarterly real output data for the G-7 countries. Although it applied only to G-7 countries, this result echoed earlier contributions and reinforced the general narrative (or impression) that the trade and financial integration that started in the 1970's was making economic growth more correlated at the global level, even in normal times.[26] The evidence, however, was still

[26] Lumsdaine and Prasad [2003] also found evidence of a "world business cycle" and argued that output fluctuations had become more closely linked across industrial economies in the post–Bretton Woods period (1973-1994) using

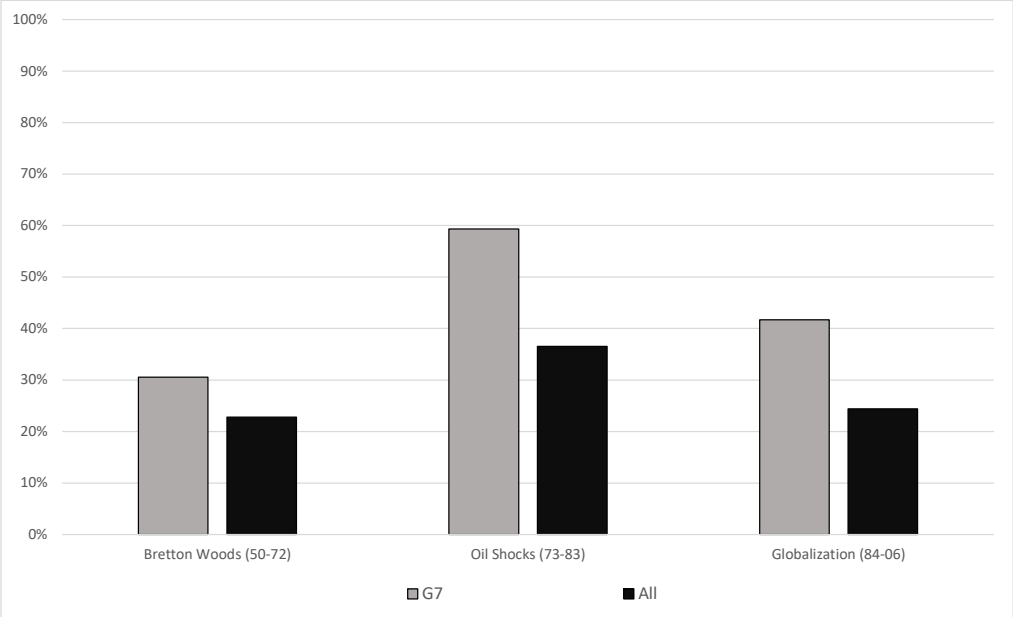
mixed. Using a larger sample (76 countries) but annual GDP data over the period 1960–1999, Kose et al. [2003b] found that the importance of the common factor for domestic output fluctuations had not changed much between 1960–1980 and 1981–1999. Even when restricting attention to G-7 countries, Doyle and Faust [2005] did not find a significant change in the correlations between the growth rate of output in the United States and in other G-7 countries over time using use quarterly real GDP from 1960 Q1 until 2002 Q4.

Important data constraints made it hard to reach a final conclusion, however. The existence of a trade-off between country coverage and the frequency of the data, along with the use of different sub-samples, prevented a direct comparison of results in the literature. The inclusion of extreme episodes in a sub-period, the oil shock decade (1973-1982) in particular, could easily bias the results. Finally, the absence of output data over the first 10 years of Bretton Woods raised the question of a mechanical under-estimation of co-movement during that period because of the exclusion of at least one major global recession (in 1958). Using our data casts a new light on these results and reveals some of its biases. First, we confirm the sensitivity of results to outliers. Since the share of variance explained by the world factor more than doubles between 1973-1982 on average (see Figure 8), including (excluding) the oil shock decade in (from) a given sub-sample can change, on its own, the conclusion one reaches.[27] Second, we find that the results derived on G-7 countries can not be generalized. When comparing our results to Kose et al. [2008], we also find that the average share variance due to the world factor among G7 countries has increased between the two periods (from 30% to 41%), even after isolating the oil shock decade (Figure 10). However, looking only at the G-7 gives too much weight to two outliers - Italy and France - which have seen seen their output re-synchronizing with the world factor tremendously over the last 70 years (see Figure 9, in the bottom right corner). This result disappears when looking at a larger sample of countries.

monthly Industrial Production data for a sample of advanced OECD countries between 1963 and 1994. Bordo and Helbling (2003) documented an increase in output synchronization across industrialized countries over the very long run (1880-2020).

[27] A similar remark applies to the Global Financial Crisis obviously, but the papers cited here were published before 2008-09.

Figure 10. Variance Decompositions - Country Groupings



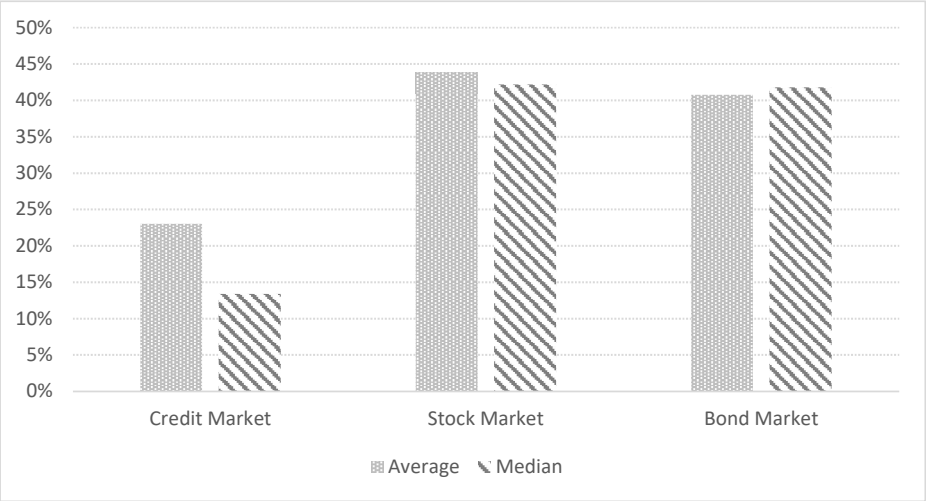
Notes: The figure reports the average share of variance explained by the world factor over time and for selected country groupings, which is also the statistic reported in Kose et al. [2008]. The conclusion is the same if we use median, which is reported in Figure 8. G-7 refers to G-7 countries only.

5.B. The Global Financial Cycle: Asset Prices vs Credit

The relatively low synchronization of credit at the world level contrasts with the strong synchronization we observe for asset prices. The latter result, which has been highlighted in several important contributions (in particular Miranda-Agrippino and Rey [2020]) and is confirmed in the present paper, still raises an important question: why do we observe such a decoupling?

We argue that this can easily rationalized by a number of economic and institutional factors. First, local securities markets are much more integrated internationally than their credit counterparts. This fact is illustrated in Figure 11, which reports the current degree of foreigners' participation in the median country for each market. We measure foreigners' participation (i) in the local stock market using the stock of foreign portfolio liabilities (expressed in % of the total stock market capitalization) (ii) in the local government bond market using the stock of government securities held by foreigners (expressed in % of all government debt securities) and (iii) in the local credit market using the stock of bank assets held by foreign banks (expressed in % of all domestic bank assets). While foreigners' participation reaches 45% in the average country in both asset markets, it is two to three times lower in the credit market; a gap similar to the one we find in terms of sensitivity to the world cycle in section 4. Second, the profile of agents borrowing on each market also varies markedly. While large borrowers (e.g. multinationals, exporters) heavily exposed to global conditions raise capital on capital markets, local credit markets cater mostly to small borrowers (firms and households), whose demand is more likely to move with local conditions.

Figure 11. Foreign participation in local asset and credit markets



Notes: Foreigners' penetration in (i) the local stock market is computed using the stock of foreign portfolio liabilities (expressed in % of the total stock market capitalization) (ii) the local government bond market using the share of all government securities held by foreigners and (iii) the local credit market using the share of total banking assets that are held by foreign banks. A foreign bank is a bank where 50 percent or more of its shares are owned by foreigners. The country sample follows the sample used for each market in the paper. To smooth potential outliers, we first average the data between 2004-2013 for each country before taking the median across countries. *Sources*: IIP, IMF, WB, Arslanalp and Tsuda [2014], Claessens and Van Horen [2014]

Finally, domestic credit is structurally more exposed to idiosyncratic political forces than capital markets. This can happen because of the presence of public or semi-public banks (e.g. national development banks in emerging markets), which can be used to pursue country-specific objectives, or because of the existence of local political credit cycles [Kern and Amri, 2020].

We also note that our results are not inconsistent with the recent international finance literature that has emphasized the synchronicity of global credit/banking flows and its sensitivity to US monetary policy [Cetorelli and Goldberg, 2012, Bräuning and Ivashina, 2020, Miranda-Agrippino and Rey, 2020]. That literature has, in general, focused on the direct cross-border funding provided by global banks - a type of credit that is not included in the domestic bank credit aggregates we use.[28] It is also not surprising this type of funding, which is overwhelmingly denominated in USD and provided to large firms, is more connected to global (and in particular US) funding conditions than local credit. For instance, Bräuning and Ivashina [2020] focus on international syndicated corporate loans denominated in USD and going to large corporate borrowers in emerging markets, while Miranda-Agrippino and Rey [2020] also use of an "aggregate" of global inflows, defined as direct cross-border credit flows provided by global banks.

Much less is known, in contrast, about how domestic credit aggregates co-move and/or react

[28]Domestic bank credit aggregates include the funding provided by foreign banks' local affiliates incorporated in the country. That data is actually used to construct Figure 11. However, direct cross border lending from global banks to the private sector is not included.

to US monetary policy, especially over the long run and for a large cross section of countries. Miranda-Agrippino and Rey [2020] only look at a global aggregate of domestic credit, not country-specific credit series. At the micro level, the causal impact of US monetary policy has been well established. Giovanni et al. [2017] study the transmission of the Global Financial Cycle to the domestic credit market Turkey between 2003 and 2013. Using administrative data covering the universe of corporate credit transactions matched to bank balance sheets, they document that an easing in global financial conditions leads to lower borrowing costs and an increase in local lending, and that domestic banks more exposed to international capital markets transmit the GFC locally. In a similar spirit, Morais et al. [2019] find that a softening of foreign monetary policy increases the supply of credit of foreign banks to Mexican firms. These country-specific studies, however, concentrate on specific episodes, and on countries that are highly dependent on foreign banks.[29] As a result, it is not surprising to see the effect of US monetary policy being muted when looking at larger sample of countries where the penetration of foreign banks is much smaller. In that respect, we are close to Dedola et al. [2017], who also did not find a significant effect of monetary policy shocks on real credit to the private sector, but found significant effect on financial prices (spreads, equity prices and interest rates). Buch et al. [2019] also argue that although international spillovers into lending to the private sector do occur, especially for US policies, the results are very heterogeneous across countries and banks.

Finally, our results show that the global synchronization of domestic credit has not increased over time. Using correlation and concordance analysis, Claessens et al. [2011] found some evidence that the extent of synchronization of financial cycles across countries had been increasing over time, mainly for credit and equity cycles. Although we confirm this fact for equity markets, the former results also disappears when using complete credit data. Overall, our results complement the existing literature by highlighting the fact that local credit markets differ *qualitatively* from equity and bond markets, and even from global credit markets. This, in turn, translates *quantitatively* into important differences in the way local credit markets synchronize and calls for caution when assessing the strength of Global Financial Cycle and/or its connection to US monetary policy. This is particularly important since domestic bank credit remains, by far, the most important source of capital for the private sector. According to BIS statistics, domestic banks were providing roughly 70% of all the credit received by the private non-financial sector in the median (emerging or advanced) country as of 2020 Q1.[30] This, in turn, provides perspective on the macro relevance of some the effects previously identified in the literature.

[29] The data used in 11 shows that Mexico, for instance, has the highest share of domestic bank assets held by foreign banks, with 76%.

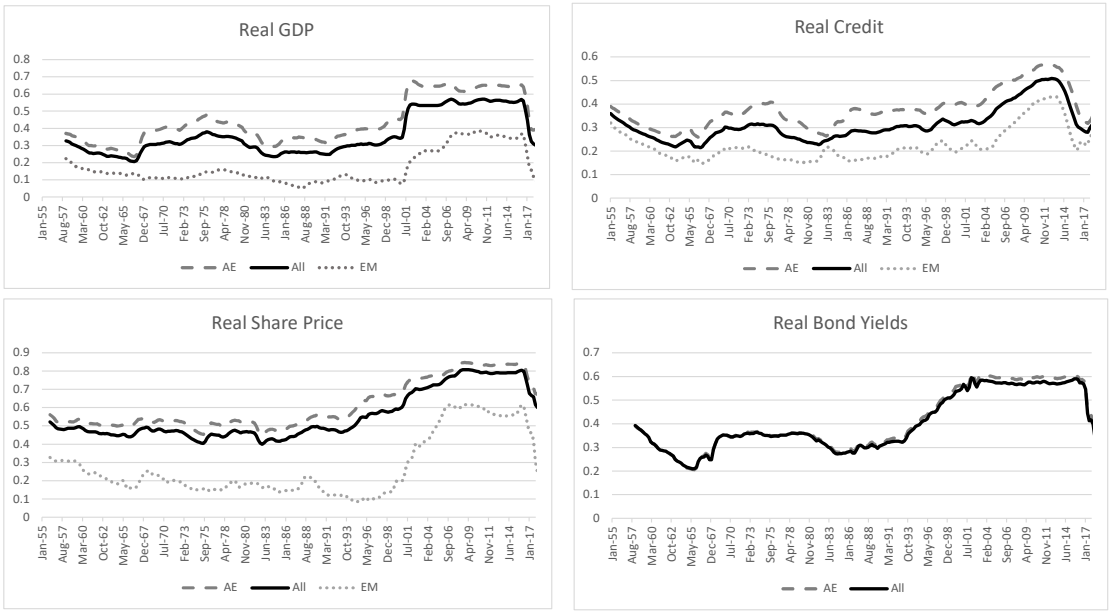
[30] This statistic is derived using BIS *Total Credit Database*. We divided the stock of domestic bank credit to the private non-financial sector, adjusted for breaks, by the total amount of credit received by the private non-financial sector.

6. Robustness

We first explore the robustness of our historical comparisons to different cut-offs. We re-estimate cycles and variance decompositions using 15-year rolling windows. Figure 12 reports the (median) share of variance explained by the different world cycles over these different windows. The dates below report the central year of the window, so that year 2000 refers to the period between 1992–2008. We find that our key findings do not depend on specific windows. For instance, for both output and credit, the stability in the strength of the world cycles we identify is not driven by very low values during the early 80's, when integration was still in its infancy. However, the impact of the GFC on both measures is very stark: for both output and credit, the measures rise suddenly when the 2007–2009 period enters the sample, giving the impression of a "break" in measures of synchronization. This broad pattern is also true for both AEs and EMs. This view contrasts with the slow and steady rise in synchronization in asset prices, which starts trending upwards in the early 90's for all countries in our sample.

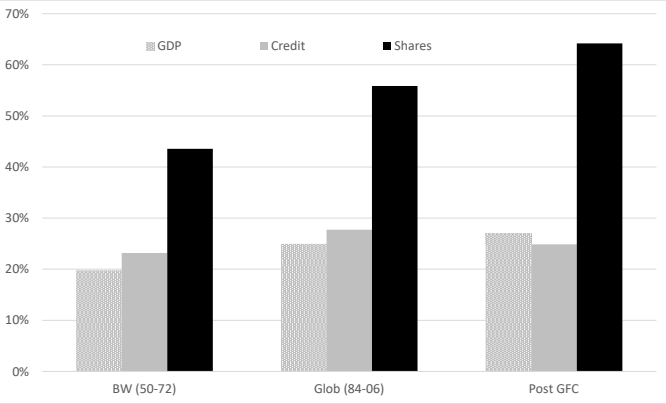
Finally we show that the decoupling between prices and quantities over the long we identify does not depend on the sample of countries we cover for each variable. Figure 13 reports the median strength of world cycle for GDP, credit and share prices using the sample of 26 countries for which we have data on equity prices, over the different sub-samples (i.e. an equivalent of Figure

Figure 12. Variance Decompositions - Rolling Windows



Notes: Figures report the evolution of variance decompositions for the median country (All, AE or EM) using 15-year rolling windows. The date on the x-axis reports the central year of the window. For instance, year 2000 refers to the period between 1992–2008. The last data point with a symmetric window is Q2-2012. After that, the become increasingly backward looking, so the last data point we report is 2017. In that case, the estimation window in 2010-2019.

Figure 13. Variance Decompositions - Constant Sample



Notes: Bars report the share of variance in domestic variables explained by each corresponding world cycle over each sub-sample. Results are reported for the median country. The sample is constant across variables and covers 26 advanced and emerging countries

8, but using a constant sample this time). We still find that both credit and GDP synchronization have been roughly left unchanged since Bretton Woods, slightly above 20%. By contrast, equity synchronization has increased dramatically since then.

7. Conclusion

Economists studying macro-financial linkages usually face a statistical "trilemma", where they need to choose between frequency (quarterly vs. annual), coverage (AEs vs. EMs) and length of coverage. Using IMF archives, we compile a new macro-financial quarterly database for both advanced and emerging economies since 1950 and use it to highlight several new facts regarding the strength of real and financial global cycles, and their evolution over time. We show that although world cycles exist and are driven by the US, their strength vary widely across variables and countries. Overall, world cycles, both real and financial, affect mostly advanced economies and asset prices. Asset price synchronization, in particular, seems to be a durable feature of the global financial system. In contrast, we find that the synchronization of output and credit at the world level has been relatively low and stable over the whole post-war period, at least during normal times. Among other things, this clearly highlights the uniqueness of the GFC in the macro-financial history of the postwar world; a time of unprecedented synchronization at the global level. It also suggests that the drivers of synchronization during the GFC are different from the ones behind "normal" international cycles.

Finally, our research raises key questions regarding the importance of the global financial cycle. The coexistence of a strong co-movement in asset prices but modest co-movement in key policy targets, such as output and credit, points to more policy autonomy than expected, especially in EM. Looking at credit in particular, a financial variable that is under more direct control of policymakers than asset prices, clearly suggests that local credit conditions for the private sector

are still not directly tied to the external environment (or to US conditions). This finding suggests that the pass-through from external conditions to local credit crucially depends on the institutional and financial landscape in the domestic economy. It also questions the macroeconomic relevance of effects previously identified in the literature, and suggests that if US monetary policy matters for the rest of the world, it is not so much because of its direct impact on credit supply, but rather because of its influence on global asset prices and risk aversion. We leave a comprehensive investigation of all these aspects for future research.

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A Appendix

AA. Data Coverage

The table reports the country coverage for each variable. A cross indicates that the data is available for that country over the whole sample.

Table A1. Dataset Coverage

Country	GDP	Credit	Stock Prices	Bond Yields	Prices
Argentina	X	X			X
Australia	X	X	X	X	X
Austria	X	X	X		X
Belgium	X	X	X	X	X
Bolivia		X			X
Brazil	X	X			X
Canada	X	X	X	X	X
Chile	X	X	X		X
Colombia		X			X
Costa Rica		X			X
Cyprus		X			X
Denmark	X	X	X	X	X
El Salvador					X
Finland	X	X	X		X
France	X	X	X	X	X
Germany	X	X	X	X	X
Greece	X	X			X
Guatemala		X			X
Honduras		X			X
Iceland	X	X			X
India	X	X	X		X
Ireland	X	X	X	X	X
Israel	X	X	X		X
Italy	X	X	X	X	X
Japan	X	X	X		X
Korea	X	X			X
Luxembourg	X				X
Malaysia		X	X		X
Malta					X
Mexico	X	X	X		X
Morocco	X	X			X
Netherlands	X	X	X	X	X
New Zealand	X	X	X	X	X
Norway	X	X	X	X	X
Pakistan	X	X			X
Peru		X	X		X
Philippines	X	X	X		X
Portugal	X	X		X	X
South Africa	X	X	X	X	X
Spain	X	X	X		X
Sweden	X	X	X	X	X
Switzerland	X	X	X	X	X
Taiwan	X	X			X
Thailand		X			X
Turkey	X	X			X
United Kingdom	X	X	X	X	X
United States	X	X	X	X	X
Uruguay	X	X			X

AB. Interpolation in long quarterly GDP statistics

Except for a few countries (the US, France and the UK), long official official quarterly GDP spanning the whole post-war period series do not exist. These series generally start in the mid 80's for a few countries, and for most countries in the early 90's. 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). To circumvent this issue, we use temporal disaggregation methods (Chow Lin, 1971) to create "synthetic" quarterly GDP series based on (i) annual GDP series from *Penn World Tables* and (ii) quarterly IP Industrial (or Manufacturing) Production data are taken from historical *IFS* volumes (IFS line 67). Figure A1 complements Figure 1 by illustrating the ability of such "synthetic" real GDP series to track the growth rates based on official quarterly data published in Japan and Mexico. It also reveals that, in the case of Mexico, historical quarterly GDP OECD data are not always based on actual output data. Our data therefore also eliminates GDP series based on simple linear interpolations.

Figure A1. Real GDP Growth: Comparison across sources Official

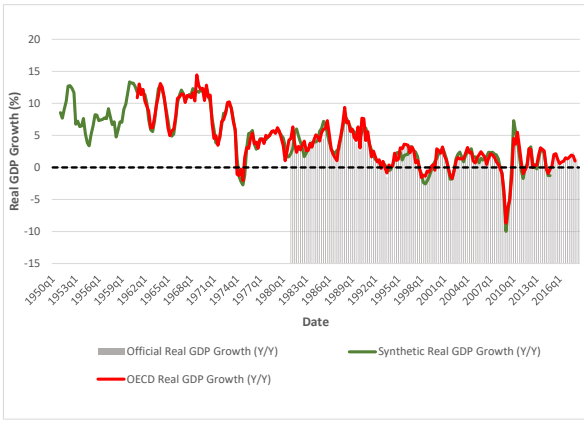

Figure A1.A. Japan

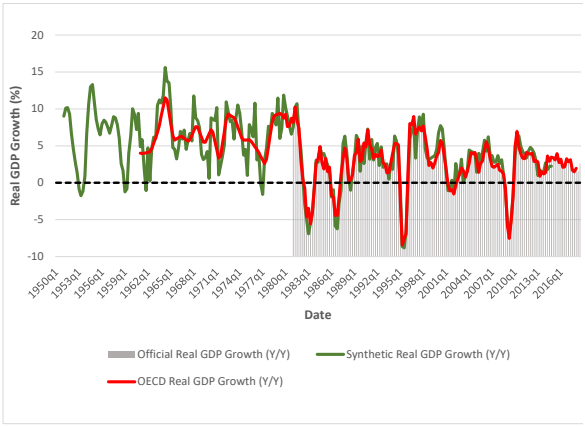

Figure A1.B. Mexico

Notes: Grey bars report the year-on-year real GDP growth rates based on official quarterly GDP data published by local authorities. Red lines report year-on-year real GDP growth based on OECD data. Green 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.

AC. Number of Factors

Columns 1 and 2 in Table A2 report the percentage of variance explained by the i-th eigenvalue (in decreasing order) of the covariance matrix and the spectral density matrix. Column 3 reports results for the Onatski [2009] test, where the null of *r-1* factors is tested against the alternative of *r* common factors. Results are provided for eigenvalues with at least 5% of explanatory variance and for the full sample (1950-2019), for all variables. Since the Onatski test statitics are sensitive

to outliers, results for inflation are computed after excluding crisis Latin American countries with at least one hyperinflation episode (Argentina, Bolivia, Brazil, Chile and Mexico). Overall, results overwhelmingly support the existence and use of a single factor model, with the largest eigenvalue accounting for a significant portion of the the variance both in the time and frequency domains in all variables (ranging from 20% to 58%). The decay for subsequent eigenvalues is very strong. P-values for the Onatski test also support the use of single factor model. Our findings are in line with other contributions, such as Miranda-Agrippino and Rey [2020], who report similar results on asset prices.

Table A2. Share of Variance and Test Results

Number of Global Factors: Output

r	% Covariance Matrix	% Spectral Density	Onatski (2009)
1	0.339	0.263	0.079
2	0.058	0.104	0.125
3	0.056	0.077	0.629

Number of Global Factors: Shares

r	% Covariance Matrix	% Spectral Density	Onatski (2009)
1	0.477	0.403	0.039
2	0.070	0.143	0.297
3	0.065	0.094	0.293

Number of Global Factors: Inflation

r	% Covariance Matrix	% Spectral Density	Onatski (2009)
1	0.572	0.692	0.006
2	0.092	0.129	0.117
3	0.074	0.078	0.710

Number of Global Factors: Credit

r	% Covariance Matrix	% Spectral Density	Onatski (2009)
1	0.200	0.140	0.004
2	0.108	0.112	0.964
3	0.075	0.093	0.779

Number of Global Factors: Bonds

r	% Covariance Matrix	% Spectral Density	Onatski (2009)
1	0.530	0.526	0.001
2	0.146	0.171	0.374
3	0.049	0.070	0.407