FROM THE GLOBAL TO THE NATIONAL CYCLE: AN INTRICATE LIAISON

M. Ayhan Kose* *International Monetary Fund*
Prakash Loungani *International Monetary Fund*
Marco E. Terrones *International Monetary Fund*

Abstract. This paper examines the linkages between the global business cycle and national cycles. We first analyse the evolution of the global business cycle and present its main properties during global recessions and recoveries. We then consider how the sensitivity of national cycles to the global cycle varies over different phases of the global cycle and depends on country-specific features. Our findings collectively portray an intricate liaison between the global business cycle and national cycles. National business cycles are tightly linked to the global cycle, but the sensitivity of national cycles to the global cycle is much higher during global recessions than expansions. There are significant differences across countries in how they respond to the global cycle as advanced economies appear to be more sensitive to global recessions than are developing economies. Moreover, countries tend to be more sensitive to the global cycle, the more integrated they are to the global economy.

1. INTRODUCTION

The depth and breadth of the worldwide recession that followed the 2007–2009 financial crisis have led to intensive discussions about our understanding of the linkages between national business cycles and the global cycle. Specifically, there was significant variation in growth performance across different groups of countries during the worldwide recession of 2009 and the ensuing recovery. Emerging economies exhibited surprising resilience during the worst of the financial crisis and rapidly returned to relatively high growth. In contrast, advanced economies experienced deep contractions and have been going through a disappointingly slow recovery.

In light of these observations, we address a basic question in this paper: How does the global cycle interact with national business cycles? We first examine the evolution of global growth over the two phases of the cycle: global recessions and recoveries. We document the main features of these episodes, analyse the behaviour of different indicators of activity, and consider the performance of different groups of countries, including advanced, emerging market and developing economies, around these periods. We then turn to an analysis of the sensitivity of national cycles to the global cycle.

Our paper builds on a rich research program studying various aspects of the global and national business cycles. Most of the previous studies focus on the dependency of the emerging and developing countries of the South to the advanced countries of the North. Earlier studies, such as Dornbusch (1985), Hoffmaister *et al.* (1998), Frankel and Roubini (2001), IMF (2001) and Calvo *et al.* (2001), examine the growth spillovers from advanced countries to emerging and developing economies. These studies mostly confirm that the cyclical fortunes of developing countries are tightly linked to developments in advanced countries: an observation advanced by Lewis (1980). Akin and Kose (2008) examine the extent of growth spillovers from the advanced countries to the emerging market economies and conclude that the impact of the advanced economies on the growth dynamics of the emerging economies has declined over time.

Another branch of this research program examines the role of trading partners' economic performance in driving the dynamics of domestic growth. For example, Arora and Vamvakidis (2004) find that advanced economies benefit from trading with rapidly growing emerging markets while developing countries benefit from trading with the relatively high-income advanced economies. Helbling *et al.* (2007) find that while spillovers from the United States to other countries have increased with greater trade and financial integration, the importance of these links should not be overestimated.[1]

Our paper makes three specific contributions to this research program. First, we focus on the linkages between the global cycle and national cycles whereas earlier studies consider the linkages between advanced economies and emerging and developing economies. Our understanding of the global business cycle has evolved over time, requiring us to have a better grasp of the interactions between the global cycle and national cycles. In particular, it is no longer sufficient to look at cyclical fluctuations in advanced economies to have a good sense of the impact of the global business cycle on national cycles. Advanced economies accounted for the lion's share of world output, nearly 70% in the 1960s; moreover, cyclical activity in much of the rest of the world was largely dependent on conditions in advanced economies as they accounted for close to 70% of global growth. With the share of advanced economies in world output down to less than 60% over the past 10 years and with their contribution to world growth approximately 20%, the coincidence between business cycles in advanced countries and global business cycles can no longer be taken for granted.

Second, countries are more integrated today through trade and financial flows than in the 1960s, creating greater potential for spillover and contagion effects. This increases the feedback, in both directions, between business cycle developments in advanced economies and those in emerging and developing economies, raising the odds of more pronounced global business cycles. The implication is

---

[1] Hirata *et al.* (2013) provide a comprehensive review of the recent literature analysing the interactions between global, regional, group-specific and national cycles.

that we need to consider the broader interactions between the global cycle and national business cycles, and how these interactions are affected by the extent of trade and financial integration.

Third, we examine the sensitivity of national cycles to the global cycle over the two different phases of the global cycle. This is an important consideration as the latest worldwide recession convincingly showed that the sensitivity of national cycles to the global cycle can change substantially depending on the phase of the cycle. We consider the impact of the global growth on national growth during the periods of global recessions and expansions, and study how this impact varies depending on different country characteristics.

Our empirical approach for examining the interactions between the global cycle and national cycles involves two steps. We first consider the evolution of global business cycles, identify the periods of global recessions and recoveries, and study the dynamics of growth around these episodes. We then present an empirical evaluation of the linkages between the global cycle and national cycles.

The first step of our exercise requires us to have an explicit measure of the global business cycle. Our measure of the global business cycle is based on the movements in world real GDP per capita. We employ a per capita measure, as this takes into account the heterogeneity in population growth rates across countries: in particular, emerging and developing economies tend to have faster GDP growth than advanced economies, but they also have more rapid population growth.

To identify the peaks and troughs of the global cycle, we employ the two standard identification approaches widely used in the context of national business cycles: a statistical approach and a judgmental approach. The statistical approach identifies local maximum and minimum values of the per capita global GDP series over a given period of time. The judgmental approach we employ follows the spirit of the approaches used by the National Bureau of Economic Research (NBER) and the Center for Economic Policy Research (CEPR) for the United States and the euro area, respectively. In particular, these institutions date business cycle peaks and troughs by looking at a broad set of macroeconomic indicators and reaching a judgment on whether a preponderance of the evidence points to a recession. We apply the judgmental approach at the global level by looking at several indicators of global activity: real GDP per capita, industrial production, trade, capital flows, oil consumption and unemployment.

These two complementary approaches provide an intuitively appealing characterization of turning points in the global business cycle and translate into a concrete definition of a global recession. Specifically, we define a global recession as a contraction in world real per capita GDP accompanied by a broad decline in various other measures of global economic activity. Because we use annual data, a global recession lasts at least 1 year. Our definition of a global recovery also closely follows the standard practice in the business cycle literature. The recovery phase is associated with the first year following the trough of the global business cycle. In addition, we examine the recovery in the first 3 years

following a global recession considering the possibility that a global recovery can take longer than a year. The results from the first step collectively indicate that the global cycle behaves significantly differently over the periods of recessions and recoveries, implying that it is important to study the sensitivity of national cycles to the global cycle over the phases of the latter.

The second step of our empirical analysis involves an econometric assessment of the interactions between the global cycle and national business cycles. We start with a parsimonious panel regression framework and then extend it to control for many other factors. Our baseline model explicitly accounts for the linkages between global growth, national growth and global financial conditions. We argue that this baseline is theoretically appealing as well because both national and global real factors (often captured by domestic and worldwide productivity shocks) and global financial conditions (often captured by world interest rate shocks) affect cyclical growth outcomes in a wide range of dynamic stochastic equilibrium models of small open economies. In addition, our specification includes country fixed effects capturing differences in institutions, structural factors and initial conditions.

The remainder of the paper is organized as follows. In Section 2, we introduce our database and methodology. In Section 3, we first identify the turning points in the global business cycle and determine the years of global recessions and recoveries. We also study the behaviour of macroeconomic variables and investigate how different groups of countries perform during the periods of global recessions and recoveries. We analyse the interactions between the global growth and national growth in Section 4. Section 5 presents a summary of our findings and concludes.

2. DATA SET AND METHODOLOGY

2.1. *Data set*

To study the evolution of global business cycles, we put together an extensive data set using annual series of a wide range of indicators of global economic activity for 163 countries covering the period 1960–2012. Some of these indicators are the components of national income accounts, including GDP, consumption and investment. Others are used for tracking certain measures of activity, such as industrial production, trade and unemployment. We rely mainly on the well-known databases, such as the World Economic Outlook (WEO) and the International Financial Statistics, but we also utilize other sources to construct our data set. We study the ongoing recovery using the GDP forecasts of the IMF's WEO for the period 2013–2014.[2]

We use a smaller sample of countries to analyse the linkages between the global cycle and national cycles, and include only those countries with sufficient and better quality data to conduct the empirical analysis. For example, we

---

[2] We present the list of countries in the Appendix. We provide additional information about the country coverage, variables in the data set and their sources in Kose and Terrones (2013).

eliminate small states (population less than 1 million in 1990), those countries with poor data coverage and those that experienced prolonged wars. These lead to an annual data set comprising 97 countries (21 advanced, 30 emerging market and 46 other developing countries) over the period 1960–2012.

2.2. *Methodology*

We first present a brief discussion of our identification of global recessions and recoveries. We then discuss the methodology we employ to study the linkages between the global cycle and national cycles.

2.2.1. *How to identify the dates of global recessions and recoveries*

We employ the growth rate of the real world GDP per capita as our measure of the global business cycle. A per capita measure is useful because it accounts for the large variation in population growth rates across countries. Moreover, it partly dampens the impact on the global business cycle of the significant differential between trend growth rates of advanced countries and emerging and developing economies. We consider two types of weights in computing the growth rate of global GDP: purchasing power parity (PPP) weights and market weights.

We use two approaches to identify the turning points in global activity: a statistical approach and a judgmental approach. Although the information sets they utilize differ, both rely on the 'classical' definition of a business cycle (Burns and Mitchell, 1946). These are complementary methods and the two of them together help us arrive at our definition of a global recession.

2.2.1.1. *Statistical approach*

The specific cycle dating method we use is the one introduced by Harding and Pagan (2002a), which extends the so-called BB algorithm developed by Bry and Boschan (1971), to identify the turning points in the log-level of a series.[3] The algorithm requires a search for maxima and minima over a given period of time. Then, it selects pairs of adjacent, locally absolute maxima and minima that meet certain censoring rules. It requires a minimum 2-year duration of a cycle and a minimum 1-year duration of each of the cyclical phases.

Our methodology essentially implies that a global recession takes place when the growth rate of our measure of the global business cycle is negative. However, this is a purely mechanical rule to identify a global recession. In reality, many other factors affect the evolution of global economic activity in real time. It is precisely because of this reason that institutions like the NBER and CEPR

---

[3] This dating algorithm is widely used in analysing cross-country dynamics of business cycles (Claessens *et al.*, 2012) as well as financial cycles (fluctuations in credit and asset prices; see Pagan and Sossounov, 2003; Claessens *et al.*, 2011). Other methodologies consider how a variable fluctuates around its trend, and then identify a 'business cycle' as a deviation from this trend. The addition of new data can affect the estimated trend, and, thus, the identification of a cycle in these methodologies.

utilize a comprehensive set of indicators and employ a judgmental approach to identify the turning points of the national and/or regional cycles.

2.2.1.2. *Judgmental approach*

This approach has a long history and finds its roots in the pioneering work of Burns and Mitchell (1946), who laid the methodological foundations of the analysis of business cycles in the United States. The NBER and the CEPR follow this approach and date business cycle peaks and troughs by looking at a broad set of macroeconomic indicators and reaching a judgment on whether a preponderance of the evidence points to a recession. For example, the NBER uses GDP, industrial production, retail sales, employment, disposable income and initial claims for unemployment insurance.

We apply the judgmental approach at the global level by looking at several indicators of global activity: real GDP per capita, industrial production, trade, capital flows, oil consumption and unemployment. It is not possible to construct the global analogs of some of the variables used by the NBER and the CEPR because they are not available for a large number of countries over a long period. However, the measures we employ here capture the essential information provided by the main variables used by these institutions. Moreover, our measures represent a broad perspective about the evolution of global business cycles. In addition to the standard activity measures, such as GDP, industrial production and unemployment, the other variables we use capture the changes in global trade and financial flows (trade and capital flows) and global energy consumption (oil consumption).

Armed with these two approaches, we can now define the concepts of global recession and global recovery. We define the global recession as a contraction in world real per capita GDP accompanied by a broad decline in various other measures of global economic activity. Because we use annual data, a global recession lasts at least 1 year. In addition to the recession phase, the recovery phase from recessions has been widely studied for national business cycles.[4] The recovery is the early part of the expansion phase. We consider the recovery phase as associated with the first year following the trough of the global business cycle. In addition, we examine the recovery in the first 3 years following a global recession, considering the possibility that a global recovery can take longer than a year.[5]

---

[4] In the context of national cycles, a number of studies examine the dynamics of recoveries (see Eckstein and Sinai, 1986; Balke and Wynne, 1995; and Mussa, 2009). Some define the recovery as the time it takes for output to rebound from the trough to the peak level before the recession. Others associate recovery with the growth achieved after a certain time period, such as four or six quarters, following the trough (see Sichel, 1994).

[5] The judgmental approach requires the use of data in real time to make a subjective assessment of the state of the economy and evolution of activity over a period of time. The implication is that it takes some time to determine the peaks and troughs of the cycle in real time. In the context of the latest US recessions, for example, the NBER Business Cycle Committee's determination of the peak date in December 2007 occurred 11 months after that date and the Committee's action in determining the trough date of June 2009 occurred 15 months after that date. Its earlier determinations took between 6 and 21 months. The NBER Committee has no fixed timing rule; it announces the dates after making sure it can assign an accurate peak or trough date.

2.2.2.   *How to study the linkages between the global cycle and national cycles*
Because we would like to provide a systematic analysis of the cyclical linkages
between the global cycle and national cycles, we start with a parsimonious
framework and then extend it to account for many other factors. Our baseline
model describes how growth in a country is linked to global growth, its own
growth history and global financial conditions. The model is theoretically
appealing as both national and global real factors (often captured by domestic
and worldwide productivity shocks) and global financial conditions (often cap-
tured by world interest rate shocks) affect cyclical growth outcomes in a wide
range of dynamic stochastic equilibrium models of small open economies (Kose,
2002; Neumeyer and Perri, 2005).

There are two major global variables in our regressions: the rest of the world
per capita growth and the world real interest rate. The first variable is similar to
the global business cycle measure we employ but differs across countries. For
each country, it is the PPP weighted output growth of the remaining countries in
the sample minus their population growth. The second variable is based on a
widely-used measure of the world real interest rate and corresponds to the
difference between the 3-month US Dollar Libor interest rate and US inflation.
In addition, we use the standard de facto measures of trade and financial
integration in our regressions: the ratio of the sum of imports and exports to
GDP, and the ratio of the sum of total assets and liabilities to GDP, respectively.

Specifically, we use a simple autoregressive distributed lag model and assume
that the per capita output growth in country i, $g_{y_{it-j}}$, can be represented by the
following specification:[6]

$$g_{y_{it}} = \alpha_i + \rho_j \times g_{y_{it-1}} + \beta \times g_{y_{rowi,t}} + \varphi \times r_t + \varepsilon_{it},$$
$$i = 1, 2, \ldots, N; t = 1, 2, \ldots, T$$

where $g_{y_{rowi,t}}$ is the annual growth of real GDP in the rest of the world in year t
and r_t is the real world interest rate. α_i captures time-invariant heterogeneity
in national growth rates. β measures the impact of a 1% increase in global
per-capita growth in period t on the national growth. Both N (number of
countries) and T (number of years) are large as we use relatively long time series
of a sizeable number of countries. Our specification implies that national cycles
are influenced by external and domestic factors. In addition, our specification
includes country fixed effects capturing differences in institutions, structural
factors and initial conditions. The world real interest rate helps capture the
influence of global credit and monetary conditions on national cycles.

As we report in the next section, the sensitivity of national cycles to the global
cycle appears to vary over the phases of the global cycle, implying that there is
an asymmetric linkage between the global cycle and national cycles. This could,
for instance, be the result of highly synchronized responses of national cycles to

---

[6] Bond *et al.* (2010), in their analysis of the effects of capital accumulation on growth, develop in
detail this family of panel regression models which are suitable to examine short-run and long-run
growth dynamics.

adverse financial shocks during global recessions (as we vividly observed during the last global recession). To study the differential responses of national cycles to the global cycles, we extend our baseline specification by interacting the growth in the rest of the world with a global recession dummy, D_t:

$$g_{y_{it}} = \alpha_i + \eta \times D_t + \rho \times g_{y_{it-1}} + [\beta_1 + \beta_2 \times D_t] \times g_{y_{rowi,t}} + [\varphi_1 + \varphi_2 \times D_t] \times r_t + \varepsilon_{it},$$
$$i = 1, 2, \ldots, N; t = 1, 2, \ldots, T$$

where D_t takes the value of one if the global economy is in recession in year t, and zero otherwise. This specification implies that the sensitivity of the national cycle to the global cycle is captured by $(\beta_1 + \beta_2)$ during global recessions and by β_1 during global expansions. Similarly, the sensitivity of the national cycle to the world interest rate is $(\varphi_1 + \varphi_2)$ during global recessions and φ_1 during global expansions. We consider the differential impact of the global interest rate on the growth of national income over the phases of the global business cycle following the literature on the asymmetric effects of interest rate movements on output depending on the phase of the cycle.[7] In addition to these types of cyclical asymmetries, the impact of global interest rates differs because of the availability of credit and international financial flows across the phases of the cycle.

Time varying country-specific features could, of course, affect the sensitivity of national cycles to the global cycle. For example, countries with stronger trade and financial linkages could be more sensitive to developments in the global cycle. In our next set of regressions, we explore the empirical importance of such features over the global cycle. We interact the rest of the world growth and the world interest rate with measures of trade and financial integration:

$$g_{y_{it}} = \alpha_i + \eta \times D_t + \rho \times g_{y_{it-1}} + [\beta_1 + \beta_2 \times D_t + \beta_3 \times T_{it-1}] \times g_{y_{rowi,t}}$$
$$+ [\varphi_1 + \varphi_2 \times D_t + \varphi_3 \times F_{it-1}] \times r_t + \delta \times T_{it-1} + \psi \times F_{it-1} + \varepsilon_{it},$$
$$i = 1, 2, \ldots, N; t = 1, 2, \ldots, T$$

where T_{it-1} and F_{it-1} capture the extent of trade and financial integration of country i in year $(t-1)$, respectively.[8] This specification implies that the sensitivity of the national cycle to the global cycle is $[\beta_1 + \beta_2 + \beta_3 \times T_{it-1}]$ during global recessions and $(\beta_1 + \beta_3 \times T_{it-1})$ during global expansions. Similarly, the sensitivity of national business cycles to global interest rates is $[\varphi_1 + \varphi_2 + \varphi_3 \times F_{it-1}]$ during global recessions and $(\varphi_1 + \varphi_3 \times F_{it-1})$ during global expansions.[9]

---

[7] A number of papers study these types of asymmetric effects of interest rates on output during recessions and expansions. See Garcia and Schaller (2002), Sensier *et al.* (2002) and Karras (1996).

[8] It is well known that the least-square dummy-variable (LSDV) estimators of dynamic panel data models might produce biased estimates when the time dimension of the panel is small (Judson and Owen, 1999). To assess for the severity of this problem in our case, we also obtain the bias-corrected LSDV (LSDVC) estimators (Bruno, 2005) for our models. We find that the LSDV and LSDVC estimators in these cases are very similar (see Kose and Terrones, 2013).

[9] The theoretical impact of increased trade and financial flows on the sensitivity of national cycles to the global cycle also depends on several other factors, including the composition of international trade and financial flows, and how synchronized and sudden the changes are in these flows (Hirata *et al.*, 2013).
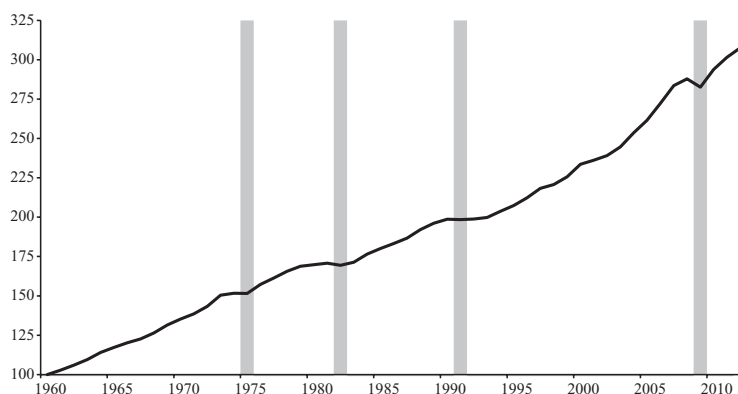
Figure 1. Evolution of world GDP, 1960–2012 (index numbers, 1960 = 100)
Notes: The index number shows the purchasing power parity-weighted world per capita real GDP and is equal to 100 in 1960. Shaded bars indicate the contractions in purchasing power parity-weighted global per capita GDP.

3. GLOBAL RECESSIONS AND RECOVERIES: DATES AND PROPERTIES

This section first reports the turning points of the global business cycle identified by the two approaches. Next, it provides a summary of the stylized facts associated with these events.

3.1. *Dates of global recessions and recoveries*

The statistical algorithm picks out four troughs in global economic activity over the past 50 years, 1975, 1982, 1991 and 2009, which correspond to declines in world real GDP per capita (Figs 1–3).[10] With both weights, the dates of peaks in the global business cycle are 1974, 1981, 1990 and 2008. The use of market weights rather than PPP weights, which tilts the weights toward advanced economies, does not affect the identification of the troughs, except the one in 1991. When the market weights are used, the trough of this episode shifts to 1993 because of the downturns in many European countries during the European Exchange Rate Mechanism (ERM) crisis of 1992–1993.

The implication of these findings is that, when measured by market weights, the duration of the 1991 global recession is 2 years, but the duration of other episodes is just 1 year. The duration of global recessions is only 1 year when we use the PPP weights. This finding echoes the results from the literature on the features of national recessions. For example, Claessens *et al.* (2012) report that

---

[10] It is important to note that not all recessions in the United States coincided with global recessions. The United States experienced eight recessions over the period 1960–2011, whereas the global economy had only four.

Figure 2. Growth of real world GDP, 1961–2012 (in percent)
Notes: This figure shows the percent change from a year earlier. World GDP growth is the weighted average of the growth rate of GDP of each country (using the purchasing power parity or market weights). Shaded bars indicate the contractions in purchasing power parity-weighted world per-capita GDP.
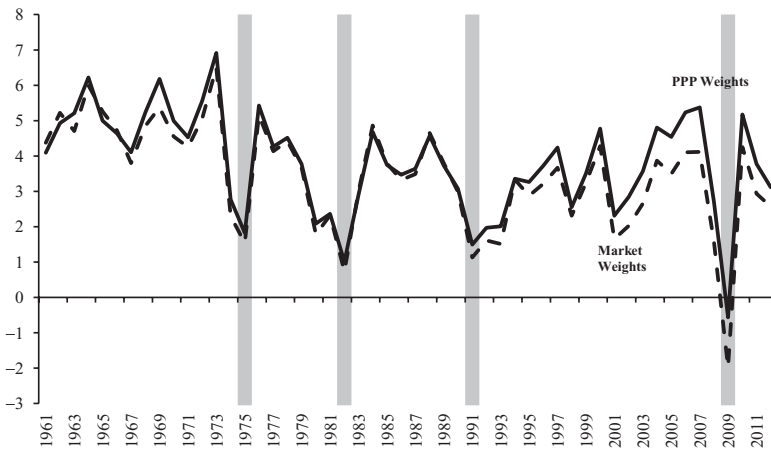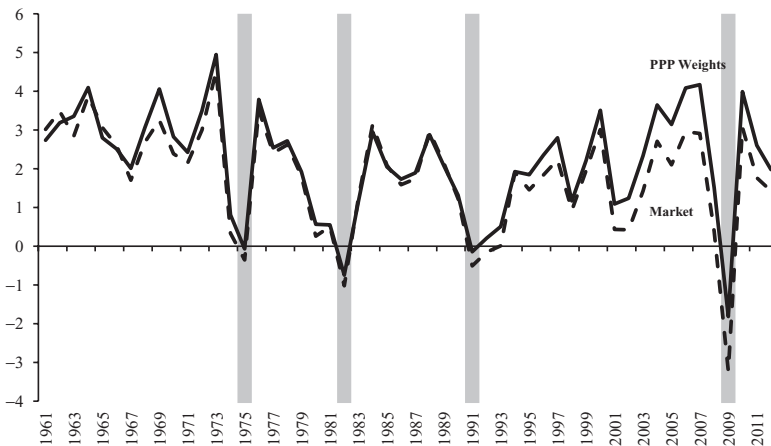

Figure 3. Growth of real per capita world GDP, 1961–2012 (in percent)
Notes: This figure shows the percent change from a year earlier. Per capita world GDP growth is the difference between world GDP growth and world population growth. Shaded bars indicate the contractions in purchasing power parity-weighted world per-capita GDP.

the average duration of roughly 250 recessions in advanced and emerging market countries since 1960 is also approximately 1 year.

The judgmental approach is applied at the global level by looking at several indicators of global activity: real GDP per capita, industrial production, trade, capital flows, oil consumption and unemployment. Figure 4 shows the evolutions of these indicators on average around the global recessions of 1975, 1982, 1991 and 2009 that were identified using the statistical approach. The behaviour of most of these indicators around the global recessions of 1975, 1982, 1991 and 2009 point to an obvious contraction in global economic activity after it reached a peak in the preceding year. In the case of the 1991 episode, the use of the judgmental approach indicates that some of the activity variables remained weak in 1992 as well, consistent with the protracted nature of this episode. In the following subsection we provide a more detailed discussion of the behaviour of these variables during these episodes.

3.2. *Main properties of global recessions and recoveries*

The four turning points we identified coincide with severe economic and financial disruptions in many countries around the world. Each episode had its own unique features in terms of the nature of challenges the world economy faced. For example, the underlying shocks that led to global recessions worked differently across the four episodes. The 1975 global recession was driven by a truly global shock (an oil price shock). The 1982 episode witnessed a series of shocks and policy responses, including the oil price shock in 1979, the Volcker disinflation and the Latin American debt crisis.

However, there were also multiple similarities across the episodes in terms of how the global economy descended into a full-blown recession. To illustrate, while the 1991 global recession coincided with a wide range of global and national shocks, it became a worldwide event through transmission of the national shocks across borders: financial disruptions in the United States, Japan and several Scandinavian countries, exchange rate crises in many advanced European economies, the German unification and the collapse of iron curtain.

Figure 4. Global recessions: Dynamics of main activity variables
Notes: Time 0 denotes the year of the respective global recession (shaded with gray). All variables are in annual frequency. Aggregates for GDP are purchasing power parity-weighted per capita real GDP indices. Aggregates for industrial production are purchasing power parity-weighted industrial production of advanced and emerging market countries. Aggregates for trade are trade-weighted real trade indices. Aggregates for unemployment rate are labour-force-weighted unemployment rates in percent. GDP, industrial production, trade and oil consumption are index numbers equal to 100 one period before the global recession year.

GDP
(index)

Industrial Production
(index)

Trade Flows
(index)

Capital Flows over GDP
(percent)

Unemployment rate
(percent)

Oil Consumption
(index)

——— 1975   - - - 1982   ········ 1991   ——— 2009
- - - Average of Global Recessions
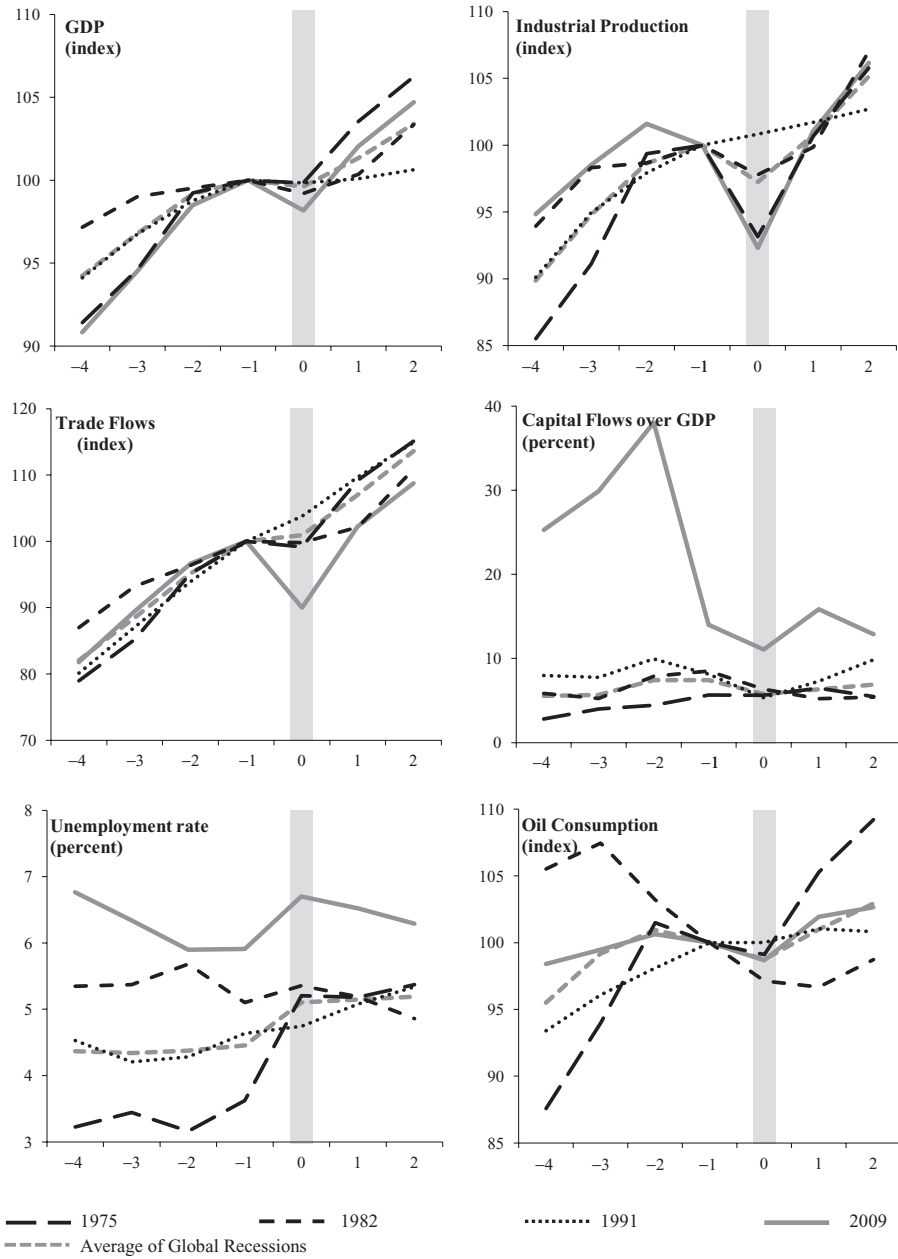
The 2009 episode started in the US financial sector but it rapidly propagated to other advanced countries and some emerging economies through international trade and financial linkages.

In addition to the four episodes identified above, the global economy experienced relatively low levels of growth in 1998 and 2001.[11] However, the statistical approach we use does not identify these episodes as troughs, because the world real GDP per capita did not contract in these years. In 1997–1998, many emerging economies, particularly in Asia, experienced sharp declines in economic activity, but growth in advanced economies held up. In 2001, conversely, many advanced economies had mild slowdowns or recessions, but growth in major emerging markets, such as China and India, remained robust. Moreover, during the years 1998 and 2001, the behaviour of these global indicators was mixed, supporting the inference from the statistical method that these episodes did not display the features of a global recession. For example, the indicators did not suggest a broad-based weakness in the global economy in 1998. In 2001, although industrial production did fall and the rate of global unemployment picked up slightly, both global trade flows and oil consumption increased.[12]

We now turn to a brief summary of the main features of global recessions and recoveries. We also present a short discussion on the degree of synchronization of recessions and recoveries across countries during these episodes.

3.2.1. *Global recessions*

The evolutions of the main indicators of global economic activity point to a number of similarities during the four global recession episodes (Fig. 4 and Table 1). For example, around the global recessions, world output, industrial production, trade, capital flows and oil consumption often start to slow down 2 years before the trough. The unemployment rate registers its sharpest increase in the year of the recession. The latest recession followed a pattern similar to that observed in past recessions, although the contractions in most indicators are much sharper.

Global recessions display some important quantitative regularities (Table 1). First, the decline in per capita GDP (PPP weighted) in a typical global recession is approximately 0.7%, which is 3 percentage points smaller than the average annual growth the world economy registers (2.43%). Second, with both weights, the 2009 global recession is by far the deepest recession in five decades. If total

---

[11] The growth rates of world output per capita (in PPP terms) were 1.1 and 1.2% in 2001 and 1998, respectively. These were the lowest growth rates the global economy registered over the period 1960–2011, except those in the years of global recessions and the years before and after these episodes.

[12] The statistical method is also used to identify the cyclical turning points in quarterly series of global industrial production. The results are broadly consistent with those from the annual series of GDP but they also indicate a trough in industrial production over the period 2001:1–2002:1. We provide a more detailed discussion of these global downturns in Kose and Terrones (2013).

Table 1. Global recessions: Macroeconomic variables (percentage change unless otherwise noted)

Variable	Average 1972–1974	1975	Average 1979–1981	1982	Average 1988–1990	1991	Average 2006–2008	2009	Average all global recessions	Average non-recession years 1960–2012	Average 3 years before	Average 1960–2012
Total output (PPP weighted)	5.08	1.82	2.74	1.01	3.79	1.50	4.44	−0.57	0.94	4.07	4.01	3.83
Total output (market weighted)	4.62	1.54	2.59	0.74	3.81	1.13	3.27	−1.97	0.36	3.70	3.57	3.44
Per capita output (PPP weighted)	3.09	−0.07	1.01	−0.74	2.09	−0.14	3.26	−1.81	−0.69	2.43	2.36	2.19
Per capita output (market weighted)	2.62	−0.35	0.86	−1.02	2.11	−0.50	2.09	−3.22	−1.27	2.06	1.92	1.81
Trade flows	8.22	−0.59	4.71	−0.23	7.72	4.19	6.91	−10.08	−1.68	7.01	6.89	6.34
Capital flows over GDP	0.71	−0.44	0.93	−2.06	0.10	−3.00	−3.77	−2.91	−1.88	0.29	−0.51	0.17
Oil consumption	4.61	−0.90	−1.74	−2.87	2.31	0.01	0.54	−1.32	−1.27	2.31	1.43	2.25
Unemployment (labour weighted)	0.13	1.58	−0.08	0.26	0.04	0.11	−0.28	0.79	0.68	−0.02	−0.05	0.08
Industrial production (PPP weighted)	5.41	−6.85	2.12	−2.21	3.54	0.81	1.81	−7.68	−3.98	4.05	3.22	3.41
Consumption (PPP weighted)	4.83	2.73	3.09	1.79	3.72	2.53	4.28	1.00	2.01	4.05	3.98	3.90
Investment (PPP weighted)	5.30	0.42	2.24	−2.63	4.60	0.25	5.63	−5.30	−1.81	5.04	4.44	4.51
Per capita consumption (PPP weighted)	2.74	0.74	1.23	−0.99	2.02	0.85	3.23	−0.24	0.09	2.33	2.30	2.16
Per capita investment (PPP weighted)	3.21	−1.57	0.34	−5.42	2.88	−1.41	4.46	−6.54	−3.74	3.30	2.72	2.76

The 1991 recession lasted until 1993 with market weights; all other recessions lasted 1 year. All variables except industrial production are in annual frequency. Industrial production is in quarterly frequency and year-over-year growth rates are annualized as the average of four quarters. Average 3 years before column reflects the average of the 3 years before global recessions. PPP, purchasing power parity.

(rather than per capita) real GDP is used as the main metric, the year 2009 witnessed the only contraction the global economy experienced since 1960. There are sharper declines in almost all indicators in 1975 and 1982 than in 1991; in 1991, in fact, world trade grew strongly despite the recession. During the 1991 global recession, only one-third of the advanced countries in our sample experienced national recessions, whereas, during the 2009 episode, all advanced countries, except Australia, registered negative growth. We present a more detailed analysis of synchronization of national recessions later in the paper.

Third, there does not appear to be much higher growth prior to global recessions as the average growth over the 3-year period before these episodes is comparable with the growth in other years. Fourth, investment, industrial production and trade often decline much more than output during global recessions, whereas consumption, on average, holds up (per capita consumption declined in the 1982 and 2009 episodes but continued to grow in the two other cases). Fifth, global unemployment picks up significantly during global recessions. The increase in the unemployment rate was particularly severe during the 1975 and 2009 episodes. Finally, both oil consumption and price decline significantly in global recessions after registering substantial increases prior to these episodes (except the 1991 episode during which global oil consumption did not change much).

Although the aggregate data we use to analyse the dynamics of global recessions provides a wealth of information, it also masks substantial variation in growth performance across different groups of countries. Advanced countries experienced contractions in their per capita GDP in all episodes except the one in 1991 (Table 2). These countries went through deep recessions during the latest episode and saw much larger declines in their GDP compared with the previous cases. Although emerging market countries were able to weather the storm of global recessions, they also suffered from significant growth slowdowns. Unlike emerging markets, other developing countries were adversely affected during the first three global recessions as their per capita output contracted in each of these episodes.

It is useful to evaluate these findings in light of the recent debate on the temporal evolution of the cyclical linkages between advanced economies and emerging market countries. This debate focuses on the ability of emerging market economies, especially emerging countries in the Asia-Pacific region, to decouple from a potential slowdown in the United States (see Helbling *et al.*, 2007; He *et al.*, 2007; Fidrmuc and Korhonen, 2010). Our findings indicate that advanced economies felt the brunt of the 2009 global recession, but both emerging markets and other developing economies were able to register growth in GDP during the latest global recession.

However, there were sharp differences across the growth outcomes of emerging economies in different regions during the latest global recession (see Kose and Terrones, 2013). The economies of emerging Asia had the most favourable outcome, experiencing relatively modest declines in growth rates. China and India, which are the two largest economies in the emerging Asia region and which maintained strong growth during the crisis, obviously played

Table 2. Global recessions: Selected macroeconomic variables of country groups (percentage change, in per capita terms)

Variable	Average 1972–1974	1975	Average 1979–1981	1982	Average 1988–1990	1991	Average 2006–2008	2009	Average all global recessions	Average non-recession years 1960–2012	Average 3 years before	Average 1960–2012
Advanced countries												
PPP-weighted output	3.22	−0.73	1.43	−0.52	3.08	0.28	1.05	−4.27	−1.31	2.56	2.20	2.26
Market-weighted output	3.11	−0.73	1.47	−0.56	3.17	0.31	1.07	−4.31	−1.32	2.47	2.20	2.18
Emerging market countries												
PPP-weighted output	4.22	3.06	2.38	0.76	2.37	0.64	6.65	1.49	1.48	3.59	3.90	3.42
Market-weighted output	3.87	2.74	2.16	0.81	2.32	−0.19	6.10	0.53	0.97	3.54	3.61	3.34
Other developing countries												
PPP-weighted output	5.78	1.76	−0.17	−0.41	0.32	−0.96	4.13	−0.24	0.04	2.02	2.51	1.87
Market-weighted output	3.22	1.92	−0.09	−1.17	−0.13	−2.78	3.99	−1.01	−0.76	1.71	1.75	1.52

See notes for table 1. PPP, purchasing power parity.

an important role in this result. Emerging Europe had the sharpest fall in total output during 2009, followed by Latin America. By contrast, and somewhat surprisingly, the economies of the Middle East and North Africa region as well as those of Sub-Saharan Africa weathered the crisis better, with only small declines in output. For these two latter groups, their relatively modest exposures to trade and financial flows from advanced economies may have limited the extent of spillovers of the global shock.

Our findings on the resilience of emerging economies during the last global recession resonate with those of some recent studies. For example, Kose *et al.* (2012) examine the sources of macroeconomic fluctuations in the advanced economies and emerging markets using dynamic factor models. They document that, during the period of globalization (since 1985), there has been some convergence of business cycle fluctuations among the group of advanced economies and among the group of emerging market economies, but there has been a concomitant decline in the relative importance of the global factor. They claim that there is evidence of business cycle convergence within each of these two groups of countries but divergence (or decoupling) between them. While some other studies also provide support for the decoupling hypothesis (Dooley and Hutchison, 2009; Rossi, 2009), the results of this research program are still not conclusive.[13]

3.2.2. *Global recoveries*
The global recoveries of the postwar period display the following features (Table 3). First, the average growth of world per capita output is 2.3% during global recoveries. A typical global recovery is accompanied by a rebound in economic activity, which is generally driven by a pickup in consumption, investment and international trade flows. Most indicators of global activity recover and start registering growth in the first year of the recovery. Specifically, industrial production, trade and capital flows quickly bounce back during the first year of a global recovery.

Second, the global recovery from the 1975 recession was the strongest one in terms of the average output growth in the first 3 years of the recovery. The ongoing global recovery is similar to the one following the 1975 recession in terms of its strength. The global recovery following the 1991 recession was the weakest episode, reflecting, in part, the sluggish growth in consumption, investment, industrial production and trade flows. Third, similar to its behaviour in national recessions, unemployment remains high in the year after the trough and tends to be more persistent than most other indicators. The weak recovery following the 1991 recession witnessed 2 years of increase in the unemployment rate.

---

[13] Dooley and Hutchison (2009) analyse cross-country financial linkages using vector autoregression models and report that the decoupling hypothesis has been supported by the data through mid-2008. Rossi (2009) concludes that the decoupling hypothesis is relevant considering the long-term changes in the global economic order. Some recent papers, however, employ simple correlations to make a case against decoupling and report that the extent of co-movement of cycles across advanced and emerging economies has not changed much since the early 1980s (Flood and Rose, 2010; and Wälti, 2009).

Table 3. *Global recoveries: macroeconomic variables (percentage change unless otherwise noted)*

Variable	1976	Average 1976–1978	1983	Average 1983–1985	1992	Average 1992–1994	2010	Average 2010–2012	Average of first years	Average of first 3 years	Average 1960–2012
Total output (PPP weighted)	5.43	4.74	2.91	3.78	1.97	1.98	5.17	4.02	3.87	3.63	3.83
Total output (market weighted)	5.15	4.57	3.00	3.88	1.61	1.58	4.25	3.25	3.50	3.32	3.44
Per capita output (PPP weighted)	3.79	3.02	1.16	2.05	0.21	0.31	3.99	2.86	2.29	2.06	2.19
Per capita output (market weighted)	3.52	2.85	1.25	2.16	-0.15	-0.10	3.07	2.09	1.92	1.75	1.81
Trade flows	10.33	7.25	2.41	4.86	5.68	5.36	13.67	7.59	8.02	6.26	6.34
Capital flows over GDP	0.85	0.07	-1.12	-0.19	2.09	2.26	4.79	-0.47	1.65	0.41	0.17
Oil consumption	6.25	4.76	-0.47	0.69	1.02	0.61	3.32	1.33	2.53	1.85	2.25
Unemployment (labour weighted)	-0.03	0.05	-0.17	-0.22	0.32	0.30	-0.18	-0.15	-0.01	0.00	0.08
Industrial production (PPP weighted)	8.08	5.93	2.10	4.17	0.89	2.23	9.48	7.25	5.14	4.37	3.41
Consumption (PPP weighted)	4.82	4.62	3.92	3.92	3.34	3.29	4.36	3.80	4.11	3.91	3.90
Investment (PPP weighted)	5.94	5.96	1.57	3.82	2.33	2.30	5.64	4.67	3.87	4.19	4.51
Per capita consumption (PPP weighted)	3.14	2.84	2.04	1.68	1.63	1.61	3.18	2.75	2.50	2.22	2.16
Per capita investment (PPP weighted)	4.26	4.19	-0.55	1.62	0.62	0.59	4.47	3.62	2.20	2.50	2.76

All variables except industrial production are in annual frequency. Industrial production is in quarterly frequency and year-over-year growth rates are annualized as the average of four quarters. Average of First 3 years column reflects the average of the 3 years following the global recessions. For industrial production and financial and other global variables average 2010–2012 column reflects the average of 2010 and 2011.

   Although the current global recovery exhibits some similarities with the previous three episodes, it is significantly different from the earlier recoveries in several dimensions. First, one of the distinguishing features of the ongoing global recovery has been its uneven nature as there have been major differences in the performance of advanced countries and emerging market economies (Table 4). Advanced countries were the engines of the previous global recoveries, but the latest episode has witnessed a role reversal between advanced and emerging economies. The latter group has accounted for the lion's share of global growth since the 2009 global recession.

   Moreover, emerging economies, as a group, enjoyed their strongest recovery to date following the 2009 global recession. Although these economies were severely affected by the collapse of global trade in 2009, they have since resumed their strong growth largely driven by buoyant domestic demand, vibrant financial markets and expansionary policies (Kose and Prasad, 2010; Leduc and Spiegel, 2013). The strong performance of emerging markets also reflects some structural improvements, such as better-regulated financial systems and stronger macroeconomic frameworks, that allowed them to pursue more credible and effective countercyclical policies. Notable exceptions are the emerging European economies, which suffered a financial shock qualitatively similar to the shock in many advanced economies.

   Second, the forecasts of economic activity, if realized, would qualify the current recovery as the weakest recovery for advanced countries during the postwar era. This reflects in part the legacy of the global financial crisis, particularly the ongoing need for balance sheet repair in the household and financial sectors. In addition, during the ongoing lethargic recovery in advanced countries, uncertainty has been high. This contrasts with the recoveries following the previous three global recessions, which were accompanied by steady declines in uncertainty (Bloom *et al.*, 2013). In a number of advanced economies, output has not rebounded yet to the levels observed prior to the global recession. Compared to the previous episodes, the growth rates of consumption and investment have also been much smaller.

3.2.3. *Synchronization of recessions and recoveries*

How synchronized are national recessions around episodes of global recessions? Not surprisingly, the fraction of countries in recession went up sharply during the four global recessions (Fig. 5). We examine the extent of synchronization measured by yearly fluctuations in the GDP-weighted fraction of countries that have experienced a decline in real per capita GDP.[14] Because countries are weighted by their PPP weights, the countries that are larger in economic size receive a greater weight in the figure. The fraction of countries in recession was approximately 50% in the first three global recessions, but

---

[14] Recent empirical studies consider how stronger global linkages affect the degree of synchronization of national business cycles. However this research program is unable to provide conclusive results (Hirata *et al.*, 2013).

Table 4. *Global recoveries: selected macroeconomic variables of country groups (Percentage change, in per capita terms)*

	1976	Average 1976–78	1983	Average 1983–85	1992	Average 1992–1994	2010	Average 2010–2012	Average of first years	Average of first 3 years	Average 1960—2012
Advanced countries											
PPP-weighted output	4.13	3.58	2.40	3.34	1.23	1.38	2.02	1.21	2.45	2.38	2.26
Market-weighted output	4.13	3.58	2.53	3.52	1.10	1.21	2.05	1.21	2.45	2.38	2.18
Emerging market countries											
PPP-weighted output	3.60	3.65	1.34	2.34	0.94	2.13	7.06	5.34	3.23	3.42	3.42
Market-weighted output	3.19	3.44	1.67	2.43	0.33	2.39	6.77	5.10	2.99	3.34	3.34
Other developing countries											
PPP-weighted output	7.45	3.42	–0.61	–0.45	–3.42	–2.19	3.20	3.39	1.65	1.04	1.87
Market-weighted output	6.53	3.12	–1.25	–0.81	–5.55	–2.72	2.94	3.29	0.67	0.72	1.52

See notes for Table 3.
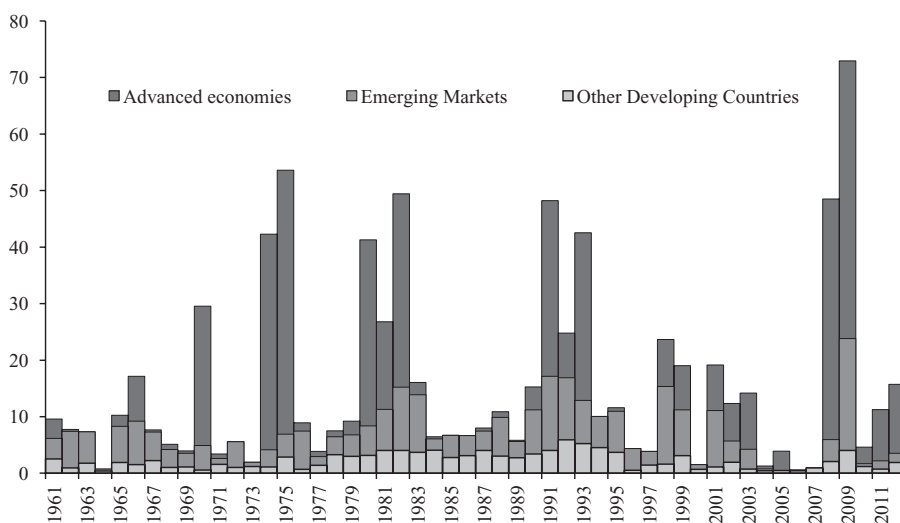
Figure 5. Synchronization of global recessions (purchasing power parity-weighted percent of countries)
Notes: This figure shows the purchasing power parity-weighted fraction of countries in recession where a recession is defined as the negative growth in domestic GDP.

went up to more than 75% in the latest episode. We also consider a measure simply tracking the fraction of countries in recession in every year. This also suggests that the fraction of countries in recession reached a local maxima during global recession years. In all global recession episodes, the fraction of countries in recession started picking up ahead of the recession year. During the two global downturns (1997 and 2001), the fraction of countries in recession was relatively low.

Although the 1975 recession was driven largely by declines in advanced countries, emerging and developing countries have played a role in the other three episodes. In 1982, recessions in many Latin American countries contributed to the decline in global activity, whereas in 1991 declines in the transition economies played an important role. The 1991 recession was a multiyear episode in which the US recession in 1990–1991 was followed by recessions among European countries during the ERM crisis. In both the 1982 and 1991 episodes, the fraction of countries in recession stayed elevated in the aftermath of the global recession.

The 2006–2007 period stands out as one in which the number of countries in recession was at a historical low. However, it has been followed by a sharp reversal in fortune. In 2009, all the advanced economies, except Australia, and roughly half the emerging market and developing countries were in recession. The degree of synchronicity of the last recession is the highest over the past half

century, possibly reflecting much stronger international trade and financial linkages during the latest episode than the earlier ones. Even though it is clearly driven by sharp declines in activity in advanced economies, recessions in a number of emerging and developing countries contributed to the depth and extent of synchronicity of the latest episode.

Our finding of the highest degree of business cycle synchronization during the latest episode is consistent with the results reported by Imbs (2010) and Lam and Yetman (2013). For example, using monthly industrial production data, Imbs (2010) concludes that the degree of cross-country business cycle correlations during the latest crisis has been the highest over the past three decades. Recent research indicates that shocks originating in credit markets have been influential in driving global activity during global recessions (Perri and Quadrini, 2010; Helbling *et al.*, 2011).

4.   LINKAGES BETWEEN NATIONAL BUSINESS CYCLES AND THE GLOBAL CYCLE

Our analysis of global recessions and recoveries points to three broad observations about the linkages between national business cycles and the global cycle. First, the global cycle behaves significantly differently over the periods of recessions and recoveries: the average decline in world per capita output is approximately 0.7% (roughly 3 percentage points lower than its average) during global recessions, whereas the average growth of world per capita output is 2.3% during global recoveries. Second, national growth outcomes differ substantially across the different phases of the global business cycle. Third, the fraction of countries in recession increases significantly when there is a global recession. Finally, growth performances of different country groups vary considerably over the global cycle, implying that the sensitivity of national cycles to the global cycle depends on the phase of the global cycle.

In light of these observations, we now turn to a formal analysis of the linkages between the national business cycles and the global cycle. As we noted in the introduction, there has been a sizeable literature studying these linkages from different perspectives. This section contributes to this research program by analysing these linkages during different phases of the global cycles. Specifically, we would like to understand whether the sensitivity of national cycles differs across these phases. We also study how the sensitivity to the global cycle varies across different country groups, and how it is influenced by various country-specific features.

To structure our analysis of the linkages between the national cycles and the global cycle, we ask two basic questions. First, how important is the global cycle for national cycles? Second, do country-specific features affect the sensitivity of national cycles to the global cycle? We present here a preliminary analysis of these questions. There are obviously many extensions to consider and we provide a discussion of some of these in the concluding section.

4.1. *How important is the global cycle for national cycles?*

Table 5 examines the relationship between national cycles (captured by per capita output growth in country *i*) and the global cycle (per capita output growth in the rest of the world) during the two phases of the global cycle (global recessions and expansions) and the full-time period.[15] When we examine the relationship for the full sample, we consider interaction terms to check whether the results from the full sample are consistent with those from the separate regressions for recessions and expansions.

There is a positive and statistically significant association between national output growth and the rest of the world growth, implying that national cycles move in tandem with the global cycle (first row). However, the nature of this relationship seems more subtle than it can be captured by a linear specification as it varies over the two phases of the global cycle. In particular, national cycles tend to be much more sensitive to the global cycle during recessions than they are during expansions (columns 1, 3, 4, 6 and 11). A 1-percentage point increase in global growth is associated with a 0.7-percentage point increase in the national growth rate during global expansion, whereas it is associated with a 1.4-percentage point increase during global recessions. These findings imply that the impact of the global cycle on national cycles is much more pronounced during global recessions than during expansions.[16]

There appears to be a negative association between the national cycles and the world real interest rate (column 11). This relationship, however, differs across the two phases of the global cycle. During global expansions, it is negative and statistically significant, whereas during global recessions, it is slightly positive but insignificant (columns 3, 6 and 11). A 1-percentage point increase in the world real interest rate during a global expansion is associated with a 0.12-percentage point decrease in the growth rate of these countries. These links, however, weaken substantially during global recessions as lenders retrench their lending activities, including for international trade.[17]

The nature of linkages between the national cycle and the global cycle appear to vary across different country groups (Table 6). In particular, both the advanced and emerging market economies are more sensitive to the global business cycle during global recessions than are the other developing countries (columns 5, 10 and 15). During global recessions, a 1-percentage point decline in

---

[15] We focus on the two phases of the business cycle, recessions and expansions, to avoid including many cyclical dummies in the regression analysis. When we run the regressions with dummies of recessions and recoveries, broadly similar results are obtained.

[16] It is important to note that the models we employ here imply no adding up constraint with respect to the global growth for the following reasons. First, the rest of the world growth on the right side of the regressions is country specific, so it changes from country-to-country. Second, the world growth is not a simple average of the country growth rates. It is a PPP weighted average of country-specific growth rates.

[17] Forbes and Warnock (2011) find evidence that global factors are key drivers of waves of international capital flows. These factors become especially important during global recessions (as in the Great Recession), as foreign investors tend to retrench their bank and equity positions. Milesi-Ferretti and Tille (2011) report that countries with large pre-crisis debt positions (asset and liabilities) were affected more at the height of the 2009 global financial crisis.

Table 5. Linkages between national and global cycles: All countries

	Global recessions			Global expansions			Full sample				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Output growth (lagged)	0.395***	0.370***	0.411***	0.285***	0.291***	0.282***	0.289***	0.293***	0.286***	0.286***	0.287***
	[0.071]	[0.075]	[0.077]	[0.039]	[0.040]	[0.039]	[0.037]	[0.038]	[0.037]	[0.037]	[0.037]
Rest of the world output growth	1.373***		1.463***	0.728***		0.717***	0.725***		0.717***	0.735***	0.714***
	[0.232]		[0.248]	[0.060]		[0.061]	[0.060]		[0.060]	[0.061]	[0.060]
Rest of the world output growth × Global recession dummy							0.507**		0.422*		0.557**
							[0.236]		[0.233]		[0.244]
Real Libor rate		−0.005	0.081		−0.135***	−0.117***		−0.135***	−0.091***	−0.117***	−0.117***
		[0.063]	[0.067]		[0.033]	[0.034]		[0.033]	[0.032]	[0.034]	[0.034]
Real Libor rate × Global recession dummy								0.113*		0.131**	0.159***
								[0.057]		[0.058]	[0.060]
Global recession dummy							0.089	−2.864***	−0.022	−0.527*	−0.231
							[0.315]	[0.279]	[0.312]	[0.274]	[0.312]
Constant	−0.002	−0.970***	−0.112	−0.013	2.065***	0.262	−0.016	2.060***	0.200	0.210	0.258
	[0.173]	[0.204]	[0.209]	[0.187]	[0.114]	[0.205]	[0.178]	[0.105]	[0.200]	[0.200]	[0.196]
Number of observations	382	382	382	4197	4197	4197	4579	4579	4579	4579	4579
Number of countries	97	97	97	97	97	97	97	97	97	97	97
R2 Adjusted	0.15	0.096	0.152	0.133	0.101	0.136	0.16	0.13	0.16	0.16	0.16

The dependent variable is the growth rate of per capita real GDP in each country. Robust and clustered standard errors in brackets. ***, ** and * denote significance at 1, 5 and 10% levels, respectively. All regressions include fixed effects.

Table 6. Linkages between national and global cycles: country groups

	Advanced countries					Emerging markets					Developing countries				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Output growth (lagged)	0.291*** [0.077]	0.269*** [0.078]	0.258*** [0.077]	0.270*** [0.077]	0.260*** [0.077]	0.276*** [0.043]	0.275*** [0.041]	0.271*** [0.043]	0.270*** [0.043]	0.271*** [0.043]	0.292*** [0.057]	0.291*** [0.058]	0.281*** [0.057]	0.282*** [0.056]	0.282*** [0.057]
Rest of the world output growth	0.660*** [0.068]		0.683*** [0.067]	0.724*** [0.073]	0.681*** [0.067]	0.693*** [0.089]		0.684*** [0.088]	0.709*** [0.093]	0.682*** [0.088]	0.778*** [0.109]		0.759*** [0.110]	0.760*** [0.110]	0.755*** [0.110]
Rest of the world output growth × Global recession dummy	0.925*** [0.304]		1.232*** [0.313]		1.328*** [0.326]	0.730* [0.393]		0.602 [0.385]		0.691 [0.411]	0.187 [0.430]		-0.028 [0.421]		0.156 [0.435]
Real Libor rate		0.213*** [0.025]	0.252*** [0.028]	0.234*** [0.027]	0.235*** [0.027]		-0.185*** [0.052]	-0.153*** [0.046]	-0.172*** [0.052]	-0.173*** [0.052]		-0.267*** [0.046]	-0.212*** [0.046]	-0.246*** [0.047]	-0.247*** [0.047]
Real Libor rate × Global recession dummy		0.012 [0.100]		0.032 [0.103]	0.103 [0.107]		0.066 [0.100]		0.087 [0.101]	0.120 [0.106]		0.188** [0.091]		0.203** [0.091]	0.211** [0.094]
Global recession dummy	-0.525 [0.566]	-3.300*** [0.429]	-0.223 [0.575]	-0.996* [0.512]	-0.354 [0.612]	0.365 [0.594]	-2.628*** [0.474]	0.193 [0.593]	-0.357 [0.501]	0.03 [0.568]	0.210 [0.479]	-2.825*** [0.476]	-0.052 [0.475]	-0.410 [0.424]	-0.327 [0.475]
Constant	0.197 [0.246]	1.464*** [0.164]	-0.315 [0.240]	-0.410 [0.238]	-0.280 [0.236]	0.614** [0.236]	2.729*** [0.182]	0.975*** [0.263]	0.955*** [0.268]	1.018*** [0.262]	-0.530* [0.290]	1.944*** [0.133]	-0.029 [0.342]	0.037 [0.337]	0.051 [0.333]
N of observations	1050	1050	1050	1050	1050	1432	1432	1432	1432	1432	2097	2097	2097	2097	2097
Number of countries	21	21	21	21	21	30	30	30	30	30	46	46	46	46	46
R2 Adjusted	0.306	0.257	0.344	0.336	0.344	0.148	0.121	0.154	0.153	0.154	46	46	46	46	46

The dependent variable is the growth rate of per capita real GDP. Robust and clustered standard errors in brackets. ***, **, and * denote significance at 1, 5 and 10% levels, respectively. All regressions include fixed effects.

global growth is associated with a 1.4 to 2-percentage point decrease in the national growth rate in the advanced and emerging economies compared with only a 1-percentage point decrease for the group of developing countries. These results are intuitively appealing and consistent with those from earlier studies analysing the importance of global and national factors in explaining business cycles in different country groups. For example, earlier studies also report that global factors tend to play a more important role in driving domestic cycles in advanced and emerging market countries than they do in other developing economies (Kose *et al.*, 2012).

The sensitivity of national cycles to the world interest rates also differ across country groups (columns 5, 10 and 15). In the case of advanced countries, the national cycles tend to move with the global interest rate cycle as there is a statistically significant positive association between the domestic growth and the world real interest rate. However, in the case of emerging markets and other developing countries, the national cycles tend to move in the opposite direction of the world interest rate cycle during global expansions (as indicated by the statistically significant negative association between the national growth and the world real interest rate). For example, a 1-percentage point increase in the world real interest rate during a global expansion is associated with a 0.17 (0.25) percentage point decrease in the national growth rate of the emerging market (other developing countries). In contrast, an increase in the world real interest rate during global recessions has a negative but statistically insignificant effect on the growth of these country groups.

These results are likely to reflect that interest rate shocks have differential effects on the business cycle of debtor and creditor countries. While there has been a role reversal in recent years, advanced countries tended to be creditors and emerging markets and other developing countries were debtors during most of the time period we study here.[18] One of the most important factors encouraging capital flows to the developing countries over the past two decades has been the sustained decline in interest rates in advanced countries, a proxy for the world interest rate. Lower world interest rates lead investors in advanced economies to search for higher yield in the emerging and developing countries.

4.2. *Do country-specific features affect the sensitivity of national cycles to the global cycle?*

Both trade and financial integration appear to influence the sensitivity of national cycles to the global cycle and the world interest rate (Table 7). The national cycle is more sensitive to the global business cycle in countries that are more open to trade flows (column 2). The intensity of this empirical relationship, however, varies over the two phases of the global cycle (columns 3 and 6). A 1-percentage point increase in the global growth is associated with a 0.66-percentage point increase in the national growth rate during a global expansion

---

[18] The negative effect in the full sample seems to reflect the fact that the number of observations involving debtor countries is larger than that of creditor countries.

Table 7. Linkages between national and global business cycles: roles of trade and financial integration

	(1)	(2)	(3)	(4)	(5)	(6)
Output growth (lagged)	0.265***	0.265***	0.266***	0.264***	0.265***	0.265***
	[0.0367]	[0.0366]	[0.0367]	[0.0368]	[0.0369]	[0.0368]
Rest of the world output growth	0.774***	0.567***	0.520***	0.772***	0.659***	0.512***
	[0.0565]	[0.0792]	[0.0748]	[0.0568]	[0.0569]	[0.0752]
Real Libor rate	−0.123***	−0.123***	−0.142***	−0.159***	−0.192***	−0.191***
	[0.0351]	[0.0351]	[0.0359]	[0.0417]	[0.0436]	[0.0433]
Trade openness (lagged)	1.204**	0.666	0.985	1.166**	1.397**	0.948
	[0.584]	[0.605]	[0.621]	[0.564]	[0.593]	[0.599]
Financial openness (lagged)	−0.249***	−0.264***	−0.253***	−0.232***	−0.218***	−0.231***
	[0.0479]	[0.0525]	[0.0501]	[0.0512]	[0.0498]	[0.0537]
Rest of the world output growth × Trade openness		0.272***	0.210***			0.208***
		[0.0837]	[0.0670]			[0.0667]
Rest of the world output growth × Global recession dummy			0.875***		1.103***	0.925***
			[0.302]		[0.319]	[0.305]
Real Libor rate × Global recession dummy			0.157**		0.196***	0.182**
			[0.0725]		[0.0739]	[0.0739]
Real Libor rate × Financial openness				0.0292*	0.0380**	0.0377**
				[0.0169]	[0.0177]	[0.0174]
Global recession dummy			−0.145		−0.127	−0.192
			[0.386]		[0.389]	[0.386]
Constant	−0.344	0.0881	0.120	−0.330	−0.179	0.154
	[0.419]	[0.428]	[0.441]	[0.404]	[0.418]	[0.421]
N of observations	3465	3465	3465	3465	3465	3465
Number of countries	97	97	97	97	97	97
R2 Adjusted	0.603	0.597	0.570	0.610	0.555	0.564

The dependent variable is the growth rate of per capita real GDP in each country. ***, ** and * denote significance at 1, 5 and 10% levels, respectively. All regressions include fixed effects.

for a country if its degree of trade openness is equal to the sample mean (0.72). Likewise, a 1-percentage point decrease in global growth is associated with 1.57-percentage point decrease in the national growth rate during a global recession for a country if its degree of trade openness is equal to the sample mean. Thus, in countries that are more open to trade flows, the national cycle is more sensitive to the global cycle. These results are consistent with those from recent studies analysing the impact of the latest global recession on output growth (Lane and Milesi-Ferretti, 2011).

The statistically significant negative association between the national cycle and the global interest rate cycle during global expansions remains intact when we introduce additional integration variables into our regressions, but this association becomes weaker in countries with stronger international financial linkages (columns 4–6). This buffer, however, is not large as a 1-percentage point increase in the world interest rate is associated with a reduction in the national output growth during a global expansion by 0.13 percentage points for a country if its degree of financial openness is equal to the sample mean (1.60). This result is easy to explain because countries with stronger financial linkages tend to attract a diverse set of capital flows, including foreign direct investment and portfolio investment, whereas those weaker linkages often rely on debt flows that are sensitive to movements in world interest rates.

In summary, the inclusion of variables measuring a country's integration to the global economy to our baseline regressions does not change the positive association between the national cycle and the global cycle. Increased trade integration tends to accentuate the sensitivity of national cycles to the global cycle, whereas increased financial integration helps shield national growth from fluctuations in world interest rates during global expansions.

5. CONCLUSION

Our understanding of the interactions between the global business cycle and national cycles has been quite limited. However, this issue has become increasingly more important after the deepest recession the global economy experienced in 2009 and the fragile recovery following this episode. Earlier studies have often focused on the impact of business cycle fluctuations in advanced economies on the growth performance of emerging and developing countries.

This paper examines the linkages between the global cycle and national business cycles. Specifically, it considers how the sensitivity of national cycles to the global cycle varies over different phases of the global cycle and depends on country-specific features. Our empirical approach involves two steps. We first consider the evolution of global business cycles, identify the periods of global recessions and recoveries, and study the dynamics of growth around global recessions and recoveries using an extensive database of macroeconomic variables of around 180 countries covering more than half a century. We then present an empirical evaluation of the linkages between the global cycle and national cycles using panel regressions.

The first step of our exercise reveals a number of valuable observations about the evolution of the global cycle during recessions and recoveries. First, the world economy experienced four global recessions over the past half century: 1975, 1982, 1991, and 2009. The average decline in world per capita output is approximately 0.7% – roughly 3 percentage points lower than its average – during these episodes. In addition, global recessions often feature concomitant declines in a wide range of activity variables, including employment, industrial production, trade, capital flows, and energy consumption. A significant fraction of countries experience contractions in output when there is a global recession.

Second, global recoveries are often accompanied by a rebound in activity, which is generally associated with a synchronized pickup in worldwide consumption, investment, and trade. The average growth of world per capita output is 2.3% during global recoveries. Moreover, the results of the first step of our analysis collectively indicate that the global cycle behaves significantly differently over the periods of recessions and recoveries. This implies that the sensitivity of national cycles to the global cycle depends on the phase of the global cycle.

We then turn to our empirical investigation of the linkages between the global and national cycles. Our baseline regression model reflects that national cycles are influenced by external and domestic factors. Our empirical analysis also consider the roles played by time varying country-specific features, such as the extent of trade and financial linkages with the global economy, in explaining the sensitivity of national cycles to the global cycle. In addition, it controls for country fixed effects that can stem from differences in institutions, structural factors, and initial conditions.

Our results collectively portray an intricate liaison between the global cycle and national cycles. As one would expect, we find that national business cycles are tightly linked to the global business cycle. However, the strength of this linkage varies significantly over the cycle as national cycles are more sensitive to developments in the global economy during global recessions than during global expansions. There are significant differences across groups of countries in how they respond to the global cycle as advanced countries appear to be more sensitive to global recessions than are developing economies. Moreover, countries tend to be more sensitive to the global cycle, the more integrated they are to the global economy.

It is important to have a disciplined approach to the study of linkages between the global cycle and national business cycles. First, as our results show, global recessions are highly synchronized and costly episodes. Hence, a disciplined approach to the study of linkages between the global cycles and national cycles can help improve the design of policies to prevent the occurrence of such global events and mitigate their adverse effects on national economies when they materialize.

Moreover, our results also indicate that the linkages between the global cycle and national business cycles are quite complex requiring different types of policy considerations. When a country faces an isolated recession, it is simply subject to an idiosyncratic shock. The country can employ a wide range of policy tools,

if it has the policy space, to cope with a domestic recession. However, when a global recession takes place, it often means national economies are subject to a global shock. In addition, national cycles become more sensitive to global activity during episodes of global recessions that often coincide with adverse global shocks as we document above. This requires the coordination of national policies to dampen the impact of the global recession on national economies. The coordination of policies can take different forms. First, even if the shock is global, the policy space that countries have differs suggesting that those with larger policy space can employ more accommodating policies. Second, the necessity to avoid beggar-thy-neighbor policies, such as trade protectionism, becomes even more relevant during global recessions.

Our findings suggest that we need to dig deeper to improve our understanding of the complex linkages between the global cycle and national cycles. We consider two possible avenues for future research. First, it is important to present an extensive analysis of the implications of global recessions and global downturns for national cycles. We just documented the basic features of these episodes, but a more detailed study that provides a more comprehensive characterization of the behaviour of the global economy around these episodes can potentially improve our ability to forecast the turning points of the global business cycle, and help improve our understanding of the adverse impact of global recessions on national cycles.

Another natural topic to explore in future research is how and why certain countries are affected more than the others by the global business cycle.[19] Specifically, it would be useful to undertake a deeper analysis of differential effects of the global and national shocks and structural features of countries, including their linkages with the global economy through different types of trade and financial flows, on the interactions between the global business cycle and national cycles. For example, the role played by the global business cycle in explaining national cycles in different country groups (commodity exporters vs. manufacturing goods exporters; debtor countries vs. creditor countries) is a promising topic to investigate further. We plan to study these issues in our future research.

REFERENCES

Akin, C. and M. A. Kose (2008) 'Changing Nature of North–South Linkages: Stylized Facts and Explanations', *Journal of Asian Economics* 19, 1–28.
Arora, V. and A. Vamvakidis (2004) 'How Much Do Trading Partners Matter for Economic Growth?', Working Paper 04/26, International Monetary Fund, Washington, DC.
Balke, N. S. and M. A. Wynne (1995) 'Recessions and Recoveries in Real Business Cycle Models', *Economic Inquiry* 33, 640–63.
Berkmen, P., G. Gelos, R. Rennhack and J. P. Walsh (2009) 'The Global Financial Crisis: Explaining Cross-Country Differences in the Output Impact', Working Paper No. 09/280, International Monetary Fund, Washington, DC.

[19] A number of recent studies have examined the reasons for cross-country differences in the impact of the latest global recession (Berkmen *et al.*, 2009; Blanchard *et al.*, 2010; Rose and Spiegel, 2010, 2011; Lane and Milesi-Ferretti, 2011; Giannone *et al.*, 2011).

Blanchard, O., H. Faruqee and M. Das (2010) 'The Initial Impact of the Crisis on Emerging Market Countries', *Brookings Papers on Economic Activity* Spring, 263–323.

Bloom, N., M. A. Kose and M. Terrones (2013) 'Held Back by Uncertainty', *Finance & Development* 50, 38–41.

Bond, S., A. Leblebicioglu and F. Schiantarelli (2010) 'Capital Accumulation and Growth: A New Look at the Empirical Evidence', *Journal of Applied Econometrics* 25, 1073–99.

Bruno, G. S. F. (2005) 'Estimation and Inference in Dynamic Unbalanced Panel-Data Models with A Small Number of Individuals', *Stata Journal* 5, 473–500.

Bry, G. and C. Boschan (1971) *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs.* New York: NBER.

Burns, A. F. and W. C. Mitchell (1946) *Measuring Business Cycles.* New York: National Bureau of Economic Research.

Calvo, G. A., C. Reinhart, E. Fernández-Arias and E. Talvi (2001) 'Growth and External Financing in Latin America', RES Working Paper No. 4277, Inter-American Development Bank, Research Department.

Claessens, S., M. A. Kose and M. Terrones (2012) 'How do Business and Financial Cycles Interact?', *Journal of International Economics* 87, 178–90.

Claessens, S., M. A. Kose and M. E. Terrones (2011) 'Financial Cycles: What? How? When?', Center for Economic Policy Research Discussion Paper No. 8379.

Dooley, M. and M. Hutchison (2009) 'Transmission of the U.S. Subprime Crisis to Emerging Markets: Evidence on the Decoupling–Recoupling Hypothesis', *Journal of International Money and Finance* 28, 1331–49.

Dornbusch, R. (1985) 'Intergenerational and International Trade', *Journal of International Economics* 18, 123–39.

Eckstein, O. and A. Sinai (1986) 'The Mechanisms of the Business Cycle in the Postwar Era', in R. Gordon (ed.), *The American Business Cycle: Continuity and Change*, London: University of Chicago Press for NBER.

Fidrmuc, J. and I. Korhonen (2010) 'The Impact of Global Financial Crisis on Business Cycles in Asian Emerging Economies', *Journal of Asian Economies* 21, 293–303.

Flood, R. P. and A. K. Rose (2010) 'Inflation Targeting and Business Cycle Synchronization', *Journal of International Money and Finance* 29, 704–27.

Forbes, K. J. and F. E. Warnock (2011) 'Capital Flows Waves: Surges, Stops, Flight, and Retrenchment', National Bureau of Economic Research Working Paper No. 17351.

Frankel, J. A. and N. Roubini (2001) 'The Role of Industrial Country Policies in Emerging Market Crises', National Bureau of Economic Research Working Papers No. 8634.

Garcia, R. and H. Schaller (2002) 'Are the Effects of Monetary Policy Asymmetric?', *Economic Inquiry* 40, 102–19.

Giannone, D., M. Lenza and L. Reichlin (2011) 'Market Freedom and the Global Recession', *IMF Economic Review* 59, 111–35.

Harding, D. and A. Pagan (2002a) 'Dissecting the Cycle: A Methodological Investigation', *Journal of Monetary Economics* 49, 365–81.

He, D., L. Cheung and J. Chang (2007) 'Sense and Nonsense on Asia's Export Dependency and the Decoupling Thesis', Working Paper No. 0703, Hong Kong Monetary Authority.

Helbling, T., P. Berezin, M. A. Kose, M. Kumhof, D. Laxton and N. Spatafora (2007) 'Decoupling the Train? Spillovers and Cycles in the Global Economy', Chapter 4, April, *World Economic Outlook*, Washington: International Monetary Fund.

Helbling, T., R. Huidrom, M. A. Kose and C. Otrok (2011) 'Do Credit Shocks Matter? A Global Perspective', *European Economic Review* 55, 340–53.

Hirata, H., M. A. Kose and C. Otrok (2013) 'Globalization vs. Regionalization', IMF Working Paper No: 13/19.

Hoffmaister, A., M. Pradhan and H. Samiei (1998) 'Have North-South Growth Linkages Changed?', *World Development* 26, 791–808.

Imbs, J. (2010) 'The First Global Recession in Decades', Working Paper Paris School of Economics.

International Monetary Fund (2001) 'How do Fluctuations in the G-7 Countries Affect Developing Countries?', *World Economic Outlook*, Chapter 2: International Linkages, Three Perspectives, Washington: International Monetary Fund.

Judson, R. A. and A. L. Owen (1999) 'Estimating Dynamic Panel Data Models: A Guide for Macroeconomists', *Economics Letters* 65, 9–15.

Karras, G. (1996) 'Are the Output Effects of Monetary Policy Asymmetric? Evidence from A Sample of European Countries', *Oxford Bulletin of Economics and Statistics* 58, 267–78.

Kose, M. A. (2002) 'Explaining Business Cycles in Small Open Economies: "How Much Do World Prices Matter?" ', *Journal of International Economics* 56, 299–327.

Kose, M. A., C. Otrok and E. Prasad (2012) 'Global Business Cycles: Convergence or Decoupling?', *International Economic Review* 53, 511–38.

Kose, M. A. and E. Prasad (2010) *Emerging Markets: Resilience and Growth Amid Global Turmoil*. Washington, DC: Brookings Institution Press.

Kose, M. A. and M. Terrones (2013) *Understanding Global Recessions and Recoveries*. Washington, DC: IMF Publications, forthcoming.

Lam, L. and J. Yetman (2013) 'Asia's Decoupling: Fact, Fairytale Or Forecast?', *Pacific Economic Review* 18, 338–61.

Lane, P. R. and G. M. Milesi-Ferretti (2011) 'The Cross-Country Incidence of the Global Crisis', *IMF Economic Review* 59, 77–110.

Leduc, S. and M. M. Spiegel (2013) 'Is Asia Decoupling from the United States (Again)?', *Pacific Economic Review* 18, 362–86.

Lewis, A. (1980) 'The Slowing Down of the Engine of Growth', *American Economic Review* 70, 555–64.

Milesi-Ferretti, G. M. and C. Tille (2011) 'The Great Retrenchment: International Capital Flows during the Global Financial Crisis', *Economic Policy* 26, 285–342.

Mussa, M. (2009) 'World Recession and Recovery: A V or an L?' Working Paper, Peterson Institute for International Economics.

Neumeyer, P. A. and F. Perri (2005) 'Business Cycles in Emerging Economies: The Role of Interest Rates', *Journal of Monetary Economics* 52, 345–80.

Pagan, A. R. and K. A. Sossounov (2003) 'A Simple Framework for Analysing Bull and Bear Markets', *Journal of Applied Econometrics* 18, 23–46.

Perri, F. and V. Quadrini (2010) 'International Recessions', Working Paper, University of Minnesota.

Rose, A. K. and M. M. Spiegel (2010) 'Cross-Country Causes and Consequences of the 2008 Crisis: International Linkages and American Exposure', *Pacific Economic Review* 15, 340–63.

Rose, A. K. and M. M. Spiegel (2011) 'Cross-Country Causes and Consequences of the Crisis: An Update', *European Economic Review* 55, 309–24.

Rossi, V. (2009) 'Decoupling Debate Will Return: Emergers Dominate in Long Run', Briefing Note IEP EN 08/01, Chatham House, London.

Sensier, M., D. R. Osborn and N. Ocal (2002) 'Asymmetric Interest Rate Effects for the UK Real Economy', *Oxford Bulletin of Economics and Statistics* 64, 315–39.

Sichel, D. E. (1994) 'Inventories and the Three Phase of the Business Cycle', *Journal of Business & Economic Statistics* 12, 269–77.

Wälti, S. (2009) 'The Myth of Decoupling', Working Paper, Swiss National Bank.

APPENDIX: COUNTRY COVERAGE

Functional country groups					
Advanced economies (24 countries)	Emerging markets (30 countries)	Other developing countries (109 countries)			
Australia†	Argentina†	Afghanistan	Djibouti	Lesotho†	Serbia
Austria†	Brazil†	Algeria	Dominica	Liberia	Seychelles
Belgium†	Chile†	Antigua and Barbuda	Dominican Republic†	Libya	Slovak Republic†
Canada†	China: Mainland†	Armenia	Ecuador†	Lithuania†	Slovenia†
Cyprus	China: Hong Kong†	Azerbaijan, Rep. of	El Salvador†	Macedonia, FYR†	Sri Lanka†
Denmark†	Colombia†	Bahamas, The	Eritrea	Madagascar†	St. Kitts and Nevis
Finland†	Costa Rica†	Bahrain, Kingdom of	Estonia†	Malawi†	St. Lucia
France†	Czech Republic†	Bangladesh†	Ethiopia	Maldives	St. Vincent & Grens.
Germany†	Egypt†	Barbados	Fiji	Mali†	Sudan
Greece†	Hungary†	Belarus†	Gabon	Malta	Suriname
Iceland	India†	Benin†	Georgia	Mauritius†	Syrian Arab Republic
Ireland†	Indonesia†	Bhutan	Ghana†	Moldova	Sao Tome and Principe
Italy†	Israel†	Bolivia†	Grenada	Montenegro, Rep. of	Tajikistan
Japan†	Jordan†	Bosnia and Herzegovina	Guatemala†	Mozambique†	Tanzania†
Luxembourg	Korea†	Botswana	Guinea	Myanmar	Timor-Leste, Dem. Rep. of
Netherlands†	Malaysia†	Brunei Darrusalam	Guinea-Bissau	Namibia†	Tonga
New Zealand†	Mexico†	Bulgaria†	Guyana	Nicaragua	Trinidad and Tobago†
Norway†	Morocco†	Burkina Faso†	Haiti	Niger†	Tunisia†
Portugal†	Pakistan†	Burundi	Honduras†	Nigeria	Turkmenistan
Spain†	Peru†	Cambodia	Iran, I.R. of	Oman	United Arab Emirates
Sweden†	Philippines†	Cameroon†	Jamaica†	Papua New Guinea†	Uruguay†
Switzerland†	Poland†	Cape Verde	Kazakhstan†	Paraguay†	Uzbekistan†
United Kingdom†	Russia†	Central African Rep.†	Kenya†	Qatar	Vanuatu
United States†	Singapore†	Congo, Dem. Rep. of	Kiribati	Romania†	Vietnam†
	South Africa†	Congo, Republic of†	Kyrgyz Republic†	Rwanda	Yemen, Republic of
	Taiwan Prov. of China†	Côte d'Ivoire	Lao People's Dem. Rep	Samoa	Zambia
	Thailand†	Croatia	Latvia†	Saudi Arabia†	Zimbabwe
	Turkey†			Senegal†	
	Ukraine†				
	Venezuela, Rep. Bol.†				

†Indicates that the countries are in the sample for regressions.