



WP/03/27

# IMF Working Paper

---

## How Does Globalization Affect the Synchronization of Business Cycles?

*M. Ayhan Kose, Eswar S. Prasad, and  
Marco E. Terrones*

## IMF Working Paper

Western Hemisphere Department, Asia and Pacific Department, and Research Department

### How Does Globalization Affect the Synchronization of Business Cycles?

Prepared by M. Ayhan Kose, Eswar S. Prasad, and Marco E. Terrones<sup>1</sup>

January 2003

#### Abstract

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

This paper examines the impact of rising trade and financial integration on international business cycle comovement among a large group of industrial and developing countries. The results provide at best limited support for the conventional wisdom that globalization has increased the degree of synchronization of business cycles. The evidence that trade and financial integration enhance global spillovers of macroeconomic fluctuations is stronger for industrial countries. One striking result is that, on average, cross-country consumption correlations have not increased in the 1990s, precisely when financial integration would have been expected to result in better risk-sharing opportunities, especially for developing countries.

JEL Classification Numbers: E32, F41, F42

Keywords: Macroeconomic fluctuations; trade and financial integration; output and consumption comovement.

Author's E-Mail Addresses: [akose@imf.org](mailto:akose@imf.org), [epasad@imf.org](mailto:epasad@imf.org), [mterrones@imf.org](mailto:mterrones@imf.org)

---

<sup>1</sup> This paper was prepared for an invited session of the 2003 annual meetings of the American Economic Association and will be published in the May 2003 Papers and Proceedings volume of the *American Economic Review*. We are grateful to Cesar Calderon, Frank Diebold, Hideaki Hirata, and Henry Kim for useful suggestions.

	Contents	Page
I.	Introduction.....	3
II.	What Do We Learn from Economic Theory?.....	3
III.	Data and Methods .....	4
IV.	Correlations.....	5
V.	Regression Analysis.....	6
VI.	Conclusions.....	8
	References.....	13
 Tables		
1.	Correlations with “World” Macroeconomic Aggregates.....	10
2.	Share of Variance Explained by the Common Factor .....	11
3.	Determinants of Correlations.....	12

## I. INTRODUCTION

The phenomenon of globalization, which refers to the rising trade and financial integration of the world economy, has gathered steam in recent decades. The growth rate of world trade has been greater than that of world output in almost all years since 1960 and the cumulative increase in the volume of world trade is almost three times larger than that of world output over this period. A more dramatic element in the process of globalization has been the surge in cross-border capital flows over the last two decades. Since the early 1980s, capital flows have jumped from less than 5 percent to approximately 20 percent of GDP for advanced countries. For emerging markets, capital flows have increased almost fourfold over the same period, and now account for roughly 5 percent of GDP in these economies.<sup>2</sup>

What is the impact of these changes on the synchronization of business cycles across countries? In this paper, we attempt to address this question by systematically examining the impact of increased trade and financial integration on international business cycle comovements. In particular, we analyze the patterns of correlations for industrial as well as developing countries within a unified empirical framework. We also examine the effects of different aspects of globalization for output as well as consumption comovement across countries.

## II. WHAT DO WE LEARN FROM ECONOMIC THEORY?

Economic theory does not provide definitive guidance concerning the impact of increased trade and financial linkages on the degree of business cycle synchronization.<sup>3</sup> International trade linkages generate both demand and supply-side spillovers across countries. For example, on the demand side, an investment or consumption boom in one country can generate increased demand for imports, boosting economies abroad. Through these types of spillover effects, stronger international trade linkages can result in more highly correlated business cycles across countries. However, trade flows could also induce increased specialization of production resulting in changes in the nature of business cycle correlations. If stronger trade linkages are associated with increased inter-industry specialization across countries, and industry-specific shocks are important in driving business cycles, then international business cycle comovement might be expected to decrease.

Financial linkages could result in a higher degree of business cycle synchronization by generating large demand side effects. For instance, if consumers from different countries have a significant fraction of their investments in a particular stock market, then a decline in that stock market could induce a simultaneous decline in the demand for consumption and

---

<sup>2</sup> Prasad, Wei, and Kose (2003) examine the increase in global trade and financial linkages.

<sup>3</sup> See Kose and Yi (2002) for a discussion about the theoretical impact of increasing trade integration on business cycle comovement. See Heathcote and Perri (2002) for the implications of increasing financial linkages on cross-country business cycle correlations.

investment goods in these countries. Furthermore, contagion effects that are transmitted through financial linkages could also result in heightened cross-country spillovers of macroeconomic fluctuations.

International financial linkages could stimulate specialization of production through the reallocation of capital in a manner consistent with countries' comparative advantage in the production of different goods. Such specialization of production, which could result in more exposure to industry- or country-specific shocks, would typically be expected to be accompanied by the use of international financial markets to diversify consumption risk. This implies that financial integration, in particular, should result in stronger comovement of consumption across countries. This effect would be expected to be stronger for developing countries that are typically less diversified in terms of their endowment and production structures and have intrinsically more volatile output, implying that their potential gains from international risk sharing are even greater than for industrial countries.

### III. DATA AND METHODS

Our empirical analysis is based on annual data over the period 1960–99 for a sample of 76 countries—21 industrial and 55 developing.<sup>4</sup> Per capita real GDP and real private consumption constitute the measures of national output and consumption, respectively. We use two measures of trade openness—a (binary) measure of restrictions on current account transactions and a standard openness ratio (ratio of imports and exports to GDP). To measure financial integration, we use an indicator measure of restrictions on capital account transactions and also a measure of gross capital flows to GDP, where the latter is analogous to the trade openness ratio. The restrictiveness indicators can be considered as measures of *de jure* trade and financial openness, while the flow measures capture *de facto* openness. This distinction is of particular importance in understanding the effects of financial integration since many countries that have maintained controls on capital account transactions have found them ineffective in preventing capital outflows. Furthermore, the *de jure* measure cannot fully capture differences in the degree of financial liberalization across countries and over time.

While it would be interesting to examine the effects of bilateral trade and financial linkages on correlations across country pairs, obtaining such data on financial linkages is not feasible. In this paper, therefore, we adopt a simpler approach of examining correlations of individual country output and consumption growth fluctuations with the fluctuations of corresponding “world” aggregates. To minimize the effects of the large economies on the results, we use PPP-weighted aggregates of output and consumption in the G-7 countries as measures of the relevant world aggregates. These countries are then excluded from the empirical analysis that follows. The use of G-7 aggregates has some additional advantages. Since the G-7 countries account for a substantial fraction of financial and trade flows to

---

<sup>4</sup> For a detailed description of the data and sources see Kose, Prasad, and Terrones (2003a).

developing countries, correlations with the G-7 aggregates are most relevant for understanding the effects of integration on business cycle comovements. In any case, as one would expect, cyclical fluctuations in the G-7 countries are highly correlated with fluctuations in total world output.

We begin by presenting a descriptive analysis of changes in patterns of correlations of different groups of countries with the world business cycle. For this part of the analysis, we divide developing countries into two groups—more financially integrated (MFI) economies and less financially integrated (LFI) economies. The former essentially constitute the group of “emerging markets” and account for a substantial fraction of net capital flows from industrial to developing countries in recent decades. Since output and consumption are nonstationary series, and in order to avoid the complications with standard filtering methods, we use growth rates of the variables in the empirical analysis.

#### IV. CORRELATIONS

We first examine some summary statistics on the correlations of output growth rates in each country with the growth rate of the composite measure of world output. Table 1 (first panel) shows that, on average, industrial countries have stronger correlations with world output than developing economies. For industrial countries, these correlations on average increase sharply in the 1970s (the oil shock period) and rise further in the 1990s. For developing countries, on the other hand, these correlations are in general much lower compared to industrial countries and, if anything, decline in the 1990s. In fact, for MFI economies, these correlations become negative during this period. Thus, there is little evidence, in terms of these coarse country groupings, that business cycle comovements have on average become more synchronized at a global level during the most recent period of globalization.

The second panel of Table 1 indicates that the temporal evolution of consumption correlations is quite similar to that of output. In addition, as has been documented by several other authors, consumption correlations are typically smaller than output correlations. A particularly interesting result is that, for MFI economies, the average correlation turns significantly negative in the 1990s. This seems at odds with the notion that financial integration should have helped these economies to better share consumption risk.

While cross-country correlations of output and consumption are useful in understanding the degree of synchronization, they only capture the contemporaneous dimension of business cycle comovement. To further study the extent of and the change in the degree of synchronization, we estimate dynamic unobserved factor models. This approach allows us to decompose fluctuations in each macroeconomic aggregate into a

common factor (common across all countries) and a country-specific factor.<sup>5</sup> We examine changes in the relative importance of the common factor by estimating the model over two periods: 1960–80 and 1981–99.<sup>6</sup> If globalization has a positive impact on the degree of business cycle synchronization over time, the contribution of the common factor to the variation of output and consumption growth should rise in the second period.

Table 2 presents the median (within each group of countries) of the fraction of the variance of output and consumption fluctuations explained by the common factor, for the full sample as well as the two sub-periods. There are four results to note. First, the common factor accounts for less than 10 percent of the variation in output and consumption fluctuations across the full sample of industrial and developing economies. Second, the importance of the common factor for output fluctuations has not changed much across the two sub-periods, suggesting that integration has not significantly changed the extent of business cycle comovement. Third, the common factor explains a much larger fraction of output and consumption fluctuations in industrial countries than it does in the developing countries. Moreover, for industrial countries, there has been a noticeable increase in the share of variance of consumption fluctuations explained by the common factor in the second period. Fourth, the global common factor has on average played only a very small role in explaining the variance of output and consumption fluctuations in the MFI and LFI economies, and the importance of the common factor has not changed much over time in either group. Overall, the results from the factor model estimates reveal a picture similar to that obtained from the simple correlations.

## V. REGRESSION ANALYSIS

In this section, we present a more formal regression analysis of the factors that influence correlations of individual country macroeconomic aggregates with the corresponding world aggregates. We use nonoverlapping ten-year correlations as the dependent variable. Table 3 (first column) shows the results of OLS regressions for output. In this table, we present coefficient estimates for only the main variables of interest.<sup>7</sup> Trade openness appears to have a weak negative effect on output correlations. While this result could be explained as a consequence of more open economies being more vulnerable to external shocks, it appears to run counter to other studies suggesting that trade linkages increase cross-country business cycle correlations. Our regressions also include a variable

---

<sup>5</sup> Our estimations of dynamic factor models closely follow Otrok and Whiteman (1997). Lumsdaine and Prasad (2003) employ a different method and estimate a common factor using the data of OECD countries to study the dynamics of international business cycles.

<sup>6</sup> We estimated factor models using shorter sample periods; however, the results are not very informative since shorter sample periods result in less precisely estimated parameters.

<sup>7</sup> We provide more detailed regression results and robustness tests in Kose, Prasad, and Terrones (2003b).

that measures direct trade relationships with the G-7 (trade with the G-7 as a share of a country's total trade). The positive coefficient on this variable indicates that trade linkages do indeed have a positive effect on output correlations. Thus, while trade openness by itself seems to reduce domestic business cycle correlations with world output, a measure of trade linkages does reveal evidence of cross-country business cycle transmission via the trade channel.

The capital account restrictions measure enters with a negative coefficient. In other words, countries with restricted capital flows have lower business cycle correlations with world output. This result suggests, as expected, that financial linkages are more important, in terms of business cycle transmission, for economies that are more open to capital flows. However, the measure of actual gross capital flows (financial openness) does not reflect this effect. Unfortunately, data limitations prevented us from being able to construct a measure of financial linkages with the G-7 in a manner analogous to the trade linkage variable. It should be noted, however, that the G-7 countries account for more than two-thirds of all private capital flows and, in recent years, an even greater fraction of flows to developing countries.

Among other variables that are included in the regressions, only the volatility of the terms of trade has a statistically significant coefficient. The negative coefficient on this variable is consistent with the earlier result on trade openness and indicates that economies that are subject to more volatile terms of trade shocks are less correlated with world output.

How robust are these results? We eschew the use of fixed effects estimators in order to avoid restricting the empirical analysis to within-country changes in volatility. Most of the variation in our sample comes from the between-country component, which is of far more relevance for the issues of interest in this analysis. Instead of using fixed effects, we examined the sensitivity of the results to the inclusion of regional dummies (column 2) as well as numerous country-specific variables—reflecting political and economic structures and other relevant institutional features—that are potentially important for explaining cross-country differences in correlation patterns. In general, these variables did not affect our main results except for the coefficient on trade openness, which is no longer statistically significant.

A more important concern with the baseline results is that of possible endogeneity. In addition, measurement error in the integration variables is also a potential problem. To address these concerns, we instrumented for the trade and financial integration variables. The results of these instrumental variable (IV) regressions are shown in column 3. Again, the main results are preserved. In particular, the coefficients on the trade linkages variable and the capital account restrictiveness indicator remain significant.

Our findings are generally in line with the results of other recent studies. For instance, Otto, Voss, and Villard (2001) and Imbs (2002) find that trade and financial linkages are



economies.<sup>8</sup> Imbs also finds that specialization patterns drive business cycle correlations. We introduced some broad sectoral measures—agriculture and manufacturing output as shares of GDP—in our regressions, but these did not appear statistically significant in any of the specifications.

We now turn to regressions for consumption correlations (Table 3, second panel). The results for this variable are weaker. Of the integration variables, only the trade linkages with the G-7 matter and these appear to have a positive effect on cross-country movements in consumption. Even this result is not robust to IV estimation. Thus, there is little evidence that globalization has influenced consumption comovements across countries. This is consistent with other research showing that imperfections in international capital markets have thus far thwarted the use of these markets for effectively sharing risk across countries and reducing within-country consumption volatility (see Kose, Prasad, and Terrones, 2003a).

Terms of trade volatility affects consumption comovement in a manner similar to that of output. Our findings regarding the importance of terms of trade volatility are consistent with the results in several recent studies (see Kose, Prasad, and Terrones, 2003b). Interestingly, the coefficient on the fiscal impulse measure is negative, perhaps indicating the use of fiscal policies as a countercyclical tool that dampens the effects of global shocks. An alternative interpretation, of course, is that fiscal policies exacerbate country-specific fluctuations.

To examine if trade and financial integration have differential effects on correlation patterns for industrial versus developing countries, we included interactions of the integration variables with an industrial country dummy. While the results discussed above were not materially affected, the effects of the trade and financial linkages on output correlations appeared to be stronger for industrial countries than for the developing countries in our sample. In addition, for these countries, there is some evidence that consumption correlations with the world aggregate are significantly positively affected by both trade and financial linkages. Although not reported in detail here, we tested the sensitivity of our regression results to the inclusion of a large number of additional controls. The main results shown here appeared quite robust in these experiments. We also did not find any obvious evidence of threshold effects or nonlinearities in the relationships that we have documented in this paper, although the results with the industrial country dummy interaction terms noted above suggest that such effects remain a possibility.

## VI. CONCLUSIONS

The results in this paper provide at best limited support for the conventional wisdom that globalization leads to an increase in the degree of synchronization of business cycles. We found some evidence for the proposition that trade and financial market integration

---

<sup>8</sup> Calderon, Chong and Stein (2002) find that trade linkages play a more important role in explaining business cycle comovement in advanced countries than in developing countries.

enhance global spillovers of macroeconomic fluctuations. One striking result is that, on average, consumption correlations have not increased in the 1990s, precisely when financial integration would have been expected to result in better risk-sharing opportunities, especially for developing countries. While this paper has provided a number of preliminary results, richer datasets and more rigorous estimation methods are needed to improve our understanding of the effects of globalization, which has important implications for the conduct of macroeconomic policies in an increasingly integrated global economy.

Table 1. Correlations with "World" Macroeconomic Aggregates  
(Medians for each group)

	Output					Consumption				
	1960-99	60s	70s	80s	90s	1960-99	60s	70s	80s	90s
Full Sample	0.14 (0.03)	0.12 (0.05)	0.18 (0.07)	0.15 (0.05)	0.09 (0.12)	0.07 (0.04)	0.06 (0.06)	0.09 (0.07)	0.07 (0.05)	0.01 (0.08)
Industrial countries	0.35 (0.06)	0.05 (0.15)	0.33 (0.08)	0.35 (0.13)	0.58 (0.09)	0.34 (0.08)	-0.02 (0.16)	0.34 (0.12)	0.35 (0.10)	0.50 (0.07)
Developing countries	0.09 (0.04)	0.12 (0.05)	0.14 (0.08)	0.11 (0.07)	-0.06 (0.07)	0.00 (0.03)	0.06 (0.09)	-0.01 (0.09)	0.04 (0.04)	-0.09 (0.06)
MFI economies	0.09 (0.06)	0.12 (0.10)	0.26 (0.14)	0.10 (0.09)	-0.18 (0.12)	-0.04 (0.06)	0.14 (0.12)	-0.04 (0.11)	-0.00 (0.10)	-0.26 (0.11)
LFI economies	0.09 (0.05)	0.12 (0.12)	0.11 (0.08)	0.11 (0.10)	0.02 (0.15)	0.01 (0.04)	0.06 (0.13)	0.01 (0.14)	0.04 (0.05)	-0.07 (0.08)

Notes: The numbers shown in this table are medians, within each group, of the correlations for each country with the corresponding world aggregate. Standard errors are shown in parentheses.

Table 2. Share of Variance Explained by the Common Factor  
(In percent)

	Output			Consumption		
	60-99	61-80	81-99	60-99	61-80	81-99
Full Sample	9.1 (2.1)	7.2 (1.7)	5.6 (1.6)	5.0 (1.8)	6.4 (1.2)	5.6 (1.5)
Industrial countries	41.4 (4.7)	30.5 (3.8)	27.2 (3.7)	27.1 (4.1)	16.0 (2.9)	22.7 (3.9)
Developing countries	4.6 (1.2)	4.7 (1.0)	2.9 (1.1)	2.9 (0.9)	3.3 (0.9)	2.3 (1.0)
MFI economies	5.1 (1.9)	3.6 (2.0)	3.2 (1.0)	1.9 (1.4)	3.1 (1.3)	2.1 (2.0)
LFI economies	4.6 (1.5)	5.9 (1.0)	2.8 (1.7)	3.0 (1.1)	3.8 (1.3)	2.5 (1.1)

Notes: All data series are transformed into logarithms, first differenced, and demeaned before the estimations. In each cell, the median fraction of variance explained by the common factor in each group is reported. The sample standard errors are shown in parentheses. Our estimations of dynamic factor models closely follow Otrok and Whiteman (1997).

Table 3. Determinants of Correlations

	Output			Consumption		
	OLS	OLS	IV	OLS	OLS	IV
Current account restrictions	-0.0130 (0.0706)	0.0257 (0.0715)	0.0496 (0.0753)	-0.0480 (0.0741)	-0.0262 (0.0765)	-0.0314 (0.0793)
Trade openness	-0.0021 * (0.0013)	-0.0013 (0.0014)	-0.0006 (0.0023)	-0.0006 (0.0013)	0.0005 (0.0013)	0.0001 (0.0021)
Trade linkages with G-7	0.0050 ** (0.0019)	0.0046 ** (0.0021)	0.0107 ** (0.0045)	0.0047 ** (0.0019)	0.0038 * (0.0019)	0.0017 (0.0048)
Capital account restrictions	-0.1859 ** (0.0767)	-0.2051 ** (0.0862)	-0.2054 ** (0.1179)	0.0639 (0.0927)	0.0433 (0.0956)	0.0325 (0.1184)
Financial openness	0.0018 (0.0023)	0.0009 (0.0024)	-0.0013 (0.0088)	0.0028 (0.0020)	0.0021 (0.0021)	0.0009 (0.0075)
Relative income	0.1846 (0.1206)	-0.0879 (0.2098)	-0.0754 (0.2497)	0.3033 ** (0.1197)	-0.0153 (0.2003)	-0.0065 (0.2399)
Terms of trade volatility	-0.7680 ** (0.2466)	-0.7127 ** (0.2513)	-0.7394 ** (0.2821)	-0.8771 ** (0.3310)	-0.8679 ** (0.3296)	-0.8975 ** (0.3527)
Fiscal impulse	-0.1768 (0.1162)	-0.1519 (0.1200)	-0.1522 (0.1633)	-0.5247 ** (0.0521)	-0.4971 ** (0.0557)	-0.4999 ** (0.0627)
Regional dummies	--	Yes	Yes	--	Yes	Yes
Rsquared	0.15	0.18	--	0.17	0.19	--
Number of observations	235	235	229	235	235	229

Notes: The dependent variable is the correlation for each country's output or consumption with the corresponding world aggregate over each ten-year period. Time dummies are included in all regressions. For the IV regressions, the instruments include relative income (versus U.S.) as of 1960, shares of agriculture and manufacturing in total output in 1960, Bank's weighted conflict index, and dummies for oil-exporting countries, landlocked countries, countries in tropical climates, existence of multiple exchange rate and existence of export surrender requirements. Robust standard errors are reported in parentheses. The symbols \* and \*\* indicate statistical significance at the 10 percent and 5 percent levels, respectively. Additional controls that we experimented with and that did not affect these results include the ratio of M2 to GDP and its standard deviation, manufacturing output as a share of GDP, inflation, fuel exports as a share of total exports and an indicator of the exchange rate regime.

## REFERENCES

- Calderon, Cesar A., Chong, Alberto E., and Ernesto H. Stein. "Trade Intensity and Business Cycle Synchronization: Are Developing Countries Any Different?" Mimeo, Central Bank of Chile.
- Heathcote, Jonathan and Fabrizio Perri. "Financial Globalization and Real Regionalization." National Bureau of Economic Research (Cambridge, MA) Working Paper No. 9292, October 2002.
- Imbs, Jean. "Trade, Finance, Specialization and Synchronization." Mimeo, London Business School, 2002.
- Kose, M. Ayhan, Prasad, Eswar, and Terrones, Marco. "Financial Integration and Macroeconomic Volatility." *IMF Staff Papers: Proceedings of the Third Annual IMF Research Conference*, forthcoming.
- Kose, M. Ayhan; Prasad, Eswar, and Terrones, Marco. "Globalization and Business Cycle Comovement." Mimeo, International Monetary Fund, 2003b.
- Kose, M. Ayhan and Kei-Mu Yi. "The Trade Comovement Problem in International Macroeconomics." Federal Reserve Bank of New York, Staff Report No: 155, December 2002.
- Lumsdaine, Robin, Prasad, Eswar. "Identifying the Common Component in International Economic Fluctuations: A New Approach." *The Economic Journal*, Forthcoming, 2003.
- Otrok, Christopher and Charles H. Whiteman. "Bayesian Leading Indicators: Measuring and Predicting Economic Conditions in Iowa." *International Economic Review*, November 1998, 39 (4), pp. 997-1014.
- Otto, Glenn, Voss, Graham and Willard, Luke. "Understanding OECD Output Correlations." *Reserve Bank of Australia*, Research Paper No: 2001-05, September 2001.
- Prasad, Eswar, Wei, Shang-Jin, and Kose, M. Ayhan. "Financial Globalization: Benefits and Risks." Mimeo, International Monetary Fund, 2003.