# International Business Cycles: World, Region, and Country-Specific Factors*

**M. Ayhan Kose**, Christopher Otrok***, and Charles H. Whiteman*****

Brandeis University, University of Iowa, University of Iowa

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**Abstract:** The paper investigates the common dynamic properties of business cycle fluctuations across countries, regions and the world. We employ a Bayesian dynamic latent factor model to estimate common components in main macroeconomic aggregates (output, consumption and investment) in a sixty-country sample covering seven regions of the world. In particular, we simultaneously estimate (i) a dynamic factor common to all aggregates/regions/countries (the world factor); (ii) a set of 7 regional dynamic factors common across aggregates within a region; (iii) 60 country factors to capture dynamic comovement across aggregates within each country; (iv) and a component for each aggregate that captures idiosyncratic dynamics. We decompose the volatility in each aggregate into the fraction due to the world, region, country, and idiosyncratic components. The results indicate that the world factor is an important source of volatility for aggregates in most countries, providing evidence for a world business cycle. We find that the region-specific factor plays only a minor role in explaining fluctuations in economic activity. While the world and regional factors together account for a larger share of fluctuations in output than in consumption, the country factor along with the idiosyncratic factor play a much larger role in explaining investment dynamics. We also compare and contrast how the three aggregates in each country relate to the world, region and country factors, and document similarities and differences across regions, countries and aggregates. We link the empirical results to the economic structure of the countries in the sample.

***Keywords**: International business cycles, Markov Chain Monte Carlo, Dynamic Latent Factor, Bayesian.*

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** Graduate School of International Economics and Finance; Brandeis University; e-mail: akose@lemberg.brandeis.edu
*** Department of Economics, University of Iowa; e-mail: Christopher-Otrok@uiowa.edu, whiteman@uiowa.edu

## 1. Introduction

By now there is significant evidence suggesting that business cycles in several countries share a number of common characteristics.[1] In particular, recent research comparing business cycles across developed countries has documented that macroeconomic fluctuations across these countries are closely linked. Moreover, business cycles in developing economies exhibit several common characteristics with those of the developed economies. These observations imply that there is an *international business cycle*, or a *world business cycle*.

While the research program on the common characteristics of business cycles has resulted in a voluminous literature, there has been no study examining the properties of the world business cycle simultaneously with regional and country-specific business cycles. This paper investigates the three types of comovement among aggregate variables by asking the following questions. First, what fraction of volatility in macroeconomic aggregates—output, consumption, and investment—can be attributed to the world, region or country-specific factors? Second, what are the time series properties of the world, region, and country-specific business cycles? Third, what are the connections between the characteristics of countries' economic structures and the importance of the three types of common factors in explaining aggregate economic activity in those countries?

To answer these questions, we employ a Bayesian dynamic latent factor model to estimate common dynamic components in macroeconomic aggregates (output, consumption and investment) in a sixty-country sample covering seven regions of the world. In particular, we simultaneously estimate (i) a dynamic factor common to all aggregates/regions/countries (the world factor); (ii) a set of 7 regional dynamic factors common across aggregates within a region; (iii) 60 country factors to capture dynamic comovement across aggregates within each country; (iv) and a component for each aggregate that captures idiosyncratic dynamics. By design, the dynamic factors capture all intertemporal cross-correlation among the observable variables.

The econometric methodology employed here was developed in Otrok and Whiteman (1998); details of the method are summarized in section II of the paper. What we add computationally in this paper is a generalization from a single dynamic factor model to a model with multiple dynamic factors. One advantage of the Bayesian procedure over earlier studies in the dynamic factor framework is that the method works well with large cross sections of data. The model has many parameters to estimate, so classical methods (e.g., numerical maximization of the likelihood) are difficult to apply due to the dimension of the problem. By examining a large cross-section of countries we are able to go well beyond

[1] Understanding the similarities of business cycle fluctuations across countries has long been a subject of interest to macroeconomists. For example, Mitchell (1927) finds that there are striking similarities in the timing of business cycles peaks and troughs of many countries. See Zarnovitz (1992) for a survey of this research program. Backus, Kehoe, and Kydland (1995), and Baxter (1995) provide surveys of recent research in international business cycles.

previous work. Earlier studies consider business cycles of a small group of economies, and limit their definition of the world business cycle to the common movements in the macro aggregates of those countries. While considering business cycles of a large set of developed countries, we also study business cycle fluctuations in a number of developing countries. Studying a larger set of countries that includes developed as well as developing economies adds to our understanding of the interdependence of the two types of economies.

In addition to working efficiently with large cross-sections of data, the method we employ can also easily handle a large number of dynamic factors. Therefore, we are able to examine regional and country-specific cycles simultaneously with the world business cycle. The importance of studying all three in one model is that studying a subset of countries can lead one to believe that the comovement among that subset is particular to that subset of countries when it in fact is common to a much larger group of countries. For example, researchers often argue for a distinct "European" business cycle by studying the comovement of European countries. We find little evidence for a European cycle; instead we find that the comovement among European countries is due to comovement common to all countries in the world.

The importance of examining the roles of different types of common dynamic factors in accounting for aggregate business cycle fluctuations is the different policy and modeling implications that depend on the relative importance of the types of factors. If most of the variation in economic activity in a number of countries with different economic policies, institutions, and economic structures is explained by a world business cycle, this lends support to the predictions of theories emphasizing the common characteristics in the operations of markets rather than the differences in economic policies or institutional environment in those countries. Moreover, if a significant fraction of domestic business cycles is due to the world common factor, this implies that economic policies targeting external balances to stabilize sudden movements in economic activity might be ineffective. Examining the sources of business cycles, and establishing a set of stylized relations between the characteristics of economic structure and the roles of different factors in accounting for the fluctuations in economic activity are also important in advancing the current research program in developing international business cycle models that should be consistent with these stylized features.[2]

A visual inspection of the estimated dynamic factors reveals that the factors exhibit many major economic events. Section III of the paper contains graphs of the world, regional and selected country factors. In this section we show that the world factor captures a steady expansionary period in the 1960s,

[2] In a recent paper, Gregory and Head (1995) document that common movements explain a significant fraction of productivity fluctuations and a much smaller part of the investment movements. They construct a stochastic dynamic model that is consistent with these features.

the global recession of the mid-1970s, the recession of the early 1980s, and the downturn in the early 1990s. The country factors also exhibit some of the important historical episodes. For example, the U.S. country factor captures several business cycle episodes that coincide with the NBER reference cycles, and the country factors of several Latin American economies exhibit the downturn associated with the debt crisis in 1982. We also find that the three factors play different roles in different time periods: in some business cycle episodes, the country-specific factor was the main force, in others the world factor seemed to be relatively more important in explaining the short run variation in economic activity. For example, in the United States, the world factor is particularly important in the late 1960s and in 1973, while both the regional and country factors seem to play a more important role in the second half of the 1970s.

A result useful for researchers interested in building structural models of world business cycles involves the differences in the time series properties of the various factors. In section IV we show that most of the persistent comovement across economies is accounted for by the world factor. The regional factors and country factors are generally less serially correlated or exhibit negative serial correlation.

An important finding of this paper is that there is a significant world component to fluctuations in aggregate output, consumption, and investment for almost all of the countries in our sample. In section V we decompose the variance of each aggregate into the fraction that is due to each type of factor. We also find that the world factor accounts for a larger fraction of business cycle variability in developed countries than it does in developing countries: while the world factor on average explains almost 42 percent of the output volatility in the G7 economies, on average less than 17 percent of the output variation is attributable to the world factor in the other countries. However, the world factor provides a statistically significant contribution to output volatility in most countries.

The variance decompositions also show that the world and regional factors together account for a larger share of the fluctuations in output than in consumption in 42 out of 60 countries. This result supports a widely documented empirical fact on imperfect international consumption risk sharing among developed economies: cross-country correlations of output are larger than those of consumption. It is interesting that using a different econometric approach we are able to capture this stylized fact and show that the data of several developing countries as well as developed ones supports the imperfect risk sharing hypothesis.

The third major result from the variance decompositions is that the regional factor plays a minor role in explaining macroeconomic variation: on average the regional factors explain 5 percent of output volatility, 5 percent of consumption volatility, and 4 percent of investment volatility. The one exception to this regularity is the North American regional factor which on average explains roughly 40 percent of output variation, 30 percent of consumption variation, and 40 percent of investment variation.

Surprisingly, the European regional factor on average accounts for less than 3 percent of the variation in macroeconomic aggregates of European countries.

We calculate variance decompositions for 180 variables; to summarize the relation between the economic structure of a country and the relative importance of the factors we use regression methods to project the percent of variance of an observable (output growth, consumption growth, investment growth) attributable to a factor (world factor, regional factor, country factor, idiosyncratic factor) on a variety of explanatory variables that are related to country characteristics. Section VI details the relationships we find from the regressions.

Our work is related to a large body of literature examining the common properties of business cycles within and across economies. The studies in this literature can be classified into two broad groups: in the first group, researchers examine the unconditional correlations of major macroeconomic aggregates within and across countries. For example, Backus, Kehoe, and Kydland (1995), and Baxter (1995) study unconditional correlations and find that business cycles in major industrialized economies are quite similar. Mendoza (1995), and Kose (1997b) document that business cycles of developing economies also share similar characteristics to those of developed countries.[3]

In the second group, more sophisticated econometric methods have been used to examine the comovement across countries. In a recent paper, closest in spirit to ours, Gregory, Head, and Raynauld (1997) use Kalman filtering and dynamic factor analysis to identify the common fluctuations across macroeconomic aggregates in G7 countries. They decompose dynamic comovement into components that are common to aggregate variables across these countries, and also those that are common across aggregates within a country. They interpret the former component as a proxy for the world business cycle. Their results suggest that fluctuations in output, consumption, and investment have both world and country-specific components.[4] Clark and Shin (1998) provide a review of the literature on the sources of

[3] Gerlach (1988), using spectral methods, find that movements in industrial production indices in a number of OECD countries are correlated. Canova and Dellas (1993), using VAR methods, examine the role of international trade in the propagation of business cycles from one country to another and find that trade interdepence plays a moderate role in transmitting business cycles. In a recent paper, Bergman, Bordo, and Jonung (1998) study cross country correlations of several macro aggregates of thirteen industrialized countries and find that business cycle fluctuations are highly synchronized across countries and across monetary regimes. Crucini (1999) establishes a link between those studies employing stochastic dynamic macroeconomic models, that try to explain common fluctuations across countries, and those empirical studies documenting several features of international business cycles.

[4] Stockman (1988) employs an error-correction method and finds that a substantial fraction of variation in industrial production is due to global sector-specific and country-specific disturbances in major industrialized economies. Norrbin and Schlagenhauf (1996) also employ a dynamic factor model to examine the role of world, nation specific, industry specific factors in explaining common movement across G7 countries, Belgium, and Netherlands. Their results indicate that while the world and country-specific factors explain some fraction of industrial output, the industry specific factor plays a minor role. Engle and Kozicki (1993) use statistical tests for a common international business cycle using the aggregate output data of G7 countries and find evidence supporting that fluctuations in output growth rates exhibit significant synchronization for all G7 economies except the United Kingdom.

business cycles, and study the importance of common and country specific shocks in inducing business cycle fluctuations within and across countries. Using a VAR factor model they find that both common and country specific shocks play important roles in accounting for the variation in industrial production in European countries. Lumsdaine and Prasad (1997) develop a weighted aggregation procedure, and examine the correlations between the fluctuations in industrial output in seventeen OECD countries and an estimated common component. They find evidence for a world business cycle and for a European business cycle.[5]

## II. Methodology

The econometric model is a multi-factor extension of the single dynamic factor model in Otrok and Whiteman (1998). There are M observable variables per country and N countries, for a total of M×N variables, denoted $y_i$, for i = 1 to M×N, and each time series is of length T. Each set of country variables has a common dynamic factor ($f_n^{country}$). Countries are grouped into R regions and all countries in a region share a common factor specific to that region ($f_r^{region}$). Finally, there is a single common world factor ($f^{world}$) which accounts for the comovement common to all M×N of the observable variables. The total number of dynamic factors to be estimated in the model is N+R+1 = K. Thus for observable i:

(1) $$y_{i,t} = a_i + b_i^{world} f_t^{world} + b_i^{region} f_{r,t}^{region} + b_i^{country} f_{n,t}^{country} + \varepsilon_{i,t} \qquad E\varepsilon_{i,t}\varepsilon_{j,t-s} = 0 \text{ for } i \neq j$$

where r denotes the region number and n the country number. The idiosyncratic errors $\varepsilon_{i,t}$ are serially correlated, and are modeled as $p_i$-order autoregressions:

(2) $$\varepsilon_{i,t} = \phi_{i,1}\varepsilon_{i,t-1} + \phi_{i,2}\varepsilon_{i,t-2} + \ldots + \phi_{i,p_i}\varepsilon_{i,t-p_i} + u_{i,t} \qquad Eu_{i,t}u_{j,t-s} = \sigma_i^2 \text{ for } i = j \text{ and } s=0, 0 \text{ otherwise}$$

The evolution of the factors is likewise governed by an autoregression, of order $q_k$:

(3) $$f_{k,t} = \varepsilon_{f_k,t}$$

(4) $$\varepsilon_{f_k,t} = \phi_{f_k,1}\varepsilon_{f_k,t-1} + \phi_{f_k,2}\varepsilon_{f_k,t-2} + \ldots + \phi_{f_k,q}\varepsilon_{f_k,t-q} + u_{f_k,t}$$

$$Eu_{f_k,t}u_{f_k,t-s} = \sigma_{f_k}^2 ; Eu_{f_k,t}u_{i,t-s} = 0 \text{ all k, i, and s.}$$

[5] Artis, Kontomelis, and Osborne (1997) examine classical business cycle turning points and find empirical evidence supporting the existence of an "European" business cycle using the industrial production data of the G7 countries. Artis and Zhang (1996), using a variety of detrending methods, study the contemporaneous movement in industrial production growth of a number of European economies and find that there is a European business cycle. Christodoulakis, Dimelis, and Kollintzas (1995) document stylized business cycle facts of 12 EU countries and find significant similarities in the patterns of business cycles in European countries. Bergman, Bordo, and Jonung (1998) find high and significant corelation between output of several European countries and interpret this result as an outcome of European common market.

The innovations, $u_{i,t}$, i = 0,...,M×N and $u_{f_k,t}$, k = 1,…,K, are assumed to be zero mean, independent normal random variables. The factors all have a similar parametric form for the time series representation; however, each factor follows its own unique process which is determined by the autoregressive parameters.

Two related identification problems arise for the model (1)-(4). First, the sign of the dynamic factor and the sign of the $b_i$ are not separately identified. This is handled by requiring one of the factor loadings to be positive for each of the factors. Second, the *scale* of the factor loadings and the factor itself are not separately identified. To solve this normalization problem, we follow Sargent and Sims (1977), Stock and Watson (1989, 1992, 1993) and others in assuming that each $\sigma^2_{f_k}$ is equal to a constant.

If, contrary to assumption, the dynamic factors were observable, analysis of the system would be straightforward. Since they are not, special methods must be employed. Gregory, Head and Reynauld (1997) follow Stock and Watson (1989, 1992, 1993) and treat the model as an observer system and use classical statistical techniques employing the Kalman filter/smoother to estimate the model parameters and extract an estimate of the unobserved factor. An alternative based on a recent development in the Bayesian literature on missing data problems, that of "data augmentation" (Tanner and Wong, 1987) is developed in Otrok and Whiteman (1998). The essential idea is to determine posterior distributions for all unknown parameters conditional on the latent factor, and then if the conditional distribution of the latent factor given the observables and the other parameters is available, the joint posterior distribution for the unknown parameters and the unobserved factor can be sampled by using a Markov Chain Monte Carlo procedure on the full set of conditional distributions.

Thus denoting by φ the set of parameters ( $a_i, b_i, \sigma^2_i, \phi_{i,p_i}, \sigma^2_{f_k}, \phi_{f_k,q_k}$ where i = 1 ,..., M×N and k = 1, …, K ), and the set of factors by f, suppose the conditional posterior distributions are given by p(φ|f) and p(f|φ). Starting from a value $f^0$ (which must be in the support of the posterior distribution of f ) produce a drawing $\varphi^1$ by sampling from $p(\varphi|f^0)$; produce $f^1$ by sampling from $p(f|\varphi^1)$, and so on. Given the bounded likelihood and proper priors we use, the joint posterior is well-behaved, and thus the regularity conditions of Geweke (1996, 1997), Tierney (1994) and Chib-Greenberg (1996) apply, meaning that the procedure produces a realization of a Markov chain whose invariant distribution is the joint posterior of interest.

In the present context, since conditional on the dynamic factors the equations in (1) are simply regression models with AR errors, the conditional posterior p(φ|f) is straightforward to analyze using the procedure due to Chib and Greenberg (1994). In fact, sampling from the conditional posterior simply requires M×N applications of the Chib-Greenberg procedure, which is already a Markov chain procedure. (An additional Chib-Greenberg pass is used to sample from the conditional posterior for each of the factor equation AR coefficients $\phi_{f_k, q_k}$, k = 1,...,K.) Otrok and Whiteman (1998) derive the conditional distribution of one factor given the parameters. The extension to multiple factors used here is straightforward. The conditional distribution of one factor, denoted $f_k$, given the model parameters, other factors and data is:

$$f(f_k | y, \varphi) \sim N(\mu, H^{-1}) \quad (5)$$

The elements of the $(T \times 1)$ mean vector, $\mu$, and the $(T \times T)$ covariance matrix $H^{-1}$, are functions of the model parameters, data and the other dynamic factors upon which we are conditioning. Completely describing the elements of $\mu$ and H and their derivation would require the introduction of a lot of notation and take a number of pages. The interested reader is referred to Otrok and Whiteman (1998) for these details.

The estimation procedure is as follows (taking starting values of the parameters and factors as given). First, take a draw of the parameters from the posterior distribution of the parameters conditional on the factors. Next, draw the world factor conditional on the parameters and the country and regional factors from the Normal distribution given above. Then draw each regional factor conditional on the world factor and the country factors in that region. Next each country factor can be drawn conditioning on the world factor and the appropriate regional factor. This completes one step of the Markov chain procedure.[6]

A practical benefit of our procedure is that it can be easily applied to a large cross-section of countries. Classical maximum likelihood methods are difficult to apply to a problem of this dimension. That is, with over 1600 parameters and 68 dynamic factors the dimension of the problem poses a serious challenge to current hill-climbing techniques.

The length of both the idiosyncratic and factor autoregressive polynomials is 3. The prior on all the factor loading coefficients was Normal(0,1). For the autoregressive polynomials parameters the prior was Normal(0,Σ), where $\Sigma = \begin{bmatrix} 1 & 0 & 0 \\ 0 & .5 & 0 \\ 0 & 0 & .25 \end{bmatrix}$. This prior was chosen to ensure stationarity.[7] The prior on the innovation variances in the observable equations is Inverted Gamma (3,0.0005).

To monitor the convergence of the chain we performed a number of experiments. First, we restarted the chain from a number of different initial values, and the procedure always converged to the same results. Second, we experimented with chains of different lengths ranging from lengths of 5000 to

[6] The order in which one draws the factor is not important. We experimented with changing the order, and the results we obtained were identical to those presented in the paper.
[7] Nonstationarity was only a problem for a small number of country-specific factors and idiosyncratic components, but we chose to use the same prior for all AR parameters for consistency.

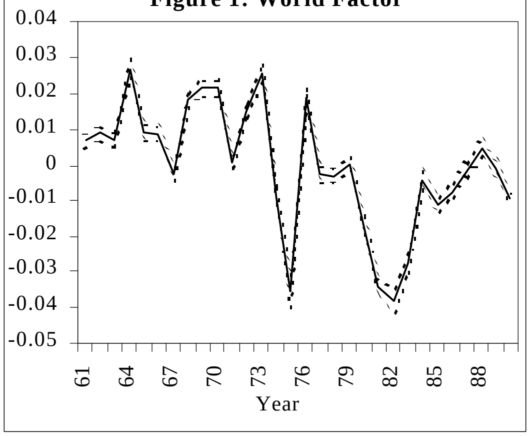
50000. For chains of length 10,000 or greater the results were the same. The results we report in the paper are based on a chain of length 50,000.

The dataset we use is from the Penn World Tables (PWT). We use output, consumption and investment data for 60 countries from 1960-1991.[8] We use only those countries with a data quality grade of C- or higher. Some additional countries were dropped since data did not exist for the entire sample period. The countries in our dataset along with the regional definitions are in the Appendix. The data are log first-differenced and then demeaned. The values of M, R, N and T are 3, 7, 60 and 30.

## III. The Dynamic Factors

Figure 1 presents the median of the world factor along with 33 and 66 percent quantile bands. The tight quantile bands indicates that the estimates of the factor are fairly precise. Of interest is the fact that the world factor exhibits many of the major economic events of the last 30 years: steady expansionary period of the 1960s, the recession of the mid-1970s (associated with the first oil price shock), the recession of the early 1980s (associated with the debt crisis, and tight monetary policies of major industrialized nations), and the downturn through the recession of the early 1990s. These results are quite interesting as the movements in the world factor can be associated with some well-known economic events.

Figure 1: World Factor




Our world factor indicates that the recession of the mid-1970s is about as severe as that of the early 1980s. In contrast, Gregory, Head and Raynauld (1997) find that the world component exhibits a

[8] We do not consider the periods of fixed and flexible exchange rate regimes separately because of the following reasons: first, there is not conclusive evidence about the impact of the exchange rate regime on macroeconomic fluctuations. For example, Baxter and Stockman (1989) and Baxter (1991) find that different types of exchange rate regimes do not result in significant changes in the behavior of main macroeconomic aggregates while Gerlach (1988) and Bowden and Martin (1995) conclude that the exchange rate regime has a significant impact on the stylized business cycle facts. Second, we do not have enough data to examine the fixed and flexible exchange rate

more severe recession in 1974 than in 1982. They construct their world common factor considering the common movements of only G7 countries. Our inclusion of developing economies as well provides a different picture of the recession of 1982. To further examine the depth of these two different recessionary periods, we compute an aggregate world output measure using the size weighted aggregate output of the countries in our sample, and compare this measure with the estimated world factor.[9] Interestingly, the world aggregate output also displays that the mid-1970s recession is slightly less severe than that in 1982. This result suggests that to fully understand the extent of world business cycles, we need to consider the changes in economic activity in major developed countries as well as developing ones that are also affected by the changes in global economic climate. In particular, the debt crisis marking the recession of 1982 heavily affected economic activity in a number of developing countries especially those in Latin America.

The relationship between macroeconomic activity and the changes in oil price has received considerable attention in the literature.[10] Our world factor suggests that the two major global recessions took place right after large sudden increases in the price of oil.[11] The contemporaneous correlation between the world business cycle and the changes in the oil price has the expected negative sign but it is quite low (-0.04.) The correlation between 1 year leading oil price and the world factor is –0.41 implying a delayed response of the world factor to changes in oil prices. These results indicate that even if there is a strong link between the changes in oil prices and worldwide economic activity, this link is observed only in very short time intervals in which there are large changes in oil prices.

In figure 2a we plot the median of the U.S. country-specific factor along with the world factor, the North American regional factor, and the growth rate of U.S. output. The country, region, and world factors are multiplied by their factor loadings. The sum of these three factors with the idiosyncratic factor of the U.S. output is equal to the U.S. output series. The U.S. country factor displays the following peaks and troughs coincided with the NBER reference cycles[12]: the recessions of 1970, 1975, 1980, and 1982, and the booms of 1973, 1981. It is interesting to observe that the movements in the world factor are consistent with some of the business cycle reference dates: the troughs of 1975, 1980, 1982, and the peaks of 1969, and 1973. While the U.S. factor and the world factor exhibit some common movements in

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period separately. Considering the amount of the data, we had to use only 12 observations for the fixed exchange period and 18 for the flexible period if we attempted to implement such an exercise.

[9] This is the calculation in Riezman and Whiteman (1992). In another experiment we estimated a dynamic factor model with the data of G7 countries following Gregory, Head, and Raynauld (1997). That model suggests the world factor displays a deeper recession in 1974 than in 1982.

[10] See Hamilton (1983).

[11] To be more specific, major oil price increases of 1974 and 1980-81 were followed by the global recessions of 1975 and 1982. The oil price data is taken from the World Bank Commodity Markets and the Developing Countries.

particular time periods, there are also some notable differences between the two factors: one particular similarity is that both factors display the troughs of 1975, 1980, and 1982, and the peak of 1973. The world factor displays a boom in the late 1960s, whereas the U.S. country factor exhibits a trough. One potential explanation for this is that aggregate investment in the U.S. fell during this period while the growth rates of aggregate output and consumption were less than those in the earlier year. The world factor shows a relatively prolonged recession during the 1980s, while the U.S. country factor exhibits two back to back booms in 1981 and 1984.

The graphs indicate that up until the mid 1970s the world factor plays a more pronounced role in determining the magnitude of the aggregate output fluctuations in the U.S. than it does in the later period. While the world factor is particularly important in the booms of late 1960s, and 1973, both the regional and country factors seem to play a more important role in the recovery of the second half of the 1970s, and in the volatile period of the 1980s. The North American regional factor displays some of the reference cycles such as the troughs of 1970, 1975, 1980, and 1982, and the peaks of 1973, and 1981.

**Figure 2a: U.S. Output Growth and Scaled Factors**

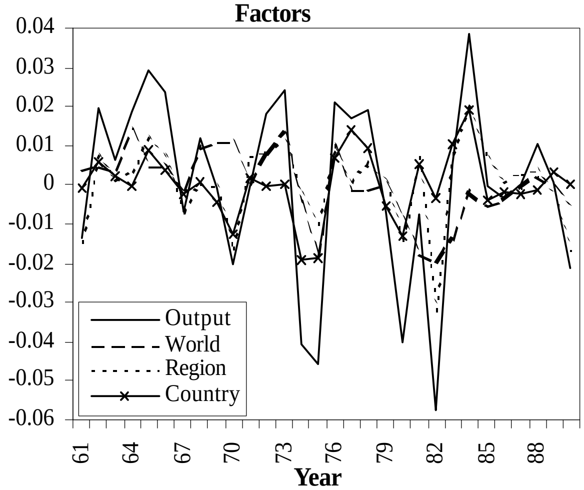



**Figure 2b: German Output Growth and Scaled Factors**

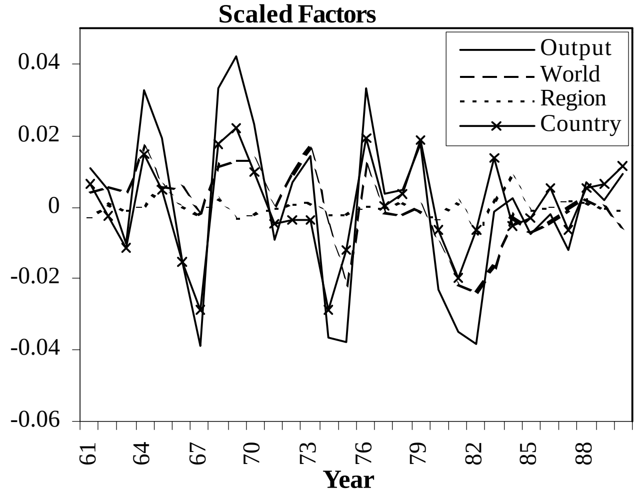



Figure 2b presents the median of the German country-specific factor along with the world common factor, European regional factor, and the growth rate of German output. Again, the country, region, and world factors are multiplied by their factor loading coefficients. The country factor captures the recessions of 1967, 1975, and 1982, and it exhibits the peaks of 1964, 1973, and 1979.[13] The world factor is important in explaining the recession of 1982, and the boom of 1973 in Germany, while the country factor contributes significantly to the recovery of the mid 1970s, the peaks of 1979 and 1983, and

[12] The NBER reference business cycle dates: Troughs: Feb. 1961, November 1970, March 1975, July 1980, November 1982, March 1991. Peaks: April 1960, December 1969, November 1973, January 1980, July 1981, July 1990.

[13] These peak and trough dates are taken from Artis, Kontomelis, and Osborn (1997).

the troughs of 1969, and 1975. The European regional factor plays only a minor role in contributing to the changes in aggregate output, though it does correspond with the recessions of 1967, 1975, and 1982, and the peaks of 1964, and 1973 in German economy.

In Figure 2c we plot the graphs the medians of Japan country-specific, world, Developed Asia factors, and the growth rate of Japan aggregate output. Compared with the economies of the U.S. and Germany, the Japanese economy has been slightly more stable during the time period we examined: in the 1960s Japan lived a prolonged expansionary period. This period was interrupted with the sudden increase in the oil price in 1974 and the country faced a major recession. The country factor captures this recession as well as the prolonged expansionary period during the 1960s. While the estimated country-specific factor displays minor recessions in 1965, 1971, and 1980, the growth rate of output during these particular years are positive. The difference between the country-specific factor and the aggregate output during these particular episodes can be explained with the following: while the aggregate output increased in 1965, 1971, and 1980, there were marked declines in aggregate investment coinciding or preceding these years in Japan. The estimated country factor captures the common movements in output, consumption as well as investment. Both the world and country-specific factors contribute to the movements in aggregate output in Japan, while their impact differs across time: for example, the world factor significantly contributes to the changes in aggregate output growth in 1964, and 1982. The country factor seems to be more dominant in the recession of 1974, and in the fluctuations in the second half of the 1980s.

**Figure 2c: Japanese Output Growth and Scaled Factors**

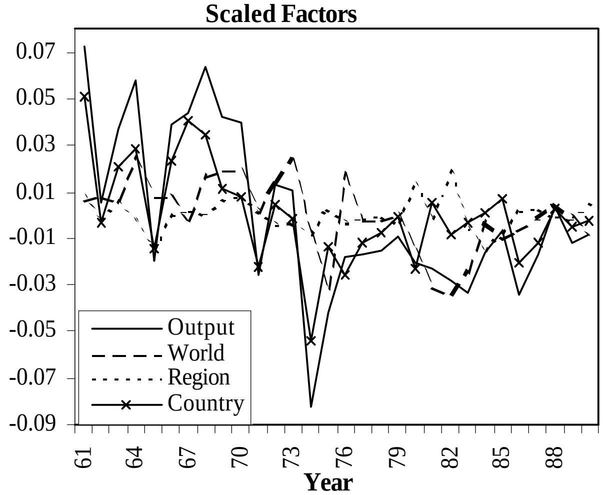
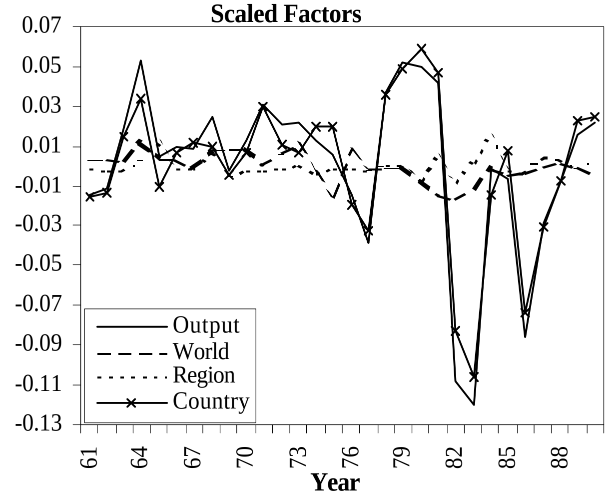



**Figure 2d: Mexican Output Growth and Scaled Factors**




The country-specific factors of developing economies also exhibit some important historical episodes. For example, the country factors of several Latin American economies (such as Mexico, Chile, and Argentina) display the downturn associated with the debt crisis in 1982. Figure 2d plots the median of the Mexican factor along with the medians of the world and region factors and Mexican output growth. Notice that the large swings in Mexican output are largely do to the country factor.

The results reported in this section suggest that the world, region, and country-specific factors played different roles in different time intervals: in some episodes, the country factor was the main force, in some others the world factor seemed to be relatively more important in explaining the short run variation in economic activity. We examine the quantitative importance of the common factors more formally in Section V.

## IV. Persistence Properties of the Dynamic Factors

We are interested in examining the persistence properties of the different types of factors in order to establish some facts that may be useful in modeling open-economies. If a type of factor is more or less persistent than the others we would want to think about what types of frictions would cause these differences. Here, the first-order autocorrelation serves as a proxy for the persistence of the estimated factors. The autocorrelation is calculated using the median of the estimated factors. Note that the quantiles of the factors are very tight, implying that there is little uncertainty in our persistence estimates.

**Table 1: Autocorrelations of Dynamic Factors**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| World | 0.50 | El Salvador | 0.45 | Peru | 0.35 | Singapore | 0.44 | Greece | -0.03 |
| **Regional Factors** | | Guatemala | 0.40 | Uruguay | 0.31 | Thailand | 0.05 | Iceland | 0.21 |
| N. America | -0.10 | Honduras | 0.05 | Venezuela | 0.06 | Bangladesh | -0.30 | Ireland | 0.26 |
| S. America | -0.14 | Jamaica | -0.13 | Cameroon | 0.22 | India | -0.06 | Italy | -0.06 |
| Africa | 0.16 | Mexico | 0.41 | Ivory Coast | 0.17 | Indonesia | 0.26 | Luxembourg | 0.11 |
| Asia (Rich) | 0.03 | Panama | 0.11 | Kenya | -0.27 | Pakistan | 0.02 | Netherlands | 0.11 |
| Asia (Poor) | 0.04 | Trididad | -0.11 | Morocco | 0.30 | Phillipines | 0.50 | Norway | 0.44 |
| Europe | -0.13 | Argentina | 0.00 | Senegal | -0.45 | Sri Lanka | -0.33 | Portugal | 0.22 |
| Oceania | 0.09 | Bolivia | 0.07 | S. Africa | 0.09 | France | -0.04 | Spain | 0.61 |
| **Country Factors** | | Brazil | 0.35 | Zimbabwe | -0.19 | Austria | -0.25 | Sweden | 0.34 |
| USA | 0.25 | Chile | 0.03 | Hong Kong | 0.10 | Belgium | -0.26 | Switzerland | 0.32 |
| Canada | 0.00 | Columbia | -0.44 | Japan | 0.30 | Denmark | -0.07 | U.K. | 0.17 |
| Costa Rica | 0.18 | Ecuador | 0.36 | Korea | 0.14 | Finland | 0.16 | Austria | -0.31 |
| Dom. Rep. | -0.32 | Paraguay | 0.02 | Malaysia | 0.13 | Germany | 0.13 | New Zealand | 0.05 |

Table 1 contains the autocorrelations of the world, region, and country-specific factors. The world factor has large and positive autocorrelation (0.50). Compared to the autocorrelations of the regional factors and most of the country factors, the world factor is much more persistent. The African regional factor is the most persistent regional factor (0.16), and the South American factor has the largest negative autocorrelation (-0.14) of the regional factors.

The autocorrelations of the country-specific factors vary substantially across countries: ranging from a low of –0.45 (Senegal) to a high of 0.61 (Spain). More than two thirds of the country factors exhibit positive autocorrelation. However, in most cases the autocorrelation is much smaller than the world factor's autocorrelation. The serial correlation in the Spanish factor is not surprising given that Spain's output, consumption, and investment time series are more persistent than those of other countries. Further, the world factor is more persistent than output of all countries except Spain. Countries whose country factors exhibit relatively low negative autocorrelation, such as Bangladesh, Colombia, Senegal, and Sri Lanka all have negatively autocorrelated output, consumption, and investment time series. Similarly, countries whose country factors exhibit relatively high positive autocorrelations, such as Spain, Philippines, Singapore, and Norway have positively autocorrelated output, consumption, and investment series.[14]

The results indicate most of the persistent, or low frequency, comovement across economies is captured by the world factor. The higher frequency comovement seems to be captured by the regional and country factors. From a modeling standpoint this leads to the question: in a dynamic business cycle model of an open economy what type of friction could lead to low frequency comovement across the world and higher frequency comovement across aggregates within a country and across smaller regions? Alternatively, we could think of a model with a persistent global technology shock and country-specific shocks that may be driven by country-specific fiscal or monetary policy shocks that are less persistent. We could also think of country and region specific shocks linked to natural disasters or wars that are more transient in nature as possible explanations for these phenomena.

## V. Variance Decompositions

To measure the quantitative importance of the relative contributions of the world, region, and country factors to variations in aggregate variables in each country we estimate the share of the variance of each macroeconomic aggregate due to each factor. We decompose the variance of each observable into the fraction that is due to each of the three factors and the idiosyncratic component. With orthogonal factors the variance of observable i can be written:

[14] Our results regarding persistence properties of world and country factors are different than those of Gregory, Head, and Raynauld (1997) on some dimensions. For example, their results indicate that Japan and Germany country-specific factors are negatively autocorrelated, and Canada, France, Italy are positively correlated. We find that Canada, Germany, and Japan's country-specific factors are positively autocorrelated, and France, Italy country factors are negatively autocorrelated. Considering that they use quarterly data (1970-1990), and we use annual data (1960-1990), and our econometric model is different than theirs, these discrepancies are not surprising. One important similarity between their findings and the results reported here should be highlighted: the world factor is more persistent than the country factors and countries' aggregate output in most cases.

(6) $\text{var}(y_{i,t}) = (b_i^{world})^2 \text{var}(f_t^{world}) + (b_i^{region})^2 \text{var}(f_{r,t}^{region}) + (b_i^{country})^2 \text{var}(f_{n,t}^{country}) + \text{var}(\varepsilon_{i,t})$

The fraction of volatility due to, say, the world factor would be:

$$\frac{(b_i^{world})^2 \text{var}(f_t^{world})}{\text{var}(y_{i,t})}$$

Since there is no guarantee that the factors are orthogonal we use orthogonalized versions of the factors to compute the variance decompositions. The order of orthogonalization is: world factor, regional factor, country factor.[15] To calculate measures of uncertainty for the variance decompositions we do the calculations at each step of the chain, which provides us with the posterior distribution of each variance decomposition.

We present the variance shares attributable to the common factors in Table 2. This table presents averages for each region. Complete tables with the variance decompositions for each individual country are in the Appendix (tables A1-A7). As Tables 2 and A1 show, the world factor explains a significant fraction of the fluctuations in all three aggregates in the North American countries. In these economies, the world factor accounts for a significant share of the variance in output and consumption. The regional factor is the most important one since it on average explains between 29 to 39 percent of variance of the three aggregates. In these economies, the country-specific factor plays an important role in accounting for the investment dynamics: on average more than 31 percent of the investment variation is due to the country-specific factor.

Table A3 presents variance decompositions for European countries. The world factor explains more than 32 percent of output and 24 percent of consumption variability. However, the world factor share of output volatility ranges widely across these countries: fluctuations in the world factor explain less than 4 percent in Iceland to a high of 70 percent in France. Roughly half of the volatility in output and almost 42 percent of variation in investment is due to the country-specific factors. Interestingly, the European regional factor plays a relatively minor role in accounting for the economic activity in these countries: while it explains less than 1 percent of output volatility in five countries, it accounts for more than 5 percent of the output variance in only three countries. Its average contribution to output fluctuations is 2 percent. The country-specific factor along with idiosyncratic factor seem to be important in inducing variations in consumption and investment in European countries: together they explain 72 percent of consumption volatility and 75 percent of investment volatility.

While the world factor does not play as an important role as it does in the North American and European countries, it still explains a sizeable fraction of aggregate volatility in countries in South

[15] The order of orthogonalization has little impact on the results. All of the result remain qualitatively the same under alternative orderings, and the quantitative differences are small.

America, Developed Asia, and Oceania (see tables A2, A5, and A7.) For example, the world factor on average accounts for more than 17 percent of the output and 12 percent of consumption volatility in South American countries. It explains 13 percent and 15 percent of the output variance in the Developed Asia and Oceania regions. The relative importance of the other common factors in explaining macroeconomic variation in these three regions also has similar quantitative characteristics: although, the role of the regional factor seems to be minor, the country-specific factor is quite important in explaining variation in all three aggregates. The country-specific factor captures more than 63 percent of the output fluctuations in all three regions.

**Table 2: Variance Decompositions: Averages by Region**

| | | **World Factor** | | | **Regional Factor** | | | **Country Factor** | | | **Idiosyncratic** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** |
| **North America** | **O** | 30.4 | 33.5 | 36.6 | 32.9 | 39.4 | 46.5 | 11.2 | 18.7 | 24.9 | 6.5 | 7.4 | 8.5 |
| | **C** | 25.8 | 28.5 | 31.3 | 22.4 | 29.4 | 37.1 | 8.3 | 15.5 | 22.5 | 21.3 | 24.1 | 26.7 |
| | **I** | 11.9 | 13.9 | 16.0 | 31.0 | 39.3 | 50.0 | 20.4 | 31.3 | 40.3 | 10.2 | 13.0 | 16.1 |
| **South America** | **O** | 16.2 | 17.9 | 19.6 | 3.0 | 4.9 | 7.2 | 59.7 | 63.9 | 67.9 | 9.7 | 11.9 | 14.4 |
| | **C** | 10.9 | 12.2 | 13.5 | 3.3 | 5.2 | 7.5 | 52.6 | 57.2 | 61.8 | 21.0 | 24.0 | 27.0 |
| | **I** | 6.7 | 7.8 | 8.9 | 1.8 | 3.1 | 4.8 | 26.9 | 30.6 | 34.4 | 53.6 | 57.2 | 60.8 |
| **Africa** | **O** | 4.9 | 5.9 | 6.9 | 3.2 | 6.1 | 10.1 | 66.1 | 70.8 | 75.1 | 12.6 | 15.3 | 18.0 |
| | **C** | 3.5 | 4.3 | 5.3 | 2.5 | 4.9 | 8.3 | 68.7 | 73.6 | 78.0 | 12.0 | 15.0 | 18.3 |
| | **I** | 3.2 | 4.0 | 4.8 | 1.6 | 3.3 | 5.5 | 7.0 | 8.9 | 10.9 | 79.3 | 82.3 | 85.1 |
| **Asia (Rich)** | **O** | 11.9 | 13.3 | 14.6 | 1.5 | 2.8 | 4.8 | 65.9 | 69.8 | 73.3 | 10.1 | 12.4 | 15.1 |
| | **C** | 9.4 | 10.6 | 11.8 | 1.1 | 2.2 | 4.0 | 53.2 | 57.5 | 61.6 | 24.7 | 28.2 | 31.6 |
| | **I** | 8.5 | 9.7 | 10.9 | 2.4 | 3.9 | 6.0 | 34.1 | 38.0 | 41.8 | 43.5 | 46.9 | 50.4 |
| **Asia Poor** | **O** | 3.6 | 4.4 | 5.2 | 3.4 | 6.1 | 9.4 | 62.3 | 67.6 | 72.4 | 16.1 | 19.9 | 24.1 |
| | **C** | 6.5 | 7.5 | 8.5 | 3.2 | 5.7 | 9.0 | 48.8 | 54.2 | 59.3 | 26.3 | 30.5 | 34.9 |
| | **I** | 0.3 | 0.5 | 0.8 | 2.1 | 3.8 | 6.1 | 20.1 | 22.8 | 25.6 | 67.8 | 71.6 | 75.2 |
| **Europe** | **O** | 30.2 | 32.3 | 34.5 | 1.3 | 2.3 | 3.7 | 44.5 | 48.2 | 51.8 | 13.4 | 15.8 | 18.5 |
| | **C** | 22.6 | 24.4 | 26.3 | 1.3 | 2.3 | 3.5 | 26.4 | 30.3 | 34.3 | 37.6 | 41.5 | 45.5 |
| | **I** | 20.6 | 22.7 | 24.9 | 0.9 | 1.6 | 2.8 | 36.9 | 41.8 | 46.6 | 28.4 | 32.4 | 36.4 |
| **Oceania** | **O** | 12.6 | 14.3 | 16.1 | 1.2 | 2.8 | 5.4 | 66.5 | 69.9 | 73.0 | 9.5 | 11.0 | 12.7 |
| | **C** | 11.9 | 13.2 | 14.5 | 0.7 | 1.7 | 3.2 | 29.9 | 33.2 | 36.6 | 47.5 | 50.6 | 53.5 |
| | **I** | 8.1 | 9.7 | 11.4 | 1.5 | 3.5 | 6.4 | 67.3 | 71.6 | 75.5 | 10.5 | 13.0 | 15.7 |

Unlike those in North America and Europe, in African countries, the country factors explain most of the volatility in output and consumption (see table A4.) The country factors account for more than 70 percent of output and 73 percent of consumption variation. A large fraction, 82 percent, of the investment variability is due to the idiosyncratic factor in African countries. While the world factor accounts for less than 1 percent of the output variation in Kenya and Cameroon, it explains more than 17 percent of Ivory Coast's and 15 percent of South African volatility.

Examination of the quantitative importance of the common factors in the Developing Asia region present a similar picture to the one for African countries (see table A5). In Developing Asian economies, the country factor plays an important role in explaining the volatilities of output and consumption. On average, it explains 68 percent of output variation and 55 percent of consumption volatility. Moreover, as in African countries, most of the variation in investment is attributable to the idiosyncratic factor in these countries, and the world factor plays a modest role, explaining less than 5 percent the output volatility.

Examining Table 2 and the tables in the Appendix we find some interesting regularities. The first is that there is a world business cycle. Our findings suggest that there is a world common component in aggregate output, consumption, and investment for almost all of the countries in our sample. As table 3 indicates the world common factor (the world business cycle) on average accounts for almost 19 percent of aggregate variation in output. Moreover, the world factor accounts for almost 15 percent of consumption and 12 percent of investment volatility.

Interestingly, the world factor plays a more important role in explaining economic activity in advanced industrialized countries than it does in developing economies. Table 3 compares the world averages to G7 averages: while the world factor explains 41 percent of the output volatility in the G7 economies, less than 20 percent of the output variation is attributable to the world factor in the other countries. The share of variance due to the world factor substantially differs across the G7 countries: it ranges from a low of 20 percent in the U.K. to a high of 71 percent in France. While the world factor captures almost 27 percent of the variation in investment, it accounts for approximately 31 percent of the consumption volatility in the G7 economies. As we have already discussed above, the role of the world factor is less important in developing countries in the South America and Africa regions.

**Table 3: Summary Variance Decompositions for World and G7**

| | | World Factor | | | Regional Factor | | | Country Factor | | | Idiosyncratic | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** |
| **G7 Countries** | **O** | 38.7 | 41.3 | 43.9 | 11.2 | 14.1 | 17.5 | 30.0 | 34.4 | 38.4 | 7.7 | 8.9 | 10.3 |
| | **C** | 28.1 | 30.6 | 33.2 | 8.6 | 11.8 | 15.5 | 17.7 | 22.2 | 26.8 | 30.3 | 33.2 | 36.2 |
| | **I** | 24.3 | 26.8 | 29.4 | 10.1 | 13.5 | 17.7 | 34.7 | 41.2 | 47.0 | 13.7 | 16.7 | 19.9 |
| **World** | **O** | 17.7 | 19.4 | 21.1 | 3.3 | 5.2 | 7.7 | 55.4 | 59.7 | 63.6 | 11.7 | 14.1 | 16.8 |
| | **C** | 13.5 | 14.9 | 16.3 | 2.9 | 4.7 | 7.1 | 44.0 | 48.6 | 53.0 | 26.7 | 30.2 | 33.7 |
| | **I** | 10.2 | 11.5 | 12.9 | 2.5 | 4.1 | 6.1 | 28.8 | 32.8 | 36.7 | 46.6 | 50.2 | 53.7 |

The world and regional factors together account for a larger share of fluctuations in output than in consumption in 42 out of 60 countries. While these two factors combined explain on average more than 19 percent of consumption volatility, they account for around 25 percent of aggregate output volatility (see table 3). This result implies that in most countries the country factors play a more important role in explaining consumption movements than the world and regional factors. This lends support to the hypothesis of imperfect international consumption risk sharing. In recent years, several authors document that cross-country correlations of output are larger than those of consumption, contrary to the predictions of dynamic general equilibrium international real business cycle models.[16]

The country factor along with the idiosyncratic factor play a much larger role in accounting for investment dynamics than the world and region factors. The country factor explains 33 percent of investment fluctuations, and the idiosyncratic factor accounts for 50 percent of investment volatility (see table 3). The world and regional factors combined account for 16 percent of investment volatility. The idiosyncratic behavior of investment volatility in our model is consistent with observed cross-country investment correlations. These correlations are low and in most of the countries they are lower than the cross-country correlations of output (see Zimmerman 1995, Christodoulakis, Dimelis, and Kollintzas 1995)[17]. One of the failures of the dynamic general equilibrium international real business cycle model is that it is unable to predict the low and positive cross-country investment correlations observed in the data.[18] In fact, they produce negative investment correlations. These models are generally driven by correlated productivity shocks. The results reported here suggest that there might be some other country-specific shocks or some other underlying cross-country differences accounting for the highly idiosyncratic behavior of the investment series.

The idiosyncratic factor is much more important in explaining investment dynamics in developing countries than the developed ones. More than 71 percent (Developing Asia) and 82 percent (Africa) of investment volatility is explained by the idiosyncratic factor. This is not the case for developed economies: among the developed countries, the idiosyncratic factor plays its most important role in Developed Asian economies: roughly 47 percent of the variation in investment is due to the idiosyncratic factor. On average, 17 percent of G7 and 33 percent of European investment volatility is accounted for by the idiosyncratic factor.

Our findings indicate that the regional factor plays a minor role in explaining macroeconomic variation: on average it explains 5 percent of output, 5 percent of consumption, and 4 percent of

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[16] Backus, Kehoe, and Kydland (1995) name this inconsistency between the theory and the data as "the quantity anomaly" See Pakko (1997) and Kose (1997b) for an extensive discussion about the quantity anomaly in the developing country data. We compute the cross country correlations of output and consumption and find that 1087 out of 1770 consumption correlations across countries are lower than those of output correlations.

[17] Zimmermann (1995) use the quarterly data of 19 industrialized countries. His results indicate that 70 out of 110 cross country investment correlations are lower than those of output. Christodoulakis, Dimelis, and Kollintzas (1995) use the annual data of 12 EU countries. They find 48 out of that 66 cross country investment correlations are lower than those of output. We also computed cross country correlations of output and investment for the economies in our sample: 1098 out of 1770 cross country investment correlations are lower than those of output correlations.

[18] See Baxter and Crucini (1993), Baxter (1995), and Backus, Kehoe, and Kydland (1995) for models predicting negative cross correlations of investment.

investment volatility (see table 3). The regional factor seems to be playing its most important role in the North America region: it explains on average almost 40 percent of output volatility.[19]

Some recent studies provide empirical evidence that there is a distinct European business cycle. Lumsdaine and Prasad (1997) estimate a European common component using the data of industrial production in 14 European countries and employing time-varying weights. Their findings indicate that there are high positive correlations between country fluctuations in Europe and the European component. They interpret this result as an evidence for a European business cycle. In a related study, Artis, Kontolemis, and Osborn (1997) examine the cycles using industrial production data of G7 and 5 other European economies. They conclude that there exists a European business cycle. In a recent paper, Bergman, Bordo, and Jonung (1998) find high and significant correlations between output fluctuations of six European countries and interpret this result as an outcome of a European common market. Interestingly, we do not find evidence supporting the existence of a distinct European business cycle. Our findings indicate that a significant fraction of the common variations across economies is captured by the world factor.[20]

We do not provide the posterior distributions of the factor loadings due to space constraints, however, for almost all countries the coverage of the posterior distribution for the world factor loading coefficient in the output equations lies completely away from zero. Further, for most countries in our sample an increase in the world factor has a positive impact on domestic output. This is also true for both the consumption and investment series. While the median of the country factor loading coefficient of consumption is positive for all countries, the median country coefficient of investment is negative for seven countries. Interestingly, for more than half of the countries the median of the regional factor loading coefficient for all three series is negative. For example, for several countries in Europe the regional factor coefficient is negative in each series. These results suggest that the relation between regional business cycles and domestic fluctuations in main macroeconomic aggregates has no clear pattern across countries.

## VI. The relation between economic structure and the dynamic factors

To aid in interpreting the 180 variance decompositions in the previous section and in the appendix, we summarize the relationship between the structural characteristics of economies and the

[19] This result is consistent with those of Bergman, Bordo, and Jonung (1998) who find, through cross country correlation of output fluctuations for 1880-1995 period, business cycles in Canada and the US move very closely during 1880-1995 period for all monetary regimes they examine.

[20] It is important to note that even the business cycle patterns of European economies are quite similar, it might be misleading to interpret this similarity as evidence supporting a unique European business cycle. The similarity across business cycle dynamics in this region can be resulted from the fact that there are global shocks hitting these economies and inducing their cycles move together. To capture the relative importance of such global shocks, it is important to examine the world, region, and country-specific factors simultaneously.

relative importance of the three types factors. To do this, we employ a simple data summary device involving regressions. In particular, we regress the percent of variance of an observable attributable to a particular factor on a variety of explanatory variables that are related to country characteristics, such as the level of per capita gross domestic product, size of government sector in the economy, or volatility of aggregate output. For example, we take the fraction of the variance of output growth explained by the world factor in the 60 countries and regress this vector on per capita gross domestic product, volatility of output and share of the government sector in output. We repeat this exercise for the fraction of output growth variance attributed to the country, regional, and idiosyncratic factors as well. The process is repeated for consumption and investment volatility.

**VI.1. Output Growth Variance Decompositions**

Table 4.1 summarizes our results about the link between the structural characteristics of an economy, and the role of the dynamic factors in explaining output volatility. There are four explanatory variables in this regression: per capita GDP (PCGDP), share of government expenditure in GDP (Gov Shr), manufacturing share of output (Man Shr), and volatility of GDP growth (GDP Vol).[21]

The coefficient on the volatility of GDP growth in the regressions using the world factor variance decompositions is significant and negative, indicating that in less volatile economies, the world factor is more important in explaining output fluctuations. In section V, we found that the world factor played a more important role in explaining output fluctuations in more developed economies. Our regression results support this conclusion: in more developed economies that have less volatile aggregate output fluctuations, the world factor is more important in accounting for output volatility.[22] There is also a positive link between the level of per capita GDP and the importance of the world factor, providing further support for the importance of the world factor in richer countries. However, the coefficient on per capita GDP is not statistically significant at conventional significance levels.

Several variables seem to be important in accounting for the cross country variation in the importance of the country factor. First, in richer countries the country factor explains a smaller fraction of aggregate output volatility. Second, in more volatile economies the country factor plays a more important role. These two results are consistent with those reported for the world factor contrasting developed and

[21] PCGDP: Real GDP per capita in constant dollars (expressed in international prices, base 1985) from PWT; Gov Shr: Real Government share of GDP [%] (1985 intl. prices) from PWT; Man Shr: Manufacturing value added (% of GDP) from World Tables 1994; output volatility is the standard deviation of output growth over the sample period.

[22] In a recent paper, Kraay and Ventura (1998) observe that business cycle fluctuations in developed economies are more correlated with the world output than those of developing countries, and construct a model based on comparative advantage and asymmetries among the industries in which developed and developing economies specialize, to explain this observation.

developing countries.[23] Third, in those economies with larger manufacturing sectors, the country factor is more important in explaining output volatility.

The regional factor is more important in economies with a larger per capita GDP and also economies with a smaller manufacturing sector. There is a positive association between the role of the regional factor in explaining output volatility and the volatility of GDP. The relationship between richer countries and the regional factor is consistent with previous results that link the economies of more developed countries more tightly together.

In countries with larger governments and with larger manufacturing sector, the idiosyncratic factor is less important. As the volatility of GDP increases, the role of idiosyncratic factor in explaining output volatility decreases. Also, in those countries with a higher per capita GDP the idiosyncratic component is less important. This is a result of the fact that more developed countries (i.e. richer) have more of their output volatility explained by the factors that are common across countries: the world and regional factors.

**Table 4.1**

**Regression of Output Variance Decomposition on Economic Structure Variables**

| | **World Factor** | | | **Country Factor** | | | **Regional Factor** | | | **Idiosyncratic Factor** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R Sqr= | 0.426 | | R Sqr= | 0.367 | | R Sqr= | 0.28 | | R Sqr= | 0.349 |
| **Variable** | **Coeff** | **T-Stat** | **Prob** | **Coeff** | **T-Stat** | **Prob** | **Coeff** | **T-Stat** | **Prob** | **Coeff** | **T-Stat** | **Prob** |
| **PC GDP** | 0.00001 | 0.88 | 0.38 | -1E-05 | -1.53 | 0.13 | 2E-05 | 4.03 | 0.00 | -8E-06 | -2.41 | 0.02 |
| **Gov Shr** | 0.00029 | 0.08 | 0.94 | 0.00337 | 0.77 | 0.45 | 0.0033 | 1.63 | 0.11 | -0.007 | -3.76 | 0.00 |
| **Man Shr** | 0.00100 | 0.26 | 0.80 | 0.0089 | 1.92 | 0.06 | -0.004 | -1.69 | 0.10 | -0.006 | -3.26 | 0.00 |
| **GDP Vol** | -5.97957 | -3.94 | 0.00 | 5.3084 | 2.88 | 0.01 | 2.14 | 2.51 | 0.02 | -1.443 | -1.91 | 0.06 |

### VI.2. Consumption Growth Variance Decompositions

Table 4.2 shows the connection between country characteristics and the role of the dynamic factors in explaining consumption volatility. We consider three explanatory variables in these regressions: per capita GDP (PCGDP), share of government expenditure in GDP (Gov Shr), and volatility of GDP growth (GDP Vol). In richer countries, the fraction of consumption variance explained by the world factor is larger, while the fraction explained by the country factor is smaller. We also find that in more volatile economies, the role of the country factor in explaining consumption volatility is greater. In Section V, we found that in most of the countries the country factors play a more important role in explaining consumption volatility than the world and regional common factors, consistent with the

[23] Head (1995) finds that country size is negatively correlated with the volatility of main macroeconomic aggregates. He develops a model that generates this feature of the data as the aggregate shocks affecting all countries have a relatively larger impact on smaller countries. Crucini (1997) constructs a multi-country general equilibrium model to study business cycles in countries of different size and finds that the model is consistent with several features of the data.

literature on imperfect international consumption risk sharing among countries. Our regression results are consistent with much larger consumption risk sharing in rich developed economies than that in developing countries.[24]

The regional factor is more important in explaining consumption volatility in those countries with higher GDP volatility. There is also a positive association between the importance of the regional factor and per capita level of GDP. As output volatility increases, the role of the idiosyncratic factor in accounting for the variation in consumption goes down. Also, as the government share increases consumption volatility becomes less idiosyncratic. The point estimate on the coefficient on per capita GDP is negative in the regressions with the idiosyncratic factor, though it is not significant at conventional levels.

**Table 4.2**
**Regression of Consumption Variance Decomposition on Economic Structure Variables**

| | **World Factor** | | | **Country Factor** | | | **Regional Factor** | | | **Idiosyncratic Factor** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R Sqr= | 0.334 | | R Sqr= | 0.495 | | R Sqr= | 0.28 | | R Sqr= | 0.435 |
| **Variable** | **Coeff** | **T-Stat** | **Prob** | **Coeff** | **T-Stat** | **Prob** | **Coeff** | **T-Stat** | **Prob** | **Coeff** | **T-Stat** | **Prob** |
| **PC GDP** | 0.00001 | 2.14 | 0.04 | -2E-05 | -2.17 | 0.04 | 1E-05 | 4.04 | 0.00 | -8E-06 | -1.16 | 0.25 |
| **Gov Shr** | 0.00336 | 1.16 | 0.25 | 0.00774 | 1.91 | 0.06 | 0.0036 | 2.30 | 0.03 | -0.015 | -4.52 | 0.00 |
| **GDP Vol** | -3.51263 | -2.78 | 0.01 | 4.88279 | 2.77 | 0.01 | 2.6657 | 3.86 | 0.00 | -4.034 | -2.87 | 0.01 |

### VI.3. Investment Growth Variance Decompositions

Table 4.3 reports results on the link between the structural characteristics of an economy and the role of common factors in explaining investment volatility. There are two explanatory variables in these regressions: per capita GDP (PCGDP) and share of manufacturing in output (Man Shr). In richer countries, the world factor plays a larger role in explaining investment variation. The country factor is more important in accounting for investment volatility in those countries with a larger manufacturing sector. There is a positive association between the importance of the regional factor in explaining investment fluctuations and the level of per capita GDP. The idiosyncratic factor explains a larger fraction of the investment volatility in those countries with a smaller per capita GDP, and a smaller manufacturing industry. As with the output and consumption variance decompositions the world and regional factors are more important in richer countries, while the idiosyncratic component is more important in poorer countries.

[24] Tesar (1995) and Kose (1997a) find that, using cross-country correlations of output and consumption, the imperfect international consumption risk sharing is a much bigger problem for developing countries than developed ones.

**Table 4.3**
**Regression of Investment Variance Decomposition on Economic Structure Variables**

| | World Factor | | | Country Factor | | | Regional Factor | | | Idiosyncratic Factor | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R Sqr= | 0.244 | | R Sqr= | 0.274 | | R Sqr= | 0.11 | | R Sqr= | 0.525 |
| **Variable** | **Coeff** | **T-Stat** | **Prob** | **Coeff** | **T-Stat** | **Prob** | **Coeff** | **T-Stat** | **Prob** | **Coeff** | **T-Stat** | **Prob** |
| **PC GDP** | 0.00001 | 2.51 | 0.02 | 2.1E-05 | 2.53 | 0.02 | 7E-06 | 2.48 | 0.02 | -4E-05 | -5.02 | 0.00 |
| **Man Shr** | 0.00608 | 1.98 | 0.05 | 0.01366 | 2.33 | 0.02 | -0.002 | -1.08 | 0.29 | -0.018 | -3.20 | 0.00 |

## VII. Conclusion

In this study we employ a Bayesian dynamic latent factor model to study the dynamic comovement of macroeconomic aggregates in a broad cross-section of countries. We provide an analysis of comovement across the world, across regions and within countries. From a technical standpoint, the contribution of the paper is to examine the three types of comovement simultaneously.

We find that there is a significant world common component present in the fluctuations in almost all of the countries in the sample. While a substantial fraction of economic fluctuations is explained by the world common component in developed economies, the country-specific component along with the idiosyncratic component account for more of the volatility in developing economies. Contrary to the results of several studies, our findings suggest that regional business cycles, except for the North America region, do not play an important role in explaining aggregate volatility.

While a substantial fraction of output fluctuations is due to the world factor, consumption and investment dynamics are driven more by country and idiosyncratic factors. In particular, the country dynamic factors play a more important role in explaining consumption fluctuations than the world and regional factors; a result that is consistent with imperfect international consumption risk sharing among countries. We find that the country-specific along with idiosyncratic factor accounts for the bulk of the volatility in investment. We also document significant relationships between country structural characteristics, such as per capita GDP, output volatility and manufacturing and government shares of GDP.

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## Appendix

### Regional Definitions

| N. America | S. America | | Europe | | Asia (Poor) | Asia (Rich) |
|---|---|---|---|---|---|---|
| USA | Costa Rica | Bolivia | France | Italy | Bangladesh | Hong Kong |
| Canada | Dom. Rep. | Brazil | Austria | Luxembourg | India | Japan |
| **Africa** | El Salvador | Chile | Belgium | Netherlands | Indonesia | Korea |
| Cameroon | Guatemala | Columbia | Denmark | Norway | Pakistan | Malaysia |
| Ivory Coast | Honduras | Ecuador | Finland | Portugal | Phillipines | Singapore |
| Kenya | Jamaica | Paraguay | Germany | Spain | Sri Lanka | Thailand |
| Morocco | Mexico | Peru | Greece | Sweden | **Oceania** | |
| Senegal | Panama | Uruguay | Iceland | Switzerland | Australia | |
| S. Africa | Trididad | Venezuela | Ireland | U.K. | New Zealand | |
| Zimbabwe | Argentina | | | | | |

**Table A1: Variance Decompositions for North America**

| | | World Factor | | | Regional Factor | | | Country Factor | | | Idiosyncratic | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 |
| USA | O | 30.7 | 33.8 | 37.0 | 28.0 | 34.4 | 42.2 | 15.2 | 22.7 | 28.5 | 6.9 | 7.9 | 9.0 |
| | C | 30.6 | 33.6 | 36.7 | 13.4 | 19.2 | 26.3 | 8.0 | 13.8 | 19.5 | 27.1 | 30.2 | 33.3 |
| | I | 14.5 | 16.7 | 19.0 | 30.7 | 37.5 | 46.7 | 23.8 | 33.1 | 40.6 | 7.9 | 10.3 | 13.1 |
| CANADA | O | 30.0 | 33.1 | 36.3 | 37.8 | 44.5 | 50.8 | 7.3 | 14.6 | 21.4 | 6.0 | 7.0 | 8.0 |
| | C | 20.9 | 23.4 | 25.9 | 31.4 | 39.5 | 48.0 | 8.5 | 17.1 | 25.6 | 15.6 | 17.9 | 20.2 |
| | I | 9.4 | 11.1 | 13.0 | 31.2 | 41.2 | 53.3 | 17.0 | 29.5 | 40.0 | 12.5 | 15.7 | 19.0 |
| Regional Average | O | 30.4 | 33.5 | 36.6 | 32.9 | 39.4 | 46.5 | 11.2 | 18.7 | 24.9 | 6.5 | 7.4 | 8.5 |
| | C | 25.8 | 28.5 | 31.3 | 22.4 | 29.4 | 37.1 | 8.3 | 15.5 | 22.5 | 21.3 | 24.1 | 26.7 |
| | I | 11.9 | 13.9 | 16.0 | 31.0 | 39.3 | 50.0 | 20.4 | 31.3 | 40.3 | 10.2 | 13.0 | 16.1 |

**Table A2: Variance Decompositions for South America**

| | | World Factor | | | Regional Factor | | | Country Factor | | | Idiosyncratic | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 |
| COSTAR | O | 40.9 | 43.6 | 46.3 | 1.5 | 2.8 | 4.6 | 39.0 | 42.4 | 45.7 | 7.7 | 9.5 | 11.7 |
| | C | 29.9 | 32.6 | 35.2 | 2.5 | 4.2 | 6.2 | 27.9 | 33.4 | 38.6 | 24.5 | 28.6 | 33.0 |
| | I | 7.2 | 8.3 | 9.5 | 0.4 | 1.0 | 2.0 | 27.5 | 34.4 | 41.8 | 48.2 | 55.1 | 61.6 |
| DOMINI | O | 7.3 | 8.6 | 10.0 | 17.2 | 26.0 | 35.7 | 50.4 | 59.8 | 68.9 | 3.5 | 4.3 | 5.3 |
| | C | 7.3 | 8.7 | 10.3 | 21.2 | 30.3 | 39.8 | 41.2 | 50.6 | 59.6 | 8.1 | 9.3 | 10.6 |
| | I | 4.7 | 5.6 | 6.5 | 4.8 | 9.4 | 15.3 | 41.4 | 47.8 | 53.0 | 34.0 | 36.2 | 38.5 |
| ELSALV | O | 19.9 | 22.5 | 25.2 | 0.5 | 1.1 | 2.2 | 65.4 | 68.4 | 71.4 | 5.5 | 6.4 | 7.5 |
| | C | 19.6 | 22.1 | 24.7 | 0.7 | 1.6 | 2.8 | 66.3 | 69.3 | 72.2 | 4.5 | 5.4 | 6.5 |
| | I | 10.2 | 11.4 | 12.6 | 0.6 | 1.2 | 2.2 | 12.0 | 13.5 | 15.1 | 71.5 | 73.1 | 74.5 |
| GUATEM | O | 45.0 | 47.6 | 50.3 | 0.2 | 0.5 | 1.1 | 41.1 | 44.0 | 46.9 | 5.7 | 6.7 | 7.8 |
| | C | 44.6 | 47.3 | 50.1 | 0.2 | 0.6 | 1.2 | 40.3 | 43.3 | 46.2 | 6.6 | 7.7 | 9.0 |
| | I | 9.9 | 11.3 | 12.7 | 2.1 | 3.7 | 5.7 | 30.0 | 33.4 | 36.9 | 47.3 | 50.5 | 53.4 |
| HONDUR | O | 30.6 | 33.5 | 36.4 | 0.5 | 1.2 | 2.2 | 41.7 | 45.3 | 48.9 | 16.2 | 18.6 | 21.2 |
| | C | 15.2 | 17.0 | 18.9 | 0.3 | 0.8 | 1.6 | 61.1 | 65.0 | 68.5 | 13.0 | 15.8 | 19.2 |
| | I | 15.8 | 17.6 | 19.4 | 3.1 | 5.5 | 8.4 | 0.2 | 0.5 | 1.1 | 71.7 | 74.8 | 77.7 |

**Table A2: Variance Decompositions for South America (continued)**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **JAMAIC** | **O** | 6.6 | 7.6 | 8.7 | 1.1 | 2.5 | 4.5 | 67.3 | 71.8 | 75.8 | 12.6 | 16.1 | 20.3 |
| | **C** | 0.1 | 0.2 | 0.4 | 0.4 | 0.9 | 1.8 | 70.6 | 75.3 | 80.0 | 17.7 | 22.4 | 26.9 |
| | **I** | 0.1 | 0.3 | 0.5 | 4.5 | 6.7 | 9.2 | 0.4 | 1.0 | 1.9 | 88.4 | 90.9 | 93.2 |
| **MEXICO** | **O** | 11.9 | 13.4 | 15.0 | 0.5 | 1.1 | 2.1 | 79.2 | 81.2 | 83.0 | 2.7 | 3.2 | 3.8 |
| | **C** | 10.4 | 11.7 | 13.1 | 0.6 | 1.2 | 2.2 | 77.8 | 79.8 | 81.6 | 5.3 | 6.2 | 7.1 |
| | **I** | 12.1 | 13.5 | 15.0 | 1.1 | 2.1 | 3.5 | 62.2 | 64.5 | 66.8 | 17.5 | 18.9 | 20.3 |
| **PANAMA** | **O** | 0.3 | 0.6 | 1.0 | 3.0 | 5.0 | 7.5 | 67.8 | 73.7 | 78.7 | 14.0 | 18.6 | 24.2 |
| | **C** | 0.7 | 1.1 | 1.5 | 0.7 | 1.5 | 2.6 | 40.4 | 46.5 | 53.0 | 43.6 | 49.9 | 55.8 |
| | **I** | 0.1 | 0.1 | 0.2 | 0.3 | 0.7 | 1.4 | 28.6 | 35.4 | 41.7 | 56.5 | 62.6 | 69.4 |
| **TRINID** | **O** | 0.9 | 1.5 | 2.3 | 18.7 | 27.9 | 37.7 | 54.2 | 64.0 | 73.4 | 4.7 | 5.6 | 6.6 |
| | **C** | 0.2 | 0.4 | 0.8 | 22.8 | 33.4 | 44.3 | 49.6 | 60.3 | 71.0 | 3.9 | 4.8 | 5.9 |
| | **I** | 1.1 | 1.7 | 2.2 | 1.4 | 2.6 | 4.2 | 0.8 | 1.5 | 2.5 | 91.6 | 93.1 | 94.2 |
| **ARGENT** | **O** | 13.1 | 14.4 | 15.8 | 0.5 | 1.2 | 2.3 | 76.4 | 78.5 | 80.4 | 3.8 | 4.7 | 5.8 |
| | **C** | 8.8 | 9.9 | 11.1 | 0.8 | 1.8 | 3.3 | 65.6 | 68.6 | 71.5 | 16.2 | 18.3 | 20.6 |
| | **I** | 12.3 | 13.6 | 14.9 | 0.2 | 0.4 | 0.8 | 55.7 | 58.7 | 61.6 | 24.1 | 26.6 | 29.1 |
| **BOLIVI** | **O** | 37.8 | 41.1 | 44.6 | 0.9 | 1.8 | 3.2 | 18.5 | 25.2 | 31.5 | 24.3 | 30.0 | 36.2 |
| | **C** | 5.2 | 6.2 | 7.4 | 1.1 | 2.4 | 4.5 | 6.0 | 12.4 | 20.8 | 67.9 | 76.0 | 82.4 |
| | **I** | 5.2 | 6.8 | 8.5 | 0.6 | 1.4 | 2.6 | 8.9 | 16.3 | 25.5 | 65.2 | 73.6 | 80.5 |
| **BRAZIL** | **O** | 22.7 | 24.6 | 26.5 | 6.2 | 8.8 | 11.6 | 53.1 | 56.6 | 60.0 | 6.8 | 8.5 | 10.7 |
| | **C** | 16.9 | 18.7 | 20.6 | 4.4 | 6.7 | 9.4 | 42.8 | 47.2 | 51.4 | 23.0 | 25.9 | 29.2 |
| | **I** | 17.7 | 19.2 | 20.8 | 1.6 | 2.7 | 4.1 | 25.0 | 29.1 | 33.3 | 44.2 | 47.6 | 51.4 |
| **CHILE** | **O** | 11.4 | 12.9 | 14.5 | 1.2 | 2.4 | 4.1 | 68.5 | 71.3 | 73.9 | 10.8 | 12.5 | 14.0 |
| | **C** | 14.4 | 16.4 | 18.4 | 2.7 | 4.8 | 7.4 | 69.2 | 72.5 | 75.5 | 3.1 | 4.3 | 5.8 |
| | **I** | 6.7 | 8.2 | 9.7 | 1.2 | 2.5 | 4.3 | 6.4 | 8.6 | 10.9 | 76.6 | 78.6 | 80.9 |
| **COLOMB** | **O** | 28.0 | 30.0 | 32.1 | 1.3 | 2.5 | 4.2 | 45.9 | 49.7 | 53.3 | 13.7 | 16.2 | 19.2 |
| | **C** | 22.4 | 24.3 | 26.2 | 1.6 | 3.2 | 5.5 | 42.0 | 46.9 | 51.7 | 19.8 | 23.6 | 27.9 |
| | **I** | 5.4 | 6.6 | 7.9 | 0.3 | 0.7 | 1.4 | 14.8 | 19.5 | 24.8 | 67.2 | 72.2 | 76.7 |
| **ECUADO** | **O** | 5.7 | 6.8 | 7.9 | 1.4 | 2.6 | 4.2 | 67.1 | 71.7 | 75.8 | 13.7 | 17.4 | 21.7 |
| | **C** | 2.8 | 3.6 | 4.5 | 0.2 | 0.6 | 1.2 | 47.9 | 52.7 | 57.2 | 37.8 | 42.1 | 46.6 |
| | **I** | 0.5 | 0.9 | 1.4 | 5.7 | 8.1 | 10.6 | 30.4 | 34.6 | 38.9 | 51.5 | 55.4 | 59.3 |
| **PARAGU** | **O** | 2.1 | 2.8 | 3.5 | 0.6 | 1.4 | 2.8 | 85.4 | 87.6 | 89.5 | 5.5 | 6.8 | 8.2 |
| | **C** | 1.0 | 1.5 | 2.1 | 0.5 | 1.1 | 2.3 | 81.9 | 84.3 | 86.4 | 10.1 | 11.8 | 13.6 |
| | **I** | 10.6 | 11.9 | 13.4 | 0.4 | 1.1 | 2.2 | 33.2 | 35.9 | 38.6 | 47.0 | 49.5 | 52.2 |
| **PERU** | **O** | 1.9 | 2.5 | 3.3 | 0.4 | 0.9 | 1.7 | 87.5 | 89.5 | 91.3 | 4.5 | 5.8 | 7.4 |
| | **C** | 3.7 | 4.7 | 5.8 | 0.2 | 0.5 | 1.0 | 73.0 | 75.6 | 78.1 | 16.2 | 18.3 | 20.5 |
| | **I** | 0.3 | 0.6 | 1.0 | 0.9 | 1.7 | 3.0 | 48.2 | 51.6 | 54.9 | 41.6 | 44.6 | 48.0 |
| **URUGUA** | **O** | 6.5 | 7.5 | 8.7 | 1.0 | 2.0 | 3.5 | 80.4 | 82.7 | 84.8 | 5.2 | 6.4 | 7.9 |
| | **C** | 2.8 | 3.5 | 4.3 | 1.2 | 2.6 | 4.4 | 72.8 | 75.8 | 78.5 | 14.7 | 16.9 | 19.2 |
| | **I** | 3.0 | 3.9 | 4.9 | 3.3 | 5.6 | 8.4 | 39.4 | 43.0 | 46.5 | 42.5 | 45.7 | 49.1 |
| **VENEZU** | **O** | 16.0 | 18.0 | 20.0 | 0.5 | 1.1 | 2.0 | 45.6 | 50.9 | 56.1 | 24.0 | 28.8 | 34.0 |
| | **C** | 0.6 | 1.0 | 1.5 | 0.3 | 0.8 | 1.7 | 22.8 | 27.7 | 32.9 | 63.9 | 69.0 | 74.0 |
| | **I** | 5.2 | 6.3 | 7.4 | 0.7 | 1.5 | 2.7 | 46.5 | 52.5 | 58.8 | 32.6 | 38.6 | 44.4 |
| **Regional Average** | **O** | 16.2 | 17.9 | 19.6 | 3.0 | 4.9 | 7.2 | 59.7 | 63.9 | 67.9 | 9.7 | 11.9 | 14.4 |
| | **C** | 10.9 | 12.2 | 13.5 | 3.3 | 5.2 | 7.5 | 52.6 | 57.2 | 61.8 | 21.0 | 24.0 | 27.0 |
| | **I** | 6.7 | 7.8 | 8.9 | 1.8 | 3.1 | 4.8 | 26.9 | 30.6 | 34.4 | 53.6 | 57.2 | 60.8 |

Table A3: Variance Decompositions for Europe

| | | World Factor | | | Regional Factor | | | Country Factor | | | Idiosyncratic | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 |
| **FRANCE** | **O** | 67.8 | 70.6 | 73.3 | 3.8 | 5.3 | 7.1 | 7.5 | 10.2 | 13.0 | 11.2 | 12.7 | 14.3 |
| | **C** | 35.3 | 38.7 | 42.2 | 6.2 | 8.8 | 11.6 | 1.1 | 2.9 | 6.2 | 41.6 | 45.7 | 49.7 |
| | **I** | 50.8 | 55.2 | 59.2 | 2.7 | 4.1 | 5.8 | 12.2 | 18.0 | 24.1 | 16.5 | 20.6 | 24.9 |
| **AUSTRI** | **O** | 49.4 | 52.1 | 54.7 | 3.6 | 5.2 | 7.0 | 19.2 | 23.1 | 26.8 | 15.7 | 18.5 | 21.7 |
| | **C** | 8.8 | 10.2 | 11.6 | 0.9 | 1.9 | 3.3 | 22.0 | 31.0 | 39.7 | 47.2 | 55.7 | 64.2 |
| | **I** | 49.0 | 52.5 | 56.0 | 0.2 | 0.6 | 1.2 | 6.4 | 10.9 | 16.3 | 29.3 | 33.5 | 37.6 |
| **BELGIU** | **O** | 59.1 | 63.3 | 67.3 | 3.4 | 5.2 | 7.3 | 9.3 | 13.2 | 17.6 | 14.1 | 16.0 | 18.3 |
| | **C** | 51.8 | 54.2 | 56.4 | 1.2 | 2.1 | 3.2 | 0.7 | 1.6 | 3.2 | 37.7 | 40.5 | 43.0 |
| | **I** | 34.0 | 38.1 | 42.4 | 0.8 | 1.9 | 3.4 | 26.0 | 33.5 | 40.4 | 18.7 | 24.3 | 30.7 |
| **DENMAR** | **O** | 21.6 | 23.5 | 25.5 | 0.2 | 0.6 | 1.1 | 63.1 | 65.5 | 67.9 | 8.4 | 9.6 | 10.9 |
| | **C** | 10.2 | 11.7 | 13.3 | 0.4 | 1.0 | 2.1 | 47.8 | 50.9 | 54.2 | 32.6 | 35.1 | 37.6 |
| | **I** | 21.3 | 23.5 | 25.8 | 0.3 | 0.6 | 1.3 | 62.7 | 65.7 | 68.7 | 7.2 | 9.0 | 10.9 |
| **FINLAN** | **O** | 12.9 | 14.8 | 16.8 | 2.0 | 4.1 | 7.1 | 60.8 | 65.1 | 69.1 | 11.3 | 13.7 | 16.4 |
| | **C** | 5.6 | 6.8 | 8.0 | 2.2 | 3.8 | 5.8 | 6.0 | 9.0 | 12.3 | 75.2 | 78.5 | 81.6 |
| | **I** | 1.7 | 2.5 | 3.5 | 1.2 | 2.9 | 5.6 | 63.7 | 69.6 | 74.8 | 18.1 | 22.4 | 27.1 |
| **GERMAN** | **O** | 53.1 | 55.3 | 57.6 | 0.5 | 1.2 | 2.2 | 33.5 | 36.0 | 38.5 | 5.5 | 6.3 | 7.3 |
| | **C** | 37.8 | 40.8 | 43.7 | 0.2 | 0.5 | 1.0 | 14.5 | 17.1 | 20.1 | 38.1 | 40.2 | 42.2 |
| | **I** | 32.6 | 35.0 | 37.3 | 0.6 | 1.4 | 2.5 | 50.6 | 54.3 | 57.7 | 5.9 | 7.8 | 10.1 |
| **GREECE** | **O** | 32.7 | 35.6 | 38.6 | 0.8 | 1.7 | 3.0 | 46.9 | 50.7 | 54.5 | 8.2 | 10.2 | 12.5 |
| | **C** | 1.8 | 2.8 | 3.9 | 1.3 | 2.6 | 4.3 | 32.3 | 38.8 | 44.8 | 48.7 | 54.2 | 60.2 |
| | **I** | 35.0 | 37.3 | 39.5 | 0.5 | 1.2 | 2.3 | 30.7 | 35.1 | 39.6 | 21.8 | 25.2 | 28.7 |
| **ICELAN** | **O** | 2.7 | 3.3 | 4.1 | 0.3 | 0.7 | 1.5 | 74.4 | 77.9 | 81.0 | 13.9 | 16.8 | 20.1 |
| | **C** | 5.7 | 6.7 | 7.8 | 0.2 | 0.5 | 1.1 | 63.8 | 68.2 | 72.4 | 19.6 | 23.5 | 27.8 |
| | **I** | 0.1 | 0.1 | 0.2 | 0.2 | 0.5 | 1.1 | 31.1 | 35.8 | 40.5 | 58.0 | 62.7 | 67.4 |
| **IRELAN** | **O** | 14.3 | 15.6 | 17.0 | 0.2 | 0.4 | 0.9 | 50.5 | 56.3 | 61.6 | 21.7 | 26.8 | 32.5 |
| | **C** | 18.2 | 20.1 | 22.2 | 0.9 | 1.6 | 2.7 | 38.0 | 43.5 | 48.9 | 28.6 | 33.8 | 39.1 |
| | **I** | 24.2 | 26.0 | 27.8 | 0.2 | 0.5 | 1.0 | 6.0 | 9.8 | 14.1 | 58.4 | 62.6 | 66.4 |
| **ITALY** | **O** | 36.6 | 39.5 | 42.3 | 1.8 | 3.0 | 4.4 | 44.1 | 47.4 | 50.6 | 7.9 | 9.1 | 10.4 |
| | **C** | 36.3 | 38.6 | 41.0 | 4.0 | 5.9 | 8.0 | 14.5 | 17.3 | 20.2 | 34.7 | 37.0 | 39.4 |
| | **I** | 18.7 | 21.7 | 24.8 | 0.9 | 1.8 | 3.0 | 58.3 | 63.0 | 67.3 | 9.6 | 12.1 | 15.0 |
| **LUXEMB** | **O** | 12.0 | 13.8 | 15.7 | 1.2 | 2.5 | 4.3 | 60.3 | 63.6 | 67.2 | 15.8 | 18.6 | 21.3 |
| | **C** | 40.3 | 42.3 | 44.3 | 0.2 | 0.6 | 1.2 | 0.1 | 0.3 | 0.6 | 53.8 | 55.9 | 57.9 |
| | **I** | 1.8 | 2.5 | 3.2 | 0.3 | 0.8 | 1.7 | 77.1 | 81.3 | 85.1 | 10.5 | 14.1 | 18.1 |
| **NETHER** | **O** | 62.3 | 64.5 | 66.5 | 0.1 | 0.3 | 0.6 | 14.4 | 17.6 | 20.8 | 14.7 | 17.0 | 19.5 |
| | **C** | 45.7 | 49.1 | 52.4 | 0.3 | 0.7 | 1.5 | 1.0 | 2.5 | 5.4 | 40.9 | 44.3 | 47.8 |
| | **I** | 30.1 | 33.0 | 35.9 | 0.2 | 0.5 | 1.1 | 25.9 | 34.2 | 41.8 | 24.7 | 31.5 | 38.7 |
| **NORWAY** | **O** | 4.6 | 5.6 | 6.8 | 1.0 | 2.2 | 3.9 | 48.0 | 53.7 | 59.0 | 31.4 | 36.6 | 42.3 |
| | **C** | 0.1 | 0.3 | 0.7 | 0.7 | 1.7 | 3.5 | 50.5 | 59.3 | 66.8 | 29.1 | 36.3 | 44.8 |
| | **I** | 0.9 | 1.3 | 1.8 | 0.3 | 0.6 | 1.3 | 4.2 | 6.7 | 10.4 | 86.5 | 90.3 | 93.0 |
| **PORTUG** | **O** | 22.2 | 24.4 | 26.6 | 0.7 | 1.4 | 2.6 | 55.5 | 59.6 | 63.4 | 10.2 | 13.0 | 16.5 |
| | **C** | 6.1 | 7.3 | 8.5 | 0.2 | 0.4 | 0.8 | 44.3 | 48.9 | 53.6 | 38.5 | 42.9 | 47.0 |
| | **I** | 24.0 | 26.2 | 28.4 | 3.9 | 5.7 | 7.8 | 11.6 | 14.9 | 18.2 | 49.1 | 52.0 | 55.0 |
| **SPAIN** | **O** | 33.3 | 35.4 | 37.5 | 1.0 | 2.0 | 3.3 | 53.5 | 56.0 | 58.5 | 4.6 | 5.4 | 6.3 |
| | **C** | 37.4 | 39.6 | 41.8 | 1.1 | 2.1 | 3.4 | 44.3 | 47.0 | 49.7 | 8.6 | 10.0 | 11.5 |
| | **I** | 16.6 | 18.5 | 20.6 | 1.2 | 2.4 | 4.0 | 58.6 | 62.3 | 65.8 | 13.5 | 15.7 | 18.0 |
| **SWEDEN** | **O** | 18.5 | 20.2 | 22.0 | 0.3 | 0.6 | 1.3 | 41.7 | 46.8 | 51.5 | 27.0 | 31.4 | 36.2 |
| | **C** | 25.1 | 26.9 | 28.9 | 0.2 | 0.4 | 0.8 | 16.1 | 21.0 | 26.4 | 45.5 | 50.7 | 55.5 |
| | **I** | 3.1 | 4.1 | 5.2 | 0.5 | 1.3 | 2.7 | 33.6 | 41.6 | 49.2 | 43.8 | 51.1 | 58.6 |
| **SWITZE** | **O** | 22.2 | 24.9 | 27.5 | 1.1 | 2.3 | 4.0 | 56.7 | 60.3 | 63.8 | 9.4 | 10.9 | 12.7 |
| | **C** | 36.7 | 38.8 | 41.0 | 1.7 | 2.8 | 4.2 | 26.6 | 29.7 | 32.8 | 25.2 | 27.6 | 30.1 |
| | **I** | 10.5 | 12.9 | 15.4 | 0.8 | 1.7 | 3.3 | 59.7 | 64.4 | 69.1 | 15.8 | 19.0 | 22.4 |
| **UK** | **O** | 17.6 | 19.4 | 21.2 | 1.2 | 2.4 | 4.1 | 62.1 | 65.2 | 68.1 | 9.8 | 11.6 | 13.6 |
| | **C** | 3.7 | 4.5 | 5.4 | 1.9 | 3.3 | 5.1 | 50.7 | 55.7 | 60.2 | 31.1 | 35.3 | 39.8 |
| | **I** | 16.6 | 18.7 | 20.8 | 0.5 | 1.1 | 2.2 | 45.9 | 50.5 | 55.0 | 24.7 | 28.4 | 32.4 |
| **Regional** | **O** | 30.2 | 32.3 | 34.5 | 1.3 | 2.3 | 3.7 | 44.5 | 48.2 | 51.8 | 13.4 | 15.8 | 18.5 |
| **Average** | **C** | 22.6 | 24.4 | 26.3 | 1.3 | 2.3 | 3.5 | 26.4 | 30.3 | 34.3 | 37.6 | 41.5 | 45.5 |
| | **I** | 20.6 | 22.7 | 24.9 | 0.9 | 1.6 | 2.8 | 36.9 | 41.8 | 46.6 | 28.4 | 32.4 | 36.4 |

**Table A4: Variance Decompositions for Africa**

| | | World Factor | | | Regional Factor | | | Country Factor | | | Idiosyncratic | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 |
| CAMERO | O | 0.3 | 0.5 | 0.9 | 2.7 | 6.0 | 11.1 | 52.4 | 58.8 | 65.1 | 25.8 | 31.2 | 36.4 |
| | C | 0.7 | 1.0 | 1.5 | 4.2 | 8.7 | 14.8 | 54.2 | 61.8 | 68.6 | 19.1 | 24.5 | 30.2 |
| | I | 0.1 | 0.3 | 0.7 | 2.4 | 4.9 | 8.3 | 0.3 | 0.8 | 1.6 | 89.1 | 92.5 | 95.2 |
| IVORYC | O | 15.1 | 17.9 | 20.9 | 2.5 | 5.9 | 11.3 | 60.1 | 66.2 | 71.2 | 5.9 | 7.3 | 8.8 |
| | C | 11.0 | 13.4 | 16.2 | 1.6 | 4.0 | 8.1 | 64.7 | 70.1 | 74.5 | 8.3 | 9.9 | 11.6 |
| | I | 7.0 | 8.4 | 9.9 | 2.4 | 5.1 | 8.6 | 12.0 | 15.0 | 17.9 | 67.4 | 69.6 | 71.7 |
| KENYA | O | 0.1 | 0.1 | 0.2 | 0.8 | 1.9 | 3.8 | 86.7 | 89.0 | 91.0 | 6.3 | 7.9 | 9.4 |
| | C | 0.6 | 1.0 | 1.4 | 0.7 | 1.7 | 3.4 | 87.5 | 89.9 | 91.9 | 4.6 | 6.0 | 7.7 |
| | I | 8.2 | 9.5 | 10.8 | 0.5 | 1.1 | 2.2 | 0.5 | 1.0 | 1.7 | 85.5 | 87.2 | 88.8 |
| MOROCC | O | 2.1 | 2.8 | 3.7 | 4.3 | 7.1 | 10.2 | 76.3 | 79.8 | 82.9 | 7.6 | 9.1 | 10.8 |
| | C | 3.3 | 4.2 | 5.3 | 1.1 | 2.3 | 3.9 | 80.4 | 83.1 | 85.6 | 7.5 | 9.2 | 11.0 |
| | I | 1.0 | 1.5 | 2.1 | 4.1 | 7.0 | 10.5 | 0.3 | 0.7 | 1.3 | 86.7 | 89.7 | 92.3 |
| SENEGA | O | 1.4 | 2.0 | 2.7 | 6.6 | 11.9 | 18.2 | 64.3 | 70.6 | 76.2 | 11.2 | 13.7 | 16.5 |
| | C | 0.2 | 0.4 | 0.7 | 4.6 | 8.6 | 13.7 | 67.9 | 73.6 | 78.6 | 12.4 | 15.4 | 18.6 |
| | I | 4.1 | 5.5 | 6.9 | 0.9 | 2.1 | 3.8 | 0.5 | 1.1 | 2.2 | 87.0 | 89.7 | 92.0 |
| SOUTHA | O | 13.9 | 15.3 | 16.9 | 0.8 | 2.0 | 3.7 | 68.7 | 71.7 | 74.5 | 7.6 | 9.3 | 11.3 |
| | C | 8.1 | 9.4 | 10.7 | 0.5 | 1.2 | 2.5 | 61.2 | 65.4 | 69.3 | 19.3 | 22.5 | 26.0 |
| | I | 1.8 | 2.4 | 3.1 | 0.4 | 1.0 | 2.1 | 32.1 | 36.7 | 41.1 | 54.2 | 58.4 | 62.8 |
| ZIMBAB | O | 1.7 | 2.3 | 3.0 | 4.7 | 8.1 | 12.3 | 53.9 | 59.6 | 65.1 | 23.8 | 28.4 | 32.7 |
| | C | 0.4 | 0.8 | 1.2 | 5.0 | 8.2 | 11.8 | 65.0 | 71.4 | 77.3 | 12.5 | 17.2 | 22.7 |
| | I | 0.1 | 0.2 | 0.3 | 0.7 | 1.6 | 3.2 | 3.6 | 6.9 | 10.8 | 85.2 | 89.2 | 92.8 |
| Regional | O | 4.9 | 5.9 | 6.9 | 3.2 | 6.1 | 10.1 | 66.1 | 70.8 | 75.1 | 12.6 | 15.3 | 18.0 |
| Average | C | 3.5 | 4.3 | 5.3 | 2.5 | 4.9 | 8.3 | 68.7 | 73.6 | 78.0 | 12.0 | 15.0 | 18.3 |
| | I | 3.2 | 4.0 | 4.8 | 1.6 | 3.3 | 5.5 | 7.0 | 8.9 | 10.9 | 79.3 | 82.3 | 85.1 |

**Table A5: Variance Decompositions for Asia (Developed)**

| | | World Factor | | | Regional Factor | | | Country Factor | | | Idiosyncratic | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 | 1/3 | Med | 2/3 |
| HONGKO | O | 13.8 | 15.2 | 16.7 | 0.5 | 1.3 | 2.8 | 59.4 | 63.5 | 67.4 | 14.8 | 17.8 | 21.2 |
| | C | 5.3 | 6.2 | 7.3 | 0.7 | 1.7 | 3.4 | 46.1 | 51.3 | 56.5 | 33.9 | 38.8 | 43.6 |
| | I | 7.1 | 8.1 | 9.2 | 0.8 | 2.1 | 4.4 | 40.9 | 46.3 | 51.5 | 35.9 | 40.7 | 45.6 |
| JAPAN | O | 34.9 | 37.2 | 39.6 | 5.3 | 8.3 | 11.9 | 40.4 | 44.8 | 48.9 | 6.5 | 7.9 | 9.5 |
| | C | 32.2 | 35.0 | 37.8 | 3.3 | 5.5 | 8.3 | 26.6 | 31.2 | 35.8 | 23.7 | 26.2 | 28.9 |
| | I | 27.5 | 29.5 | 31.4 | 4.5 | 7.2 | 10.6 | 35.4 | 39.9 | 44.2 | 19.0 | 21.7 | 24.6 |
| KOREAR | O | 5.5 | 6.4 | 7.4 | 0.5 | 1.2 | 2.2 | 70.1 | 74.7 | 78.6 | 12.9 | 16.5 | 21.0 |
| | C | 5.2 | 6.1 | 7.2 | 0.4 | 0.9 | 1.8 | 57.1 | 61.4 | 65.9 | 26.1 | 30.4 | 34.4 |
| | I | 2.0 | 2.5 | 3.2 | 0.2 | 0.5 | 1.0 | 7.4 | 11.1 | 14.9 | 81.1 | 85.0 | 88.7 |
| MALAYS | O | 5.7 | 7.0 | 8.5 | 1.0 | 2.2 | 4.1 | 82.9 | 85.4 | 87.5 | 3.5 | 4.2 | 5.0 |
| | C | 2.7 | 3.7 | 4.7 | 0.5 | 1.1 | 2.3 | 64.2 | 66.9 | 69.3 | 25.2 | 27.1 | 29.2 |
| | I | 3.9 | 5.1 | 6.3 | 0.7 | 1.7 | 3.1 | 82.6 | 85.0 | 87.1 | 6.0 | 7.2 | 8.4 |
| SINGAP | O | 1.3 | 1.8 | 2.5 | 1.5 | 3.4 | 6.5 | 73.8 | 78.0 | 81.7 | 11.9 | 14.5 | 17.3 |
| | C | 0.2 | 0.4 | 0.6 | 1.7 | 3.7 | 7.0 | 72.6 | 77.0 | 80.7 | 14.1 | 16.9 | 19.8 |
| | I | 8.2 | 9.6 | 10.9 | 7.6 | 11.0 | 14.7 | 7.3 | 9.6 | 11.9 | 65.8 | 68.8 | 71.7 |

**Table A5: Variance Decompositions for Asia (Developed) (continued)**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **THAILA** | **O** | 10.5 | 11.9 | 13.3 | 0.2 | 0.6 | 1.2 | 69.1 | 72.6 | 75.8 | 11.0 | 13.7 | 16.8 |
| | **C** | 10.6 | 11.9 | 13.3 | 0.2 | 0.5 | 1.1 | 52.7 | 57.2 | 61.4 | 25.4 | 29.6 | 33.7 |
| | **I** | 2.6 | 3.3 | 4.1 | 0.5 | 1.1 | 2.1 | 30.9 | 36.2 | 41.3 | 53.1 | 58.1 | 63.2 |
| **Regional** | **O** | 11.9 | 13.3 | 14.6 | 1.5 | 2.8 | 4.8 | 65.9 | 69.8 | 73.3 | 10.1 | 12.4 | 15.1 |
| **Average** | **C** | 9.4 | 10.6 | 11.8 | 1.1 | 2.2 | 4.0 | 53.2 | 57.5 | 61.6 | 24.7 | 28.2 | 31.6 |
| | **I** | 8.5 | 9.7 | 10.9 | 2.4 | 3.9 | 6.0 | 34.1 | 38.0 | 41.8 | 43.5 | 46.9 | 50.4 |

**TableA6: Variance Decompositions for Asia (Developing)**

| | | **World Factor** | | | **Regional Factor** | | | **Country Factor** | | | **Idiosyncratic** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** |
| **BANGLA** | **O** | 0.9 | 1.4 | 2.0 | 11.8 | 19.5 | 27.9 | 41.3 | 49.6 | 57.7 | 21.5 | 27.3 | 32.8 |
| | **C** | 3.2 | 4.1 | 5.0 | 13.4 | 20.8 | 29.1 | 40.0 | 48.8 | 57.2 | 17.6 | 23.0 | 29.0 |
| | **I** | 0.1 | 0.1 | 0.3 | 0.3 | 0.9 | 1.8 | 0.4 | 0.9 | 1.7 | 95.7 | 97.2 | 98.2 |
| **INDIA** | **O** | 4.3 | 5.1 | 5.9 | 5.5 | 9.9 | 15.2 | 42.4 | 49.9 | 57.1 | 25.7 | 31.8 | 38.1 |
| | **C** | 3.9 | 4.7 | 5.5 | 1.7 | 3.9 | 7.6 | 40.7 | 47.5 | 54.0 | 34.7 | 40.9 | 47.0 |
| | **I** | 0.1 | 0.1 | 0.2 | 0.3 | 0.8 | 1.6 | 4.2 | 6.6 | 9.6 | 88.2 | 91.4 | 94.0 |
| **INDONE** | **O** | 6.4 | 7.5 | 8.6 | 0.4 | 0.9 | 1.9 | 68.0 | 72.9 | 77.0 | 13.4 | 17.2 | 21.9 |
| | **C** | 20.2 | 22.1 | 24.0 | 1.2 | 2.4 | 4.1 | 24.0 | 28.0 | 32.4 | 41.8 | 46.0 | 50.0 |
| | **I** | 0.1 | 0.1 | 0.2 | 0.3 | 0.7 | 1.4 | 48.1 | 54.5 | 59.9 | 38.3 | 43.7 | 49.9 |
| **PAKIST** | **O** | 1.0 | 1.4 | 1.9 | 0.7 | 1.7 | 3.6 | 74.6 | 78.0 | 81.1 | 14.7 | 17.2 | 19.9 |
| | **C** | 1.4 | 1.9 | 2.5 | 1.2 | 2.8 | 5.5 | 76.1 | 79.9 | 83.3 | 10.7 | 13.3 | 16.0 |
| | **I** | 1.6 | 2.2 | 2.9 | 1.8 | 4.1 | 7.4 | 8.5 | 10.6 | 12.8 | 77.6 | 81.0 | 83.8 |
| **PHILIP** | **O** | 3.5 | 4.4 | 5.5 | 1.9 | 3.8 | 6.4 | 74.1 | 78.0 | 81.5 | 9.5 | 11.7 | 14.4 |
| | **C** | 4.4 | 5.3 | 6.3 | 1.0 | 2.2 | 3.9 | 41.8 | 46.6 | 51.2 | 40.1 | 44.2 | 48.5 |
| | **I** | 0.1 | 0.2 | 0.4 | 2.4 | 4.3 | 6.9 | 59.1 | 64.0 | 68.6 | 25.9 | 29.9 | 34.0 |
| **SRILAN** | **O** | 5.6 | 6.5 | 7.5 | 0.3 | 0.8 | 1.7 | 73.5 | 77.0 | 79.9 | 11.9 | 14.4 | 17.3 |
| | **C** | 5.8 | 6.7 | 7.7 | 0.8 | 1.8 | 3.5 | 70.4 | 74.2 | 77.5 | 12.7 | 15.5 | 18.7 |
| | **I** | 0.1 | 0.3 | 0.6 | 7.5 | 12.0 | 17.4 | 0.2 | 0.4 | 0.8 | 80.9 | 86.4 | 91.0 |
| **Regional** | **O** | 3.6 | 4.4 | 5.2 | 3.4 | 6.1 | 9.4 | 62.3 | 67.6 | 72.4 | 16.1 | 19.9 | 24.1 |
| **Average** | **C** | 6.5 | 7.5 | 8.5 | 3.2 | 5.7 | 9.0 | 48.8 | 54.2 | 59.3 | 26.3 | 30.5 | 34.9 |
| | **I** | 0.3 | 0.5 | 0.8 | 2.1 | 3.8 | 6.1 | 20.1 | 22.8 | 25.6 | 67.8 | 71.6 | 75.2 |

**Table A7: Variance Decompositions for Oceania**

| | | **World Factor** | | | **Regional Factor** | | | **Country Factor** | | | **Idiosyncratic** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** | **1/3** | **Med** | **2/3** |
| **AUSTRA** | **O** | 15.6 | 17.6 | 19.6 | 1.7 | 3.7 | 6.8 | 63.6 | 66.9 | 70.0 | 8.7 | 9.9 | 11.1 |
| | **C** | 16.6 | 18.1 | 19.7 | 0.6 | 1.4 | 2.7 | 38.7 | 41.4 | 44.0 | 35.9 | 38.0 | 40.0 |
| | **I** | 9.8 | 11.3 | 12.9 | 2.2 | 4.8 | 8.4 | 70.4 | 74.4 | 77.9 | 5.8 | 7.4 | 9.3 |
| **NEWZEA** | **O** | 9.5 | 11.1 | 12.6 | 0.8 | 1.9 | 4.1 | 69.4 | 72.9 | 76.0 | 10.2 | 12.1 | 14.3 |
| | **C** | 7.1 | 8.2 | 9.4 | 0.9 | 2.0 | 3.6 | 21.0 | 25.0 | 29.2 | 59.1 | 63.1 | 67.0 |
| | **I** | 6.4 | 8.1 | 9.9 | 0.9 | 2.1 | 4.4 | 64.2 | 68.8 | 73.1 | 15.1 | 18.5 | 22.0 |
| **Regional** | **O** | 12.6 | 14.3 | 16.1 | 1.2 | 2.8 | 5.4 | 66.5 | 69.9 | 73.0 | 9.5 | 11.0 | 12.7 |
| **Average** | **C** | 11.9 | 13.2 | 14.5 | 0.7 | 1.7 | 3.2 | 29.9 | 33.2 | 36.6 | 47.5 | 50.6 | 53.5 |
| | **I** | 8.1 | 9.7 | 11.4 | 1.5 | 3.5 | 6.4 | 67.3 | 71.6 | 75.5 | 10.5 | 13.0 | 15.7 |