

Co-Movements of Latin American Equity Markets with the World's Other Equity Markets: Global Portfolio Diversification Implications

Gulser Meric
Rowan University

Leonore Taga
Rider University

Joe Kim
Rider University

Ilhan Meric
Rider University

In this paper, we use the Principal Components Analysis (PCA) multivariate statistical technique to study the global portfolio diversification implications of the co-movements of six Latin American equity markets with the world's other equity markets with data for the January 1, 2003-January 1, 2014 period. Earlier studies find low correlation between Latin American equity markets and the world's other equity markets. Our empirical findings in this paper indicate that the correlation of Latin American equity markets with the world's other equity market increased considerably. However, our PCA results indicate that global excellent portfolio diversification opportunities with Latin American equity markets still exist.

INTRODUCTION

Studying the co-movements of global equity markets has long been a popular research topic in finance (see, e.g., Makridakis and Wheelwright, 1974, Philippatos et al., 1983, and Meric and Meric, 1996). Low correlation between national equity markets is often presented as evidence in support of the benefit of global portfolio diversification (see, e.g., Levy and Sarnat, 1970, Solnik, 1974, Lessard, 1976, Watson, 1978, and Meric and Meric, 1989).

A study by Meric and Meric (2004) demonstrates that correlation between national equity markets has been increasing and the benefits of global portfolio diversification has been decreasing over time. The empirical evidence provided by Meric and Meric (1997, 1998) and Meric et al. (2001) show that long-term correlation between national equity markets increases sharply after a global equity market crash.

Because of their low correlation with each other and with developed equity markets, emerging equity markets can provide substantial portfolio diversification benefit to global investors [see, e.g., DeFusco et al., 1995, Ratner and Leal, 1996, and Meric et al., 2011). However, global portfolio diversification opportunities with Latin American equity markets have not been studied sufficiently. In this paper, we

attempt such a study with data for six Latin American equity markets for the January 1, 2003-January 1, 2014 period.

LATIN AMERICAN ECONOMIES AND TRADE RELATIONS

The Latin American Economies: 2003-2013

The real GDP growth rate in Latin American countries for selected years are presented in Table 1. The growth rates of the six Latin American economies included in this study (hereinafter referred to as the LA-6) were slowest just before and at the start of the 2003-2013 period, followed by a “golden period” of more rapid growth. During these years, real annual GDP growth averaged 5%, 5.7 % excluding 2009, which was adversely affected by the financial crisis. This growth rate was much more rapid than in the earlier period beginning in the early 1990s, and leading up to the years of this study. Another slowdown at the end of our period, 2012-2013, affected all of the countries, with Argentina and Brazil experiencing the greatest shock. Mexico’s economy declined only slightly (Talvi, 2014) and Werner (2015).

TABLE 1
REAL GDP GROWTH, ANNUAL PERCENTAGE CHANGE, SELECTED YEARS

| | 2002 | 2004 | 2009 | 2011 | 2012 | 2013 | 2015 Projection |
|-----------|-------|------|------|------|------|------|--------------------|
| Argentina | -10.9 | 9.0 | 0.1 | 8.4 | 0.8 | 2.9 | 0.4 |
| Brazil | 3.1 | 5.7 | -0.2 | 3.9 | 1.8 | 2.7 | -3.0 |
| Chile | 2.2 | 6.8 | -1.0 | 5.8 | 5.5 | 4.3 | 2.3 |
| Colombia | 2.5 | 5.3 | 1.7 | 6.6 | 4.0 | 4.9 | 2.5 |
| Mexico | 0.1 | 4.3 | -4.7 | 4.0 | 4.0 | 1.4 | 2.3 |
| Peru | 5.5 | 5.0 | 1.0 | 6.5 | 6.0 | 5.8 | 2.4 |

Sources: *World Economic Outlook Database, October 2015; Latest IMF Projections, IMF Survey: Countries and Regions.*

An empirical study by Talvi (2014) finds significant co-movements of the LAC-7 economies (the LA-6 plus Venezuela; the LAC-7 account for 93% of Latin America’s GDP). Most of the fluctuations of this group (65%) were due to the influence of external factors affecting all of these economies, specifically growth rates of the “advanced” countries and China, commodity prices, and international financing costs (Talvi, 2014). Werner (2015) attributes the rapid growth 2004-2011 mostly to rising commodity prices, which then declined beginning in mid-2011, after which growth rates declined. The countries included in our study, with the exception of Mexico, are commodity exporters. Mexico’s growth is tied to that of the U.S. economy (Werner, 2015).

Current Economic Overview

The economic environment of LAC can be characterized by uncertainty on economic policy, and low business and investor confidence. The Latin American economy has been battling with declining export prices, due to slowing global economic growth, and the loose monetary policies that attracted the influx of short term capital, and prompted capital outflows.

The GDP, a major determinant of equity market potential, for the region, indicates a continued declining curve. An IMF survey predicts the growth in the area to continue to decline in 2015, with a modest recovery in 2016, driven by commodity prices, and a long period of strong capital inflows and credit growth regionally and low interest rates globally. The region’s lackluster growth is weighed down

by the larger economies such as Argentina and Brazil. The region's economic growth clearly shows an inequality among the nations of the region in terms of GDP projections.

The decelerating GDP in 2015 and the outlook for 2016 attest to the volatility of the region, as Brazil, Latin America's largest economy, continues to show signs of being stuck in recession, and is unlikely to see a significant rebound.

An Overview of Regional Economic Cooperation

The population, GDP, and major export and import partners of the Latin American countries included in the study are presented in Table 2. Brazil has the largest population and GDP in the sample. Chile has the smallest population and Peru has the smallest GDP. United States is the most important export and import partner of Mexico and Colombia. China is the most important export and import partner of Brazil, Chile, and Peru. Brazil is the most important export and import partner of Argentina.

TABLE 2
DESCRIPTIVE STATISTICS FOR THE COUNTRIES INCLUDED IN THE STUDY

| | Population (millions) ¹ | GDP (billions\$) ² | Exports (billions\$) ³ | Imports (billions\$) ³ | Major Export Partners ⁴ | Major Import Partners ⁴ |
|-----------|------------------------------------|-------------------------------|-----------------------------------|-----------------------------------|--|---|
| Argentina | 43.4 | 543.1 | 71.9 | 62.45 | Brazil 20.3% China 6.9% US 5.5% | Brazil 23.7% US 17.9% China 12.7% Germany 5.1% Bolivia 4.2% |
| Brazil | 204.3 | 2,347 | 224.6 | 230.6 | China 18% US 12.1% Argentina 6.3%, Nether. 5.8% | China 16.3% US 15.4% Argentina 6.2% Germany 6% Nigeria 4.2% |
| Chile | 17.5 | 258 | 75.7 | 67.9 | China 24.4% US 12.3% Japan 10% S. Korea 6.2% Brazil 5.4% | China 20.9% US 19.8% Brazil 7.9% Argentina 4% |
| Colombia | 46.7 | 377.9 | 57.0 | 61.6 | US 26.3% China 10.5% Panama 6.6% Spain 5.8% India 5.1% | US 28.5% China 18.4% Mexico 8.2% |
| Mexico | 121.7 | 1,291 | 398.3 | 400.4 | US 80.2% | US 48.8% China 16.6% Japan 4.4% |
| Peru | 30.4 | 202.6 | 39.5 | 40.8 | China 18.3% US 16.1% Switzer. 6.9% Canada 6.6% Brazil 4.2% Japan 4.1% | China 21% US 21% Brazil 4.7% Mexico 4.6% Ecuador 4.2% |

* Data Source: <http://www.cia.gov/cia/publications/factbook>

¹July 2015 est.

²GDP is converted to dollars at the official exchange rate; 2014 est.

³2014 est.

⁴2014

Latin American countries continue to engender growth through the LAC's economic integration, but are facing the limits of multilateral agreements as the member nations compete for market share within a saturated marketplace. Three significant trade agreements in the region are the Central American Integration System (SICA), Andean Group, and Southern Cone Common Market (MERCOSUR). Mercosur is the most dominant of customs unions in Latin America, uniting the economies of Brazil, Argentina, Uruguay, Paraguay and, most recently, Venezuela, initially designed as a South American equivalent to the European Union. Except for Brazil, the countries are led by commodity exports: as a result, the export-oriented commodity industries generally find themselves supplying the major global hubs, such as Europe, the United States and, more recently, China. This incompatibility and lack of comparative advantage in the export product mix of Mercosur has been an intrinsic weakness of Latin America's export marketing strategies. With the saturated and stagnant regional market, Brazil has been eagerly negotiating with the EU, looking for a free trade area agreement, which will require unanimous consent from the Mercosur members.

DATA AND METHODOLOGY

The weekly equity market index returns used in the study are computed with the MSCI global equity market indices downloaded from the DataStream database for the January 1, 2003-January 1, 2014 period. The study includes the following forty-eight global equity markets: *America*: Argentina, Brazil, Canada, Chile, Colombia, Mexico, Peru, United States; *Europe*: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom; *Middle East/Africa*: Egypt, Israel, Jordan, Morocco, South Africa; *Asia/Australia*: Australia, Hong Kong, India, Indonesia, Japan, Malaysia, New Zealand, Pakistan, P. R. of China, Philippines, Russia, Singapore, South Korea, Taiwan, Thailand.

Principal Components Analysis (PCA) is a statistical technique widely used in empirical studies to study the contemporaneous co-movements of global equity markets. A detailed discussion of the technique can be found in Mardia et al. (1979) and Marascuilo and Levin (1983). The PCA technique clusters global markets with similar movement patterns in the same principal component. Equity markets with high factor loadings in the same principal component are highly correlated and can provide limited global portfolio diversification benefit. Global investors can maximize the benefit of global portfolio diversification by choosing equity markets with high factor loadings in different principal components.

Makridakis and Wheelwright (1974), Philippatos et al. (1983), and Meric and Meric (1989) have made the use of the PCA multivariate technique popular in studying the contemporaneous co-movements of global equity markets. We use the PCA multivariate technique in this paper to study the contemporaneous co-movements of forty-eight global equity markets including six Latin American equity markets.

CORRELATION OF LATIN AMERICAN EQUITY MARKETS WITH THE WORLD'S OTHER EQUITY MARKETS

The correlation coefficients between the pairs of the six Latin American equity markets during the period studied are presented in Table 3. The highest correlation coefficient in the matrix is between Brazil and Chile. It implies that a portfolio consisting of stocks from these two equity markets would provide the least diversification benefit. The lowest correlation coefficient is between Argentina and Colombia. This implies that a portfolio consisting of stocks from these two equity markets would provide the greatest diversification benefit.

The average correlation coefficient for each Latin American equity market with the other five Latin equity markets is presented in Table 4. The highest average correlation coefficient belongs to Brazil. This implies that the Brazilian equity market is the most open (most integrated) equity market in Latin America. The Mexican equity market has the second highest average correlation coefficient. This implies that the Mexican equity market is the second most open (second most integrated) equity market in the

region. The Colombian equity market has the lowest average correlation coefficient. This implies that the Colombian equity market is the most isolated (least integrated) Latin American equity market. The Argentine equity market has the second lowest average correlation coefficient. This implies that the Argentine equity market is the second most isolated (second least integrated) equity market in the region.

TABLE 3
CORRELATION COEFFICIENTS BETWEEN LATIN AMERICAN EQUITY MARKETS:
JANUARY 1, 2003-JANUARY 1, 2014

| | Argentina | Brazil | Chile | Colombia | Mexico |
|----------|-----------|--------|-------|----------|--------|
| Brazil | 0.603 | | | | |
| Chile | 0.508 | 0.714 | | | |
| Colombia | 0.403 | 0.560 | 0.495 | | |
| Mexico | 0.564 | 0.793 | 0.685 | 0.548 | |
| Peru | 0.534 | 0.683 | 0.544 | 0.449 | 0.626 |

TABLE 4
AVERAGE CORRELATION COEFFICIENT WITH OTHER
LATIN AMERICAN EQUITY MARKETS

| | Average |
|-----------|---------|
| Brazil | 0.671 |
| Mexico | 0.643 |
| Chile | 0.589 |
| Peru | 0.567 |
| Argentina | 0.522 |
| Colombia | 0.491 |

The correlation coefficients of the six Latin American equity markets with the world's other equity markets are presented in Table 5. The average correlation coefficient figures indicate that Latin American equity markets are most closely correlated with North American equity markets and least closely correlated with the Middle East/African equity markets (i.e., the Middle East/African equity markets provide the most beneficial portfolio diversification benefit to global investors in Latin American equity markets). In North America, Latin American equity markets are more closely correlated with the Canadian equity market than with the U.S. equity market. The Latin American equity market most closely correlated with the Canadian and U.S. equity markets is the Brazilian equity market. The Latin American equity market least closely correlated with the Canadian and U.S. equity markets is the Colombian equity market (i.e., Canadian and U.S. investors obtain the greatest portfolio diversification benefit by investing in the Colombian equity market). In the Middle East and Africa group, Latin American equity markets are most closely correlated with the South African equity market and least closely correlated with the Jordanian equity market (i.e., global investors who invest in Latin American equity markets can obtain the most diversification benefit by investing in the Jordanian equity market in this group of equity markets).

The Brazilian and Mexican equity markets are the most closely correlated Latin American equity markets with European and Asia/Australian equity markets. The Colombian and Argentine equity markets are the least closely correlated Latin American with European and Asia/Australian equity markets (i.e., global investors investing in European and Asia/Australian equity markets can obtain the most portfolio diversification benefit by investing in the Colombian and Argentine Latin American equity markets). Global investors who invest in Latin American equity markets obtain least portfolio diversification benefit by investing in the United Kingdom and French equity markets and most portfolio diversification

TABLE 5
CORRELATION COEFFICIENTS OF LATIN AMERICAN EQUITY MARKETS WITH
THE WORLD'S OTHER EQUITY MARKETS: JANUARY 1, 2003-JANUARY 1, 2014

| | Argentina | Brazil | Chile | Colombia | Mexico | Peru | Average |
|---------------------------|-----------|--------|-------|----------|--------|-------|---------|
| <i>America</i> | | | | | | | |
| Canada | 0.605 | 0.799 | 0.634 | 0.506 | 0.719 | 0.752 | 0.669 |
| United States | 0.540 | 0.733 | 0.599 | 0.464 | 0.757 | 0.615 | 0.618 |
| <i>Average</i> | 0.573 | 0.766 | 0.617 | 0.485 | 0.738 | 0.684 | 0.644 |
| <i>Europe</i> | | | | | | | |
| Austria | 0.584 | 0.717 | 0.591 | 0.529 | 0.708 | 0.621 | 0.625 |
| Belgium | 0.556 | 0.629 | 0.565 | 0.546 | 0.644 | 0.580 | 0.587 |
| Czech Republic | 0.480 | 0.644 | 0.491 | 0.509 | 0.596 | 0.563 | 0.547 |
| Denmark | 0.549 | 0.708 | 0.617 | 0.503 | 0.690 | 0.590 | 0.610 |
| Finland | 0.514 | 0.677 | 0.549 | 0.465 | 0.628 | 0.530 | 0.561 |
| France | 0.586 | 0.750 | 0.635 | 0.545 | 0.724 | 0.622 | 0.644 |
| Germany | 0.565 | 0.743 | 0.622 | 0.534 | 0.717 | 0.606 | 0.631 |
| Greece | 0.446 | 0.551 | 0.465 | 0.441 | 0.537 | 0.461 | 0.484 |
| Hungary | 0.472 | 0.655 | 0.491 | 0.494 | 0.627 | 0.530 | 0.545 |
| Ireland | 0.484 | 0.583 | 0.522 | 0.448 | 0.624 | 0.498 | 0.527 |
| Italy | 0.575 | 0.688 | 0.592 | 0.492 | 0.674 | 0.567 | 0.598 |
| Netherland | 0.573 | 0.716 | 0.621 | 0.554 | 0.722 | 0.604 | 0.632 |
| Norway | 0.594 | 0.749 | 0.599 | 0.512 | 0.662 | 0.684 | 0.633 |
| Poland | 0.488 | 0.664 | 0.515 | 0.494 | 0.650 | 0.576 | 0.565 |
| Portugal | 0.507 | 0.646 | 0.594 | 0.469 | 0.624 | 0.534 | 0.562 |
| Spain | 0.554 | 0.640 | 0.520 | 0.493 | 0.609 | 0.555 | 0.562 |
| Sweden | 0.532 | 0.733 | 0.625 | 0.540 | 0.710 | 0.616 | 0.626 |
| Switzerland | 0.498 | 0.653 | 0.584 | 0.520 | 0.661 | 0.567 | 0.581 |
| Turkey | 0.428 | 0.634 | 0.518 | 0.493 | 0.616 | 0.542 | 0.539 |
| United Kingdom | 0.580 | 0.757 | 0.645 | 0.530 | 0.731 | 0.628 | 0.645 |
| <i>Average</i> | 0.528 | 0.677 | 0.568 | 0.506 | 0.658 | 0.574 | 0.585 |
| <i>Middle East/Africa</i> | | | | | | | |
| Egypt | 0.332 | 0.398 | 0.327 | 0.374 | 0.401 | 0.312 | 0.357 |
| Israel | 0.409 | 0.535 | 0.486 | 0.372 | 0.538 | 0.428 | 0.461 |
| Jordan | 0.163 | 0.257 | 0.278 | 0.195 | 0.245 | 0.156 | 0.216 |
| Morocco | 0.236 | 0.273 | 0.271 | 0.279 | 0.273 | 0.263 | 0.266 |
| South Africa | 0.507 | 0.760 | 0.620 | 0.539 | 0.720 | 0.664 | 0.635 |
| <i>Average</i> | 0.329 | 0.445 | 0.396 | 0.352 | 0.435 | 0.365 | 0.387 |
| <i>Asia/Australia</i> | | | | | | | |
| Australia | 0.534 | 0.715 | 0.653 | 0.489 | 0.681 | 0.624 | 0.616 |
| Hong Kong | 0.462 | 0.636 | 0.580 | 0.475 | 0.631 | 0.505 | 0.548 |
| India | 0.413 | 0.587 | 0.535 | 0.483 | 0.577 | 0.491 | 0.514 |
| Indonesia | 0.450 | 0.561 | 0.502 | 0.452 | 0.544 | 0.510 | 0.503 |
| Japan | 0.424 | 0.522 | 0.475 | 0.416 | 0.525 | 0.444 | 0.468 |
| Malaysia | 0.450 | 0.522 | 0.519 | 0.423 | 0.540 | 0.481 | 0.489 |
| New Zealand | 0.459 | 0.579 | 0.544 | 0.450 | 0.588 | 0.522 | 0.524 |
| Pakistan | 0.125 | 0.139 | 0.125 | 0.175 | 0.188 | 0.104 | 0.143 |
| P. R. of China | 0.469 | 0.643 | 0.564 | 0.468 | 0.622 | 0.517 | 0.547 |
| Philippines | 0.385 | 0.479 | 0.458 | 0.446 | 0.500 | 0.420 | 0.448 |
| Russia | 0.551 | 0.740 | 0.622 | 0.504 | 0.684 | 0.605 | 0.618 |
| Singapore | 0.510 | 0.673 | 0.607 | 0.476 | 0.693 | 0.582 | 0.590 |
| South Korea | 0.482 | 0.590 | 0.528 | 0.424 | 0.601 | 0.487 | 0.519 |
| Taiwan | 0.441 | 0.525 | 0.476 | 0.371 | 0.521 | 0.445 | 0.463 |
| Thailand | 0.437 | 0.530 | 0.553 | 0.427 | 0.528 | 0.484 | 0.493 |
| <i>Average</i> | 0.439 | 0.563 | 0.516 | 0.432 | 0.562 | 0.481 | 0.499 |

benefit by investing in the Greek and Hungarian equity markets in Europe. Global investors who invest in Latin American equity markets obtain least portfolio diversification benefit by investing in the Russian and Australian equity markets and most portfolio diversification benefit by investing in the Pakistani and Philippine equity markets in the Asia/Australia group.

PRINCIPAL COMPONENTS ANALYSIS

To determine the principal components of the equity markets with similar contemporaneous movement patterns, the correlation matrix of the weekly index returns of the forty-eight global equity markets is used as input in the PCA computer program. The Varimax rotation is employed to maximize the factor loadings of the equity markets in each principal component with similar movement patterns. Using Kaiser's significance rule, statistically significant principal components with eigenvalues greater than unity are retained for analysis.

The analysis yields five statistically significant principal components. The factor loadings of the five principal components are presented in Table 6. The factor loadings of the equity markets with the highest factor loading in each principal component are shown in dark font. If an equity market also has a high factor loading in another principal component, it is shown in italics in light font. Equity markets with high factor loadings in the same principal component are highly correlated. Therefore investing in the equity markets with high factor loadings in the same principal component would provide only a limited portfolio diversification benefit to global investors. Investors can maximize the benefit of global portfolio diversification by investing in the equity markets with high factor loadings in different principal components.

The first principal component explains 30% of the total variation in the original data matrix. This principal component is mainly dominated by European equity markets. The U.S. and Canadian equity markets from North America and the Australian and New Zealand equity markets from the Asia/Australia group also have their highest factor loadings in the first principal component. The Austrian, Danish, and New Zealand equity markets that have their highest factor loadings in the first principal component also have high factor loadings in the second principal component. Therefore, Austrian, Danish, and New Zealand investors can only have a limited portfolio diversification benefit by investing in the Asian and Israeli equity markets with high factor loadings in the second principal component. The U.S., Norwegian, Canadian, Hungarian, and Polish equity markets that have their highest factor loadings in the first principal component also have high factor loadings in the third principal component with the Latin American, South African, Russian, and Turkish equity markets. Therefore, U.S., Norwegian, Canadian, Hungarian, and Polish investors can only have a limited portfolio diversification benefit by investing in the Latin American, South African, Russian, and Turkish equity markets with high factor loadings in the third principal component. The Czech Republic equity market that has its highest factor loading in the first principal component also has a high factor loading in the fourth principal component with the Jordanian, Moroccan, and Egyptian equity markets. Therefore, Czech investors can have only a limited portfolio diversification benefit by investing in the Jordanian, Moroccan, and Egyptian equity markets with high factor loadings in the third principal component.

The second principal component explains 20.3% of the total variation in the original data matrix. All Asian equity markets, except the Russian equity market, and the Israeli equity market have their highest factor loadings in the second principal component. The Israeli equity market also has a high factor loading in the first principal component. Therefore, the Israeli equity market does not appear to be a good portfolio diversification prospect for global investors in the European, U.S., Canadian, Australian and New Zealand equity markets with high factor loadings in the first principal component and the Asian equity markets with high factor loadings in the second principal component. However, the Israeli equity market appears to be a good global portfolio diversification prospect for investors in the Latin American, South African, Russian, and Turkish equity markets with high factor loadings in the third principal component, the Jordanian, Moroccan, and Egyptian equity markets with high factor loadings in the fourth principal component, and the Pakistani equity market with a high factor loading in the fifth principal component.

TABLE 6
PRINCIPAL COMPONENTS ANALYSIS FOR THE
JANUARY 1, 2003-JANUARY 1, 2013 PERIOD

| Countries | P.C. #1 | P.C. #2 | P.C. #3 | P.C. #4 | P.C. #5 |
|---------------------|--------------|--------------|--------------|--------------|--------------|
| France | 0.859 | | | | |
| Italy | 0.841 | | | | |
| Spain | 0.828 | | | | |
| Germany | 0.825 | | | | |
| Netherlands | 0.825 | | | | |
| Switzerland | 0.789 | | | | |
| Belgium | 0.771 | | | | |
| U.K. | 0.766 | | | | |
| Sweden | 0.749 | | | | |
| Austria | 0.740 | <i>0.576</i> | | | |
| Portugal | 0.740 | | | | |
| Finland | 0.726 | | | | |
| Ireland | 0.713 | | | | |
| Denmark | 0.676 | <i>0.408</i> | | | |
| Greece | 0.643 | | | | |
| U.S. | 0.633 | | <i>0.476</i> | | |
| Norway | 0.620 | | <i>0.462</i> | | |
| Canada | 0.601 | | <i>0.576</i> | | |
| Australia | 0.588 | | | | |
| Hungary | 0.582 | | <i>0.527</i> | | |
| Poland | 0.571 | | <i>0.503</i> | | |
| New Zealand | 0.516 | <i>0.470</i> | | | |
| Czech Republic | 0.497 | | | <i>0.418</i> | |
| Hong Kong | | 0.759 | | | |
| P. R. of China | | 0.740 | | | |
| South Korea | | 0.739 | | | |
| Indonesia | | 0.734 | | | |
| Taiwan | | 0.718 | | | |
| Singapore | | 0.710 | | | |
| Thailand | | 0.703 | | | |
| Malaysia | | 0.696 | | | |
| Philippines | | 0.640 | | | |
| India | | 0.677 | <i>0.339</i> | | |
| Japan | | 0.583 | <i>0.421</i> | | |
| Israel | <i>0.392</i> | 0.479 | | | |
| Brazil | | | 0.675 | | |
| Peru | | | 0.647 | | |
| South Africa | <i>0.526</i> | | 0.580 | | |
| Russia | <i>0.425</i> | | 0.549 | | |
| Mexico | <i>0.461</i> | | 0.527 | | |
| Turkey | | | 0.515 | | |
| Chile | | <i>0.432</i> | 0.497 | | |
| Colombia | | | 0.456 | | |
| Argentina | | | 0.453 | | |
| Jordan | | | | 0.666 | |
| Morocco | | | | 0.575 | |
| Egypt | | | | 0.527 | |
| Pakistan | | | | | 0.926 |
| Variance Explained | 30.0% | 20.3% | 13.4% | 4.8% | 2.3% |
| Cum. Var. Explained | 30.0% | 50.3% | 63.7% | 68.5% | 70.8% |

component. The Indian and Japanese equity markets that have their highest factor loadings in the second principal component also have high factor loadings in the third principal component with the Latin American, South African, Russian, and Turkish equity markets. Therefore, Indian and Japanese investors can only have a limited portfolio diversification benefit by investing in the Latin American, South African, Russian, and Turkish equity markets with high factor loadings in the third principal component.

The third principal component explains 13.4% of the total variation in the original data matrix. This principal component is dominated by Latin American, South African, Russian, and Turkish equity markets (i.e., Investors in the Latin American equity markets can have a limited portfolio diversification benefit by investing in the South African, Russian, and Turkish equity markets). The South African, Russian, and Mexican equity markets that have their highest factor loadings in the third principal component also have high factor loadings in the first principal component. Therefore, global investors who invest in the South African, Russian, and Mexican equity markets can have a limited portfolio diversification benefit by investing in the equity markets with high factor loadings in the first principal component. The Chilean equity market that has its highest factor loading in the third principal component also has a high factor loading in the second principal component with the Asian and Israeli equity markets. Therefore, global investors who invest in the Chilean equity market can have a limited portfolio diversification benefit by investing in the Asian and Israeli equity markets.

The fourth principal component explains 4.8% of the total variation in the original data matrix. The Jordanian, Moroccan, and Egyptian equity markets have their highest factor loadings in the fourth principal component. These three equity markets are highly correlated and a global portfolio consisting of stocks from these three equity markets would have a limited diversification benefit. However, the Jordanian, Moroccan, and Egyptian equity markets appear to be good portfolio diversification prospects for investors in the Latin American equity markets with high factor loadings in the third principal component, the equity markets with high factor loadings in the first three principal components, and the Pakistani equity market that has its highest factor loading in the fifth principal component.

The fifth principal component explains only 2.3% of the total variation in the original data matrix. The movements of the Pakistani equity market appear to be distinctly different from the other equity markets in the sample. Therefore, the Pakistani equity market is the only equity market with the highest factor loading in the fifth principal component. It appears that the Pakistani equity market is a good prospect for global portfolio diversification for all six Latin American equity markets with high factor loadings in the third principal component and for all the other equity markets with high factor loadings in the first four principal components.

SUMMARY AND CONCLUSIONS

Studying the co-movements of global equity markets has long been a popular research topic in finance. However, co-movements of Latin American equity markets with the world's other equity markets have not been studied sufficiently. In this paper, we undertake such a study with the MSCI indices obtained from the DataStream database for six Latin American equity markets for the January 1, 2003-January 1, 2014 period.

Our findings indicate that Latin American equity markets are highly correlated with the U.S., Canadian, South African, Russian, and Turkish equity markets with limited portfolio global portfolio diversification benefits. The Colombian and Argentine are the two Latin American equity markets with the most portfolio diversification benefit to U.S. and Canadian investors.

Latin American equity markets appear to be attractive global portfolio diversification prospects for all Asian equity markets (except the Japanese and Indian equity markets), for all European equity markets (except the Norwegian, Hungarian, and Polish equity markets), and for the Australian, New Zealand, Israeli, Jordanian, Moroccan, and Egyptian equity markets. Of all the equity markets studied, the six Latin American equity markets covered in this study appear to have the lowest correlation with the Pakistani equity market.

Our study focuses on portfolio risk. However, it does not consider country risk. A theoretical framework that accounts for country risk may lead to better global portfolio decisions. We focus on portfolio risk. However, we do not consider portfolio returns. A risk/return framework would provide more useful information for better global portfolio decisions. Finally, we emphasize contemporaneous correlations. An inter-temporal framework with co-integration analysis and Granger-causality tests may facilitate better global portfolio decisions.

REFERENCES

- DeFusco, R.A., Geppert, J.M. & Tsetsekos, G.P. (1995). Long-run diversification potential in emerging stock markets. *Financial Review*, 31, (2), 343-363.
- Lessard, D.R. (1976). World, country, and industry relationships in equity returns. *Financial Analysts Journal*, 32, (1), 32-38.
- Levy, H. & Sarnat, M. (1970). International diversification of investment portfolios. *American Economic Review*, 60, (3), 668-675.
- Makridakis, S.G. & Wheelwright, S.C. (1974). An analysis of the interrelationships among the major world equity Exchanges. *Journal of Business Finance and Accounting*, 1, (2), 195-215.
- Marascuilo, L.A. & Levin, J.R. (1983). *Multivariate statistics in social sciences: A researcher's guide*, Monterey, CA: Brooks/Cole Publishing Company.
- Mardia, K., Kent, J. & Bibby, J. (1979). *Multivariate analysis*, New York: Academy Press.
- Meric, G., Leal, R., Ratner, M. & Meric, I. (2001). Co-movements of U.S. and Latin American stock markets before and after the 1987 crash. *International Review of Financial Analysis*, 10, (3), 219-235.
- Meric, G., Pati, N. & Meric, I. (2011). Co-movements of the Indian stock market with other stock markets: Implications for portfolio diversification. *Indian Journal of Finance*, 5, (10), 13-20.
- Meric, I. & Meric, G. (1989). Potential gains from international portfolio diversification and inter-temporal stability and seasonality in international stock market relationships." *Journal of Banking and Finance*, 13, (4/5), 627-640.
- Meric, I. & Meric, G. (1996). Inter-temporal stability in the long-term co-movements of the world's stock markets. *Journal of Multinational Financial Management*, 6, (4), 73-83.
- Meric, I. & Meric, G. (1997). Co-movements of European equity markets before and after the 1987 crash. *Multinational Finance Journal*, 1, (2), 137-152.
- Meric, I. & Meric, G. (1998). Correlation among the world's stock markets before and after the 1987 crash. *Journal of Investing*, 7, (3), 67-70.
- Meric, I. & Meric, G. (2004). The diminishing benefit of global portfolio diversification. *Global Business and Finance Review*, 9, (2), 43-51.
- Philippatos, G.C., Christofi, A. & Christofi, P. (1983). The inter-temporal stability of international stock market relationships: Another view. *Financial Management*, 12, (4), 63-69.
- Ratner, M. & R. Leal. (1996). Causality tests for the emerging markets of Latin America. *Journal of Emerging Markets*, 1, (1), 29-40.
- Solnik, B. H. (1974). Why not diversify internationally? *Financial Analysts Journal*, 30, (4), 48-54.
- Talvi, E. (2014). *Latin America macroeconomic outlook: A global perspective*, Washington, D.C.: Brookings.
- Watson, J. (1978). A study of possible gains from international investment. *Journal of Business Finance and Accounting*, 5, (2), 195-206.
- Werner, A. (2015). The Latin American growth slowdown. *Americas Quarterly*, Spring 2015, 33-37.