South American Capital Markets:
Statistics of the Past Decade

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Abstract:

This paper investigates the question of whether there exists evidence in support of convergence in market returns within the South American capital markets and whether these markets are becoming efficient. Both questions are analyzed using time series as well as panel data. A non-parametric approach is used to study market efficiency to account for heteroskedasticity in highly volatile data. We have found support that the returns of Latin American capital markets are converging within selected groups and limiting" group mean returns are weak-form efficient.

Abstrakt:

Tento článek se zabývá otázkou, zda existuje evidence o tom, že výnosy na Latinskoamerických kapitálových trzích konvergují, a zda se tyto trhy stávájí efektivními. Obě otázky jsou analyzovány pomocí časových řad a panelových dat. Neparametrický přístup je použit ke studiu tržní efektivnosti z důvodů heteroskedasticity ve vysoce volatilních datech. Výsledkem analýzy je závěr, že výnosy na Latinskoamerických kapitálových trzích konvergují v rámci vybraných skupin a že limitní" průměrné výnosy splňují hypotézu slabé efektivnosti trhu.

Keywords: market return differential, convergence, panel data, stationarity, market efficiency.

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1. Introduction

This paper examines the emerging capital market of South America in order to assess its efficiency and to test for the convergence of market returns in its different countries. The analysis of convergence addresses a question of whether the markets in Latin America are becoming a single market rather than a group of segmented ones. We find the evidence in support of the convergence of market returns in Latin American equity markets. This convergence is most pronounced for real and dollar market returns, while nominal returns converge more slowly. When we test the hypothesis of weak market efficiency we have to allow for heteroskedasticity and/or employ a non-parametric approach. When we do so we find results generally supportive of the hypothesis that returns in the markets are weak form efficient which contradicts the findings of Urrutia (1995) among others.

During the past decade a number of new equity markets have emerged worldwide. Their behavior can be characterized basically by high volatility and low correlation with the developed capital markets in Europe and North America. However, a more subtle analysis of their behavior is still needed. What development has Latin America seen during the past two decades on general? Twenty years ago most South American countries were ruled by military governments and faced serious economic difficulties. Less than ten years ago civilian governments replaced dictatorships but economies were still plagued by high inflation, instability and debt. Generally sound macroeconomic policies adopted thereafter managed to bring inflation under control and restore economic stability. Such development led to the formation of the Andean Group and more importantly Mercosur, which potentially represents the world's most ambitious scheme of free-trade based regional integration since the foundation of the European Community.

Given this background, it is no surprise that capital markets in South America have experienced great turmoil, resulting in higher volatility than is observed within developed markets. For instance, stock markets in both Argentina and Mexico fell by 40% in the first two months of 1995; on the other hand, the official index of the Venezuela stock exchange almost tripled in 1996. Returns in Latin American equity markets were often far higher than underlying fundamentals indicated. Some of the countries are segmented from world equity markets and as Harvey (1995) points out, much of an ability to understand these countries' equity markets depends on local information. Capital markets in this region have also benefited from privatization as the sell-off of state assets has brought a dramatic increase in the supply of new tradable securities. Growing informational links among Latin American equity markets might help to gradually reduce differences in market returns in respective countries. Such a process would be characterized by the convergence of market returns in South American equity markets. Because of high average returns and little integration with the US market, investing in these markets is going to be more attractive for institutional and individual investors from the US and other mature markets. An interesting issue is whether investors would be able to discover patterns in stock prices and receive excess returns. To explore this issue we will test a weak market efficiency hypothesis for these countries along with a convergence approach.[1]

The convergence of market returns will be analyzed by using the concept of the σ-convergence outlined by Barro and Sala-i-Martin (1991). Translated from the original application to growth of output, σ-convergence, in the current context, describes the fact that market returns' convergence should be reflected in a reduction in the market return differentials across countries over time. Such a diminishing dispersion is typically measured by sample standard deviation of the respective time series. However, as Quah (1995) points out in his recent study on growth convergence empirics, "What matters, instead, is how the entire cross-section behaves".

Tests of weak market efficiency are constructed using well-known variance-ratio tests (see Lo and MacKinlay (1988, 1989) among others), and Chow and Denning (1993) extension to a multiple (combined) test. For comparison, a nonparametric runs test is included.

A comprehensive market return analysis allows us to formulate several conclusions that are based on our combined methodological approach. The results of this paper are supportive of convergence in general. Differences in market returns become

[1] A market is called *weakly efficient* if current prices fully reflect all information contained in past prices. Basically, it means that stocks follow a random walk and that it is, therefore, impossible to earn abnormal returns by studying the previous behavior of price series.

smaller and the convergence effect is most pronounced in the case of dollar returns and least evident in nominal returns in local currencies. Another finding is that the point to which these markets are going to converge is, for some groups of countries, not against weak market efficiency. Furthermore, we find that the pattern to which these markets are converging is in accord with weak-form market efficiency. In other words, there is a tendency for returns in Latin American capital markets to converge along with a property of weak market efficiency.

The paper is organized in the following manner. Section 2 describes the econometric methodology used for testing convergence and the random walk hypothesis. Section 3 describes the data and presents empirical results. Section 4 briefly concludes.

2. Methodology

2.1 Convergence of Market Returns

The following econometric methodology utilizes a combination of cross-sections of individual time-series. A panel data analysis of market return differentials' convergence is conducted in order to fully exploit the effect of cross-variances in a pooled time series of moderate length. Previous econometric research has demonstrated the specific advantages of utilizing panel data in studying a wide range of economic issues.[2] As shown by Levin and Lin (1992), the statistical power of a unit root test for a relatively small panel may be an order of magnitude higher than the power of the test for a single time series.

The analysis is performed for three types of market returns (X_t) which are measured as a percentage change in the respective market index over two successive periods. The nominal return for an individual country is defined as

$$nX_t = \left(M\mathrm{I}_t / M\mathrm{I}_{t-1}\right) - 1 \qquad (1)$$

[2] Kočenda and Papell (1997) recently applied this methodology to study inflation convergence in the European Union

where MI_t denotes the nominal market price index at time t. In a consistent manner we define the real market return as

$$rX_t = \left(\left(MI_t / CPI_t \right) / \left(MI_{t-1} / CPI_{t-1} \right) \right) - 1 \tag{2}$$

where CPI_t is a consumer price index at time t. Similarly, we define the dollar return as

$$dX_t = \left(\left(MI_t / e_t \right) / \left(MI_{t-1} / e_{t-1} \right) \right) - 1 \tag{3}$$

where (e_t) denotes the nominal exchange rate of a local currency for a unit of US dollar at time t.

Weak market efficiency is defined using all known prices available from the past. All such information should be reflected in the market index, we model the evolution of market returns (X_t) for a group of i individual countries with observations spanning over t time periods in the following way:

$$X_{i,t} = \alpha + \phi X_{i,t-1} + \varepsilon_{i,t} \tag{4}$$

The fact that market return is modeled as an AR(1) process is based on the above defined weak market efficiency and does not represent any theory of how this variable is determined. It is a rather suitable form for the convergence test introduced later in this section.

When averaging market returns over individual countries for each time period, a simple mean of the market return ($\overline{X_t}$) within the group can be described as

$$\overline{X_t} = \alpha + \phi \overline{X_{t-1}} + \varepsilon_t \tag{5}$$

where $\overline{X_t} = \frac{1}{n}\sum_{i=1}^{n} X_{i,t}$. The market return differential is defined as the difference between an individual market return and the average for the whole group at time t. Subtracting equation (5) from (4) yields

$$X_{i,t} - \overline{X_t} = \phi\left(X_{i,t-1} - \overline{X_{t-1}}\right) + \varepsilon_{i,t} \tag{6}$$

In the presence of pooling, the intercept α vanishes since, by construction, the market index differentials have a zero mean over all the countries and time periods. How the countries are pooled into different groups is described in detail in the following section.

Equation (6) establishes the base for the convergence methodology proposed by Ben-David (1995, 1996). Convergence in this context requires that market return differentials become smaller and smaller over time. For this to be true, ϕ must be less than one. On other hand ϕ greater than one indicates divergence of market return differentials.

The convergence coefficient ϕ for a particular group of countries can be obtained using the Dickey and Fuller (1979) test on equation (6). The augmented version of this test (ADF) is used in order to remove possible serial correlation from the data.[3] Since the analysis is performed on the panel data, there will be no intercept by construction. Denoting the market return differential as $d_{i,t} = X_{i,t} - \overline{X_t}$, and its difference as $\Delta d_{i,t} = d_{i,t} - d_{i,t-1}$, the equation for the ADF test is written as

$$\Delta d_{i,t} = (\phi - 1)d_{i,t-1} - \sum_{j=1}^{k}\gamma_j \Delta d_{i,t-j} + \varepsilon_{i,t} \tag{7}$$

where the subscript i = 1,...,k indexes the countries in a particular group. Equation (7) tests for a unit root in the panel of market return differentials. The null hypothesis of a

[3] We have found that in cases of real and dollar returns the correlation sensitivity threshold was about 0.50. The encountered multicollinearity was taken care of by employing the ridge regression of Hoerl and Kennard (1970).

unit root is rejected in favor of the alternative of level stationarity if $(\phi - 1)$ is significantly different from zero or, implicitly, if ϕ is significantly different from one.

The number of lagged differences (k) is determined using a parametric method proposed by Campbell and Perron (1991) and Ng and Perron (1995). An upper bound of the number of lagged differences k_{max} is initially set at an appropriate level.[4] The regression is estimated and the significance of the coefficient γ_j is determined. If the coefficient is not found to be significant, then k is reduced by one and the equation (7) is reestimated. This procedure is repeated with a diminishing number of lagged differences until the coefficient is found to be significant. If no coefficient is found to be significant in conjunction with the respective k, then k = 0 and a standard form of the Dickey-Fuller test is used in the analysis. A 10 percent value of the asymptotic normal distribution (1.64) is used to assess the significance of the last lag.[5]

Recent work has established that a sub-unity convergence coefficient ϕ is indeed a robust indication of convergence.[6] Ben-David (1995) performed 10,000 simulations for each of three possible cases where data should portray the processes of convergence, divergence, and neutrality. His numerous simulations provide ample evidence of convergence or divergence when these features truly portray the situation. When neutral data with no strong inclination in either direction are used the convergence coefficient tends towards unity.

What critical values should be used when analysis is conducted on panel data? The most available critical values for panel unit root tests were tabulated by Levin and Lin (1992). These values do not incorporate serial correlation in disturbances and are, therefore, incorrect for small samples of data. Using the Monte Carlo technique, Papell (1996) tabulated critical values taking serial correlation into account and found that for both quarterly and monthly data in his data sets, the critical values were higher than those reported in Levin and Lin (1992).

Because of these findings, the exact finite sample critical values for the resulting test statistics were computed using Monte Carlo methods in the following way.

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[4] k = 14 is used as k_{max} since monthly data is used.

[5] Ng and Perron (1995) discuss the advantage of this recursive t-statistic method over alternative procedures where k is either fixed or chosen to minimize the Akaike Information Criterion.

Autoregressive (AR) models were first fit to the first differences of each panel group of market return differentials using the Schwarz (1978) criterion to choose the optimal AR models. These optimal estimated AR models were then considered to be the true data generating process for errors of each of the panel group of data. Finally, for each panel, pseudo samples of corresponding size were constructed employing the optimal AR models described earlier with iid N(0,σ^2) innovations. σ^2 is the estimated innovation variance of a particular optimal AR model. The resulting test statistic is the t-statistic on the coefficient (1-ϕ) in equation (7), with lag length k for each panel group chosen as described above.

This process was replicated 10,000 times and the critical values for the finite sample distributions were obtained from the sorted vector of such replicated statistics. The derived finite sample critical values are reported for significance levels of 1%, 5%, and 10% in the tables along with the results of the ADF test conducted on different panel groups in the respective time periods.

2.2 Testing of Weak Market Efficiency: Variance-ratio test

If Latin American equity markets are weakly efficient, then returns should follow a random walk. This means that the process (time series of market returns) can be described as

$$X_t = \mu + X_{t-1} + \varepsilon_t \ , \quad E[\varepsilon_t] = 0, \quad Var[\varepsilon_t] = \sigma^2, \quad \textit{for all } t \qquad (8)$$

or

$$\Delta X_t = \mu + \varepsilon_t \ , \quad \Delta X_t \equiv X_t - X_{t-1} \qquad (9)$$

Suppose we have nq+1 observations $X_0, X_1, \ldots, X_{nq}$ of the process X_t, where n and q are arbitrary integers greater than 1. Under the null hypothesis of homoskedasticity of ε_t H_0 : $\varepsilon_t \ i.i.d.\ N(0,\sigma^2)$, one can easily construct MLE[7] for μ and σ^2; note that for model (8) straightforward calculation yields:

[6](ϕ > 1) respectively for divergence
[7] Note that all standard regularity conditions are satisfied; hence, these estimators are efficient and asymptotically normal.

$$\hat{\mu} = \frac{1}{nq}\sum_{k=1}^{nq}[X_k - X_{k-1}] = \frac{1}{nq}[X_{nq} - X_0], \tag{10}$$

and

$$\hat{\sigma}_1^2 \equiv \hat{\sigma}^2 = \frac{1}{nq}\sum_{k=1}^{nq}[X_k - X_{k-1} - \hat{\mu}]^2. \tag{11}$$

Furthermore, backward substitution of (8) into itself gives

$$X_t = \mu + X_{t-1} + \varepsilon_t = 2\mu + X_{t-2} + \varepsilon_t + \varepsilon_{t-1} = q\mu + X_{t-q} + \varepsilon_t + \varepsilon_{t-1} + \ldots + \varepsilon_{t-q}, \tag{12}$$

i.e. the variance of the *q*th difference grows proportionally with q.
Using (12) we can construct an alternative estimator of σ^2, say σ_q^2, for each q

$$\sigma_q^2 \equiv \hat{\sigma}^2 = \frac{1}{nq^2}\sum_{k=1}^{nq}[X_k - X_{k-1} - q\hat{\mu}]^2. \tag{13}$$

Under the null hypothesis these estimators should be close to each other. Lo and MacKinlay (1988) introduced a variance-ratio statistic

$$M_r(q) = \hat{\sigma}_q^{\,2} / \hat{\sigma}_1^{\,2} - 1, \tag{14}$$

which is, under null hypothesis, asymptotically normally distributed,

$$\sqrt{nq}\, M_r(q) \approx N\left(0, \quad \frac{2(2q-1)(q-1)}{3q}\right). \tag{15}$$

In order to improve finite sample properties of the variance-ratio test, it was suggested (ibid)[8] to use an unbiased version of an alternative estimator σ_q^2 as

[8] Nevertheless, $M_t(q)$ is not unbiased (is asymptotically unbiased as it was before) and the gain in the finite sample properties should not be overestimated. For sake of simplicity we shall use this adjustment.

$$\hat{\sigma}_q^2 = \frac{1}{m}\sum_{k=1}^{nq}[\, X_k - X_{k-1} - q\hat{\mu}\,]^2 \qquad (16)$$

where

$$m = q(nq - q + 1)\left(1 - \frac{q}{nq}\right). \qquad (17)$$

When we allow for heteroskedasticity, under some regularity conditions[9] it can be proven (ibid) that

$$M_r(q) \approx N\big(0, \quad V(q)\big), \qquad (18)$$

where

$$V(q) = \sum_{j=1}^{q-1}\left[\frac{2(q-j)}{q}\right]^2 \delta\ (j) \qquad (19)$$

and

$$\delta(j) = \frac{\sum_{k=j+1}^{nq}(X_k - X_{k-1} - \mu)^2 (X_{k-j} - X_{k-j-1} - \mu)^2}{\left[\sum_{k=1}^{nq}(X_k - X_{k-1} - \mu)^2\right]^2} \quad . \qquad (20)$$

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9 (A1) For all t, $E[e_t]=0$, $E[e_t, e_{t-t}]=0$ *for any* $t \neq 0$.

(A2) $\{\varepsilon_t\}$ is ψ-mixing with coefficients ψ(m) of size r/(2r-1) or is α-mixing with coefficients α(m) of size r/(r-1), r>1, such that for all t and for all τ≥0, there exists some δ>0 for which $E\left|\varepsilon_t, \varepsilon_{t-\tau}\right|^{2(r+\delta)} < \Delta < \infty$.

(A3) $\lim_{T\to\infty}\frac{1}{T}\sum_{t=1}^{T}E[\varepsilon_t^2] = \sigma^2 < \infty$.

(A4) For all t, $E[\varepsilon_t\ \varepsilon_{t-j}\ \varepsilon_t\ \varepsilon_{t-k}] = 0$ for any non-zero j, k where j≠k.

The sample version of (19) is defined as

$$\hat{V}(q) = \sum_{j=1}^{q-1} \left[\frac{2(q-j)}{q} \right]^2 \hat{\delta}(j)\,, \tag{21}$$

where

$$\hat{\delta}(j) = \frac{\sum_{k=j+1}^{nq} (X_k - X_{k-1} - \hat{\mu})^2 (X_{k-j} - X_{k-j-1} - \hat{\mu})^2}{\left[\sum_{k=1}^{nq} (X_k - X_{k-1} - \hat{\mu})^2 \right]^2}\,. \tag{22}$$

For large values of nq an asymptotic test can be considered:

(1) Under homoskedastic errors:

$$z_1(q) \equiv \sqrt{nq}\; M_r(q) \left(\frac{2(2q-1)(q-1)}{3q} \right)^{-1/2} \approx N(0,1) \tag{23}$$

and

(2) under hetereskedastic errors

$$z_2(q) \equiv \sqrt{nq}\; M_r(q)\; \hat{V}^{-1/2}(q) \approx N(0,1)\,. \tag{24}$$

For more details see Lo and MacKinlay (1988).

There is a problem in using the variance-ratio test: in order to have the size of the test (probability of Type I error) equal to α, one has to choose a particular q to run the test.[10] This problem was addressed and solved by Chow and Denning (1993). The design of the new test is based on test statistics

$$z_1^* = \quad Max\,\{z_1(q),\, q = 1, \ldots r\} \tag{25}$$

and

$$z_2^* = \quad Max\{z_2(q), q = 1,\ldots r\}. \qquad (26)$$

Recall that under the random walk hypothesis, for every q=1,2, ...k, $z_1(q)$ and $z_2(q)$ are asymptotically normally distributed. It was shown in Chow and Denning (1993), using the results of Richmond (1982), that the critical values for z_1^* and z_2^* are upper α points of the Studentized Maximum Modulus (SMM) distribution, with parameters r (number of z's) and N (degree of freedom)[11] .

Thus, the simple multiple test is just a modification of the well-known variance-ratio test and the testing procedure is the following. First, we compute variance-ratio tests for q=1,..k, and construct z_1^* and z_2^*, respectively. The critical values of SMM can be found in Stoline and Ury (1979).[12]

Since market returns exhibit significant differences from a normal distribution, it is useful to employ distribution-free tests to verify our findings. One frequently used nonparametric test of the random walk hypothesis is the runs test of Levene (1952)[13], see also Sachs (1982) and Urrutia(1993).

Note that a random walk has a unit root and that the increments of random walk are uncorrelated. In other words, a random walk process is a subset of the unit root hypothesis.[14] Basically, one would conclude that we reject either weak market efficiency or convergence of returns. However, there is an important and substantial difference in approach. In testing the weak market efficiency we study a single series, while for convergence we use a panel data structure, with the same mean and an autoregressive

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[10] In fact, several recent studies use multiple comparisons: a simple variance ratio test is computed for different q's. Of course, the size of the test is not α, and hence the decision of whether we reject/accept the hypothesis on level α, might be different.

[11] Note that this approach has been used for testing multiple means before F-test was introduced.

[12] This multiple variance ratio test was applied to study the Central European equity markets by Filer and Hanousek (1997).

[13] Here a run is defined as a sequence of consecutive changes in returns in the same direction. A z-transformation of the number of runs, z=(m-E(m))/std(m) has asymptotically standard normal distribution. Note that critical values for small samples are tabulated for instance in Hollander, M., Wolfe D.A. (1973).

[14] See also a decomposition of the unit root process into a random walk and a stationary process in Beveridge and Nelson (1981).

parameter ϕ imposed on all countries. Moreover, since we expect that innovations were correlated across countries, the mean return for a group of countries might show weak-form efficiency even if such efficiency was rejected for one or more countries studied alone.

3. Empirical Observations

3.1 Data

The time span of the data is from 1986:2 to 1995:12. The monthly market price indices and exchange rates were obtained from various issues of the Emerging Stock Markets Factbook published by the International Financial Corporation. The monthly consumer price indices were obtained from the International Monetary Fund's International Financial Statistics. Of the three different returns, returns in local currency might be more meaningful than dollar returns because the studied markets were to a large extent closed to outside portfolio investment during the period studied. Real returns in local currency on the other hand remove the influence of severe inflations that were a common feature in most of the studied markets.

Table 1 shows all the countries that were included in our analysis and describes the composition of various groups for which we tested the convergence and random-walk hypothesis. The broadest group represents Latin America and contains Argentina, Brazil, Chile, Colombia, Peru, Venezuela, and Mexico. Later we eliminated Peru because of data insufficiency and created a Latin America without Peru group.[15] The Core group of countries resulted after Mexico was removed due to its close trade connections with the United States (even long prior to NAFTA) and its sensitivity to the US economy and equity market. Finally, the Core group was reduced by one country at a time so that five resulting control groups containing four remaining countries could be used as a robust check of sensitivity related to the elimination of a country from the Core group.

A brief survey of statistical properties of nominal, real, and dollar returns for each country is presented in Tables 2 - 4. From the presented means we can see that even during severe turmoil market returns were on average positive over time. This is most visible in the case of nominal returns but caution should be used because removal of inflation does not provide dramatically improved results. Values of both skewness and kurtosis suggest that distributions of all types of returns are quite far from normality. Tables 5 - 7 provide a similar picture when our groups of countries are analyzed.

3.2 Convergence

We present the results of a convergence test in Tables 8 - 10 for the three types of market returns. In general, we see that differences in market return differentials diminish continuously over time. The coefficient ϕ is clearly smaller than one and statistically significant at the 1% level in the majority of cases. The convergence effect is least pronounced in the case of nominal returns.[16] This comes as no surprise since the severe inflations that plagued Latin American economies during part of the period studied surely affected levels of market indices from which the returns were constructed.

Real returns show a great convergence, which is only slightly lower than that of dollar returns. This can be considered an extremely important result because it actually shows that market returns cleaned from effects of inflation or currency instability are quite rapidly converging.

The results are not sensitive to the elimination of a single country from the analyzed panel. There is some indication that Argentina and Brazil might slightly surpress the convergence effect in cases of nominal and real returns respectively. The analysis is otherwise robust and real returns provide the most consistent outcomes.

3.3 Weak Market Efficiency

The results of classical and combined tests of the weak-form market efficiency are presented in Tables 11 - 16 for respective types of market returns. In general, if we allow for heteroskedasticity of disturbances, the hypothesis of weak market efficiency for any country or country group was not rejected. These results, for example, contradict those of

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[15] Peru opened its stock exchange later than other countries. Our data start in 1993.

[16] From the test it follows that as the positive value of the statistically significant coefficient ϕ approaches unity, then the convergence effect becomes smaller.

Urrutia (1995), where the random walk hypothesis for Latin American equity markets using variance-ratio test with several lags was rejected. Note, that we have used different time span in our study. Nevertheless, it is clear that Urrutia(1995) did not adjust the size of the tests. We have done this exercise using tables presented ibid. Obtained results are in accord with our findings - we do not reject weak form of market efficiency. Note that descriptive statistics for Latin American market returns are quite far from values we expect for normal distribution. Therefore, the results of the variance-ratio test might be sensitive to the assumption of normality.[17] One can test the robustness of our findings using non-parametric (distribution free) tests. An often used non-parametric test of random walk is the run test (see Levene (1952)). Under the null hypothesis of random walk the z-statistic is approximately standard normal. Our results do not reject weak market efficiency for any country group, except for the full set of Latin American capital markets. Note that in this case we have only a few data points and the short data set exhibits trend in growth.[18] For the single country, run tests indicate a violation of weak market efficiency for Argentina (nominal returns), Chile (dollar returns), Columbia and Mexico (both real returns).

4. Conclusion

We have found evidence in support of the convergence of market returns in Latin American equity markets. This convergence is most pronounced for real and dollar market returns, while nominal returns converge more slowly. The results are exposed to a sensitivity analysis. Systematic modification of the Core group yields evidence of its robustness. Eliminating one country from the group does not seriously affect the magnitude of the convergence coefficient.

When studying the weak form of market efficiency, one has to take into account very high market volatility and heteroskedasticity of disturbances, caused primarily by state interventions including a large sell-off of state assets (privatization), and the reform

[17] Fama (1965) suggested a set of tests for normality of returns. Such tests are based on skewness, kurtosis and studentized range. These tests indicated that for our data set there was a significant departure from normality.

[18] For the full set we have only 35 monthly observations, due to the inclusion of Peru.

process in general.[19] Therefore, to test the hypothesis of weak market efficiency we have to allow for heteroskedasticity and/or employ a non-parametric approach.

To summarize, we have found support that the returns of Latin American capital markets are converging within selected groups and "limiting" group mean returns are weak-form efficient. When we do so we find results generally supportive of the hypothesis that returns in the markets are weak form efficient.

[19] Note that the reforming governments of Latin America have realized that healthy capital markets are crucial to improving the efficiency with which savings are transformed into investment.