Integration vs. Segmentation in the Canadian Stock Market

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ABSTRACT

This paper examines the issue of integration versus segmentation of the Canadian equity market relative to a global North American market. We compare the international and domestic versions of the CAPM, and find that integration, or the mean-variance efficiency of the global market index, is rejected by the data. Segmentation is the preferred model, based on a maximum likelihood procedure correcting for thin trading. We further divide the sample into securities that are interlisted in Canada and the U.S., and those that are not. Integration is rejected for both groups, which indicates that the source of segmentation can be traced to legal barriers based on the nationality of issuing firms.

EMPIRICAL STUDIES OF INTERNATIONAL capital markets have left the issue of segmentation versus integration largely unresolved. Yet the question of national or international pricing of assets has crucial implications for financial decisions.[1] If national stock markets are segmented, then international portfolios should display superior risk-adjusted performance because some of the priced domestic systematic risk is diversifiable. Also, with segmentation, many irrelevance propositions for corporate financial strategy break down: home firms face optimal hedging decisions, as well as optimal foreign versus home borrowing decisions. Finally, criteria for capital budgeting decisions will be quite different under national and international pricing.

The purpose of this paper is to shed some light on this integration versus segmentation question for the Canadian equity market vis-à-vis a global North American market. In this paper, integration is defined[2] as a situation where investors earn the same risk-adjusted expected return on similar financial instruments in different national markets. The key problem, of course, is the pricing

[1] This issue also has some relevance for future work on international asset pricing. Previous work in this field can be broadly divided into two strands of literature. Typical of the first approach are Solnik [26], Grauer, Litzenberger and Stehle [14], Adler and Dumas [1] and Stulz [32] who focus on the implications of exchange risk on the pricing of assets, assuming no impediments to the integration of financial markets. Another conceptually different framework is that of Black [41], Stulz [31], and Errunza and Losq [8] who assume away exchange risk and analyze the effect of specific barriers to investment on the pricing of assets. The implications of segmented markets for corporate financial policy has been studied by Rubinstein [23], Adler and Dumas [1], and Stapleton and Subrahmanyam [29].

[2] As in Kohlhagen [15].

of risk. In the framework of the Capital Asset Pricing Model (CAPM), integration imposes restrictions on the pricing of assets, by ruling out relationships between expected returns and purely domestic factors. With integration, the world market index should be mean-variance efficient and, as a result, the only priced risk should be the systematic risk relative to the *world* market. On the other hand, complete segmentation implies that only *national* factors, e.g., the domestic systematic risk should enter the pricing of assets. It is important, however, to note that empirical tests of the above propositions are, as usual, joint tests of integration versus segmentation combined with the particular asset pricing model chosen. In principle, the methodology presented in this paper could be extended to other pricing models, such as the Arbitrage Pricing Theory, provided the priced factors are suitably identified.

Our approach to the question of integration or segmentation focuses on the restrictions imposed by the model on the *pricing* of assets.[3] Documenting barriers to investment is not sufficient to prove segmentation, since prices are determined by marginal investors who may find innovative ways to get around controls.[4]

Segmentation can be the result of many barriers to international investment. This study contributes to the literature by classifying market imperfections into two categories, and being able to distinguish the most probable causes of imperfection. The first category can be called *indirect barriers.* It is often argued that foreign investments are substantially hindered by the difficulty of obtaining information about foreign stocks, differences in the depth and quality of financial reporting due to differences in accounting disclosure requirements, impediments based on traditional practices such as reluctance to deal with foreigners, or any other cost of doing investment business abroad. Alternatively, another category, which we shall call *legal barriers*, stems from differential juridical status between domestic and foreign investments, be they tax considerations, restrictions on ownership of foreign securities, or more generally any other barrier linked to the country of origin of the security. Canadian pension funds, for example, are not allowed to hold more than 10% of their assets in foreign securities. Our procedure allows us to distinguish which of those two categories is the prime determinant of segmentation.

We analyze the issue of segmentation versus integration for Canadian stocks relative to a global North American market encompassing U.S. and Canadian stocks. As it turns out, the joint hypothesis of integration and mean-variance efficiency of the world market is rejected by the data, which indicates some form of segmentation. In order to pinpoint the source of segmentation, we separate the sample of Canadian securities into firms interlisted on U.S. and Canadian stock markets and firms that are not. Let us call the latter purely "domestic" Canadian firms. From the viewpoint of U.S. investors, interlisted stocks are

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[3] Numerous previous studies attempted to discriminate between segmentation and integration on the basis of correlations. Adler and Dumas [1], [2] and Solnik [27] argue that the covariance matrix gives no information on the presence or absence of segmentation.

[4] For example, Maldonado and Saunders [17] found no significant difference in the dollar price of U.S. stocks traded in New York and in London, despite foreign exchange restrictions on U.K. residents.

subject to the same listing requirements and are as easy to trade as U.S. stocks; the indirect barrier argument is much weaker for this class of Canadian stocks. If indirect barriers were the only source of segmentation, then we would expect that interlisted stocks are integrated whereas domestic stock are segmented. On the other hand, if both interlisted and domestic stocks were segmented, we could reasonably conclude that effective barriers are of the legal type.

This paper is organized as follows. Section I reviews previous studies and discusses the advantages of testing international asset pricing models in Canada. Section II describes the data and illustrates the problem of thin trading in Canada. In Section III we detail the framework used to test integration versus segmentation. Portfolio betas and cross-sectional coefficients are estimated simultaneously by a Maximum Likelihood procedure, correcting for thin trading effects. Section IV presents the results, and the conclusions are summarized in Section V.

I. Integration vs. Segmentation in the Canadian Market

The first empirical test of segmentation vs. integration is that of Stehle [30], who could not reject the hypothesis of segmentation nor of integration of U.S. stocks relative to the world market.[5] His tests were based on the traditional Fama-McBeth [9] cross-sectional, time-series approach, which, as indicated by Gibbons [13] is relatively less powerful than a Maximum Likelihood approach, where the betas and cross-sectional parameters are estimated simultaneously. We employ the latter procedure.

Also, Stehle's results could be partly explained by the collinearity between the U.S. index and the world index, with more than 60% weight placed on the U.S. index. Thus, one advantage of performing tests of integration in Canada is that these tests should be more powerful than in the U.S., the Canadian market being far less heavily weighted in the world index. In fact, Brennan and Schwartz [6] reject integration of Canadian securities with a North American market over the period 1968–1980. Unfortunately, stocks interlisted in Canada and on the NYSE, which account for about 30% of the value of the Canadian market, were counted twice in the global index. Tests of the mean-variance efficiency of this global index become difficult to interpret.

A second major advantage of the Canadian securities market is its close ties with the U.S. stock market: by far the vast majority of foreign securities traded in the U.S. is Canadian, and vice-versa. The existence of numerous interlisted securities provides us with a controlled experiment, by allowing a comparison of the pricing of interlisted and purely domestic stocks. This classification was also used by Booth and Johnston [5], who found that the ex-dividend day behavior of interlisted stocks is markedly different from that of domestic stocks. This does not imply differences in pricing, for it is not obvious that tax effects[6] are

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[5] More recently, Errunza and Losq [8] could not reject the hypothesis of integration nor a weak form of segmentation for common stocks traded in less developed markets.

[6] In Canada, the dividend tax credit lowers the effective tax rate on returns from Canadian stocks. Also, contributions to special savings plans are deductible from taxable income.

incorporated into the pricing of assets: the controversy on the effect of personal taxes and dividends sufficiently demonstrates that the link is not immediate.[7] Incidentally, we compared[8] transaction prices for interlisted stocks in the U.S. and in Canada, and found that there were few arbitrage opportunities, after transaction costs.[9] However, this equalization of prices does not necessarily indicate integration for these common securities, because some factors may be priced in one market and not in the other.

Finally, following the same procedure as Stehle [30], we simplify the issue of exchange risk by assuming a logarithmic utility function for all investors. Under these conditions,[10] the price level and questions related to purchasing power parity become irrelevant for optimal portfolio choice. Thus, all prices are converted into Canadian dollars, and the analysis is performed in nominal terms. Solnik [25] and Grauer, Litzenberger and Stehle [14] focused on different aspects of exchange risk, real versus nominal, but as Solnik [30] has shown, the two conceptually different approaches lead to optimal portfolios quite close to each other. This follows from the fact that the variability in stock prices is much greater than the variability in exchange rates, in turn much greater than the variability in inflation rates. In addition, in the case of Canada, exchange risk is probably smaller than for other countries, given the strong relationship between the U.S. and Canadian dollars.

II. The Data

Monthly rates of return on Canadian stocks were taken from the Laval Securities tape[11] for the period from January, 1963 to December, 1982. The Laval tape contains monthly data on 1040 Canadian common stocks that were traded on the Toronto Stock Exchange (TSE) during part or all of the period (1963–1982), excluding only those mine or oil stocks that never reached the $5.00 price level. Since betas were estimated using 60 monthly observations, all securities with less than 60 months of consecutive data were eliminated from the sample, thus reducing the number of usable securities to 749. The Canadian market index return, R_c, was computed as the value-weighted average of returns for all included stocks.[12] Canadian interlisted securities were identified from the Toronto Stock

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[7] See Litzenberger and Ramaswamy [16], and Miller and Scholes [19].

[8] The problem with these comparisons is that they should be conducted on transaction prices measured at about the same time, thus necessitating large transaction volumes in each market. Few Canadian firms meet these conditions.

[9] There were, however, exceptions: during the period 1963 to January 1974, the U.S. imposed the Interest Equalization Tax on foreign securities listed in the U.S. A number of Canadian companies were exempt from the tax, because of predominant stock ownership by U.S. residents. But for those not exempt, we found that prices paid by U.S. residents were usually higher than in Canada, about 11 to 12%, which corresponds to the tax rate.

[10] Developed more fully in Adler and Dumas [2].

[11] The construction of the Laval data base is described in Morgan and Turgeon [20].

[12] The Laval data base was found to contain errors in the number of outstanding shares for some companies. Abnormal entries were detected by a filter on firm market values, and cross-checked with the data in the Toronto Stock Exchange Monthly Review.

Table I
Breakdown of Canadian Securities

Year (December)	Domestic Stocks		Interlisted Stocks	
	Number	Value (C$ Billion)	Number	Value (C$ Billion)
1968	388	18.7	85	25.3
1969	435	19.6	85	24.2
1970	442	17.9	84	23.7
1971	466	20.6	84	25.3
1972	496	27.0	88	32.7
1973	529	25.0	86	31.3
1974	501	18.2	86	21.5
1975	504	21.7	87	24.3
1976	507	23.8	87	26.0
1977	494	27.1	82	27.8
1978	455	33.4	80	36.0
1979	419	43.2	74	57.3
1980	400	58.8	68	65.1
1981	378	48.2	67	57.5
1982	353	48.5	66	53.6

Note: Domestic stocks are those listed solely on the TSE; interlisted stocks are also listed on either the NYSE or the AMEX.

Exchange Monthly Review. In the Laval subsample, we found 23 stocks traded on the NYSE and 75 stocks on the AMEX, for a total of 98 interlisted stocks.

Table I details the breakdown of Canadian securities among interlisted and purely domestic stocks. As expected, the larger Canadian companies are also listed in U.S. markets; interlisted firms are, on average, six times larger than purely domestic firms.

The risk-free rate, R_f, was derived from the yield on 3-month Treasury Bills,[13] published in the Bank of Canada Review. The U.S. index return, R_{US}, is the value-weighted return for all stocks listed on both the New York and American Stock Exchanges, converted to Canadian Dollars. We computed the global index return, R_G, as the value-weighted average of R_{US} and of the Canadian securities not interlisted in both countries. This avoids double-counting interlisted stocks, which is important in tests of asset pricing where collinearity in the two factors may lead to faulty inferences. As of December 1982, the proportion of Canadian stocks in the global index was 5.9%.[14]

One of the problems plaguing price measurement in Canada is that of *thin* trading. Even after weeding out companies with less than 60 months of consecutive data, we found that the monthly trading volume of many stocks was still very low.[15] In addition, monthly prices recorded on the Laval tape are last transaction prices reported by the TSE *during* the month, and not necessarily on the last trading day. The effect of thin trading can be best illustrated by

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[13] Assuming a flat term structure.

[14] On that date, the value of all stocks listed on the NYSE and on the AMEX was C$1,716.8 billion.

[15] This problem was also emphasized by Fowler et al. [11].

Table II

Autocorrelation in Canadian Indices

	Canadian Market Stock Index		Interlisted Stock Index		Domestic Stock Index	
Period	Value Weighted	Equal Weighted	Value Weighted	Equal Weighted	Value Weighted	Equal Weighted
Jan 68–Dec 72	0.203	0.473**	0.124	0.217	0.290*	0.514**
Jan 73–Dec 77	0.008	0.104	−0.023	0.018	0.040	0.122
Jan 78–Dec 82	0.002	0.305*	−0.065	0.059	0.113	0.357**
Jan 68–Dec 82	0.053	0.291*	−0.010	0.083	0.140	0.332*

Note: Significance at 5% and 1% levels denoted by * and **, respectively.

examining first-order autocorrelation coefficients for various stock indices. As shown in Table II, the Canadian equally-weighted index displays significantly positive autocorrelation, which is mainly due to small, thinly traded firms, traded mostly domestically. Interlisted stock indices do not display large autocorrelation coefficients. Thus, thin trading is important enough to warrant formal incorporation into the empirical methodology, because this phenomenon may lead us to falsely reject integration.[16]

III. Test Methodology

We consider two competing models of asset pricing for Canadian securities. With segmentation, the only priced factor is the systematic risk vis-à-vis the Canadian index. On the other hand, if the U.S. and Canadian equity markets are integrated, the global index, which includes U.S. and Canadian securities, should be mean-variance efficient, and the only priced factor should be the systematic risk vis-à-vis this global index.

Defining all returns to be *excess* returns, the purely international CAPM implies

$$E(\tilde{R}_i) = \gamma_0 + \gamma_1 \beta_i^G \tag{1}$$

where

$\tilde{R}_i \equiv \tilde{R}_i^* - R_f =$ excess return on asset i, the difference between the nominal preturn, R^*, and the risk-free rate

$\tilde{R}_G \equiv \tilde{R}_G^* - R_f =$ excess return on the global market.

The Sharpe-Lintner version corresponds to the case where $\gamma_0 = 0$. A non-zero γ_0 implies a version of the Black model [3] where the expected return on the zero-beta portfolio is the riskless rate plus a constant, γ_0. Note that the CAPM implies the restriction, $\gamma_1 = E(\tilde{R}_G) - \gamma_0$. According to (1), the systematic risk, β_i^C, relative to the Canadian portfolio, $\tilde{R}_C$, should not have any explanatory power for the pricing of assets. However, as Stehle [30] pointed out, integration cannot

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[16] Without a thin trading correction, thinly traded Canadian stocks could load on the Canadian index rather than on the global index only because thin trading is more pervasive in Canada than in the U.S.

be tested by running directly a univariate regression on β_i^C, since the return on the Canadian market is positively correlated with the return on the global market. A multiple regression on the two factors is similarly inappropriate because of this collinearity issue. Instead, we have to isolate in the domestic index the component which is independent of the world index, by a projection

$$\tilde{R}_C = c_0 + c_1 \tilde{R}_G + \tilde{V}_{C \cdot G} \tag{2}$$

A proper test of integration would focus on the added explanatory power of the asset systematic risk $\beta_i^{C \cdot G}$ relative to the *residual* $V_{C \cdot G}$. Therefore, the model implied by integration can be reformulated as

$$E(\tilde{R}_i) = \gamma_0 + \gamma_1 \beta_i^G + \gamma_2 \beta_i^{C \cdot G} \tag{3}$$

which is consistent with (1) if the coefficient γ_2 is zero. A test of integration versus segmentation will test $\gamma_2 = 0$ against the alternative that γ_2 is positive.[17] Observe that (3) can be interpreted as a two-factor version of Ross's [22] arbitrage pricing theory.

On the other hand, a model of segmented capital markets assumes that the only factor relevant for the pricing of assets is the systematic risk relative to the domestic portfolio

$$E(\tilde{R}_i) = \delta_0 + \delta_1 \beta_i^C \tag{4}$$

Again, because of the correlation between the global index and the domestic index, we isolate the purely international component by projection:

$$\tilde{R}_G = d_0 + d_1 \tilde{R}_C + \tilde{V}_{G \cdot C} \tag{5}$$

and compute the asset beta, $\beta_i^{G \cdot C}$, relative to this residual. If we write

$$E(\tilde{R}_i) = \delta_0 + \delta_1 \beta_i^C + \delta_2 \beta_i^{G \cdot C}, \tag{6}$$

complete segmentation implies that δ_2 should be zero.

An empirical test of integration can be devised as follows. The rate of return on asset i can be decomposed into an expected component, $E(\tilde{R}_{it})$, and an innovation, so that the rate of return can be written as:

$$\tilde{R}_{it} = E(\tilde{R}_{it}) + \beta_i^G(\tilde{R}_{Gt} - E(\tilde{R}_{Gt})) + \beta_i^{C \cdot G} \tilde{V}_{C \cdot G,t} + \tilde{e}_{it}, \tag{7}$$

where the expected value of the innovation is zero by construction. Under rational expectations, we can substitute (3) into (7) and write

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\begin{aligned}
\tilde{R}_{it} &= \gamma_0 + (E(\tilde{R}_{Gt}) - \gamma_0)\beta_i^G + \gamma_2 \beta_i^{C \cdot G} \\
&\quad + \beta_i^G(\tilde{R}_{Gt} - E(\tilde{R}_{Gt})) + \beta_i^{C \cdot G} \tilde{V}_{C \cdot G,t} + \tilde{e}_{it} \\
&= \gamma_0(1 - \beta_i^G) + \gamma_2 \beta_i^{C \cdot G} + \beta_i^G \tilde{R}_{Gt} + \beta_i^{C \cdot G} \tilde{V}_{C \cdot G,t} + \tilde{e}_{it}
\end{aligned} \tag{8}
$$

Under the joint hypothesis of integration and efficiency of the global market, γ_2 should be equal to zero. To correct for thin trading effects, the procedure was

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[17] It can be shown that if segmentation was the true model, then γ_2 should be positive, provided the domestic index is positively correlated with the global index.

modified as suggested by Dimson [7]: each single regression on the contemporaneous market index was replaced by a *multiple* regression on the market index at time $(t - 1)$, t, and $(t + 1)$. With one lead and one lag added, (8) becomes[18]

$$\tilde{R}_{it} = \gamma_0(1 - \beta_i^G) + \gamma_2\beta_i^{C \cdot G} + \sum_{k=-1}^{+1} \beta_{ik}^G \tilde{R}_{G,t+k} + \sum_{k=-1}^{+1} \beta_{ik}^{C \cdot G} \tilde{V}_{C \cdot G,t+k} + \tilde{e}_{it} \quad (9)$$

where $\beta_i^G = \sum_{k=-1}^{+1} \beta_{ik}^G$, and $\beta_i^{C \cdot G} = \sum_{k=-1}^{+1} \beta_{ik}^{C \cdot G}$.

A similar equation applies for the test of segmentation. This specification is closely related to the model of Brennan and Schwartz [6] who do not, however, impose the restriction implied by the CAPM on γ_1.

The parameters γ_0, γ_2, β_{ik}^G, and $\beta_{ik}^{C \cdot G}$ in this non-linear equation were estimated jointly by a Maximum Likelihood procedure.[19] This technique, first suggested by Malinvaud [18],[20] is an extension of Generalized Least Squares to a set of non-linear equations. Iterations are performed successively on the model parameters and on the variance-covariance matrix of the residuals until convergence occurs.

To be feasible, estimation of (9) requires reduction of the number of securities (a few hundred) in the original sample to a smaller number of portfolios. Nine portfolios[21] were derived as follows. For each January from 1968 to 1982, Dimson beta coefficients were estimated on the basis of the previous 60 monthly returns without missing observations. The classification should be designed to maximize the dispersion of the independent variables. Since the betas with the residuals, $\beta^{G \cdot C}$ and $\beta^{C \cdot G}$ were quite unstable over time, we chose to classify securities according to their Dimson betas with the Canadian and with the Global index. Two sets of portfolios were derived: in the first (CAN/GLO), securities were classified into three portfolios according to their Canadian betas, then each portfolio was subdivided into three portfolios according to their Global betas. The order was reversed for the second set of portfolios (GLO/CAN). This procedure was repeated for the subsets of domestic and interlisted firms.[22]

IV. Empirical Results

Tables III and IV present the results of the Maximum Likelihood procedure for the period (1968–1982). The tests of integration are reported in Table III. A test of integration vs. segmentation implies that γ_2 is zero against the alternative

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[18] Since we only use actual monthly transaction prices, one lead and one lag term are sufficient for all practical purposes. As pointed out by Fowler and Rorke [11], Dimson's [7] estimator is consistent with Scholes and William's [24] results if the market displays no autocorrelation. This is the case for our Canadian and global market indices, which are value-weighted. Finally, the extension to a multivariate regression is straightforward, since all right-hand side variables in (9) are orthogonal to each other with no autocorrelation nor cross-correlation across series.

[19] Maximum likelihood estimation has been applied to tests of the CAPM by Gibbons [13] and Stambaugh [28].

[20] And generalized by Gallant [12].

[21] The number of portfolios was limited by computational and degrees of freedom considerations. We have 178 time observations. Conditional on the covariance matrix, the system requires simultaneous estimation of 6 betas times 9 portfolios plus 2 coefficients, or 56 parameters. In addition, when we separate the sample into interlisted and domestic firms, the matrix to be inverted is of rank 112.

[22] For interlisted firms, the number of securities in each portfolio varied from a minimum of 6 to a maximum of 9. Domestic portfolios contained at least 21 securities, and at most 39 securities.

Table III

Tests of Integration
(1968–1982)

	γ_0	γ_2	χ_7^2
All Canadian Firms			
Sorting: GLO/CAN	.00275	.00575**	9.922
	(.00319)	(.00130)	
CAN/GLO	.00417	.00525**	9.643
	(.00327)	(.00128)	
Domestic Firms			
Sorting: GLO/CAN	.00310	.00607**	11.545
	(.00307)	(.00161)	
CAN/GLO	.00231	.00493**	9.660
	(.00317)	(.00160)	
Interlisted Firms			
Sorting: GLO/CAN	−.00899	.00439**	13.850
	(.00558)	(.00093)	
CAN/GLO	−.00929	.00370**	13.170
	(.00696)	(.00094)	

Projection of Canadian Index on Global Index

$$\hat{R}_C = .00758^{**} + .8352^{**}R_G \qquad R^2 = .5271$$
$$\quad\;\;(.00280)\qquad(.0596)$$

Notes: Standard errors in parentheses. Significance at the 5% and 1% levels denoted by * and **, respectively. The chi-squared statistic tests the cross-sectional restrictions imposed by the two-factor model. The period covered is February 1968 to November 1982, or 178 observations.

that it is positive. Remarkably, we find that the hypothesis is strongly rejected for all portfolios, since γ_2 is always significantly positive; the lowest t-statistic is 3.1. The parameter estimates and significance levels are quite similar across sorting procedures, which indicates that the rejection of integration is a robust result.[23] The chi-squared statistic reported in the last column tests the cross-sectional restrictions imposed by the model. This two-factor model is consistent with the data for all portfolios.

To identify any difference between domestic and interlisted firms, we ran a joint regression on 18 portfolios, and tested the hypotheses that the coefficients were the same for the two groups. The resulting χ_2^2 statistics were 4.43, and 3.80, for the GLO/CAN and CAN/GLO sorting respectively, which are below the 5% level of confidence of 5.99. Therefore, we cannot reject the hypothesis that the coefficients γ_0 and γ_2 are the same for domestic and interlisted firms. Integration is rejected in favor of segmentation for domestic as well as for interlisted firms.

Finally, Table IV presents the tests of segmentation. If purely international factors were priced, we would expect to find δ_2 to be significantly positive. Here, δ_2 is negative across sorting and portfolios, but significantly negative only for the

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[23] Note that our procedure leads to conservative estimates. Without the thin trading correction, the values of γ_2 would have been 10 to 15% higher than those reported in Table IV.

Table IV

Tests of Segmentation
(1968–1982)

	δ_0	δ_2	χ_7^2
All Canadian Firms			
Sorting: GLO/CAN	.00214	−.01058**	8.682
	(.00325)	(.00365)	
CAN/GLO	.00495	−.00657	11.072
	(.00325)	(.00350)	
Domestic Firms			
Sorting: GLO/CAN	.00177	−.01156**	9.221
	(.00322)	(.00412)	
CAN/GLO	.00271	−.00418	11.057
	(.00318)	(.00399)	
Interlisted Firms			
Sorting: GLO/CAN	−.00008	−.01114*	23.755**
	(.00459)	(.00500)	
CAN/GLO	.00923	−.00240	24.152**
	(.00464)	(.00444)	

Projection of Global Index on Canadian Index
$$\hat{R}_G = .00452 + .6311^{**}R_C \qquad R^2 = .5271$$
$$\quad (.00246) \quad (.0451)$$

Notes: Standard errors in parentheses. Significance at the 5% and 1% level denoted by * and **, respectively.

GLO/CAN portfolios. The large differences in estimates across sorting suggest that this result may not be reliable. From the chi-squared statistic, it seems that this two-factor model is consistent with the data, except for interlisted firms. Thus, although the segmentation model was sometimes at odds with the data, we failed to discover a positive relationship between expected returns and purely international factors.

V. Conclusions

This paper examined the issue of segmentation versus integration of the Canadian equity market vis-à-vis a global North American market. We find that an international CAPM was not a good description of the pricing of Canadian securities for the period from 1968 through 1982. National factors not present in the global index are an essential component of expected return in Canada. We therefore reject the joint hypothesis of integration of the North American equity market combined with the CAPM.[24] There is evidence of segmentation in the pricing of Canadian stocks. Our ability to reject at least one of the competing hypotheses can be traced to the use of the maximum likelihood technique, which is more powerful than the traditional Fama-MacBeth two-pass approach.

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[24] Of course, these results are also conditional on the assumption of a logarithmic utility function for all investors, which considerably simplifies the issue of exchange risk.

This rejection of integration held for both interlisted and domestic firms, which exhibited very little difference in behavior as far as pricing is concerned. Conditional on the CAPM, this similarity for interlisted and domestic firms indicates that a major source of segmentation can be traced to legal barriers linked to the country of origin of listed securities.

Of course, our results could be interpreted as a test of an arbitrage pricing model where two factors, national and international, are specified a priori. The evidence suggests that the purely national factor is priced. Canadian stocks, which are for the most part resource-oriented, do not conform to an international one-factor pricing model. The methodology could be extended to more general multifactor asset pricing models, and it would be interesting to see whether purely national factors also lead to rejection of integration.

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DISCUSSION

JAMES N. BODURTHA JR.[*]: Extending the work of Stehle [8], Jorion and Schwartz analyze the market integration and segmentation hypotheses for the Canadian stock market. The important contribution of the paper is its attention to a market which should provide a test of these mutually exclusive hypotheses. There are two major reasons for this.

First, this work examines a relatively small portion of the global market portfolio for segmentation. When a large portion of the global market is tested for segmentation, testing is difficult because this market will be priced both directly, under the segmented market hypothesis, and indirectly, as a major portion of world wealth, under the integrated market hypothesis. The purely domestic stocks in the Canadian market sample made up approximately three percent of the combined U.S. and Canadian market portfolio which is used for integrated market relative pricing. The interlisted stocks on both the Canadian and U.S. markets made up between three and four percent of this portfolio. Therefore, risk unique to the Canadian equities' can be potentially different from global market risk.

Secondly, differential taxes and investment restrictions have existed and do exist between the U.S. and Canadian equity markets. The authors categorize