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Measurement of Financial Integration in the GCC Equity Markets: A Novel Perspective

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Abstract

We investigate the degree of integration in the Gulf Cooperation Council (GCC) equity markets. The intuition rests on the premise that with perfect integration, the price of risk is equalized across markets. Based on the formal measurement theory of market integration in Chen and Knez (1995), we equate market segmentation with deviations from the law of one price and estimate the extent to which markets in the GCC assign to similar payoffs prices that are close. The methodology is applied pair-wise to all six member countries between 2006-2007. Our analysis shows that the largest segmentation happens between Saudi Arabia (or Dubai) and the rest of their GCC peers. We examine explanations for the observed patterns through a similar sectoral analysis. While the latter does not provide much justification for the observed integration levels, both national and sector-based findings provide useful information for portfolio investors and policymakers.

Introduction

By 2010, the Gulf Cooperation Council[1] (GCC) aims at reaching full financial and monetary integration. Presently, it remains the most comprehensive economic integration agreement within the region that enhances Arab financial integration. Its objective is to strengthen integration and ties between member countries at all levels. In order to achieve these goals, member states have agreed to free the movement of human and (more importantly) physical and financial capital and to coordinate their financial, monetary and banking policies for the purpose of enhancing cooperation between monetary agencies and central banks. However, with few intra-GCC merger and acquisition activities, minimal cross-listings of stocks, no near plans for establishing common capital markets and supervisory and regulatory bodies among member states, cooperation among the GCC equity markets, in particular, may be perceived as rather weak. This, coupled with slow progress in economic integration, raises important questions about the timetable for meeting the Council's founding objectives.

This paper presents evidence on the presence (or otherwise) of financial integration among the equity markets of the GCC member countries. We explore issues from a novel perspective as we apply a new methodology which captures miss-pricing in these markets without having to appeal to a single specific asset pricing model. Ultimately, the objective is to determine the magnitude of violations of the *law of one price* (LOOP) across the various markets, using the integration measure proposed by Chen and Knez (1995).

Not unlike many topics in financial economics, market integration has received anything but scant attention from researchers. The literature has known a number of notional ideas on market integration, albeit some have been a tad vaguer than others. The lack of a general agreement on a formal definition of integration (Adler and Dumas, 1983) has necessarily taken the literature on different routes. To date, numerous studies have been devoted to establishing the presence of integration across markets. The intense scrutiny is not surprising given the significance of

1. The six Council members include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

the topic. To the extent that financial integration impels the efficiency of financial markets, it can improve the risk-return alternatives available to investors, hence stimulating increased demand for funds and services. On the one hand, this could allow for the size growth of domestic financial markets; on the other, higher efficiency of markets (and their intermediaries) counters arguments that insist on the excessive links of markets having left them all too vulnerable to news (Ayuso and Blanco, 1999). Finally, regional integration could be viewed as a major reason behind not only the weakening of portfolio diversification opportunities, but also the changes in the allocation of multinationals' foreign direct investment.[2]

The rest of the paper is organized as follows. The next two sections show the significance the topic and review the related literature. Section four lays down the theoretical foundation of the integration measure. It is followed in section five by a concrete framework through which the measure can be tested empirically. Specifically, the algorithm is presented and connections to returns data coming from all seven GCC equity markets are explored. Section six presents the empirical results on estimating pair-wise integration across national markets and various sectors as well. Finally, section seven concludes the paper.

2. This is of significant import to the Arab world, which receives the smallest per capita share of foreign direct investment in the world (EIU Viewswire, 2002).

Motivation and Background of Integration Measurement

This study adds to the existing literature by shedding additional light on the presence of integration in stock markets of the GCC. It is also the first of its kind in using minimum assumptions to address some questions that have been left unanswered by others. All the literature on Arab stock markets has focused on linkages, either of the short, long, or contemporaneous type.[3] To the extent that linkages can not provide accurate information as to whether there exists genuine financial integration in the form of minimum barriers of any kind, such studies simply can never have the last say. Furthermore, linkage-based studies contend that the absence of high correlations among international markets is good reason for a local investor to diversify abroad on the premise that this will take him/her to a higher mean-variance frontier. Such recommendation, of course, need not be true simply because low correlations typically involve countries with high variances. In this case, the benefits from geographic diversification will come at the expense of increasing risk (or the investor achieves the same mean portfolio by adding more risk not because of some forgotten risk-less opportunity for profit). Having said this, in this study and by way of assessing the extent to which equity prices in the GCC countries have converged of late, we sidestep this problem by placing risk and its pricing at the very heart of our analysis.

Additionally, the usefulness of this study is evident in light of other approaches, perhaps not common to Arab markets per se but that are well-known to the financial integration literature. In such attempts, researchers often rely on some asset pricing model to answer the question of integration in the LOOP sense. These models define risk either linearly in the form of the capital asset pricing model (CAPM), the arbitrage pricing theory (APT), or any of their variants (Korajczyk, 1995), or non-linearly as in consumption-based models (Obstfeld, 1995). One problem with this line of reasoning, however, is that every time the presence of integration is put to the test, the structure of the model itself is necessarily called into question.

3. For an extensive coverage of that literature see: Neaime (2002, 2005, 2006a, and 2006b), Neaime and Hakim (2002), and Hakim and Neaime (2003).

Also, other criticisms levied against such applications in the integration literature have much to do with the inability of the proposed parametric models to explain many a puzzling phenomenon regarding the behavior of stock returns in domestic markets (for example, C-CAPM and the equity premium or risk-free rate puzzles). Again, the current study is nonparametric, thus bypassing criticisms of the sort just delineated.

Last but not least, PPP-based tests comparing prices of a basket of goods (indices) across markets have also been used in the literature as the most direct way of testing for LOOP globally. However, just as well, such applications have not been free of their own shortcomings. Primarily, they have been criticized for their heavy dependence on the choice of indices and on the strong assumption of homothetic preferences and identical tastes. As will become clear in the following sections, the measures discussed and proposed herein will be seen—in a fashion similar to PPP-based studies as representing the degree to which price kernels differ in their pricing of risk common to both markets. However, for all intents and purposes, the present SDF-based methodology sidesteps the faults that have plagued its PPP-based counterpart.

Perfect market integration is generally understood as the absence of all sorts of barriers that keep capital from flowing unimpeded across national borders or market types. Barriers can include any from sharp differences in regulations, tariffs, taxes, restrictions on trading, or even information costs. More importantly, each of these could result in different markets demanding different levels of compensation for risk. The core assumption in this study is that all goods in a market must trade at a unique price: one can not buy a commodity for a certain price p and immediately resell it in the same market for a price $p' > p$. This assumption is at the very definition of LOOP and is consistent with the weakest and most basic arbitrage sense. It is not only a concept that we impose on our individual (stand-alone) markets, but one that we require for the latter to satisfy almost perfectly among one another should they be deemed integrated. Therefore, according to this notion of integration, two integrated markets should assign identical prices to uncertain but identical payoffs. Alternatively, integration in the present context is associated with convergence in the respective price levels of two markets. If two markets (viewed collectively) violate LOOP, then they are not perfectly integrated (and therefore mispricing is non-zero in this case).

Against this backdrop, Chen and Knez (CK hereafter, 1995) developed their formal theory that measures the degree of integration between markets. The intuition behind their framework is simple: relying solely on the concept of LOOP, they calculate the mis-pricing between markets, arguing that the greater the discrepancy between the prices the more segmented these markets are. CK make use of the stochastic discount factor (SDF) framework popularized earlier by Hansen and Jagannathan (1991 and 1997), Braun (1991), Knez (1991), and Snow (1991) for use on domestic assets. They prove that integration (in the LOOP sense) between two markets implies that the intersection between their sets of admissible stochastic discount factors is non-empty. Essentially, CK propose measuring the degree of market segmentation by the minimum of the square distance between two spaces, each spanning (comprising) all admissible SDFs for that market. Hence, a minimum distance of zero suggests consistent pricing or perfect integration.

In a more specific conceptual framework, the distance measure can possess different economic contents depending on the markets under consideration. If one considers two GCC markets separated by capital controls (e.g. the Saudi stock market and any other of its peers), [4] the measure may represent a potential efficiency gain from the removal of such barriers. Otherwise, the measured distance represents the minimum amount of cross-market frictions that is necessary to prevent investors from taking advantage of the pricing discrepancy across markets (CK, 1995). If no such controls exist between the two markets, then a non-zero distance gives the minimum level of frictions that is necessary for price misalignments to persist across the two markets' borders. These are the minimum

4. As is the case with all GCC stock markets, foreign investment is limited and GCC non-nationals face different degrees of access to publicly listed shares. However, the Saudi market is by far the most restrictive Arab market in terms of ownership: other GCC nationals are allowed to own a maximum of 25 percent of locally listed companies, and foreign non-GCC ownership is restricted to closed investment funds only.

costs necessary to prevent investors from taking advantage of the discrepancy in the price level (also known as an opportunity for arbitrage). Alternatively, if the two markets are subsets of assets from the same stock market, then the measure may reflect the average impact of market frictions or information costs available within that market. In any event, although the measure can be treated, among other, as a measure of an actual cross-market arbitrage opportunity (a theoretical opportunity for riskless profit), it is probably best viewed as a general index of price misalignment. In other words, it is the pricing error that investors should expect if they treat a given pair of markets as integrated.

In contemplating their distance measure, CK (1995) follow Hansen and Jagannathan (1991, 1997) in exploiting the properties of the SDF. Ultimately, their methodology is free of assumptions on any specific asset pricing model. In a similar fashion, it assumes neither market completeness (markets spanning the entire set of contingencies) nor aggregation. It also says nothing about a representative investor and/or the sort of preferences he/she exhibits. In principle, it is relatively uninfluenced by biases produced under other integration studies where the relative sizes of the markets may play a role (Latif and Kazemi, 2006).

Related Literature

The use of SDF-based methodologies for market integration is relatively new and concise. CK (1995) were the first to apply their methodology to monthly returns on portfolios from the NYSE and Nasdaq from January 1973 to December 1991 only to find that their integration measures are economically small in magnitude but significantly different from zero. Using CK's framework, Sontchik (2003) finds that country-based integration has decreased in the EMU countries (both top-down and pairwise) after the introduction of the euro, while Ayuso and Blanco (1999) document an increase in the degree of integration during the nineties between the American, German, and Spanish stock exchanges. Finally, through simulation exercises, Latif and Kazemi (2006) find that the SDF framework of CK possesses some of the more desirable properties of (1) converging to its true value as the length of the sample is improved, and (2) increasing in magnitude with the inclusion of more assets and/or as the correlation between the sampled market pairs is enhanced. They also study the behavior of the distance measure among the equity markets of ten developed economies over the thirteen-year period, January 1990 to December 2002. They find that a higher level of integration is observed especially towards the second half of their sample period.

Theoretical Framework

This section outlines how CK (1995) use a set of observed asset returns to estimate their integration measure. The interested reader is referred to the original paper for a formal proof of the results stated herein.

Let π_t be the current price which relates a given future contingent payoff p_{t+1} to an unobserved SDF d_{t+1} according to the basic pricing equation:

$$\pi(p_t) = E[d_{t+1}p_{t+1}] \qquad (1)$$

There are several ways to interpret this expression, the most common of which is to assume for example that the price $\pi_t\,(p_t)$ of a stock gives the rights to a payoff $p_{t+1} = \pi_{t+1} + div_{t+1}$, where div_{t+1} is the dividend payment between t and $t+1$. Alternatively, price π_t is one for a gross return for which the payoff $p_{t+1}=R_{t+1}$, or π_t is zero for the excess return on assets a and b with payoff $p_{t+1} = R^e_{t+1} = R^a_{t+1} - R^b_{t+1}$. We follow the extant literature in focusing solely on gross returns as the latter are more likely (than prices) to be stationary, so each payoff $p_{i,t+1}$ is the return between t and $t+1$ per dollar invested in the ith asset.

Presently, we identify N traded assets in each market M.[5] The SDF vector d_{t+1} connects next period's payoff p_{t+1} with its current price $\pi(p_t)$. For a given asset or portfolio of assets, many such vectors exist since markets are assumed incomplete. We refer to each d satisfying equation (1) $\forall i \in N$ as an admissible

5. M could be any of the seven GCC equity markets.

SDF and let D_A and D_B be the sets of all admissible SDFs for markets M_A and M_B, respectively. Then, if LOOP holds separately in each market, both D_A and D_B are non-empty. If, additionally, M_A and M_B are perfectly integrated in the LOOP sense, then $D_A \cap D_B \neq \varnothing$. Perfect market integration does not require that $D_A = D_B$. Rather, it is sufficient that there be at least one common pricing rule (or SDF) which can consistently price all assets in the two markets. Hence, the degree of market segmentation can be provided by the minimum squared distance between the two sets D_A and D_B, as captured by the real-valued function $\sqrt{g(.,.)}$ where $g(.,.)$ is such that:

$$g(A,B) \equiv \min_{d_A \in D_A, d_B \in D_B} \left\| d_A - d_B \right\|^2$$

From a theoretical perspective, if $g(A,B)$ is zero, markets *A* and *B* are perfectly integrated in the LOOP sense. In practice, the same measurement theory can also be used to gauge the degree of domestic integration, as suggested by the original authors. Consequently, in empirical tests, if $g(A,A)$ is non-zero within the same market *A*, then it can be taken as a lower bound on the pair-wise international integration measure of *A* (Ayuso and Blanco, 1999). Otherwise, when measuring integration, it is preferable that '*g*' be generally used in relative terms, as a change in integration between distinct markets and/or over periods of time.[6] Also, the theory of pair-wise integration can be generalized to multiple markets, where perfect integration in the LOOP sense is obtained for all markets if and only if $g(M_1,\dots,M_K) \equiv \min_{d_1 \in D_1,\dots,d_K \in D_K} \sum_{k=2}^{K} \left\| d_1 - d_k \right\|^2 = 0$. However, in this paper, the discussion is confined to pair-wise integration as it is necessary a condition for group-integration.

In estimating the market integration measure, we solve the minimization distance problem between the two sets D_A and D_B of admissible stochastic discount factors. Given the lack of a general closed-form solution to problems of

6. Unfortunately, our data covers too few time periods for an adequate analysis of integration over time. However, everywhere, we stress in our static setting the relative terms in which the integration measure ought to be interpreted.

this type, an algorithm is involved consisting of the two iterative steps:

1. Compute the shortest distance $g(\hat{d}_A, D_B)$ between a point $\hat{d}_A \in D_A$ and the set D_B. Following Hansen and Jaganathan (1997), the solution to the problem $g(\hat{d}_A, D_B) \equiv \min_{d_B \in D_B} \left\| \hat{d}_A - d_B \right\|^2$ reflects the extent to which pricing the payoffs in M_B using $\hat{d}_A$ (rather than some $d_B \in D_B$) results in errors, and is provided by:

$$g(\hat{d}_A, D_B) = [E(X_B \hat{d}_A) - \pi_B(X_B)]' [E(X_B X'_B)]^{-1} [E(X_B \hat{d}_A) - \pi_B(X_B)] \qquad (3)$$

Next, locate $\hat{d}_B \in D_B$, where $\hat{d}_B$ represents the least square projection of $\hat{d}_A$ onto D_B as in:

$$\hat{d}_B(\hat{d}_A) = \hat{d}_A - X'_B [E(X_B X'_B)]^{-1} E(X_B \hat{d}_A) - \pi_B(X_B)] \qquad (4)$$

2. Project $\hat{d}_B$ back onto D_A to find the minimum squared distance between $\hat{d}_B$ and D_A, deriving the corresponding expressions for $g(\hat{d}_B, D_A)$ and $\hat{d}_A\left(\hat{d}_B(\hat{d}_A)\right)$.

Steps one and two are repeated back and forth until $g(.,.)$ converges within a tolerance level of 0.05 basis points. This stopping rule is set at the more stringent 0.01 basis-points level for $M_A = M_B$ (or integration within the same market) since the magnitude of 'g' is smaller in this case. The logic of this algorithm is depicted in a figure resembling Chart 1 in CK (1995):

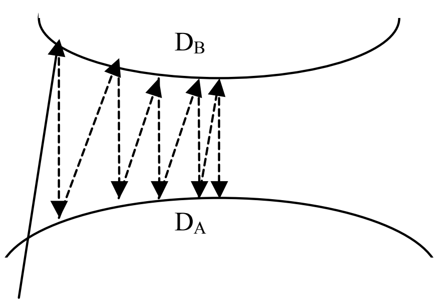

Figure 1 Illustration of the Estimation Algorithm

Empirical Framework

In empirically implementing the procedure, we naturally resort to the analogy principle, replacing population moments by their sample counterparts. The two markets for which distances are computed are defined as follows. Altogether, the procedure can be conveniently summarized in four steps:

(a) First, one market (M_A) is taken as a benchmark, for which a group of 20 securities[7] are randomly chosen to represent what would be known as N_A or sub-market A, whose assets are priced by the set of discount factors D_A. For the Bahrain Stock Exchange (BSE), only 11 companies comprise the whole market (for dearth of activity as regards all the other traded stocks), so for pair-wise integration involving BSE and itself or BSE and any of its GCC peers N includes 5 assets;

(b) Another random combination of N_B =20 (or 5 in the case of BSE) securities are selected from M_B. These are all priced by the set D_B. In the event that integration involves the same national market ($M_A = M_B$), the randomly chosen stocks comprising sub-samples N_A and N_B are restricted to being different;

(c) A minimum distance is computed between the set D_A and the set D_B, according to the above-stated algorithm and stopping rule;

(d) Steps (a) to (c) are repeated 10,000 times, so we can rely on a normal distribution for g, for which we report the mean and standard deviation. Correspondingly, we apply a simple t-test to check for the significance of our '*g*' estimate.

We require returns data on every company listing on all seven GCC equity markets. Our source of data is the up-to-date GulfBase online source of detailed financial information on the joint stock companies in the GCC countries. We rely on daily data which gives us 219 observations over the sample period January 7,

7. Notice that the need to take a sub-sample of a market (rather than the whole market itself) is CK's (1995) solution to performing the algorithm on markets that differ in the number of listing companies. As a practical matter, the number of assets to include in a sub-sample is constrained by the available data. The choice of 20 securities for a sub-sample size is one that seemed representative of the pricing properties of each market as a whole. One important finding that we obtained from the simulation exercise in Latif and Kazemi (LT, 2006) is the sort of tradeoff that exists between the number of assets comprising sub-samples N_A and N_B and the sample size T. LT's estimate of 'g' stabilized when T was at least triple the number of assets included in the sample, a condition largely met in our case.

2006 to January 24, 2007. We assume that the time period is sufficiently large for the standard laws of large numbers to hold. The number of assets is assumed fixed over the period of consideration, so only stocks that are relatively active and contain all 219 observations are incorporated. The active companies are already listed on the GulfBase website. Of those listed, however, we omit companies that either (1) have very intermittent data or (2) suffer from low activity as identified by a floor on the number of trading days over the sample period. With regards to the latter, we avoid reducing some of the markets to a handful of companies by defining (rather flexibly) a stock as active if it trades during at least 20 percent of the 219-trading-day sample period. The resulting sample includes the daily closing price, sector, number of transactions, and volume of trade for 388 out of the 644 companies comprising the GCC equity markets and for all official market and sector-based indices. Table A.1 in the Appendix contains a detailed description of the number of companies in each market, as identified by the sector they belong to. Such information is provided for both the current sample and the GCC population at large. Evidently, most companies are concentrated in a few sectors (banking and investment, industry, real estate and construction, and service and insurance), which may suggest that the key to market integration may lie in those well-represented sectors.

For every company/index, daily gross returns are computed as one plus the difference in the logarithm of two subsequent prices. Although nowhere in the paper do we use aggregated indices, the dynamics of capital markets may be best portrayed by the moments of the official market and sector-based indices. Accordingly, Tables A.2 to A.8 in the Appendix give detailed data description of the realized returns over the 219-day sample period for each market (including the daily average return, standard deviation, skewness and kurtosis for each official market/sector-based index). Far and wide, the standard deviations of the returns more than outweigh their corresponding means, but this is only emblematic of data of such frequency. The highest realized average daily return over the sample period pertains to the Muscat Stock Market (MSM). All other markets earned negative daily returns, although these are insignificant. As in Latif and Kazemi (2006), we expect MSM, from a risk-return point of view, to be less integrated with the rest of the markets (especially the least-realized earners of them: Saudi Arabia, Dubai, Doha, and Abu Dhabi). As will become apparent, the estimation results to come do not nullify this hypothesized claim.

One can also notice that the individual sectors behave quiet differently in different national markets. Naturally, this lends itself to a sub-sector wise integration analysis, lumping all same-sector company stocks in one portfolio (irrespective of their market of origin). It also suggests that the various industry representations within a country may hold the answer to why some markets may appear more segmented (i.e. they share no common SDF) than others. Such a claim will be tested shortly.

Estimation Results

In pricing the risk common to the GCC markets, the emerging evidence (on price convergence) is only mixed. Table 1 reports the estimates of the weak integration measures for the pairs of seven GCC equity markets. Each bin in the table is divided into three rows, reporting in the first two each of (i) the average of the minimum distance measure across all 10,000 random sub-sample pairs and (ii) its corresponding standard deviation. Both sample moments are denominated in basis points. The third row includes the average number of iterations (over all 10,000 pairs) needed to achieve the aforementioned stopping rule. A summary list of the most salient results is delineated next.

One of the most obvious findings is that each market is almost perfectly integrated within itself. Empirically, the issue with 'g' when $M_A = M_B$ is that it only equals zero between two exactly identical sub-samples. However, our algorithm, as suggested by CK, is forced to randomize the latter without replacement. As a result, no one asset in N_A is repeated again in N_B which necessarily inflates the resultant estimates. Fortunately, we obtain a mean value of *'g'* (while ranging between 0.0012 and 0.236 basis points) that is not significantly different from zero using the standard t-test. In a nutshell, these estimates indicate minimal frictions within the same market, or none of our markets show the presence of virtually any arbitrage opportunity.

On a more interesting note, the off-diagonal elements in Table 1 reveal a systematic mis-pricing for some country pairs under the null hypothesis of pair-wise integration. Again, for every country pair the distance measure combining the two markets is quite small in economic terms; however, some of these measures are significantly different from zero so perfect pair-wise integration can be safely rejected in that case. This means that the GCC structure of equity returns over the last year can be characterized by a handful of markets that are segmented in the LOOP sense: Muscat and Abu-Dhabi, Saudi Arabia and nearly all other markets except for Dubai and Abu-Dhabi, and Dubai with all except for Saudi Arabia and Abu-Dhabi. Such results contain a strong warning that there is a possibility that the potential benefits of diversification across the different GCC markets may be outweighed by the magnitude of the mis-pricing reported for these pairs. For the remaining ones, however, arbitrage opportunities do not seem feasible (after taking account of transaction costs). In other words, for these almost perfectly integrated markets the findings tend to confirm the usual statements about gains from international diversification, i.e., if one thinks mispricing as a kind of transaction cost, high return foreign investment strategies between Kuwait and Muscat or Bahrain and Doha must be considered somehow attractive in this case.

Table 1 Summary statistics of pair-wise integration measures across countries

	Saudi Arabia	Kuwait	Muscat	Bahrain	Abu Dhabi	Dubai	Doha
Saudi Arabia	0.082356 0.095822 34	18*** 9.3236 6	29* 7.9209 6	23** 10 4	12 7.985 6	7.4525 6.1807 6	20* 7.6262 6
Kuwait		0.23631 0.80769 43	7.2692 4.2648 7	4.9487 3.7144 5	11 5.0705 6	19* 4.6469 6	4.4207 3.3133 7
Muscat			0.018214 0.012991 15	4.7263 3.1977 5	17* 4.5271 6	23* 3.4889 6	5.6481 3.4333 7
Bahrain				0.14896 0.98703 12	14 4.5653 4	19* 3.831 4	5.2555 3.6976 5
Abu Dhabi					0.0165 0.01412 13	2.0848 1.6079 10	8.7981*** 4.9062 6
Dubai						0.0012242 0.0014806 5	16* 3.9722 5
Doha							0.0072157 0.0051896 9

Note: In each bin, the mean of the integration measure over 10,000 random sub-samples of each market pair appears first. Underneath it is the standard deviation of the corresponding sample distribution. Both the mean and standard deviation are in basis points.The bottom-most number is the average number of iterations (over all 10,000 random sub-sample pairs) for an algorithm to achieve convergence. One (two, or/three) star(s) indicate statistical significance at the 1 (5/10) percent level.

Due to the different sector composition of each national market, we also measure mispricing in the different sector pairings. The intuition is that the integration measures in Table 1 may be the result of innovations in the stock prices that are primarily motivated by industry-specific information. If this be true, then the average level of misalignments across the various industries should provide a measure of the impact of sector-specific shocks on the national market pairings. The focus here is on stocks affiliated with the largest sectors: banking and investment (113 stocks across all 7 GCC markets), real estate and construction (52 stocks), industry (73 stocks), and services and insurance (110 stocks).

Table 2 provides values for the mean of the sector-based integration measure together with its corresponding standard deviation. Again, the diagonal elements representing self-integration are quite small in both economic and statistical terms. For most of the off-diagonal pairings ($M_A \neq M_B$), average 'g' is statistically low, too.

However, the “real estate and construction” sector fetches the statistically highest ‘g’ when paired with “banking and investment” or “services and insurance.” In this case, treating either of these two pairs as one is costly for a portfolio investor, and therefore it pays that he/she hires a specialist in each one (Sontchik, 2003). All other sector-pairs could be safely treated as one. For these others, it pays to diversify across sectors.

At first glance, the obtainable results in the table have the potential to isolate the culprits behind the mispricing in Table 1. For example, if one of two countries in a pair is high in the “services and insurance” sector while the other country is high in the “real estate and construction” sector or the “banking and investment” sector, then we believe the value of ‘g’ for that country pairing is high, too. Empirically, though such a claim is of narrow use. While it explains the relatively high 0.236 basis points for the self-integration measure of the Kuwaiti Stock Exchange (which comprises more than 50 percent and 41 percent of the sampled “real estate/construction” and “banking/investment” companies, respectively), it is not as helpful in deciphering other patterns. Thus, we conclude that, on average, the largest sources of mis-pricing in GCC country pairings do not allow for a clear sectoral justification.

Table 2 Statistics of pair-wise integration measures across major sectors

	Banking and Investment (113 stocks)	Real Estate and Construction (52 stocks)	Industry (73 stocks)	Services and Insurance (110 stocks)	All Industries (388 stocks)
Banking and Investment (113 stocks)	0.15469 0.48418 40	6.0441*** 3.2968 17	4.4739 3.4124 14	3.5653 2.6315 12	2.047 2.0007 42
Real Estate and Construction (52 stocks)		0.044581 0.038214 23	6.6508 4.33 21	7.098** 3.7973 15	1.9837 2.2683 46
Industry (73 stocks)			0.075211 0.092568 32	4.156 2.9605 24	2.7592 2.6197 48
Services and Insurance (110 stocks)				0.128 0.4548 41	2.5493 2.6385 48
All Sectors (388 stocks)					0.80635 1.5593 71

Note: Same as in Table 1, except that the pairings happen over sectors and not national markets. One (two, or three) star(s) indicates statistical significance at the 1 (5/10) percent level.

What then explains the findings in Table 1? With regard to Dubai's lack of integration with many of its peers, the answer seems quite straightforward: it is often presumed that the depth in this market is inferior to the liquidity and depth in the rest of the GCC markets.[8] As such, Dubai is less likely to satisfy LOOP with its peers almost perfectly. Concerning the Saudi-Kuwait stock market pair, Saudi-Oman, Saudi-Bahrain, and Saudi-Doha, it is important to recall that the Tadawul Saudi Stock Market lost more ground in the year 2006 than any of its GCC counterparts, which automatically lends support to the segmentation identified herein. The adjustment of the GCC market in 2006 was in part a reaction to the exuberance that had pushed asset prices up to levels that bore little relation to their fundamentals. During 2006, the Tadawul All-Share Index (TASI) fell by 63 percent, the Doha Securities Market Index (DSMI) by 55 percent, the Dubai Financial Market Index (DFMI) by 53 percent, the Abu Dhabi Securities Market Index (ADSMI) by 52 percent, the Kuwait Stock Exchange Index (KSEI) by 24 percent, the Muscat Securities Market Index (MSMI) by 17 percent, and the Bahrain Stock Exchange Index (BSEI) by 15 percent.

8. The Dubai Financial Market is one of the most recent financial markets, established only in 1998. The only younger GCC market is the Abu Dhabi Securities Market, established in the year 2000.

Conclusion

The first steps have already been taken towards the networking of the GCC stock markets. The heads of the latter met even as far back as in March 2000 to discuss ways to unify legislation, corporate frameworks, settlements, deposits, and transfers (ESCWA, 2003). As a result, cross-border trading in the GCC has been facilitated through the easing of restrictions on GCC investors in the markets of Bahrain, Kuwait, and Oman. Nonetheless, all GCC markets have a long way to go before they can achieve perfect integration.

This study is the first of its kind in measuring price misalignments in the GCC equity markets over the period January 2006 to January 2007. The results are not only mixed but also very preliminary, leaving a spray of interesting questions for future research. For one, are the blatant mis-pricings observed for some pairings a product of the sample size? With that in mind, one can not overstate the need to expand the scope of this study to include a bigger sample. At the least, that would allow for (1) testing the robustness of our measures and (2) tracking their performance over time. It would also be interesting to investigate what the source of the observed price misalignments might be whether it has more to do with factors which are under price/regulatory control than with anything else.

Financial integration in the sense of minimum barriers of all types across the GCC markets can result in a number of benefits. One, it allows for further opportunities for risk-sharing and inter-temporal consumption smoothing. This, according to Cochrane (1991) and Townsend (1994), may imply that consumption of individuals in areas where risk is fully shared co-moves with the consumption of those residing in other regions of that area, while it does not co-move with region-specific shocks. Two, complete eradication of barriers to cross-market trading, clearing and settlement platforms may result in more efficient allocation of capital across the more productive investment opportunities. Three, increased financial integration may eventually translate into greater financial development. As in Jayaratne and Strahan (1996), Bekeart et al. (2002), and Rousseau (2002), this is of foremost consequence as financial development can be conducive to subsequent economic growth. Of course, the channels through which increased financial integration impacts on the GCC countries are more complex than this brief enumeration. Yet, it remains that the evidence documented in this paper implies that many of these opportunities are far from fully exploited.

Appendix

Table A.1 Distribution of stocks across national markets and sectors

GCC Market	TASI		DFM		ADSM		KSE		BSE		MSM		DSM		Total	
Banking and Investment	10	10	17	10	17	12	52	47	19	7	27	21	8	6	150	113
Real Estate and Construction	8	8	11	5	13	11	29	28	0	0	0	0	0	0	61	52
Energy	1	1	0	0	2	2	0	0	0	0	0	0	0	0	3	3
Food	0	0	4	0	8	7	5	5	0	0	0	0	0	0	17	12
Industry	33	28	1	1	4	4	25	18	2	0	54	16	7	6	126	73
Telecom	2	2	1	0	4	3	0	0	0	0	0	0	0	0	7	5
Services and Insurance	24	19	13	7	14	7	53	37	18	4	42	15	21	21	185	110
Overseas Companies	0	0	0	0	0	0	17	11	7	0	0	0	0	0	24	11
Agriculture	9	9	0	0	0	0	0	0	0	0	0	0	0	0	9	9
Not Listed	25	0	6	0	4	0	3	0	5	0	18	0	1	0	62	0
Total No. of Stocks	112	77	53	23	66	46	184	146	51	11	141	52	37	33	644	388

Note: The numbers in bold provide the actual number of companies in each sector/market. The numbers to the right of them are their current sample counterparts. TASI is the Tadawul Saudi Index, DFM is the Dubai Financial Market Index, ADSM is the Abu Dhabi Securities Market Index, KSE is the Kuwait Stock Exchange Index, MSM is the Muscat Securities Market Index, DSM is the Doha Securities Market Index, and BSE is the Bahrain Stock Exchange Index.

Table A.2 Sample moments for the official market and sector-based Tadawul indices

Country	Symbol	Index Name	Mean	Std Dev	Skewness	Kurtosis
Saudi Arabia	TASI.1	Banking Index	-0.00331	0.027359	-0.4209459	1.845945
	TASI.3	Industrial Index	-0.00408	0.035925	-0.3270993	0.890039
	TASI.4	Cement Index	-0.00283	0.037359	-0.3183263	0.892503
	TASI.2	Services Index	-0.00511	0.04487	-0.2979929	-0.43741
	TASI.5	Electricity Index	0.002316	0.120191	13.7003272	213.7753
	TASI.6	Telecommunication Index	0.990909	0.121376	-6.6302339	93.60031
	TASI.7	Agricultural Index	-0.00483	0.055972	-0.1002781	-1.03923
	TASI	Overall Market Index	-0.00368	0.030571	-0.4333709	1.35643

Table A.3 Sample moments for the official market and sector-based DFM indices

Country	Symbol	Index Name	Mean	Std Dev	Skewness	Kurtosis
Dubai	DFM.13	Banking Index	-0.00202	0.019807	-0.2548242	6.615158
	DFM.72	Inv. and Fin. Services Index	-0.0026	0.028913	0.44266041	5.121097
	DFM.14	Insurance Index	-0.00305	0.02194	-0.2814824	5.861996
	DFM.73	Real Estate and Const Index	-0.00199	0.030139	0.19080112	1.898335
	DFM.82	Transportation Index	-0.00291	0.032024	0.34013564	2.932497
	DFM.83	Materials Index	-0.00416	0.028717	-0.8941531	8.54982
	DFM.84	Consumer Staples Index	-0.00145	0.014891	1.52721699	34.36446
	DFM.85	Telecommunication Index	3.09E-05	0.025129	1.57084632	6.819263
	DFM.86	Utilities Index	-0.0036	0.030423	0.45758465	4.599279
	DFM	Overall Market Index	-0.00214	0.022348	0.04112323	4.576062

Table A.4 Sample moments for the official market and sector-based ADSM indices

Country	Symbol	Index Name	Mean	Std Dev	Skewness	Kurtosis
Abu Dhabi	ADSM.8	Banks and Fin. Serv. Index	-0.00144	0.015023	0.33586651	3.418973
	ADSM.78	Real Estate Index	-0.00301	0.020513	0.21145855	3.696228
	ADSM.11	Energy Index	-0.00353	0.025805	0.53122402	4.870662
	ADSM.10	Consumer Index	-0.00249	0.022801	0.04461245	1.419287
	ADSM.79	Construction Index	-0.00231	0.018023	0.23240985	3.253882
	ADSM.9	Insurance Index	-0.00095	0.012339	-0.3045592	1.325444
	ADSM.80	Telecommunication Index	-0.00085	0.019221	0.78164013	3.877298
	ADSM.12	Industrial Index	-0.0021	0.020194	0.05991389	1.179839
	ADSM.81	Health Care Index	-0.00248	0.024086	-0.7673557	2.184722
	ADSM	Overall Market Index	-0.00177	0.014687	0.43490289	3.279971

Table A.5 Sample moments for the official market and sector-based KSE indices

Country	Symbol	Index Name	Mean	Std Dev	Skewness	Kurtosis
Kuwait	KSE.18	Banking Index	0.000437	0.011193	0.5168872	5.70241
	KSE.19	Investment Index	-0.00118	0.013648	0.00867514	2.23623
	KSE.20	Insurance Index	0.000288	0.007822	0.22217718	1.921084
	KSE.21	Real Estate Index	-0.00144	0.01429	-0.1505349	2.103013
	KSE.22	Industry Index	-0.00058	0.012366	-0.2211335	1.941797
	KSE.23	Services Index	-0.0003	0.009976	-0.1995128	1.946257
	KSE.67	Food Index	-0.00117	0.0136	0.23889383	1.347565
	KSE.68	Non-Kuwait Index	-0.00095	0.009558	0.27321447	3.217374
	KSE.69	Mutual Funds Index	0.000109	0.010713	6.48038654	52.89072
	KSE.70	Parallel Market Index	0.000479	0.007506	15.6843871	246
	KSE	Overall Market Index	-0.00079	0.010604	-0.1305809	3.164782

Table A.6 Sample moments for the official market and sector-based BSE indices

Country	Symbol	Index Name	Mean	Std Dev	Skewness	Kurtosis
Bahrain	BSE.71	Banking Index	0.000223	0.0096	0.25474305	7.766355
	BSE.28	Investment Index	-0.00043	0.008135	-0.8931204	5.70591
	BSE.29	Insurance Index	-0.00081	0.010154	-0.6610724	4.031809
	BSE.30	Services Index	-0.00073	0.011487	1.29251419	12.63186
	BSE.31	Industry Index	-0.00016	0.005664	-3.4755492	48.30448
	BSE.32	Hotel and Tourism Index	-7.8E-05	0.005487	0.34752976	12.97706
	BSE	Overall Market Index	-0.00027	0.005927	0.1943448	2.623612

Table A.7 Sample moments for the official market and sector-based MSM indices

Country	Symbol	INDEX NAME	Mean	Std Dev	Skewness	Kurtosis
Muscat	MSM.34	Banking and Investment Index	-0.00018	0.008342	-0.3128198	1.394436
	MSM.37	Industry Index	0.001368	0.011693	0.20851696	3.305795
	MSM.38	Services and Insurance Index	0.000519	0.00713	0.24239102	0.774395
	MSM	Overall Market Index	0.000241	0.007285	-0.4331129	2.220116

Table A.8 Sample moments for the official market and sector-based DSM indices

Country	Symbol	Index Name	Mean	Std Dev	Skewness	Kurtosis
Doha	DSM.39	Banking Index	-0.00164	0.018134	0.03358708	1.098342
	DSM.40	Insurance Index	-0.00161	0.0213	0.00920126	1.382073
	DSM.41	Services Index	-0.00082	0.01648	-0.000534	0.654424
	DSM.42	Industry Index	-0.00167	0.019066	0.12893704	0.763849
	DSM	Overall Market Index	-0.00144	0.016486	0.07966051	1.263362

Note: All of mean, standard deviation, skewness, and kurtosis correspond to daily official sector/market index returns over the 219-day sample period. TASI is the Tadawul Saudi Index, DFM is the Dubai Financial Market Index, ADSM is the Abu Dhabi Securities Market Index, KSE is the Kuwait Stock Exchange Index, MSM is the Muscat Securities Market Index, DSM is the Doha Securities Market Index, and BSE is the Bahrain Stock Exchange Index.

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