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## *"Towards A Market Based Composite Political Risk Indicator for Country Oil and Gas Industry Sectors"*

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# TOWARDS A MARKET BASED COMPOSITE POLITICAL RISK INDICATOR FOR COUNTRY OIL AND GAS INDUSTRY SECTORS

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**Abstract**

The purpose of this paper is to test an international oil and gas market model, hypothesised to arrive at new indicator of pure composite political risk for country oil and gas sectors. Current political risk ratings are largely subjectively quantified and are not frequently published. Investors in oil and gas industry portfolios as well as trade and investment policy formulators should be interested that there is a strong theoretical and practical basis where pure political risk indicators may be obtained daily rather than monthly using stock market generated data. A systemic international capital asset pricing model is a useful framework as long as available financial and economic information is captured along with systemic interdependence and control introduced for country size and wealth effects. If so, an indication of the influence of human (political) factors in each country oil and gas industry sector can be provided.

**Key words: Political risk, oil and gas industry sector, market model, risks scores, economic and financial risk.**

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## Introduction

Studies into energy crises in recent years has focussed on largely global economic and financial factors and to a lesser extent on the inhibition of the free interplay of supply and demand of commodities, such as oil, through cartel pricing behaviour. The impact of pure political risk on energy markets has also been neglected. Pure composite political risk, according to risk ratings agencies, is described as the late fulfilment of international obligations by a country due to political factors (such as riots, strikes and civil unrest) and influenced by human and cultural factors (such as corruption, history of law and order and quality of bureaucracy). The components of pure composite political risk according to ICRG (2010) are contained in Appendix 1.

The central hypothesis of this study is that the risks to international oil and gas industry market sectors due to composite political factors may be indicated daily by the standard errors of regressions of adapted international oil and gas industry market pricing models after adjusting for country size and income effects[2]. The groups of countries have different economic positions in gross domestic product and populations and the final analysis of this study will require an adjustment of standard errors of market models to include the latest statistics for each country banking market in per capita income. Purchasing power parity is used so that control may be introduced for the relative cost of living and inflation rates of the sampled countries rather than simply the exchange rate. The exchange rate alone may not account for real difference in income between bank countries.

In each oil and gas industry market, the basic market model controls for country global economic conditions (using country and global stock market price indices) and for global oil and gas industry market conditions (using a global oil and gas industry price index). In summary, the purpose of this paper is to provide the framework for the calculation of a daily composite political risk indicator for international oil and gas industry sectors. Support for these issues will be provided if the residual series of the market models behave in a similar way to country political risk ratings in a stochastic sense and if the adjusted standard errors of these models (according to per capita income and domestic stock market effects) demonstrate a similar ranking to political risk ratings.

## Theory and literature

Financial economic theory, drawing specifically from portfolio theory (Markowitz, 1959), the theory of the capital asset pricing model or CAPM (Sharpe, 1964; Ross, 1976; Roll, 1977,

[2] The basic model appears in a book chapter by Simpson (2009).

Fama and French,1992) and the efficient market hypothesis of EMH (Fama, 1970[3]) provide the theoretical base for the study. Arbitrage pricing theory based on the CAPM (Roll, 1977), is particularly relevant when extended to an international context in an international capital asset pricing model for country oil and gas industry markets. Systematic or quantifiable (expected) components of the model are economic and financial in nature and the unsystematic (unexpected) component is country specific. The latter element is therefore reflective of human behaviour in a country's political system, which in turn is affected by social, legal and cultural factors in that country.

The literature review draws on substantive evidence of significant relationships between economic and financial information and sovereign risk, country risk and political risk (For example, Holthausen and Leftwich, 1986 (Footnote 2); Hand, Holthausen and Leftwich, 1992 (Footnote 2); Maltosky and Lianto, 1995[4]; Cantor and Packer, 1996[5]; Erb, Harvey and Viskanta, 1996[6]; Diamonte, Liew and Stevens, 1996[7]; Hill, 1998[8]; Radelet and Sachs, 1998[9]; Ferri, Liu and Stiglitz, 1999[10]; Reisen and von Maltzan, 1999[11]; Hooper and Heaney, 2001[12]; Brooks, Faff, Hillier and Hillier, 2004[13]; Hooper, Hume and Kim, 2004[14]; Busse and

[3] Security markets can be tested for informational efficiency at three levels. They are weak-form efficient if stock prices and/or returns are a random walk, semi-strong-form efficient if stock prices and/or returns immediately reflect all available public information and they are strong-form efficient if stock prices and/or returns reflect all public and private information.

[4] Sovereign risk rating downgrades are informative to equity markets, but upgrades do not supply markets with new information.

[5] Sovereign risk ratings had a significant impact on bond yield spreads.

[6] Country risk measures are correlated with future equity returns but financial risk measures reflect greater information. They also found that country risk measures are also highly correlated with country equity valuation measures and that country equity value oriented strategies generated higher returns.

[7] Country risk represents a more important determinant of stock returns in emerging rather than in developed markets. They also found that over the past 10 years country risk had decreased in emerging markets and increased in developed markets. They speculated that if that trend continued the differential impacts of country risks in each of those markets would narrow.

[8] In times of crisis many investors may be determined to minimise exposure to securities affected by country risk until they have more information, but after a period of calm the spreads being offered appear to be too high relative to the risks. After more investors return to the market the spreads get less and when there is another crisis the cycle recommences.

[9] Country/sovereign risk ratings agencies were too slow to react to crises and when they did react it was suggested that their ratings intensified and prolonged the crisis.

[10] Ratings agencies behaved in a pro-cyclical manner by upgrading country/sovereign risk ratings during boom times and downgrading them during crises.

[11] Ratings agencies exacerbated boom-bust cycles in financial markets and put emerging markets at greater risk.

[12] Concluded that multi index models should be tested that incorporate a regional index, an economic development attribute, commodity factors and a political risk variable in order to more effectively price securities.

[13] Equity market responses to country/sovereign risk ratings changes revealed significant responses following downgrades.

[14] Ratings agencies provided stock markets and foreign exchange markets in the United States with new tradeable information. Ratings upgrades increased stock markets returns and decreased volatility significantly.

Hefeker, 2005[15]; Simpson, 2007, 2007a[16]). Most researchers (except for example, Busse and Hefeker (2004) and Simpson (2007, 2007a) examine country and sovereign risk ratings rather than pure political risk ratings.

However, most evidence indicates that country/sovereign risk (which includes pure political risk) has a significant relationship with stock market price changes. These price changes include those of the important oil and gas industry sector. It should be noted that some evidence is produced that indicates that financial crises refected in reduced stock market price changes are the main influences on sovereign risk ratings. If this is the case, and if this is also applicable to various country oil and gas industry markets, risk ratings agencies cannot contribute new information to oil and gas industry markets for investors and nor could they be useful to government policy makers.

Many multifactor models may not be firmly founded in capital market or economic theory and there are many different specifications (Reilly & Brown, 2003). Ultimately, if political, social, legal and cultural factors are to be taken into account in a model of country stock market price changes, it is necessary to assume that they are incorporated in such a basic market model. This avoids the myriad of problems encountered in more advanced versions of the CAPM or the APT or the multifactor models. Reilly and Brown (2003) imply that it is feasible to apply a basic market model to a financial system using systemic stock price index data provided the constituents of the indices used are representative of the industry in the country concerned.

Global interdependence of country stock markets (and, it is herewith suggested, country oil and gas industry sectors) may produce spill-over effects. Researchers that have studied stock market spillovers are many, but include Baig and Goldfajn (1998), Forbes and Rigobon (1999), Dungey and Zhumabekova (2001), Caporale, Cipollini and Spagnolo (2003), Rigobon (2004) and also currency market literature in Ellis and Lewis (2000). This literature has focused on the manifestation of financial contagion. The study in this paper controls for global oil and gas industry and stock market effects on different oil and gas industry markets and interdependence in these sectors will be examined using VAR based cointegration tests.

This analysis emphasises an important aspect of regression errors. The error term of a basic market model, according to portfolio theory, is an indicator of unsystematic risk. This component of total risk, in a systemic international market model, is the diversifiable

[15] Government stability, the absence of internal conflicts and ethnic tensions, basic democratic rights and the ensuring of law and order are highly significant determinants of foreign investment flows.

[16] Evidence of the direct adverse effects of extreme political acts on industries and economies is provided and cited.

component and it encapsulates country specific factors as well as other factors such as natural disasters. Control cannot be introduced into the model for the latter group of factors, however, the former country specific factors, by definition, includes difficult to measure human and legal factors that impact political risk and these factors can be captured as a composite group. Essentially, the lower the adjusted standard errors of the oil and gas market models, the lower the political risk. This is because the lower errors reflect lower unsystematic risk, and it suggested that a major component of unsystematic risk is country specific political risk.

## **The model, method and data**

Political risk is largely composed of legal differences between countries and that these differences are impacted by other human factors relating to social and cultural environments. The model that follows cannot control for the various components of pure political risk (such as corruption, quality of bureaucracy, history of law and order etc). However, the model recognises that there is a composite political risk value that is comprised of all of these human and legal components. Political news good or bad arrives randomly. If daily data are examined, models must attempt to provide daily composite political risk indication. They do not do this at present where ratings are reported at best, monthly.

An international oil and gas sector capital assets pricing model is specified and expanded to control for the interaction of that a country oil and gas sector with the global oil and gas industry markets and global stock markets. According to CAPM theory, adapted for a country oil and gas sector, all economic and financial influences are captured in the regression intercept and its coefficients. All country specific and therefore all human, social, cultural, legal and political influences (which collectively make up composite political risk) on the country oil and gas industry are captured in the unsystematic risk component. That is, in the error term of the regression. The basic international capital asset pricing model is expanded to be assumed to be applicable to an industry sector rather than a firm within that sector and brings in international influences.

The oil and gas industry sectors of 5 countries are examined (2 developed countries and 3 developing countries). Countries selected for the sample are selected as examples of both developed and developing countries (the latter group contains those countries that are undergoing the process of globalisation of their stock markets and industrial sectors).

The daily data for each country, for global oil and gas industry and stock markets are obtained from representative indices published by DataStream for the period 31/12/1999 to 3/2/2010.

Monthly composite political risk ratings are extracted from the International Country Risk Guide (ICRG, 2009) for the period October 2000 to November 2008 with the period of study reduced due to missing political risk values. Augmented Dickey Fuller (ADF) and Philips Perron (PP) tests need to be run on prices and first differences (price changes) to confirm non-stationarity of levels and stationarity of first differences. Whilst problems with skewness and kurtosis created distributions that are neither uniform nor normal (according to Jarques Bera tests), unit root tests show that the level series are non-stationary and the first difference series and errors of the related first difference regressions are stationary. The series are thus integrated non-stationary processes.

***Step 1***

The first step is the specification of a basic international country oil and gas industry price market model of unlagged prices for each country oil and gas industry sector as follows:

$$P_{E\,i_t} = \alpha_t + \beta 1(P_{GE_t}) + \beta 2(P_{GS_t}) + e_{i\,t} \qquad 1)$$

Where;

$P_{E\,i_t}$ is the price on a country's oil and gas industry share price index $i$ at time t.

$P_{GE_t}$ is the price on the global oil and gas industry index at time t.

$P_{GS_t}$ is the price on the global stock market price index at time t.

$\alpha_{i_t}$ and $\beta_{i_t}$'s are the regression coefficients representing the proportion of systematic or market risk in country oil and gas industry sector $i$ at time t.

$e_{i_t}$ is the error term of the regression indicating the unsystematic risk in the country oil and gas industry sector $i$ at time t.

Heteroskedasticity is persistent. This could be controlled for by the specification of a generalised least squares regression or an autoregressive conditional heteroskedasticity model. The major purpose, however, is to firstly capture the errors in level series so that these may be stochastically compared to level series pure political risk ratings. For ease of analysis and for the purposes in demonstrating the stochastic relationship between level series ordinary least squares (OLS) regression errors and political risk ratings, this study utilises OLS regression analysis and level series price index values as the first step of the analysis.

***Step 2***

The daily residuals of Equation 1) are converted to monthly average residuals to compare with monthly political risk ratings for the period October 2000 to November 2008. The sample period covered in Equation 1) on daily data is reduced by a few months to accommodate missing values of political risk ratings. According to the main hypothesis of the study the errors of the international market model will behave in a similar fashion to pure composite political risk scores. For the purposes of this study it is deemed necessary to treat lower political risk country systems as having a lower risk score. The ratings agencies treat higher scores as being associated with lower risk and the risk scores are in a scale of 1 to 100. The raw risk score in this study is deducted from 100 so that a lower score represents lower political risk.

It is important to note that the first differences of the residuals of the oil and gas market models, the political risk ratings and the errors of that regression are demonstrated to be stationary, according to ADF and PP tests. It is clear that these are integrated non-stationary processes. If these series are cointegrated, support is lent to the hypothesis that the level series regression errors may be used in a VAR model to calculate and adapt the standard errors of that relationship to provide a new political risk indicator. Standard errors of the relationship between the international market model residuals (adapted for country size and wealth effects and country stock market effects) might be considered a proxy for composite political risk ratings. But, prior to this a series of market model regression errors need to be compared to political risk ratings. The following is the model to be used to test the central hypothesis.

$$E_{OG_{i_t}} = \alpha_{OG_{i_t}} + \beta(PR_{i_t}) + e_{i_t} \qquad 2)$$

Where $E_{OG_{i_t}}$ is the error of the level series regression in Equation 1) for country i at time t and $PR_{i_t}$ is the pure composite political risk rating for country i at time t.

The purpose of specifying this equation is to compare the stochastic relationship between the errors of the daily level series market models for each country oil and gas sector converted to monthly series (the average residual for each month) to the monthly level series risk ratings. If the errors terms of Equation 2) are stationary it may give an indication of cointegration of the series of market model regression errors and political risk ratings. Unit root tests in Augmented Dickey Fuller (ADF) and Phillips Peron (PP) are utilised to test the stationarity of the errors of Equation 2). The stronger tests of the strength of that relationship are carried out using a vector autoregressive model (VAR) and VAR based tests of cointegration. Equation

2) is respecified into a VAR with both variables in Equation 2), optimally lagged according to various information criteria. If the cointegration tests are positive and if the VAR has a strong explanatory power in adjusted R Squared statistics, then the variables are demonstrated to behave in a similar stochastic fashion. This is because the series will have been proven to exhibit similar trends in variability and will together achieve equilibrium at some point in the long-term. The explanatory power of the VAR model is a test of the strength of the relationship.

***Step 3***

If the adjusted R Square value in the VAR is high and if cointegration is demonstrated it is clear that the oil and gas market model residual and the political risk ratings are related. The final part of the analysis is to adjust the standard errors (rather than raw regression errors) of each country oil and gas market model for differences in per capita income in the first stage and then for the country domestic stock market effects in the second stage. The per capita income numbers are extracted from International Monetary Fund (2009) calculations for countries of the world sorted by gross domestic product at purchasing power parity per capita. The adjusted standard errors in each stage are then ranked and compared to the rankings of the mean political risk scores for each country. If the rankings are similar then the illustration of the proxy for political risk will lie in the adjusted standard errors of the country oil and gas market regressions.

## Findings

***Step 1***

Table 1 illustrates the findings from the Equation 1) regressions for each country oil and gas industry stock market sector in the sample of countries selected.

**Table 1**

**Regressions of country oil and gas market sectors in level series**

| Country | Adjusted R Square Value of level series regression (ranking) | Standard Error of level series regression | DW Statistic of regression errors<br><br>Levels/First differences | Significant Variables |
|---|---|---|---|---|
| Australia | 0.968 (2) | 135.676 | 0.057/2.296 | Oil and gas world index and world stock market index |
| Canada | 0.957 (3) | 105.937 | 0.014/2.297 | “ ” |
| China | 0.886 (5) | 48.907 | 0.121/2.212 | “ “ |
| India | 0.860 (6) | 58.852 | 0.014/1.742 | “ “ |
| Malaysia | 0.789 (7) | 75.943 | 0.009/2.066 | “ “ |

**Note: Significance levels are at 1%.**

The results initially indicate strong explanatory power, but according to the DW statistic the results are spurious due to significant serial correlation in the errors of the regressions. First differencing of all variables in the market models removes serial correlation, but substantially reduces the explanatory power of the model. However, it is the level series regression information that is used in this study. The purpose of running and reporting the results in the level series regression is to capture the level residuals as a series and to show the regression standard errors, which are later to be adjusted and compared to political risk ratings in the final part of the analysis.

***Step 2***

The daily errors or regression residuals from Equation 1) for each country oil and gas market are captured in a series. These are then converted to a monthly series in order to compare to pure composite political risk ratings, which are only available monthly. Political risk ratings are amended prior to the analysis to show that the lower the risk rating (out of 100), the lower the composite political risk. Higher regression errors (higher levels of country specific or unsystematic risk) are associated with higher pure composite political risk. Due to missing values of the political risk ratings the sample period for the monthly data is reduced to include the period October 2000 to November 2008.

Table 2 summarises the results of the unit root tests for the level series regression errors for Equation 2) and political risk ratings when the former are converted to monthly series.

**Table 2**

**Unit root tests for variables of oil and gas market model from Equation 2) in level series and in monthly data**

| Country | Market model residual $E_{OG_{i_t}}$ | Political risk ratings PR | Error of Equation 2) e | First differenced errors of Equation 2) |
|---|---|---|---|---|
| Australia | **-1.626/-1.304 (0.466/0.625)** | -3.369/-3.487 (0. 0.015/0.010) | -1.606/-1.353 (0.455/0.602) | **-32.100/-56.746 (0.001/0.000)** |
| Canada | -10.589/-11.694 (0.000/0.001) | **-1.688/-2.022 (0.434/0.277)** | -10.514/-11.624 (0.000/0.001) | **-56.238/-57.976 (0.001/0.001)** |
| India | **-0.452/-0.471 (0.895/0.891** | **-2.340/-2.304 (0.0.162/0.173)** | -0.750/-0.736 (0.828/0.832) | **-29.113/-42.317 (0.000/0.000)** |
| Malaysia | **-1.537/-1.482 (0.511/0.539)** | **-2.351/-2.376 (0.158/0.151)** | -1.611/-1.577 (0.473/0.491) | **-27.234/-50.099 (0.000/0.001)** |
| China | **-2.212/-2.209 (0.203/0.204** | **-2.131/-2.089 (0.233/0.250)** | -2.152/-2.152 (0.225/0.225) | **-10.331/-50.522 (0.000/0.001)** |

**Note: Results are shown as ADF/PP tests with probabilities in parenthesis. The critical values of the ADF/PP test statistics are 1% at -3.499. 5% at -2.892 and, 10% at -2.583.**

Both the monthly level series market model residual and the level series political risk rating variables are for the most part non-stationary ( except for the Australian political risk variable, which  is stationary at the 5% level and the Canadian market model residual, which is stationary at the 1% level). First differencing of the errors of Equation 2) convert those series to stationarity at the 1% level.  It is evident that for the greater part, as highlighted in the Table, the level series are integrated non-stationary processes and the application the level series in a VAR, based on optimally lagged variables in Equation 2), is feasible in order to test for cointegration and causality.

The VAR stability condition check is run for all country oil and gas markets and shows that the VARs are stable (no root lies outside the unit circle). The results of the VAR and of the VAR based cointegration and causality tests are shown in Table 3

**Table 3**

**Results of VAR and VAR based cointegration and causality tests**

| **Country** | **Adjusted R Square: With the residual series of the country oil and gas market regression treated endogenously** | **Optimal lag (Months) according to information criteria. Tested in up to 20 lags** | **Cointegrating equations according to VAR based Johansen tests using Trace and Maximum Eigenvalue statistics (assuming a linear deterministic trend)** | **Causality over 4 lags according to VAR based Granger tests** |
|---|---|---|---|---|
| Australia | 0.909 | 1 according to FPE, AIC, SC and HQ | 1 at the 5% level of significance | No evidence of dual or one-way causality at the 10% level of significance. |
| Canada | 0.870 | 1 according to FPE, AIC, SC and HQ | 2 at the 5% level of significance | No evidence of dual or one-way causality at the 10% level of significance |
| China | 0.860 | 1 according to FPE, AIC, SC and HQ | 2 at the 5% level of significance | No evidence of dual or one-way causality at the 10% level of significance |
| India | 0.978 | “ “ “ “ | 1 at the 5% level of significance | One way causality is significant at the 5% level where political risk ratings for India Granger cause the Indian oil and Gas market regression errors. |
| Malaysia | 0.897 | 1 according to LR, FPE, AIC, SC and HQ | 2 at the 5% level of significance | No evidence of dual or one-way Granger causality at the 10% level. |

**Note: LR is the likelihood ratio. FPE is final prediction error, AIC is Akaike information criteria. SC and HQ are Schwartz and Hannan Quinn information criteria.**

It is evident from these results that the residual series from the market model and the political risk ratings series are related through cointegration. They have similar stochastic trends and come to stability together in the long-term. Appendix 2 provides a graphical representation of the movement of the errors when each variable is treated endogenously. There is no significant evidence at any level of dual or one-way causality according to VAR based Granger tests run over lags up to 4 months.

***Step 3***

As the final step in this analysis the standard errors (reported in Table 1, but based on the raw market model residuals) are adjusted according to size and wealth affects in each country and compared to the mean political risk ratings for each country. If there is a similar ranking in the adjusted standard errors to the ranking of the mean political risk ratings there may be some basis for saying that these adjusted standard errors of international oil and gas market models are an indicator of country political risk. Lower values of the adjusted standard error would represent lower political risk because the unsystematic component (comprised to a large extent of political risk) is lower.

Per capita income levels are shown in Table 4. These levels are divided into the standard errors (to adjust the errors for country size and wealth effects).

**Table 4**

| Level (ranking) | Per capita income range $ |
|---|---|
| 8 (1) | 35,000 to 40,000 |
| 7 (2) | 30,000 to 35,000 |
| 6 (3) | 25,000 to 30,000 |
| 5 (4) | 20,000 to 25,000 |
| 4 (5) | 15,000 to 20,000 |
| 3 (6) | 10,000 to 15,000 |
| 2 (7) | 5,000 to 10,000 |
| 1 (8) | 0 to 5,000 |

**Note: The ranking of each country in terms of the level of per capita income is provided in parenthesis.**

The results of this brief analysis are shown in Table 5. The levels in Table 5 are divided into the standard errors in Table 6 to adjust the standard errors and to provide a ranking of adjusted errors to compare with the mean political risk ratings for each country,

**Table 5**

**Ranking of oil and gas market model standard errors and mean political risk ratings**

| Country (1) | Standard error of market regression (2) | Per capita income in USD (per capita income level) (3) | Adjusted standard errors (ranking in sample) (4) | Political risk ratings (ranking in sample) (5) |
|---|---|---|---|---|
| Australia | 135.676 | 37,302 (8) | 16.960 (2) | 12.743 (1) |
| Canada | 105.937 | 38,290 (8) | 13.242 (1) | 13.015 (2) |
| Malaysia | 75.943 | 13,551 (3) | 25.314 (4) | 26.208(3) |
| China | 48.907 | 6,546 (2) | 24.454 (3) | 32.188 (4) |
| India | 58.852 | 2,932 (1) | 58.852 (5) | 39.446 (5) |

**Note: For example, 8 represents the highest level of per capita income of $35,000 to $40,000. This category includes Australia and Canada whose standard errors are divided by 8. Australia's standard error of 135.676 in Column 2 is divided by 8 to obtain an adjusted standard error of 12.743 in Column 3.**

Note that the rankings for per capita income are slightly different to the rankings of political risk. Australia and Canada are similar countries with similar economic positions. Both are developed countries with well established physical and commercial infrastructures. Malaysia and China rankings are also different to the political risk ratings rankings. It is evident that the developing countries of Malaysia, China and India rank below the developed countries of Australia and Canada in standard errors rankings, recalling that the higher the adjusted error, the higher the political risk in the various oil and gas markets.

***Step 4***

Equation 1) in this study has served its purpose in demonstrating that the level series errors of the international market model behave stochastically in a similar manner to political risk ratings. The adjusted standard errors of that model demonstrate that developed countries and developing countries have similar rankings when compared to the rankings for political risk. However, it is clear that the rankings are not exactly the same and control must be introduced for the country domestic stock market effects. In order to provide this, a domestic oil and gas market model (which includes the country stock market index) needs to be combined with the international market model and specified in first differences to remove problems of serial correlation. The combined market model to be studied is as follows, where $\Delta P_{S_{i_t}}$ 's represent the changes in the share price index for country i at time t.

$$\Delta P_{OG_{i_t}} = f(\Delta P_{s_{i_t}}, \Delta P_{SW_t}, \Delta P_{OGW_t})$$

The standard errors of these relationships in each country oil and gas market may then be adjusted according the per capita income effects fin each country. The results of this regression are as follows in Table 6.

**Table 6**

**Results of regression of combined oil and gas market models with standard errors, adjusted standard errors and political risk ratings**

| Country<br>(1) | Adjusted R Square value<br>(2) | DW statistic<br>(3) | Standard error<br>(4) | Ranking of per capita income<br>(5) | Adjusted standard errors (ranking)<br>(6) | Political risk rating (ranking)<br>(7) |
|---|---|---|---|---|---|---|
| Australia | 0.141 | 2.295 | 29.084 | 1 | 29.084 (2) | 12.743 (1) |
| Canada | 0.637 | 2.298 | 12.610 | 1 | 12.610 (1) | 13.015 (2) |
| Malaysia | 0.025 | 2.064 | 5.894 | 6 | 35.364 (3) | 26.208(3) |
| China | 0.132 | 2.210 | 6.683 | 7 | 46.781 (4) | 32.188 (4) |
| India | 0.106 | 1.743 | 6.586 | 8 | 52.688 (5) | 39.446 (5) |

**Note: The ranking of country per capita income in column 5 is multiplied by the standard error in column 4 to arrive at the adjusted standard error in column 6.**

These results show that serial correlation problems in the errors have been removed according to DW tests. The adjusted R square values are not particularly high but they are significant at the 1% level. In each case (except for China) the statistically significant explanatory variable is the global oil and gas market (significant at the 1% level in each country oil and gas market system), with the domestic stock market and the world stock market not statistically significant at any level. In the case of China, the Chinese stock market variable is significant at the 5% level, the global oil and gas market variable is significant at the 1% level and the world stock market variable is not significant at any level.

With this final step stronger evidence is now provided that ranks the adjusted errors of the combined domestic and international market model in a similar ranking to the country political risk ratings with the only exception being the ranking of Australia and Canada where Australia is ranked 2 and Canada ranked 1. Tit is put forward that evidence is produced herewith that supports the hypothesis that standard errors of market models can reflect political risk ratings if the standard errors are adjusted for domestic market effects and per capita income effects. The lower the adjusted standard errors, the lower the political risk.

**Limitations**

Further research is needed to lend greater support for the central hypothesis. A more comprehensive list of countries needs to be included in the empirical investigation and market data. It is demonstrated that whilst the international model is needed in level series to capture level series regression errors to compare to political risk ratings after adjustment it would be better to also run a regression of a combined market model in first differences to remove serial correlation problems and incorporate domestic stock market effects along with per capita income effects.

**Conclusion**

This paper set out to provide, based on financial economics theory and evidence, support for the hypothesis that systemic international oil and gas market models can indicate pure composite political risk that impact the oil and gas sector, using daily stock market generated data. It is suggested that this information is useful to investors in portfolios of oil stocks and trade and investment policy makers because at present political risk ratings are largely subjectively quantified and are infrequently published. The sample of countries chosen to test the central hypothesis contains 2 developed countries and 3 developing and transitional economies.

The first step in the analysis was to specify international market models for each country oil and gas sector. Following this the residuals for each market model were collected in a daily series, but then converted to a monthly series to compare that variable to monthly political risk ratings. These now monthly variables and the errors of a regression of those variables were again tested for non-stationarity and stationarity in the latter case, to demonstrate that the processes were integrated and non-stationary and to ensure they could be made to interact in a VAR. The study then moved to run VAR based tests of cointegration and causality.

The study has provided support for the notion that the residual of the international market model for each oil and gas market studied possesses similar stochastic trends to the political risk ratings and together these variables achieve equilibrium in the long-term. The explanatory power of the respective VARs in the adjusted R Square value is high. In relation to short-term dynamics on lags of up to 4 months, there is no evidence of significant dual or one-way causality at any level in any of the country oil and gas systems studied. The rankings of the standard residuals from the oil and gas market model regressions, after they are adjusted to take account of country size and wealth effects, is not dissimilar to the country political risk rankings. When a final step is taken to incorporate domestic stock market effects into a combined domestic and international market model in first differences the results are more favourable with the standard errors of that relationship, after adjustment for per capita income, showing and even closer ranking of the adjusted errors to the political risk ratings rankings.

The conclusion is that an analysis of daily international stock and oil and gas market data for each country market can reveal a daily indication of pure composite political risk. Future research will combine domestic and international market models with first differences applied to capture the standard errors. Level series VARs will continue to be run using the captured level series regression errors to compare to level series political risk ratings in order to run VAR based tests of cointegration and causality. More research needs to be done, but initial results are encouraging and should be of interest to oil and gas market investors, trade and investment policy formulators and portfolio managers. This is because some of the subjectivity of risk ratings is removed and the indication of political risk is more frequent.

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## Appendix 1

**Definitions and explanations of pure political risk components (ICRG, 2005)**

**Government stability** ratings are an assessment of a government's ability to remain in office by carrying out declared policy plans. The subcomponents of this factor are government unity, legislative strength and popular support. According to the ICRG ratings, socio-economic conditions relate to pressures that conspire to constrain government action or to fuel social dissatisfaction. The subcomponents in this category are the level of unemployment, the degree of consumer confidence and the level of poverty.
**The investment profile factor** affects the risk to investment not covered by other political, economic and financial components and is made up of contract viability and expropriation, profit repatriation, and payment delays.
**Internal conflict** is an assessment of political violence in a country and its impact on governance. The highest rating means that there is no armed or civil opposition to the government and the government does not engage in arbitrary violence (either direct or indirect) against its own people. Under this rationale the lowest scores would apply to those countries where there is ongoing civil war. The subcomponents of this risk factor are thus, civil war or coups threat, terrorism or political violence, and civil disorder.
**External conflict** measures are an assessment of the risk to the incumbent government from foreign action, which includes non-violent external pressure (for example, diplomatic pressure, withholding of aid, trade restrictions, territorial disputes, and sanctions) to violent external pressure (such as, cross-border disputes and all-out war). The subcomponents of this category of pure political risk are cross-border conflict, and foreign pressures.
**Corruption** is an internal assessment of the political system. Corruption distorts the economic and financial environment and reduces the efficiency of government and business in the way the foreign direct investment is handled. Corrupt practices enable people to assume positions of power through patronage rather than ability. By so doing, an inherent instability is introduced into the political process. Examples of corruption include special financial payments and bribes, which ultimately may force the withdrawal of or withholding of a foreign investment. However, excessive patronage, nepotism, job reservations, "favour for favours", secret party funding, and suspiciously close ties between government and business have a lot to do with corruption. A black market can be encouraged with these forms of corruption. The potential downside is that popular backlash may lead to the rendering of the country ungovernable.
**Military in politics** is a problem because the military are not democratically elected. Their involvement in politics is thus a diminution of accountability. Other substantial ramifications are that the military becomes involved in government because of an actual or created internal or external threat. Government policy is then distorted (for example, defence budgets are increased at the expense of other pressing budgetary needs). Inappropriate policy changes may be a result of military blackmail. A full-scale military regime poses the greatest risk. Business risks may be reduced in the short-term but in the longer-term the risk will rise because the system of governance is susceptible to corruption and because armed opposition in the future is likely. In some cases, military participation will represent a symptom rather than a cause of higher political risk.
**Religious tensions** emanate from the domination of society and or governance by a single religious group that seeks to replace civil law and order by religious law. Other religions are excluded from the political and social process. The risk involved in such scenarios involves inexperienced people dictating inappropriate policies through civil dissent to outright civil war.
**The law and order components** are assessments of the strength and impartiality of the legal system and popular observance of the law respectively.
**Ethnic tensions** relate to racial, nationality or language divisions where opposing groups are intolerant and unwilling to compromise.
**The democratic accountability component** is a measure of how responsive government is to its people. The less responsive it is the greater the chance that the government will fall. This fall will be peaceful in a democratic country but possible violent in a non-democratic country. The institutional strength and the quality of the bureaucracy is a measure that reflects the revisions of policy when governments change. Low risk in this area applies to countries where the bureaucracy has the strength and expertise to govern without major changes in policy or interruptions in government services. That is, bureaucracies have a degree of autonomy from political pressure with an established independent mechanism for recruitment and training.

## Appendix 2

## Graphs of endogenous residuals

**Note: Australian market model residual is AUSRESIDP, Australian Political risk is PRAUS. For Canada, China, India and Malaysia the variables are denoted CANRESIDP, PRCAN, CHINRESIDP, PRCHIN, INDRESIDP, PRIND AND MALRESIDP, PRMAL.**


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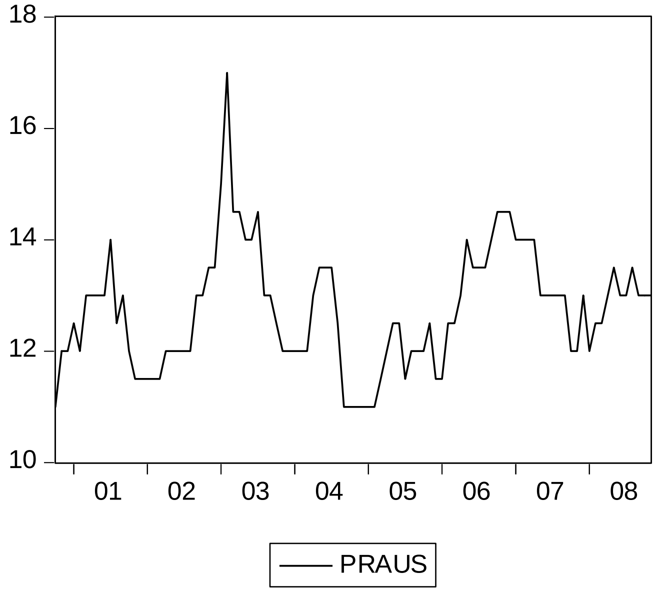
AUSRESIDP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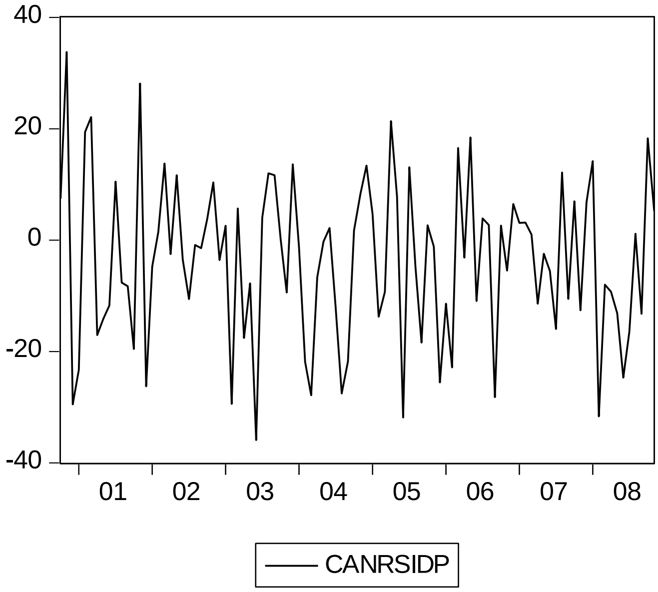
PRAUS



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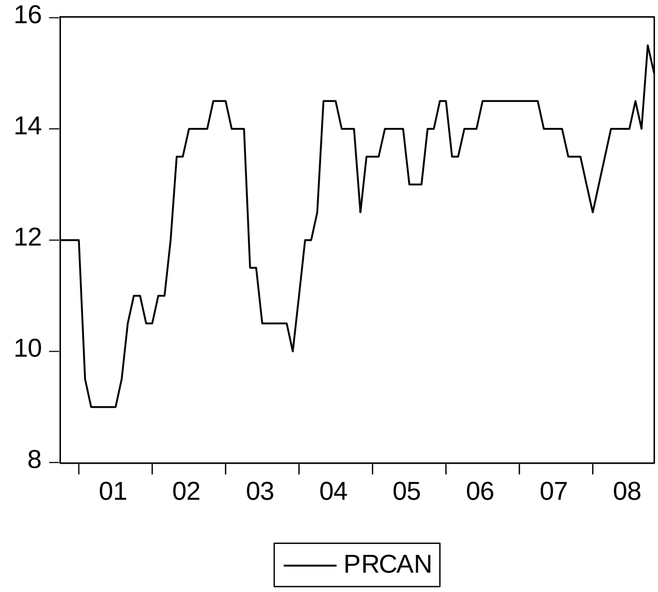

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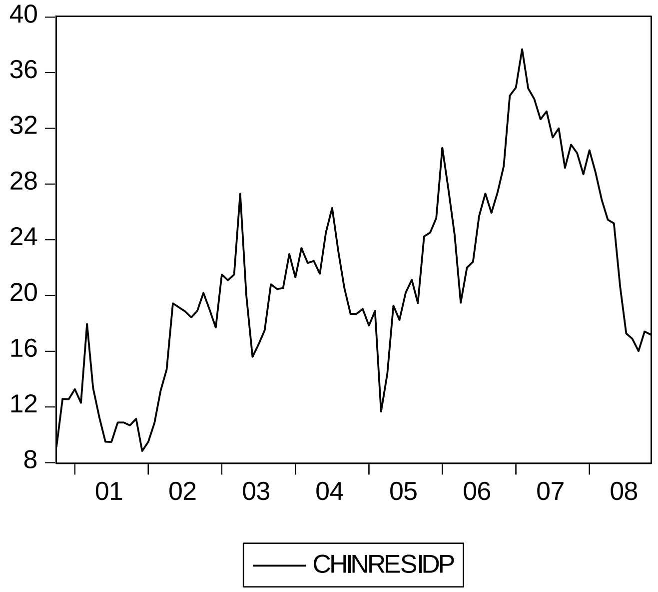
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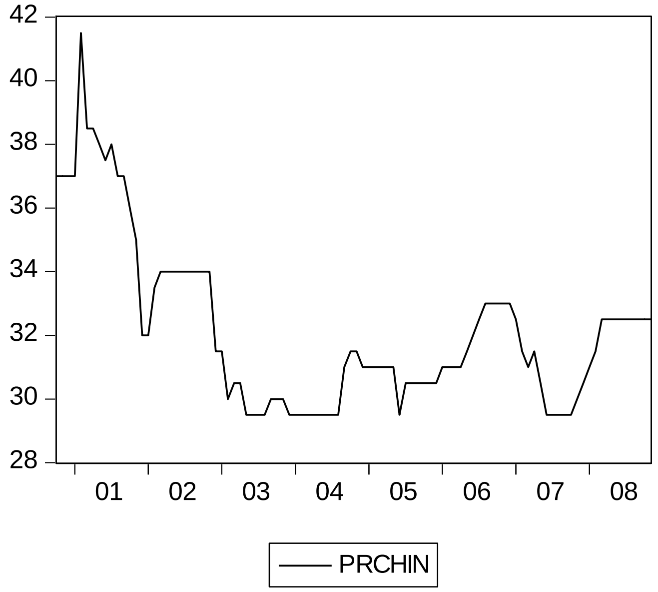
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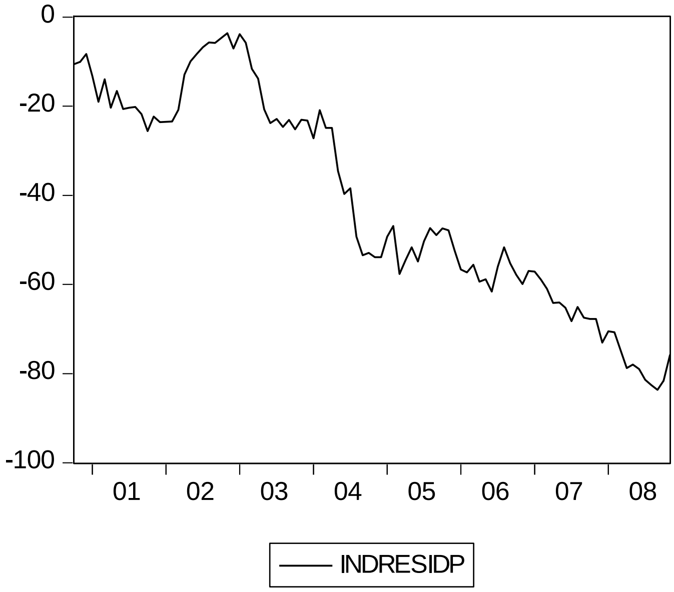
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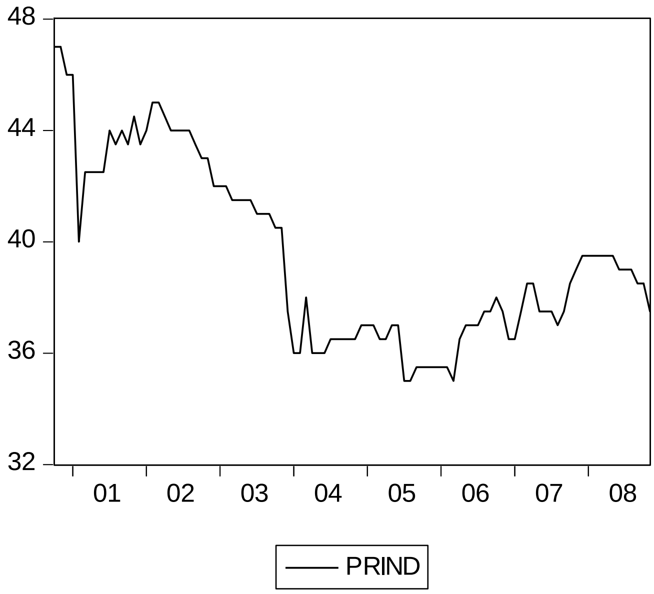
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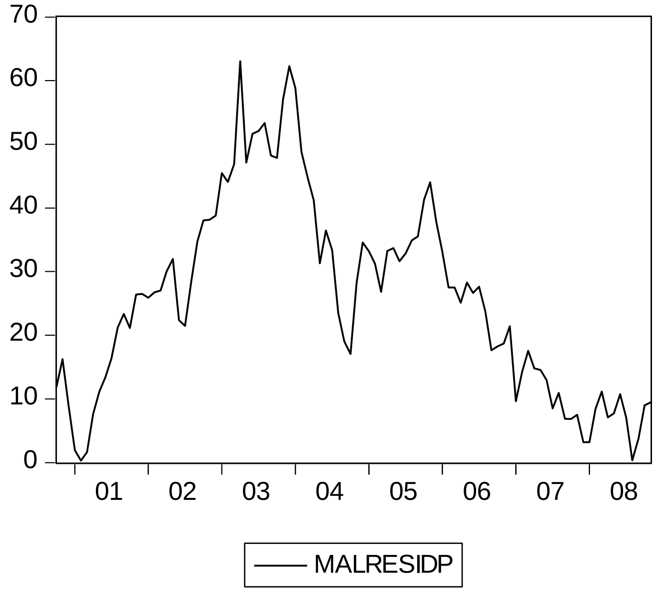
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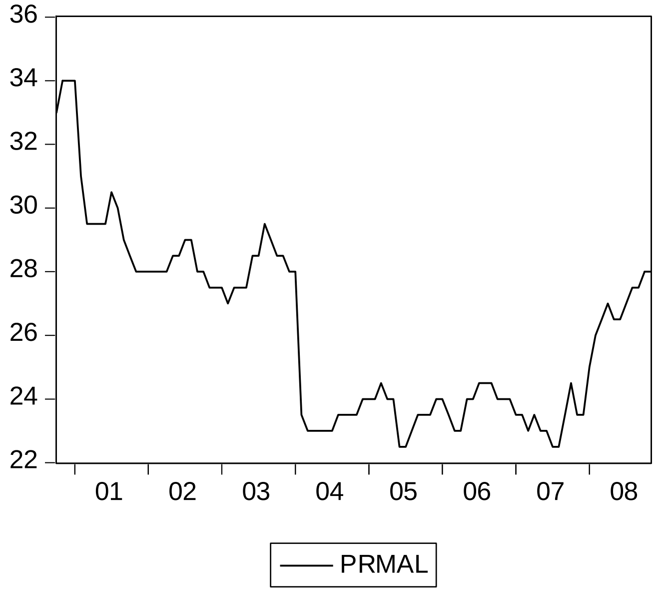
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