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# **Country Risk Components in Risk-Adjusted Time-Varying Natural Gas Price Benchmark Returns: Implications for Export Pricing with Evidence from Australia, China and the United States**

**By**

**John Simpson<sup>1</sup>**

## **ABSTRACT**

Global natural gas markets are neither fully developed nor informationally efficient. Factors other than randomly arriving good and bad news, regarding economic, financial and political risks, affect prices. Despite this constraint, the model in this study is tested for feasibility as a starting point for analysis. It compares time-varying risk-adjusted gas returns from a benchmark price adjusted by the risk-free rate in the exporter country, to country risk ratings in individual markets. The motivation is that gas producers need to determine the contribution of country risks for appropriate export pricing in terms of the risk/return tradeoff.

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## INTRODUCTION

The concept of an international credit risk premium in trade, debt and equity markets derives from a basic domestic credit risk premium. In domestic debt finance, the premium reflects the perceived risk of default when lending is undertaken either directly through bank lines of credit or indirectly through bond financing. The risk premium is the difference between the market rate for a particular category of credit risk and the risk free rate.

The risk free benchmark rate is usually a government borrowing rate of interest. Governments are assumed free of credit risk. The risk free rate represents a direct lender's cost of funds and the credit margin (the risk premium) is the spread between cost of deposit funds and the earnings from those funds when transformed to loan assets. The borrower's risk category is often derived from credit risk scores ascribed by rating agencies. The higher the risk, the greater the expected return.

In domestic equity finance, the total risk premium represents the difference between the returns of a security  $R_i$  and the risk free rate  $R_{f_t}$  at time  $t$  where:

$$R_i = (P_i - P_{i-1}) / P_{i-1} \quad 1)$$

$P_i$  and  $P_{i-1}$  represent the price of the security  $i$  at time  $t$  and time  $t-1$  respectively.

and

$$R_{p_t} = R_i - R_{f_t} \quad 2)$$

where  $R_{p_t}$  represents the total risk premium.

In international financing and investment the concept of country risk replaces domestic credit risk. This implies that there exists a total country risk premium. Country

risk is international credit risk. Country risk relates to the ability or willingness of a country, or an international firm, to service its external obligations (Bourke and Shanmugam, 1990). The “ability” aspects are economic and financial components. The “willingness” aspect is a political or policy component. Political risk is therefore the slowing down in the meeting of external obligations for overtly political reasons such as riots, strikes and civil unrest. Political risk in the case of a country or policy risk in the case of a firm is also related to the degree of regulatory reform in an economy or in the degree of proper governance enforcement and regulatory compliance by firms.

The economic and financial components of country risk are measurable and objectively assessed, but the overall assessment of country risk is difficult because political risk is difficult to assess. Political risk is usually unquantified and subjective in its assessment. It is based on opinions relating to political outcomes. Recently, risk rating agencies have attempted to develop further the method of quantification of this subjective component of country risk.

One of the problems facing the global natural gas industry is the lack of investor belief and confidence in various regulatory regimes in different producer and consumer countries. The problem relates directly to differences in political risk. This lack of investor confidence is also directly related to financing of trade in gas and the increased perceived credit risk involved in international payments and shipping contractual obligations.

Small or isolated markets and large developing markets (such as China) should have differently administered and managed market structures and regulatory regimes to those in mature markets (such as the United States). Country consumers of gas are

seeking diversification of country producers and vice versa due to the differences in country economic, financial and political riskiness (that is, to diversify away unsystematic country specific (political risk) components<sup>2</sup>). There are different levels of development of macro and microeconomic reforms and therefore different needs in developing and mature country markets. Nevertheless, appropriate regulatory systems in risky countries can increase investor confidence.

Significant regulatory reform has been achieved in some countries and generally, in these countries, risks are lower. There is a greater choice of natural gas contracts through deregulation and restructuring within many countries. For example, in the USA since 1984, there has been a separation of natural gas supply from interstate pipeline transportation, deregulated natural gas production and the wholesale market, and competition has been introduced in interstate pipeline transportation. Privatisation is increasingly being seen as a means of improving efficiency and increasing investment (Juris, 2006).

Country risk not only affects investment in supply infrastructure. It also impacts finance and payments for gas shipments, guarantees of shipment and continuity of supply. Pricing of shipments according to country risk premia becomes important for exporting countries. For example, Australia, an emerging major gas exporter, is a developed country with low levels of political and economic risk. Risk pricing of its gas exports under different regulatory environments is vital.

That there is a connection between market integration and political risk has been studied by Asche et al (2000) who find, in a continental European study, that

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<sup>2</sup> See Markowitz (1952) and the basics of portfolio theory in security markets adapted for the gas market.

cointegration tests showed that different border prices for gas to Germany move proportionally over time. This indicated integration of the German gas market. They also studied whether or not there were large price differences between gas from Norwegian, Dutch and Russian exporters. They find differences in mean prices (Russian gas was cheaper) and the reasons for the price differences were ascribed to differences in volume flexibility and perceived political risk.

Hartley and Medlock (2005) commenced a comprehensive study on the political and economic influences on the future market for natural gas by recognising that required rates of return on investments in energy infrastructures varied geographically. They provided a base case which assumed that the required rates of return matched those sought in similar US projects and then selected scenarios (representing a range of political actions as well as economic outcomes) were compared to the base case to ascertain the affect of such factors on the global gas market.

When Hartley and Medlock (2005) calculated risk-adjusted returns for gas projects they used the data from the International Country Risk Guide (ICRG) as well as a data series on the risk premium on lending which was provided by the World Bank. They constructed a “gas investment risk index” using pure political risk scores obtained from the ICRG (2000-2006). Hartley and Medlock (pp. 27-28) find that

“..increased gas trade will enhance interactions between regional gas markets and promote arbitrage and global pricing over time. For example, it is apparent that supply infrastructure and demand growth in Northeast Asia will significantly influence the developing global market for natural gas”.

The research problem in this paper is centred on basic tests of the feasibility of a different methodology where country economic, financial and political risks are combined to represent country risk and compared to time-varying risk-adjusted gas

returns in order to quantify those components for use in gas export pricing. The fundamental position of the paper is that less risky countries, in accordance with the tenets of financial economics<sup>3</sup>, should pay less for purchases of gas from riskier countries and receive more for their sales of gas to riskier countries.

The pricing of risk should not be taken as a form of penalty on developing or transitional countries or as discriminatory pricing behaviour by economically, financially and politically less risky countries. The pricing of gas taking country risk into account needs to be treated as an incentive for LDCs and economies in transition to implement appropriate political and economic reforms. This includes deregulation of their natural gas markets.

## **A GLOBAL NATURAL GAS PRICE BENCHMARK**

In the absence of an official global benchmark gas price, the specification of an interim benchmark is proposed. The questions then are as follows: Which is the most developed and deregulated market and thus the most likely global leader in global gas market integration? Which market is the greatest consumer of natural gas? Which market supplies itself to the greatest degree? Which market is showing the greatest transition from for example, coal and oil fired power generation for industry? Which market has an established benchmark for natural gas?

The price benchmark in the Americas is the Henry Hub (HH). This price is determined at a physical location in Louisiana USA and has a greater potential than the National Balancing Point (NBP) price in the UK as a candidate to become a global

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<sup>3</sup> Refer to portfolio theory in Markowitz (1952) and the risk/return tradeoff.

benchmark price for natural gas (Mazighi, 2005). This is because more gas in the UK market is sold on long-term contracts with prices indexed to oil. Even though the HH is said to show less normality in fluctuation than the NBP price, the USA is the largest market (estimated in 2005 at more than 660 billion cubic metres compared to 100 cubic metres in the UK). The HH prices are quoted on the New York Mercantile Exchange (NYMEX) on a daily basis.

The HH price represents standardised quantity and quality of gas in terms of the percentages content of methane, carbon dioxide and other impurities, and heat value per cubic metre. Other requirements of a benchmark are probably more likely to be met by the HH rather than NBP. It is more likely that suppliers and consumers can meet or connect electronically and offer exchange of physical for physical product, futures against futures and futures against physical product swaps in the USA and the Americas. The Americas market is more likely to be able to report continuous information with transparency and without discrimination or privileged access to that information. In addition, that market has a larger number of players so that the market is liquid. Supply can adjust quicker to demand without any need for discounting.

## **ECONOMIC, FINANCIAL AND POLITICAL RISK**

The proxy for country risk is taken as the composite risk rating published by the International Credit Risk Group (ICRG). This rating is made up of the following economic, financial and political components.

**Economic** risk ratings reflect strengths and weaknesses for a country in its:

- GDP per head
- real GDP growth
- annual inflation rate
- budget balance as a percentage of GDP; and
- current account balance of payments as a percentage of GDP

The **financial** risk rating reflects the ability of a country to finance its official, commercial and trade debt obligations taking into account such factors as:

- foreign debt as a percentage of GDP
- foreign debt as a percentage of exports of goods and services
- net international liquidity as a percentage of import cover; and
- exchange rate stability

The **political** risk ratings reflect a country's perceived political stability by ascribing comparable ratings to:

- government stability
- socioeconomic conditions
- investment profile
- internal conflict
- external conflict
- corruption
- military in politics
- religious tensions
- law and order

- ethnic tensions
- democratic accountability; and
- bureaucratic quality

The composite risk ratings therefore represent country risk which combines economic, financial and political factors to reflect very high, high, moderate, low and very low riskiness in the rated countries.

### **EXPORT PRICING OF NATURAL GAS**

Before the results of this study are reported, it may be useful to observe how pricing errors can be made, in times of excess demand. In this example, the components of country risk are not being discussed and nor are risk-adjusted gas returns. Gas price benchmarks generally relate the price of gas to the price of oil for logical reasons. They are replacement fuels and are often produced together in the one location. The following example of Australia's gas pricing to China and Japan illustrates how a large gas export deal to China was clearly underpriced. It was underpriced in terms of the optimal relationship with oil prices and it is also evident that country risk factors have not been taken into account.

However, that the Australian negotiators deserve credit for negotiating such a large contract in a potentially enormous market. They have created an export momentum for Australian natural gas. They may have been conscious of an initial need to buy market share. Nevertheless, the deal was negotiated during times of excess demand when Australia should have been a price-maker and China, as an economy in transition, has higher levels of country risk that should have demanded a higher price. A precedent has

been set but loyalty of buyers is not guaranteed and is also improbable in times of excess supply.

To further explain the China gas deal, a little background is required. Whilst contract formulae or specific contract prices are not in general for public knowledge, LNG pricing for importing countries is receiving greater attention as more countries move over to gas energy. The method of import pricing of LNG is known to differ from region to region. The pricing is usually linked to oil prices, but which oil prices are they linked to? In Asia (for example, Japan), the import price formula is thought to be based on a basket of crude oil prices commonly referred to as the Japanese Crude Cocktail (JCC).

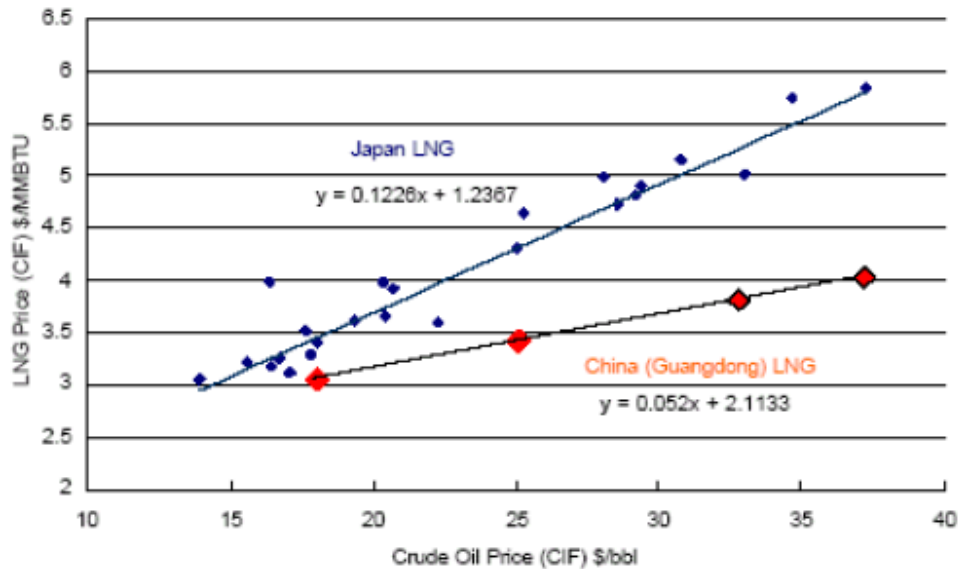
The first Chinese project for Australia was in Guangdong province and was negotiated in 2002, with the first delivery in June 2006. The Chinese probably regard the negotiated price as a precedent price and will in future try to negotiate towards this lower bound<sup>4</sup>. Australian exporters are expected in future to negotiate towards the upper bound which could be in excess of, for example, the bound negotiated with Japanese importers.

Figure 1 is cited in Eng (2006) and shows the differences in the Japanese and Chinese pricing models for LNG gas imports and primarily demonstrates the lower connection negotiated by China with oil prices.

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<sup>4</sup> As prices are quoted Cost Insurance Freight (CIF); the regression lines might be closer together if prices were negotiated Free on Board (fob) leaving the importers to negotiate separately the transaction costs for insurance and freight.

**Figure 1**  
**LNG Pricing Formulae – fitted**



Source: Asia-Pacific Energy Research Centre, 2005. China data estimated by PetroStrategies; Japan LNG prices from IEA Energy Prices and Taxes, JCC prices from EDMC, Institute of Energy Economics of Japan. (Cited and produced in Eng, 2006).

Note: The equations in the above graph are estimates as stated where y is the gas price and x is the JCC oil price. Note the lower value of the Chinese coefficient for oil. The acronym BTU denotes a measure of gas quality in British Thermal Units.

Another danger with the Chinese precedent is that in times of excess supply, other countries will want a similar deal to that negotiated with China. For example, Eng (2006) builds a case for the adoption by New Zealand of the lower bound Chinese pricing model for possible Australian LNG imports. These imports may not necessarily be sourced from Australia but the distance from Australia to New Zealand compares to that from Australia to China. In addition, it is understandable that New Zealand would want to negotiate a lower price due to its lower levels of country risk.

Whilst the case for the Chinese model is compelling for New Zealand, it is not so for Australia, as the volumes required would be expected to be substantially less and Australia has already negotiated closer to the upper Japanese pricing bound with other

countries, some of which are developed countries with lower levels of country risk<sup>5</sup>. It is clear that a pricing formula for both forecasting and negotiation of global gas prices is needed and country risk factors need to be taken into account.

## **THE METHODOLOGY AND DATA**

In this study, risk-adjusted gas returns are calculated by deducting the monthly risk-free rate (proxied by the Australian cash rate so that the variable becomes an Australian gas export risk-adjusted gas returns variable) from the monthly returns of the HH gas price (taken as a global gas price benchmark) obtained from the Datastream database and reflecting prices at the close of business each month from the 1<sup>st</sup> January 2002 to 30<sup>th</sup> December 2005.

The Australian cash rate is determined in the money market as a result of the interaction of demand for and supply of overnight funds. The Reserve Bank defines and explains the rate as follows. The Reserve Bank's ability to pursue successfully a target for the cash rate stems from its control over the supply of funds which banks use to settle transactions among themselves. These are called exchange settlement funds, after the accounts at the Reserve Bank in which banks hold these funds. This is the Australian cash rate as quoted by the Reserve Bank of Australia at the close of business on the last day of each month over the period of the study. For the purposes of this paper, the Australian cash rate is taken to be the risk-free rate. The rates quoted coincide with the HH monthly price on the day of quotation.

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<sup>5</sup> If lower political risk is taken into account (comparing New Zealand with for example China) it would, however be logical for New Zealand to negotiate lower political risk premia.

The proxy to represent country risk scores is selected from composite economic, financial and political risk ratings published monthly by ICRG. An explanation is required as to why this study uses ICRG rather than other leading risk rating agency data. Simpson (2002) undertook a cross-sectional study of 1995 country and international banking risk ratings and economic and financial data, and from this study several comments may be made about leading ratings agencies. First, the risk ratings from these agencies are highly positively correlated. Second, country risk ratings may be largely replicated using primarily trade performance and debt serviceability data (that is, economic data). Third, pure political risk factors have a very small role in the ratings replication process. A problem also remains with cross-sectional data analysis that it is not possible to determine where risk data lead or lag economic or financial crises.

The ICRG ratings are preferred in this study because there is a pure political risk component in the composite scores. The composite risk ratings in ICRG are rated monthly for each country from zero to one hundred in terms of high to low riskiness. Definitions of the components of country risks are provided in Appendix 1.

For the purposes of this study, in terms of the ease of analysis in equating low risk scores with low risk countries and high risk scores with high risk countries, each country's composite score is deducted from one hundred (the ratings are reversed) and converted to decimals which represent a perception of a probability of default due to country risk factors. The data are analysed using the Eviews (2001) statistical package.

## THE MODEL

The spot prices for natural gas at time  $t$  and time  $t-1$  are denoted  $P_{g_t}$  and  $P_{g_{t-1}}$ . The returns of the gas price ( $R_{g_t}$ ) are calculated according to Equation 1. The risk-free rate is denoted  $R_{f_t}$  (that is, the risk-free rate in the exporting country) and the calculation of the risk-adjusted gas returns is in accordance with Equation 2 and  $Rp_{g_t}$  is the risk-adjusted gas returns for the exporter country.

Thus,

$$R_{g_t} = (P_{g_t} - P_{g_{t-1}}) / P_{g_{t-1}} \quad (3)$$

and

$$Rp_{g_t} = R_{g_t} - R_{f_t} \quad (4)$$

The change in country risk for a country  $i$  at time  $t$  (denoted  $\Delta S_{CR_{i_t}}$ ) is proxied by a variable based on ICRG composite risk ratings. The following equation represents the model to be tested in this study;

$$Rp_{g_t} = \alpha_{g_t} + \beta_{g_t} (\Delta S_{CR_{i_t}}) + e_{g_t} \quad (5)$$

In this case, the regression intercept is  $\alpha_{g_t}$  (representing the base global spot risk-adjusted gas returns). The regression coefficient is  $\beta_{g_t}$ . This coefficient represents the contributions of the change in composite risk in a particular country to the base global risk-adjusted gas returns. The error term,  $e_{g_t}$  represents the contribution to the intertemporal global risk-adjusted gas returns not explained by a country's country risk factors.

As a final part of the analysis, Equation 5 is respecified into a VAR by optimally lagging the variables so that VAR-based cointegration and causality tests may be undertaken.

If markets are efficient, it would be expected that there would be a positive relationship between country risk changes and risk-adjusted gas returns in terms of the risk/return tradeoff. In other words, in a positive relationship less of the risk-adjusted gas returns would remain unexplained.

The Equation 4 regressions are run for the United States and China who are assumed to be importing natural gas from Australia. Gas exporters, such as Australia, with low economic and political risks and advanced gas regulatory reforms would be entitled to charge higher risk premia for their exports of gas. This is because they are assumed to have made greater progress than developing countries in initiating and implementing appropriate macro and microeconomic reforms particularly in the regulation of their gas industries. This should be rewarded. Their product should be priced accordingly and they would rightly be in the position of being a price-maker in times of excess demand with the ability to insist on such higher risk premia.

In times of excess supply, prices of gas will fall as more suppliers compete to sell their product to demand which is quite easily satisfied. In times of excess supply, the prices will naturally fall and the consumer/importer will under normal conditions select the lowest price. The exporter is likely to become a price-taker under this market condition. However, as discussed above, excess demand conditions are expected to prevail in the global gas industry for at least the next decade as infrastructures and investment build up. This paper provides for an export price-maker scenario.

## **LIMITATIONS**

In addition to a problem with the sample size (the sample selected being primarily to illustrate the feasibility of the model), the error term is likely to be significantly large. This is because only a small proportion of the variability of the global spot risk-adjusted gas returns may be explained by individual country risk factors. Much would depend on the share that a particular country has in the global gas market either as an importer or an exporter and also the importance of the trade in gas with Australia. The model in this study is deliberately underspecified in order to capture the significance of the proportion of variability of the global spot risk-adjusted gas returns explained by the changes in country risk ratings.

In addition, it needs to be recognised that the global gas market is not fully developed or informationally efficient. Gas supplies are stranded due to a lack of available FDI due in part to country risk factors. Excess demand in the market makes producers price-makers in this scenario. Another factor is that the HH is used as the global price proxy, and whilst it seems to be the best available benchmark, it is probably not fully representative of a global gas price and may be a greater reflection of USA supply and demand conditions.

## **RESULTS**

Table 1 provides the descriptive statistics of the level series in country risk ratings and Australian risk-adjusted gas returns. It is noted that the level series risk ratings are, according to the Jarque-Bera statistic, normally distributed. On the surface it is evident that country risk in China is not substantially higher than in the USA. Table 2 shows the

descriptive statistics for the monthly changes in the country risk ratings for China and the United States. The distribution for the United States country risk changes shows properties of normality according to the Jarque-Bera test. The changes in the country risk ratings are higher in China than in the US as would be expected.

**Table 1**  
**Descriptive statistics of level series of Australian risk-adjusted gas returns and country risk ratings**

	<b>RP</b>	<b>USA</b>	<b>CHIN</b>
Mean	-0.0493	0.2317	0.2360
Median	-0.0847	0.2315	0.2340
Maximum	1.1109	0.2630	0.2580
Minimum	-0.5495	0.1980	0.2100
Std. Dev.	0.2618	0.0137	0.0120
Skewness	1.8479	-0.4591	-0.1639
Kurtosis	10.0222	2.9048	2.4543
Jarque-Bera	123.3200	1.7047	0.8104
Probability	0.0000	0.4263	0.6668
Sum	-2.3213	11.1230	11.3310
Sum Sq. Dev.	3.1547	0.0088	0.0068

Note: Rp, USA and CHIN denote the Australian risk-adjusted gas returns and risk ratings for the US and China respectively.

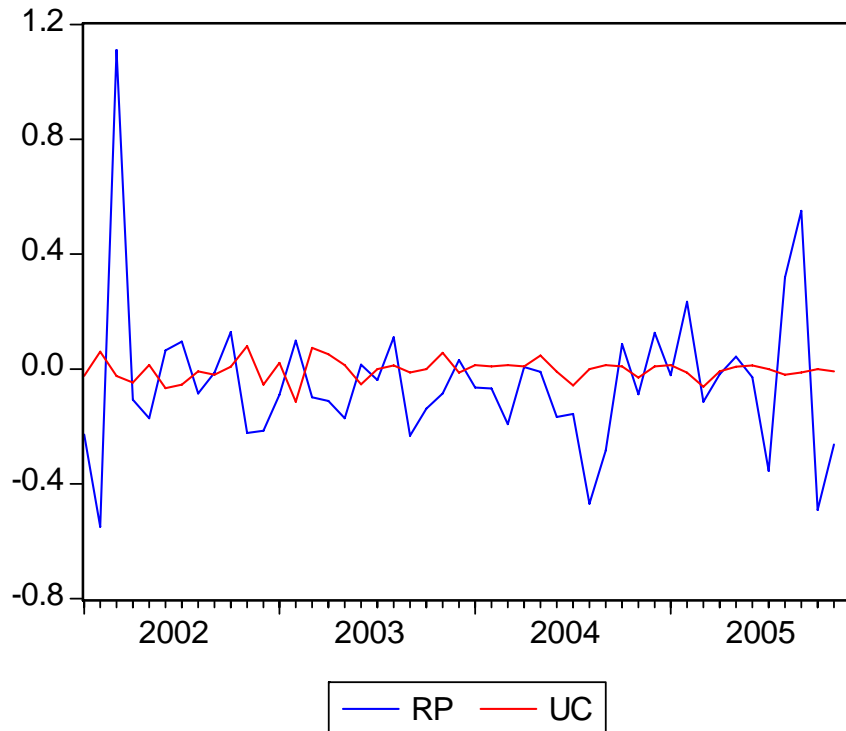
**Table 2**  
**Descriptive statistics of monthly changes in risk ratings (as changes in perceived probabilities of default)**

	UC	CC
Mean	-0.0035	0.0043
Median	0.0000	0.0000
Maximum	0.0800	0.0952
Minimum	-0.1140	-0.0411
	0.0374	
Std. Dev.		0.0221
Skewness	-0.2500	1.8259
Kurtosis	3.822801	8.468546
Jarque-Bera	1.8155	84.679
Probability	0.4034	0.0000
Sum	-0.1653	0.2030
Sum Sq. Dev.	0.0646	0.0226

Note: CC denotes China and UC denotes the United States changes in country risk ratings when converted to perceived probability of default due to country risk reasons.

Figures 2 and 3 show the relationships between risk-adjusted gas returns and country risk changes.

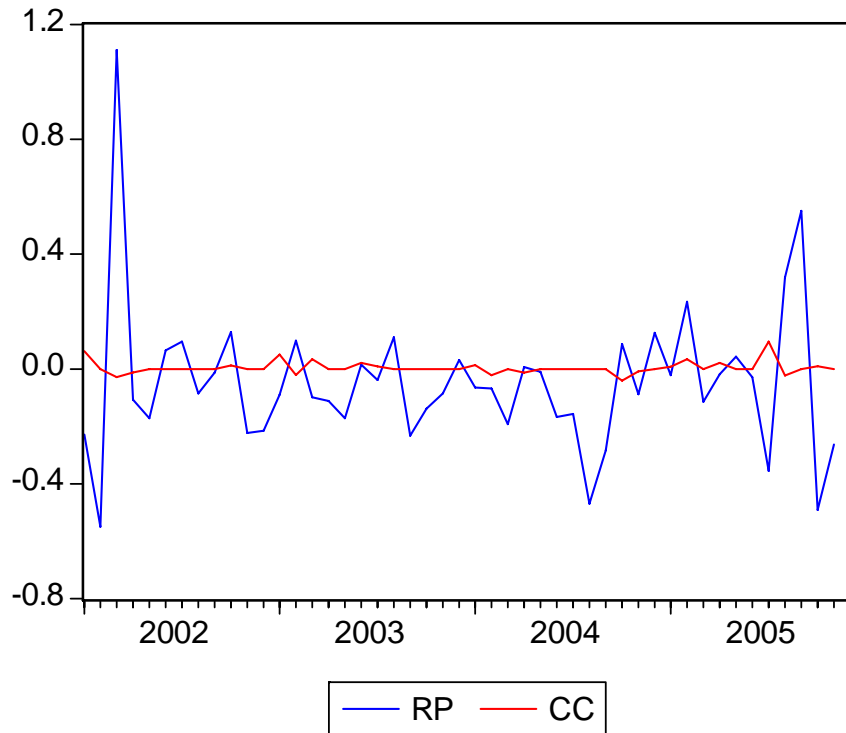
**Figure 2**  
**The relationship between risk-adjusted gas returns in Australia and US country risk changes**



Note: RP is the risk-adjusted gas returns. UC denotes US monthly country risk changes. The RP line shows greater volatility against its mean value. The UC fluctuates within a smaller range about the mean.

Figure 2 provides an indication of a weak relationship probably due to the lack of informational efficiency in the global gas market. This relationship with the Chinese country risk changes is similar as depicted in Figure 3.

**Figure 3**  
**The relationship between Australian risk-adjusted gas returns and Chinese country risk changes**



Note: RP denotes risk-adjusted gas returns. The change in the Chinese country risk rating is denoted CC. The figure depicts a weak relationship between the variables. The RP line shows greater variance about the mean than the CC line.

Table 3 contains the results of Augmented Dickey-Fuller (ADF) unit root tests (Dickey & Fuller, 1981) which show that the series are each integrated non-stationary processes (the risk-adjusted gas returns and the changes in risk scores being first differenced series).

**Note:**

<b>ADF test critical values:</b>	1% level	-3.5847
	5% level	-2.9281
	10% level	-2.6022

**Table 3**  
**Unit root tests for the risk-adjusted gas returns series and the US and Chinese changes in country risk series**

Variable		ADF t statistic
Rp	Stationary	-7.3737
UC	Stationary	-5.0609
CC	Stationary	-8.5062
Error of RP: UC regression	Stationary	-7.4051
Error of RP: CC regression	Stationary	-7.3726

Note: p values are significant at the 1% level.

Tables 4 and 5 contain the results of the regression analysis. It is noted that the explanatory power is not strong. However, the independent variables in each case are statistically significant at the 5% and 10% levels in the cases shown in Tables 4 and 5 respectively and the Durbin-Watson (DW) test statistic (Durbin & Watson, 1971) reveals that serial correlation is not a problem and that the results are not spurious. However, White tests reveal that heteroskedasticity is persistent in the errors of the regressions of Australian risk-adjusted gas returns against the country risk changes in the USA and China<sup>6</sup>. In addition, the t-statistics and coefficients show a negative relationship between country risk changes and risk-adjusted gas returns in both the United States and in China.

**Table 4**  
**Regression of Australian risk-adjusted gas returns on country risk changes in China**

Statistic	Value
Adjusted R-Squared	0.0804
Coefficient	-3.9556
Standard Error	1.6373
t-statistic	-2.4160
DW	2.2893

Note: Results are significant at the 5% level.

<sup>6</sup> The lack of significance of the F statistics and Obs\* R Square values reveal an inability to accept the null hypothesis of no heteroskedasticity in the errors.

**Table 5**  
**Regression of Australian risk-adjusted gas returns on country risk changes in USA**

Statistic	Value
Adjusted R Squared	0.0095
Coefficient	-1.4858
Standard error	1.0206
t statistic	-1.4559
DW	2.1936

Note: Results are significant at the 10% level.

The results in Tables 4 and 5 also show that the change in country risk in China has a stronger relationship with the Australian risk-adjusted gas returns than that with United States country risk changes. The contribution of country risk in China to the Australian risk-adjusted gas returns is about 8 times stronger than that from the USA.

As the series in the two models are integrated and non-stationary processes, a bivariate Vector Autoregressive (VAR) model is specified in order to run VAR-based Johansen cointegration (Johansen, 1988) and Granger causality tests (Granger, 1988). Whilst the results need to be treated with caution due to the sample size, it is first found that a VAR stability condition check reveals a stable VAR with no root lying outside the unit circle.

In addition, Table 6 shows evidence of cointegration in a bivariate model that includes Australian risk-adjusted gas returns, changes in US country risk and changes in Chinese country risk. The variables in the longer-term exhibit similar stochastic trends and together come to equilibrium on an optimal lag of 1 to 2 months. Table 7 contains evidence that Granger causality runs from the changes in the country risks in China to the Australian gas price premia variable with significance at the 1% level. There is no evidence that causality runs from the changes in US country risks. There is evidence of joint causality of the US and Chinese variables at the 5% level of significance

(considered individually the changes in China are the statistically significant exogenous force at the 1% level). This indicates that the changes in the country risks in the US and China are together exogenous and lead the variability in the risk-adjusted gas returns on an optimum lag of 1 to 2 months. There is no statistically significant evidence of reverse causality from the Australian risk-adjusted gas returns variable.

**Table 6**  
**Cointegration of Australian risk-adjusted gas returns and changes in country risk scores in the USA and China**

Sample (adjusted): 2002M04 2005M11

Included observations: 44 after adjustments

**Trend assumption: Linear deterministic trend**

Series: RP (Risk-adjusted gas returns), UC (changes in USA country risk) CC (changes in Chinese country risk)

Lags interval (in first differences): 1 to 2

**Unrestricted Cointegration Rank Test (Trace)**

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.460489	53.17430	29.79707	0.0000
At most 1 *	0.350097	26.02229	15.49471	0.0009
At most 2 *	0.148269	7.061307	3.841466	0.0079

**Trace test indicates 3 cointegrating eqn(s) at the 0.05 level**

**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.460489	27.15201	21.13162	0.0063
At most 1 *	0.350097	18.96098	14.26460	0.0084
At most 2 *	0.148269	7.061307	3.841466	0.0079

**Maximum Eigenvalues indicate 3 cointegrating equations at the 0.05 level**

**Table 7**  
**VAR Granger Causality/Block Exogeneity Wald Tests**

Sample: 2002M01 2005M12

Included observations: 45

**Dependent variable: RP**

Excluded	Chi-sq	df	Prob.
UC	0.957900	2	0.6194
<b>CC</b>	<b>11.34101</b>	<b>2</b>	<b>0.0034</b>
<b>All</b>	<b>12.12399</b>	<b>4</b>	<b>0.0165</b>

## CONCLUSION

This study used examples of a developed country (Australia) as a gas exporter, a developed country (US) as a gas importer and a transitional economy (China) as a gas importer. The example is provided to illustrate the importance of country risk in natural gas export pricing. The importance of political risk in gas markets has previously been supported in continental European studies such as Asche et al (2000) and Hartley and Medlock (2005). The latter also provide support for a significant effect of country risk on rates of return in energy infrastructures including natural gas. They provided evidence for a wide range of political scenarios and economic outcomes that could have an influence on a global gas market.

There are several limitations of this study. The sample size is small and the errors of the regressions contain persistent heteroskedasticity. In addition, the volatility of the Australian risk-adjusted gas returns series and the low explanatory power of the regressions demonstrates the degree of informational inefficiency and lack of development in the global gas market. If the market was efficient, a greater part of the variation of the Australian risk-adjusted gas returns would be explained by economic,

financial and political risk factors. The study suggests that whilst the HH may not be entirely useful as a global benchmark, it may be all that is presently available.

Nevertheless, changes in country risk scores for both China and the United States are statistically significant variables in an Australian risk-adjusted gas returns model. In this study, a benchmark global gas price in the HH was adjusted by the Australian risk-free rate. In this respect, it reflects the Australian gas benchmark price with returns adjusted by the Australian risk free rate. As there is a negative relationship between country risk changes and Australian risk-adjusted gas returns in models with low explanatory power, it is evident that country risk is not a highly important consideration in gas export pricing. However, the limited evidence that country risk changes in China have a substantially larger contribution to the Australian risk-adjusted gas returns variability than those in the USA is an indication that country risk factors may be an important consideration in export pricing.

The evidence is weak due to the limitations of the data and sample size but the study does show statistically significant relationships. Further evidence on top of regression analysis is provided in VAR-based tests of cointegration and causality. It is found that, in a single bivariate model, each of the series studied produce similar stochastic trends and move to stability in the longer-term. In addition, the US and Chinese country risk change variables when interacting together are exogenous in such a model and as such these variables lead the variability in Australian risk-adjusted gas returns on a lag of 1 to 2 months.

Overall, the study suggests that country risk needs to be considered in export pricing. This may suggest a direction for future pricing for Australian and other exporters

of natural gas as the global market becomes more informationally efficient, as more countries deregulate their gas markets and import greater volumes of this form of energy in partial replacement of oil imports. Global natural gas market efficiency will mean substantially more of the natural risk-adjusted gas returns will be explained by economic, financial and political risk factors. Future research may need to improve explanatory power of the basic model by the weighting of risk-adjusted gas returns according to the share of the global supply of natural gas by the exporter country and the individual country risk scores may need to be weighted by the share of global demand by the selected importer countries.

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## APPENDIX 1: DEFINITIONS AND EXPLANATIONS OF PURE POLITICAL RISK COMPONENTS (ICRG, 2006)

**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.