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Country risk, ownership concentration and debt ratio of gas transport projects: A statistical analysis

Simon Roussanaly[a,*] and Axel Pierru[b]

[a] SINTEF Energy Research, Sem Sælandsvei 11, NO-7465 Trondheim, Norway
[b] IFP Energies nouvelles, 1 et 4 avenue Bois- Préau, 92852 Rueil-Malmaison, France

Abstract

This paper provides a regression analysis of the debt ratio of project-financed LNG infrastructures and gas pipeline projects, by using data relating to projects whose financial close occurred between June 2004 and March 2011. The projects located in risky countries tend to exhibit lower debt ratios, which is consistent with the basic view of risk-averse funds suppliers. However, surprisingly enough, the more concentrated the equity ownership, the lower the debt ratio.

Keywords: Debt ratio; Gas; LNG; Pipeline; Project finance; Equity;

1. Introduction

Like other capital-intensive infrastructures, LNG infrastructures and gas pipeline projects are usually funded through project finance. This specialised form of debt finance involves lending to a project company set up for the sole purpose of developing an individual project. The debt has to be repaid from the cash flows generated by the project, and debtholders have only a limited recourse back to the corporate sponsors of the project. A specific debt ratio can therefore be associated with each project, which is not the case for corporate-financed projects[2] (i.e., projects financed on the owner's balance sheet).

In general, project finance seems an efficient way of maximizing debt financing - backed by the future project revenues - since empirical studies conclude that projects funded through project finance are highly

* Corresponding author. Tel.: +47 735 93 767; fax: +47 735 97 250.
E-mail address: simon.roussanaly@sintef.no .

[2] See Pierru [1] for an in-depth discussion of this issue in the upstream petroleum industry.

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leveraged. Shah and Thakor [2] invoke asymmetry of information to explain why project finance involves higher leverage than does conventional corporate financing. Brealey et al. [3] stress that project finance allows the allocation of specific project risks (i.e., completion and operating risks, price risks and geopolitical risks) to those parties best able to manage them. Furthermore, as stressed by Morrison [4], transnational gas pipeline sector is driven by geopolitics, but, once projects approved, project finance is an obvious funding option: "the schemes have high upfront costs, steady tariff payments during their lifetimes and many sponsors in the project company – all ideal conditions for project finance".
However the financing mix of projects is susceptible to substantially vary with respect to the industrial sector considered. In this context, this paper provides some new empirical insights on the financing mix of LNG and gas pipeline projects, by using data relating to projects financed between June 2004 and March 2011 (based on their financial closure date). The analysis mainly focuses on the debt ratio observed for the projects considered. The following section offers a preliminary description of the projects considered, along with the rationale of the variables used. A statistical study is then achieved and the resulting empirical insights are discussed.

2. Description of projects considered and rationale of variables used

We have documented[3] 26 LNG or gas pipeline projects financed through project finance and whose date of financial close fell between 29 June 2004 (Egypt LNG Train 1) and 4 March 2011 (Nord Stream Phase 2). Financial close implies the formal signing of financial documentation and the satisfaction of all conditions that are required to be satisfied before the borrower (i.e., the project) can request drawdown. Table A1 gives a detailed list of the 26 pipeline and LNG projects that form the sample. These gas infrastructure projects all involved the creation of capacity from scratch or the expansion of existing capacity (none involved a purely financial transaction such as refinancing or asset acquisition). The LNG projects, that involve the construction of liquefaction plants or regasification plants, may include the construction of associated storage tanks and pipeline[4], but not shipping. We did not consider the financing of the shipping parts of LNG projects, insofar as ships can be lease-financed. The LNG carriers, which technically can easily be foreclosed and reallocated to other projects, are effectively “liquid” assets, unlike LNG infrastructure which is traditionally considered as specific asset[5] [5]. As a result, in the shipping sector, debt ratios tend to be particularly high.

For various reasons, several infrastructure projects financed after 2004 are not included in our sample. In particular, Rasgas 2-3 has been ruled out because of successive dates of financial close that could have been source of confusion. The Asia Trans Gas Pipeline, whose financial close occurred in 2008, was not considered either because we could not determine the accurate ownership syndicate structure. Furthermore, certain projects were financed on the sponsors' balance sheet and are therefore not considered here (since no specific debt financing can be associated with them). In particular, Rayong LNG Receiving Terminal (a $700 million investment in Thailand) was fully financed by the public company PTT, and EG LNG Train 1 (a $1.4 billion investment in Equatorial Guinea) as well as Angola LNG (a $4 billion investment in Angola) were fully corporate-financed by their sponsors.

In our statistical study, we consider the following variables:

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[3] Sources: CEDIGAZ, Wood McKenzie, IFPEN's Economic & Information Watch Department.

[4] For instance, Peru LNG (2008) comprises a 408km pipeline to connect the liquefaction plant to an existing pipeline network east of the Andes.

[5] See Von Hirschhausen and Neumann for a recent analysis of this issue.

2.1. Debt ratio

In this paper, a project's debt ratio is computed as the ratio of the amount of senior debt to the project's total investment cost as anticipated at the date of financial close. Note however that, even after financial close, a project's financing can still be subject to modifications - in compliance with existing debt covenants, like thresholds of debt-service cover ratios - if new market conditions are favorable. In addition, if unexpected additional investment costs are incurred, subordinated debt may be issued during construction. The senior debt may comprise bank debt (including from development banks and export credit agencies[6]), bonds, sponsor loans[7] and Islamic financing[8].

2.2. Concentration of equity ownership

As stressed by Esty [6], project-finance companies generally exhibit highly-concentrated equity ownership, with syndicates typically formed of two or three sponsoring firms. Esty and Megginson [7] suggest that, in project finance, more concentrated ownership of equity reduces agency costs through better incentives alignment and oversight of managers by owners. As a consequence, projects with higher equity ownership concentration may have higher debt ratios. In a consistent way, a diluted equity ownership may reveal that sponsors consider the project as especially risky. In this paper, the concentration of equity ownership is measured as the Herfindahl index of the project, as suggested by Vaaler et al. [8]. This index corresponds to the sum of the square of each sponsor equity share in the project.

2.3. Date of financial close

The economic and financial crisis of 2008 had a major impact on the energy industry [9] and the gas industry in particular [10]: falling demand and prices, a credit crunch, etc. Nevertheless, the effect of the crisis on the financing mix of gas infrastructure projects may be ambiguous. Clearly, the global credit crunch should lead to a reduction in debt ratios. However, there are arguments in favour of an opposite effect of the economic crisis. Indeed, at a time of relatively low natural gas prices and, more broadly, an increasingly negative economic outlook, companies may be tempted to increase the share of debt in the financing for these projects - especially as interest rates remain low - in order to increase the profitability of the invested equity capital.
In this paper, we assume that the projects whose financing could have been affected by the crisis were those with a financial-close date after 15 September 2008 (i.e., after Lehman Brothers went bankrupt). The corresponding explanatory variable is a 0-1 dummy variable (equal to 1 if the project financial close is post-crisis).

2.4. Country risk

Projects located in risky countries may have smaller debt ratios - as senior lenders may want to limit their risk exposure and demand stricter conditions. The country risk to consider here is that perceived by investors at the project's date of financial close. This variable is equal to the OECD rating for the risk of

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[6] These financial institutions guarantee loan tranches or make direct loans.

[7] A sponsor loan is a loan made to the project by one or several project's sponsors (i.e., the SPV shareholders). When a sponsor also supplies some senior debt, relationships amongst lenders are potentially more complex.

[8] For instance in the Dolphin Energy Project.

country[9] at the date of the financial close. For a transnational pipeline, the rating considered is equal to the maximum rating over all countries crossed by the pipeline. For the projects considered here, this variable ranges between 0 and 6 (Yemen LNG, Accugas Pipeline).

2.5. Size of the project

An industrial firm that diversifies its portfolio of assets will tend to take smaller stakes in larger projects. As a consequence, larger projects may therefore have more diluted equity ownerships. In addition, as stressed by Ghemewat [11], larger projects represent harder-to-reverse commitments (if poorly implemented), whereas smaller projects may be considered as easier to reverse or liquidate upon project company failure. Larger projects may therefore also have lower debt ratios. In our sample, the largest project is Sakhalin 2 with an investment of $20 billion, the smallest is Gate LNG expansion with a total investment cost of $208 million. The explanatory variable Project Size is the natural logarithm of the total investment cost.

2.6. Type of infrastructure

Distinct types of infrastructure - possibly with differing idiosyncratic risk exposures- might have different debt ratios or equity ownership structures. In this respect, the 26 projects surveyed fall into three types of infrastructure: pipelines (10 projects), liquefaction plants (9 projects) and regasification terminals (7 projects). We consider a 0-1 dummy variable for liquefaction plants and another dummy variable for regasification plants.

Table 1 gives a synthetic view of the sample of projects under study.

Table 1. Number of projects (total investment cost in brackets, in billion US dollars)

	Pre-crisis	Post-crisis
Pipeline	3 (5.6)	7 (19.8)
Liquefaction	8 (47.8)	1 (18.2)
Regasification	6 (6.8)	1 (0.2)

3. Preliminary remarks on the evolution of investments and loans

In our sample, as Figure 1 indicates, the number of projects by type of infrastructure is relatively variable from one year to the next. Between 2005 and 2007, a decline in the number of projects was observed for all types of infrastructure (with no pipeline projects in 2006 and 2007). From 2008 on, the number of pipeline projects follows a continuous growth[10], while a high number of LNG projects has been financed in 2008. The subsequent small number of LNG projects may be attributable to factors other than the 2008

[9] See http://www.oecd.org/dataoecd/9/12/35483246.pdf. This rating index is relevant for long-term projects like those considered here.

[10] Apart from economic considerations, physical constraints may explain some of the investment in new capacity, as the IEA [12] observes: "part of the incremental pipeline capacity that is being built is designed to substitute for, rather than supplement, existing capacity: this is especially the case with new Russian export lines to Europe. Also, the availability of gas to supply some existing pipelines, to which they are dedicated, will tend to fall as the source fields mature and production declines".

crisis, such as the outlook for growth in unconventional gas in importing countries, especially in North America. The year 2011 is shown as a dotted line since it only includes projects with a financial closure date prior to April 2011.

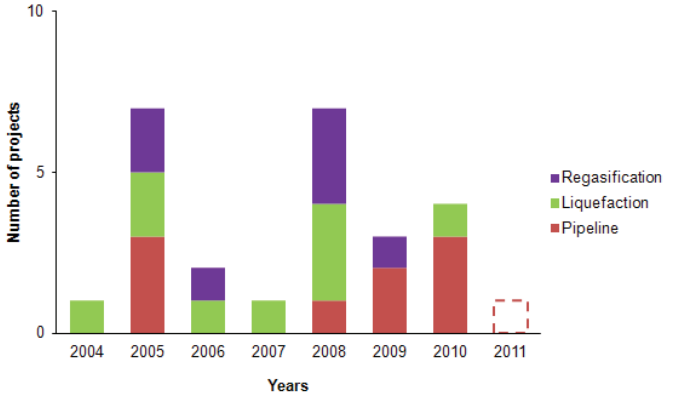

Figure 1. Number of projects by type of infrastructure

Figure 2 shows the variations in the total amount invested in each type of project, along with the corresponding total amounts borrowed. The shape of these curves resembles Figure 1. Baker et al. [13] consider that the total global single-project capacity of the commercial-bank market is probably stuck around $3 billion for the foreseeable future. However, the aggregate global capacity of ECAs and development banks has benefited from the Chinese government's willingness to provide large amounts of capital to projects that commit substantial portions of their production to Chinese buyers (e.g., PNG LNG Phase I, Asia Trans Gas Pipeline). The size of LNG projects has nevertheless increased, the projects undertaken being more and more large and complex, a trend that might continue in the future.

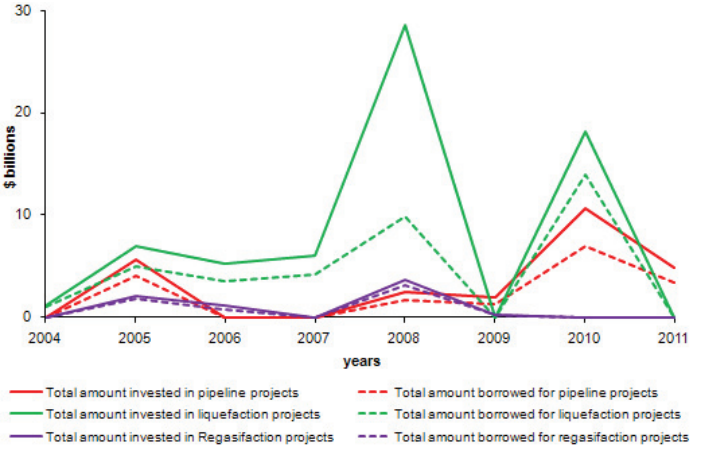

Figure 2. Evolution of invested and borrowed amounts

4. Descriptive analysis of debt ratios

According to Dailami and Leipziger [14], in project finance in general, a typical financing mix consists of 20% to 40% equity (provided by project promoters) and the rest raised as debt. The average debt ratio is

67% according to Kleimeier and Megginson [15] and 71% according to Esty [16]. Megginson [17] finds that in 2009 debt financing accounted for 81% of the total project-finance volumes versus 19% equity funding. Here, when considering all the 26 projects, the mean debt ratio[11] amounts to 69% and is consequently in line with the above values. Figure 3 illustrates the distribution of Debt ratio per type of infrastructure.

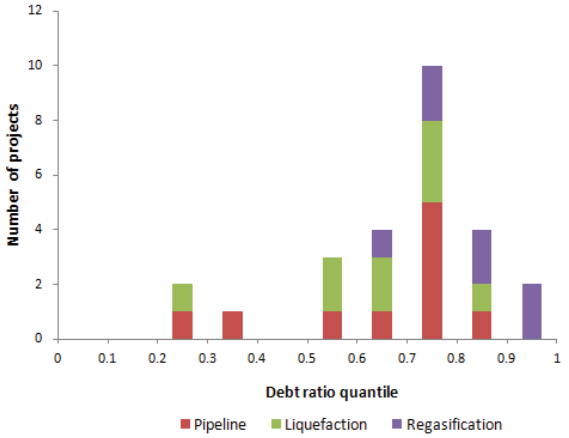

Figure 3. Projects classified by quantile of debt ratio

By type of infrastructure, the average debt ratio is 0.68 for pipeline projects, 0.57 for liquefaction projects, and 0.84 for regasification projects. To draw definite conclusions is however difficult, since these differences in average debt ratios may result from various possible reasons: a higher proportion of expansion or pre-crisis projects for a given type of infrastructure, different geographical distributions (for instance most liquefaction projects are located in sub-investment-grade countries).

5. Regression analysis

Here, the small number of projects under consideration does not allow us to distinguish the impact of the regasification dummy variable from that of the country-risk variable. As a matter of fact, all but one[12] regasification projects are located in countries displaying an OECD rating equal to zero, and the majority of the projects located in countries with a rating of zero are regasification projects. More generally, to explain the debt ratio, we tested various alternative specifications where coefficients of the project size and dummies for post-crisis or type of infrastructure never appeared significant at a 5% level. As a result, for descriptive purposes, we propose the regression presented in Equation (1), in which the debt ratio of the project *i* located in the country *j* is the dependent variable.

$$\text{Debt ratio}_i = \alpha_0 + \alpha_1 \cdot \text{Country risk}_j + \alpha_2 \cdot \text{Ownership Concentration}_i + \varepsilon_i \quad (1)$$

In this regression, the country risk – such as perceived at the financial close date of project *i* – and Ownership concentration of project *i* are the explanatory variables of the project debt ratio. ε_i is the disturbance, assumed to be independently and identically normally distributed. It can be noted that

[11] By regressing the debt amount with respect to the investment cost, Figure A1 offers an alternative view of the average debt ratio that is then 0.54 over the full sample, but 0.73 if the project Sakhalin 2 is not considered.

[12] The only exception is GNL Quintero whose financial close occurred when the OECD rating for Chile was 2.

the country risk and the concentration of equity ownership exhibit a relatively low degree of collinearity, with a correlation coefficient of -0.38 (see also Figure A2). As shown in Table 2, all estimated coefficients are significant. The Durbin-Watson statistics shows that the null hypothesis of zero auto-correlation in the residuals is not rejected at both 1% and 5% levels of significance. The null hypothesis of a normal distribution of the residuals is not rejected by the Jarque-Bera test at a 5% significance level.
The sign of the estimated coefficients in Table 2 shows that the more risky is the country where the project is located, the smaller is the project's debt ratio. However, surprisingly enough, the more concentrated the equity ownership, the lower the debt ratio (see also Figure A3 for further illustration). By studying Asian project finance in general, Vaaler et al. [8] find the opposite result: projects with more concentrated ownership see higher financial leverage. Our result also seems to contradict Esty and Megginson's [7] suggestion that a more concentrated equity ownership should reduce agency costs. Other factors, with opposite effects, may explain our result: for instance, a diluted equity ownership may ensure the involvement of sponsors with previous experience in the same type of project (and therefore increase the lenders' appetite for the project's debt). Finally, according to the constant estimated in Table 2, a project located in a riskless country with a large number of sponsors (i.e., a near-zero Herfindahl index) would have a debt ratio close to 0.94.

Table 2. Regression coefficients and standard errors (in parentheses)

Coefficient	**Value**
Constant (α_0)	0.94*** (0.09)
Country risk (α_1)	-0.04** (0.02)
Ownership Concentration (α_2)	-0.31** (0.12)
Adjusted R-squared	0.23
Durbin-Watson statistics	2.20

** p<0.05, *** p<0.01

6. Conclusion

This paper makes some empirical observations based on the financing of recent LNG and gas pipeline projects. Thus, the projects located in risky countries tend to exhibit lower debt ratios. This seems consistent with the basic view of risk-averse funds suppliers. Surprisingly enough, a more concentrated equity ownership is associated with a lower debt ratio, which seems to contradict Esty and Megginson's [7] suggestion that a more concentrated equity ownership should reduce agency costs. However, all these findings have to be considered with precaution: the dummy variables for the type of infrastructure and the 2008 crisis may not have a significant effect because of the small number of projects considered (and not because they really have no effect). Furthermore, other factors, such as the unanticipated growth in non-conventional gas, may also have played a role. Further investigations will have to be made in the future to interpret these results.

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AppendixA

Table A1. Gas transport projects

Project	Financial close date	Infrastructure	Country	Debt ratio	Herfindahl index of equity
Egypt LNG Train 1	Jun-04	Liquefaction	Egypt	0.85	0.28
Sabine Pass LNG terminal	feb-05	Regasification	United States	0.80	1.00
Cheyenne Plains Pipeline	may-05	Pipeline	United States	0.64	1.00
Egypt LNG Train 2	jul-05	Liquefaction	Egypt	0.80	0.32
Dolphin Energy	Jul-05	Pipeline	Oman, Qatar UAE	0.72	0.38
Freeport LNG	dec-05	Regasification	United States	1.00	0.50
Qatargas 3	dec-05	Liquefaction	Qatar	0.70	0.56
Atlantic LNG Cross Island Pipeline	dec-05	Pipeline	Trinidad & Tobago	0.80	1.00
Tangguh LNG	aug-06	Liquefaction	Indonesia	0.68	0.21
Canaport LNG Terminal	nov-06	Regasification	Canada	0.69	0.63
Qatargas 4	aug-07	Liquefaction	Qatar	0.71	0.58
Gulf LNG Clean Energy Terminal	feb-08	Regasification	United States	0.79	0.38
Yemen LNG	may-08	Liquefaction	Yemen	0.58	0.23
Sakhalin 2	jun-08	Liquefaction	Russia	0.27	0.35
GNL Quintero	jun-08	Regasification	Chile	0.85	0.28
Peru LNG	jun-08	Liquefaction	Peru	0.54	0.34
Gate LNG	jul-08	Regasification	Netherlands	0.94	0.33
Southern Lights Pipeline	sept-08	Pipeline	Canada United States	0.71	1.00
Gate LNG Expansion	mar-09	Regasification	Netherlands	0.85	0.33
Elba Express expansion	may-09	Pipeline	United States	0.35	1.00
Fayetteville Express Pipeline	nov-09	Pipeline	United States	0.82	0.50
Nord Stream Phase I	mar-10	Pipeline	Russia Germany	0.71	0.32
PNG LNG Phase I	mar-10	Liquefaction	Papua new Guinea	0.77	0.24
Ruby Pipeline	may-10	Pipeline	United States	0.52	0.50
Accugas Pipeline	jun-10	Pipeline	Nigeria	0.24	1.00
Nord Stream Phase 2	mar-11	Pipeline	Russia Germany	0.71	0.32

Figure A1. Alternative view of the average debt ratio (per type of infrastructure and over the full sample)

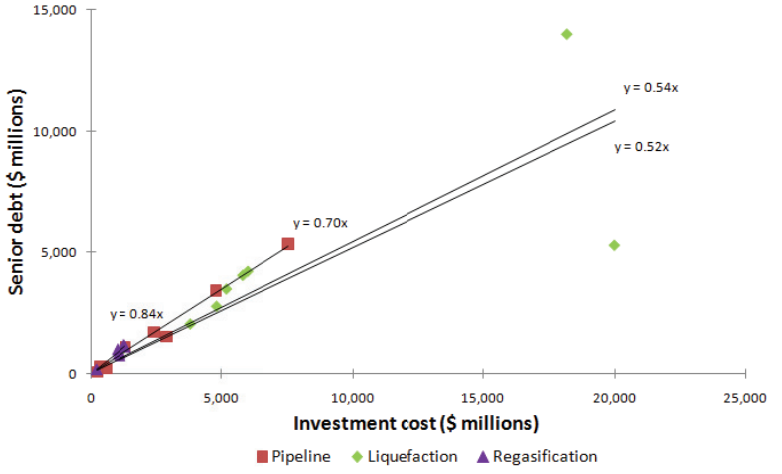

Figure A2. Ownership concentration versus country risk (per type of infrastructure)

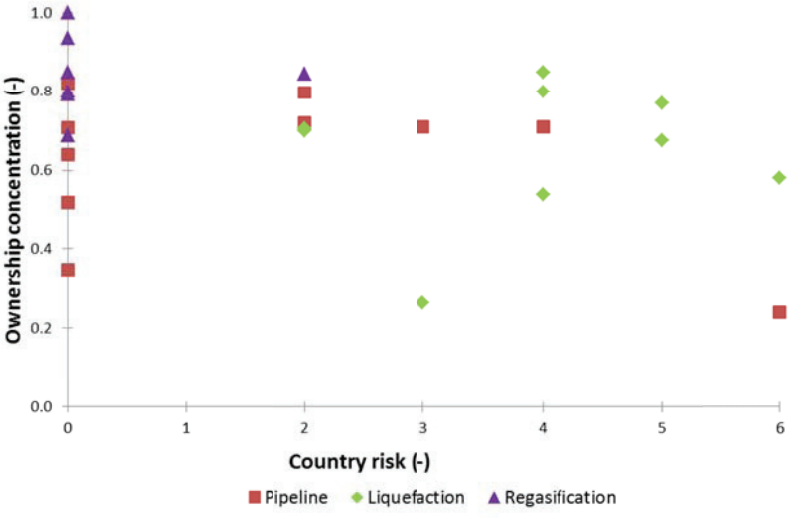

Figure A3. Debt ratio versus ownership concentration (per type of infrastructure)