Introduction

1.1. INTRODUCTION TO THE THESIS

This thesis presents empirical research into the project finance risk pricing decision made by Australian project lenders for domestic project finance. The project risk premium is the required risk-based yield, usually expressed as a margin over the standard rate used in a particular market, such as Australian dollar Bank Bill Swap Rate (A$ BBSW) in Australia.

Being involved in a project, Australian lenders often carry a share of various key risks such as operating, environmental, political/regulation, market, and sponsors. The impact of these risks is thought to vary depending on their interactions and the influences of non-risk pricing factors such as the lender's experience in project finance, market expertise, financial capacity, and competitive pressures. In contrast to other types of loans, project financing is "the provision of funds for a single-purpose facility that generates the cashflow to repay the debt. Debt is secured by the project assets and cashflows, not by the assets or general credit of the project's sponsors" (Davis, 1996, p.6). The complexity of project financing and its reliance on the project's own assets and cashflows make risk assessment and pricing an extremely critical component of the lending decision. Any risk that has not been properly identified, evaluated and priced can potentially lead to a lender loss.

Despite the importance of project finance risk pricing, it has received little attention in the finance literature. In particular, little is known about how risks and non-risk factors affect the project finance risk pricing decision. This lack of explanation is especially worrisome given the rapid growth of project financing for the larger projects in Australia.
To address this deficiency in the literature, a project finance risk pricing model is developed from the professional and academic finance literature. There are two main features providing a comprehensive view of the decision, namely: (1) the influence of project finance risks on the project risk pricing decision and (2) the influence of non-risk factors on the project risk pricing decision.

While a complete theoretical development of the model is presented to fully inform the investigation, this thesis focuses solely on studying the first feature of the model - the impact of project finance risks on the project risk pricing decision. The actual influence of the non-risk pricing factors is held out for future research. In particular, this thesis examines the impact of project finance risks in three specific aspects. The first is to establish the relative importance of each of the various risks on the project risk pricing decision. The second studies the impact of risk interactions on the project risk pricing decision. The third examines the degree of self-insight possessed by Australian project lenders when making the project risk pricing decision.

These specific findings should provide project lenders with a more insightful understanding of the project finance risk pricing decision.

1.2. OVERVIEW OF AUSTRALIAN INVOLVEMENT IN PROJECT FINANCE

The involvement of Australian lenders in project finance can be seen through the participation of Australian commercial banks, Australian arms of multinational banks, institutional investors, superannuation funds, and Export Finance and Insurance Corporation (EFIC) in project financing both overseas and domestically. Australian commercial banks considered as key players in the market include Australian and New Zealand Banking Corp. (ANZ), National Australia Bank (NAB), Commonwealth Bank of Australia (CBA), Macquarie Bank, and Infrastructure Trust of Australia (Project Finance, 1998, 1999). They have been actively involved in project financing as both providers and arrangers. In 1997/1998, NAB came second in the list of "Global Top 20 Providers" with 13 projects worth US $ 1,815.06 million, followed by ANZ with 26
projects worth US$ 1,527.59 million (Project Finance, 1999). Also, all of the Australian key players, except CBA, were on the list of “Global top 20 arrangers”. In 1998/1999, ANZ was selected in the list of “Global top 20 providers and arrangers”, while NAB, ANZ and CBA were all well positioned in the top ten Asia Pacific arrangers with the amount financed worth US $ 1,487.82 million, US $ 1,325 million and US $ 610.61 million respectively (Project Finance, 1999).

For domestic projects, involvement of both Australian banks and Australian arms of multinational banks are significant. Their participation is shown below in "Australian League Tables" (Project Finance Book Lists 1998/1999)

Table 1.1. TOP TEN PROJECT FINANCE PROVIDERS IN AUSTRALIA

<table>
<thead>
<tr>
<th>RANK</th>
<th>PROVIDER NAME</th>
<th>AMOUNT ($M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NAB</td>
<td>1,487.55</td>
</tr>
<tr>
<td>2</td>
<td>ABN AMRO</td>
<td>970.52</td>
</tr>
<tr>
<td>3</td>
<td>CBA</td>
<td>906.12</td>
</tr>
<tr>
<td>4</td>
<td>WestLB</td>
<td>528.08</td>
</tr>
<tr>
<td>5</td>
<td>Deutsche</td>
<td>527.19</td>
</tr>
<tr>
<td>6</td>
<td>Dresdner</td>
<td>514.22</td>
</tr>
<tr>
<td>7</td>
<td>Westpac</td>
<td>502.99</td>
</tr>
<tr>
<td>8</td>
<td>ANZ</td>
<td>475.2</td>
</tr>
<tr>
<td>9</td>
<td>Bank of America</td>
<td>395.11</td>
</tr>
<tr>
<td>10</td>
<td>Banque Nationale de Paris</td>
<td>366.27</td>
</tr>
</tbody>
</table>

Source: Project Finance Book Lists 98/99, p. 38

EFIC also plays an important role in project finance through providing finance and insurance to Australian firms and financial institutions involved in project financing. EFIC’s biggest deal in 1997 was providing political risk insurance for bank financing of the US$ 1.2 billion Bajo de la Alumbrera copper-gold project in Argentina, in which EFIC took US$ 200 million of the risk and led, for the first time, a syndicate of export credit agencies in providing standardised documentation (EFIC 1997-1998 Annual
Report). To diversify its business portfolio and to overcome the slowdown in its business caused by the Asian crisis, EFIC has implemented a global approach with more involvement in project financing deals beyond Asian markets. According to Dones (1999), Turkey and the Middle East are markets where EFIC is planning to increase its activities.

Australian involvement in the market can also be counted on the basis of the number of project financings conducted in Australia. As Project Finance Book Lists 1998/99 (p. 38) summarises, “Australian project finance since 1996 has been characterised by its innovation and diversity”. The top 10 signed projects from January 1996 to August 1998 are shown as follows:

<table>
<thead>
<tr>
<th>RANK</th>
<th>PROJECT NAME</th>
<th>AMOUNT (A$ M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loy Yang A Privatisation</td>
<td>3,675.65</td>
</tr>
<tr>
<td>2</td>
<td>Brisbane Airport Privatisation</td>
<td>2,200.00</td>
</tr>
<tr>
<td>3</td>
<td>Yallourn Power Privatisation</td>
<td>1,913.00</td>
</tr>
<tr>
<td>4</td>
<td>Hazelwood Coal Power Station</td>
<td>1,880.00</td>
</tr>
<tr>
<td>5</td>
<td>PowerNet Victoria Privatisation</td>
<td>1,836.00</td>
</tr>
<tr>
<td>6</td>
<td>Optus GSM Network</td>
<td>1,800.00</td>
</tr>
<tr>
<td>7</td>
<td>WA Gas Pipeline Privatisation</td>
<td>1,594.05</td>
</tr>
<tr>
<td>8</td>
<td>CitiPower Distribution</td>
<td>1,400.00</td>
</tr>
<tr>
<td>9</td>
<td>Melbourne City Link</td>
<td>1,380.24</td>
</tr>
<tr>
<td>10</td>
<td>Loy Yang B Purchase</td>
<td>975</td>
</tr>
</tbody>
</table>

Source: Project Finance Book Lists 98/99, p. 38

Clearly, project finance plays an important role in the Australian finance industry with active participation by Australian commercial banks, Australian arms of multinational banks, institutional investors, export credit agencies, and multinational firms.
1.3. DESCRIPTION OF THE PROBLEM AREA

1.3.1. Limitations of the Referent Literature

The reliance of project finance on the project’s own assets and cashflows makes the risk pricing process an extremely important component of the lending decision. However, little is still known about how project finance risks affect the project risk pricing decision.

In the area of project finance, the academic literature (e.g. Baughn and Mandich, 1983; Buljevich and Park, 1999; Bruce et al, 1997; Davis, 1996; McKechnie, 1990; Nevitt and Fabozzy, 2000; Holliwell, 1997; Sapte, 1997; Smith and Walter, 1997; Rose, 1991; Ross, 1999; and Tinsley 1999 and 2000) tends to be limited to general descriptions and management strategies for project finance risks. The literature also focuses mainly on individual risks without considering risk interactions. In addition, non-risk factors associated with the lender’s organisation, such as expertise in a particular market, experience in project finance, financial capacity, and competitive pressures, are often ignored. Professional literature, such as articles written in project finance journals (Beale, 1999; Barker, 1999; Carter, 1997 and 1999; and Gibbons et al, 1999), provides some insight into the impact of project finance risks on the project risk pricing decision. However, this information is untested by scientific inquiry and lacks generalisation, having been drawn from individual cases.

Research into the lending literature (Aguais et al, 1998; Altman, 1988; Ami, 1998; Angelini et al, 1979; Bates, 1998; Ferrari, 1992; Heffernan, 1996; Park and Zwich, 1985; Ramcharran, 1999; and Valentine, 1998) also fails to provide an appropriate framework for the study. This is largely because the lending frameworks found in the literature mostly deal with conventional lending practices rather than with project financing decisions. Conventional lending comprises both domestic and offshore loans. The risk assessment process for conventional domestic loans focuses mainly on the borrower’s credit history, financial conditions, and lending purposes, with consideration
of several other risks, such as market, legal, Act of God, and management (Aguais et al., 1998; Altman, 1988; Bates, 1998; Ferrari, 1992; Heffernan, 1996; and Valentine, 1998). For conventional offshore loans, the risk assessment process is extended to include country risk and foreign exchange risk together with factors associated with the lender’s position such as experience, expertise, financial capacity, and loan portfolio exposure (Ami, 1998; Angelini et al., 1979; Heffernan, 1996; Park and Zwich, 1985; and Ramcharran, 1999). Project finance shares common lending principles with conventional lending, but also has its own characteristics as risks in project finance are not the usual company risks but the risks of the project itself. In addition, as project finance usually involves various parties, project lenders not only have to identify and assess risks, but also have to thoroughly examine whether these risks are well distributed. Given the unique nature of project finance and its reliance on risk management to secure the loan asset in the absence of traditional borrower credit guarantees, its risk pricing process becomes much more complicated than that in the conventional lending decision.

In short, reviewing both project finance and lending literature shows that, despite the importance of project finance risk pricing skills, they have received very little attention from the literature. Further investigation into the risk pricing process is therefore necessary.

1.3.2. The Proposed Model of Project Finance Risk Pricing

To frame the thesis’s inquiries and generate a more complete understanding of the project risk pricing process, a project finance risk pricing model is presented in Figure1.1.

Firstly, the model presents five risk pricing factors (ie. operating, environmental, political/regulation, market, and sponsors). They are project finance risks most frequently cited in the project finance literature (Baughn and Mandich, 1983; Buljevich and Park, 1999; Bruce et al., 1997; Davis, 1996; McKechnie, 1990; Nevitt and Fabozzy, 2000; Holliwell, 1997; Sapte, 1997; Smith and Walter, 1997; Ross, 1999; and Tinsley
1999 and 2000). The model posits that these risk factors are key elements affecting the project risk premium, which is often expressed as a spread over the standard rate (e.g. A$ BBSW) for lenders in a particular project. These risk factors can be analysed individually as well as jointly since considering their interactions would provide a more comprehensive measurement of the risk level faced by project lenders. For instance, political instability in the host country might delay the operation of a project and consequently reduce its revenue stream.

Coupled with the risk factors, self-insight, which is defined by Mear and Firth (1987, p. 176) as "an individual's ability to express the relative emphasis he or she places on information cues when generating judgements", is also considered. By doing so, a general understanding of skilled behaviours of project lenders will be gained, demonstrating whether they have a high and accurate risk awareness or their risk judgment skills are more automatic and require less attention.

Secondly, the model suggests that the project risk pricing decision may also be adjusted based on a number of non-risk pricing factors. They are experience in project finance, expertise in a particular market, financial capacity, and competitive pressures (Altman, 1985; Ami, 1998; Angelini et al, 1979; Buljevich and Park, 1999; McKechnie, 1990; Nevitt and Fabozzy, 2000; Heffeman, 1996; Smith and Walter, 1997; and Davis, 1996). For instance, highly competitive pressures in the project financing market might lead to a lower risk premium offered by project lenders. Likewise, expertise in a particular market may lead to a lower degree of risk faced by project lenders.

After thoroughly judging the project finance risks and considering the non-risk factors, project lending officers then decide the project financing risk premium, which will be recommended to their superiors and the credit committee. This pricing decision can be made either individually or collectively in a group setting.
Given the proposed model and the thesis’s objectives, the research questions will be as follows:

1. How does each of the following risk factors influence the lender’s project risk pricing decision? (a. Operating Risk; b. Environmental Risk; c. Political/Regulation Risk; d. Market Risk; e. Sponsors Risk)

2. What is the role of risk interactions in the project risk pricing decision?

3. What is the degree of self-insight into the project risk pricing decision?

The influence of the non-risk factors presented in the model is held out for future research.
1.4. STATEMENT OF THE RESEARCH'S PURPOSE AND SIGNIFICANCE

1.4.1. Statement of Purpose

This empirical research aims to provide a more comprehensive understanding of the project finance risk pricing decision in terms of:

- The influence of individual risks and their interactions on the project risk pricing decision and
- The degree of self-insight generally possessed by project lenders when making the project risk pricing decision.

1.4.2. Statement of Significance

This empirical study provides a deeper understanding of project finance risk pricing decisions, which has received little attention in the finance and lending literature. It is hoped that its findings are also valuable to organisations involved in project financing such as commercial banks, export credit agencies, consulting firms, and superannuation funds. For those already involved in the field, the study offers an opportunity to evaluate their existing practices. For newcomers, the study provides valuable practical guidance and a wider range of risk awareness. Furthermore, this increased knowledge of the impact of main effects and interaction effects of project finance risks on the project risk pricing decision will be of use in the training of project lenders and the supply of project finance risk pricing information.

In particular, this empirical research is important and valuable for Australian project lenders. While the Australian project finance market has grown rapidly over the years, little research has been done in the Australian context. This research will help both banking educators and Australian organisations involved in project finance.
1.5. RESEARCH METHODOLOGY

To achieve three objectives set out in this thesis, a one-half repeated fractional factorial design \( (2^{5-1}) \) was chosen to structure the survey experiment. Analysis of variance (ANOVA) was employed to analyse the data.

Using a \( 2^{5-1} \) repeated fractional factorial design, sixteen hypothetical cases represented by the five project finance risks were formed. Each risk was divided into two levels: "higher" and "lower". "Higher" meant riskier than two of the last three project financing deals that project lenders had priced. "Lower" meant less risky than two of the last three project financing deals that project lenders had priced. Each case was evaluated in two ways: (1) on a nine point scale ranging from a score of one ("low risk") to a score of nine ("high risk") and (2) on basis points over A$ BBSW. As such, risk main effects and interaction effects would be calculated. These calculations are referred to as objective weights.

After completing the sixteen cases, the participants were asked to allocate 100 points across the five given risks in proportion to the perceived relative importance of each risk in formulating their decisions. By doing so, subjective weights given to each project finance risks would be measured. Then, a comparison between the objective and the subjective weights was made to examine the average degree of self-insight possessed by project lenders when judging the hypothetical risk pricing cases to make the project risk pricing decision.

Participants taking part in this survey experiment were project lending officers working for Australian commercial banks, Australian arms of multinational banks, Australian superannuation funds, and consulting firms. The survey package included:

1. A cover letter briefly explaining the survey's purpose, acknowledging the participants' contributions, and ensuring the confidentiality of their replies.
2. The research experiment comprising sixteen hypothetical risk pricing cases, a question asking participants to allocate 100 points across five given risks in relation
to their perceived importance, and six additional questions regarding the participants’ general background (e.g. sex, age, experience in project financing, etc).

3. A plain language statement for participants as required by the University's Human Research Ethics Committee. The participants could contact and inform the committee if they had any complaints concerning the manner in which the research study was conducted.

For the return of completed questionnaires, each participant was given a return postage paid envelope with the university’s address. This helped to reduce unnecessary inconvenience and cost for the participants and to ensure the confidentiality of their answers. After two weeks, a follow-up letter was sent to all participants with a friendly reminder to those from whom completed questionnaires had not yet been received.

1.6. ASSUMPTIONS AND LIMITATIONS OF THE STUDY

1.6.1. Assumptions of the Study

It is assumed that project lending officers participating in the survey are able to make valid and reliable project risk pricing decisions based on hypothetical cases containing two levels of treatment. Grounds for this assumption are drawn from the fact that processing standard risk level data to make a pricing decision is a routine and highly learned function to Australian project lending officers. In addition, the reasonableness of this assumption is measured by project lending officer assessments as to whether the experiment captures the essential aspects of the project risk pricing decision.

1.6.2. Limitations in Scope

- Discussion of the Model:
The first part of the model is limited to those risk factors most frequently cited in the literature and particularly associated with the operating phase of domestic projects
(projects conducted in Australia). A project is usually divided into two phases, namely pre-completion and post-completion. Each phase is priced differently due to its nature. To avoid unnecessary confusion and obtain more accurate responses from project lenders, the model presents only risk factors related to the post-completion phase (i.e. operating phase) of a project. As a result, completion risk is not considered. Additionally, as discovered from various pilot studies, most projects financed by Australian lenders are based in Australia. Whilst a number of domestic projects might have an element of foreign exchange involved at some stage, the model focuses more on other risks associated with domestic projects and does not take into account foreign exchange risk.

The second part of the model is limited to non-risk pricing factors directly related to an individual project. As such, other factors associated with loan portfolio management, such as loan portfolio diversification, interest rates, or availability of funds, are not considered.

- **Discussion of the Experiment:**
  This empirical study focuses solely on testing the first aspect of the model: the impact of the five risk factors on the risk pricing decision. As a result, the actual impact of the non-risk pricing factors on the project risk pricing decision remains untested. In addition, potential impact on the project risk pricing decision caused by project lenders’ characteristics such as risk perceptions, risk attitudes, risk motivation, or emotions, etc are not considered.

- **Discussion of the Population:**
  The research population is limited to lending officers working in the Australian banking industry. Other organisations involved in project finance such as multinational companies, export credit agencies, or aid organisations are not included.
1.6.3. Limitations in Design

Using experimentation poses several limitations in design. The first concern is artificiality of the research experiment since the degree of risk in this experiment is limited to two levels: a lower and a higher. Moving toward greater complexity in the factorial experiment in order to reflect the multitude of possible variations of the decision would prove to be unfeasible, particularly for this research with the numerous risk factors involved. Nevertheless, there is confidence that the two levels of treatment chosen will enable the study’s research objectives to be achieved. This is so as the participants will simply be processing standard risk level data to make a pricing decision - something they do on a daily basis.

The second concern are carry-over effects due to changes in the performance of participants when they progress through the entire experiment and impacts of residual effects from previous conditions on the responses to the currently administered treatments. However, these effects are believed to be substantially reduced due to the reasonable duration time of the experiment (about 20 minutes recorded during the pilot studies). Additionally, the task of evaluating risk premiums for projects is a routine and highly learned function to the participants in this experiment.

1.6.4. Limitations in Application

Application of the study’s findings to other than Australian project lending officers may not be possible given the fact that the study uses an Australian sample and focuses on the Australian environment. Also, it is more relevant to project lenders than to those who are dealing with other types of lending. Nevertheless, the application of this study is substantial since:

1. The degree to which discrepancies may arise in the use of risk assessment techniques and risk management strategies in project financing for both Australian lenders and non-Australian lenders is expected to be limited. This expectation is based on the
fact that both Australian and other lenders are more or less exposed to the same types of project finance risks.

2. Although the study focuses solely on the impact of project finance risks on the project risk pricing decision, it is to some extent useful for lending officers in other areas. A more comprehensive understanding of risk pricing process including self-insight into the decision making process can be gained from this study.

1.7. OVERVIEW OF THE THESIS

The thesis proceeds by setting out a “risk overview” in Chapter Two, in which the definition, assessment, and management of project financing risks are reviewed. It provides readers with a general understanding of project financing risks before pursuing more specific field research for the thesis. Chapter Three sets out the literature necessary for a better understanding of the risk pricing process presented in the model. It includes: (1) the impact of the five project finance risks and their interactions on the risk pricing decision; (2) the impact of the non-risk pricing factors on the risk pricing decision; and (3) the degree of self-insight possessed by project lenders when making the project risk pricing decision. Chapter Four presents the research hypotheses and questions along with the research methodology details and implementation strategy for the study. Chapter Five details the results of the study in terms of (1) the influence of individual risks; (2) the influence of risk interactions; and (3) the degree of self-insight. The thesis concludes with Chapter Six, which discusses the results of the study in light of the extant literature and presents the thesis’s conclusions. The chapter also considers the limitations of the study conducted and presents new directions for further research into risk assessment and management practices for project lenders.
Project Finance Risk
Overview

2.1. INTRODUCTION

Project finance is a unique fund raising instrument for capital intensive projects, such as the construction of airports, toll roads, bridges, tunnels, ports, telecommunications facilities, railways, and power stations. In contrast to other types of corporate loans, debt in project finance is usually secured by the project's assets and cashflows, not by the assets or general credit of the project's sponsors. The reliance of project finance on the project's own assets and cashflows makes risk identification, assessment, and distribution an even more critical component of the lending decision.

This chapter sets out to provide readers with a primer on project finance risks. The five project finance risks presented in the model, namely operating, environmental, political/regulation, market, and sponsors risks are defined and assessed. Additional risks not included in the model, such as completion and foreign exchange, are also discussed to provide a more general understanding of project finance risks. Specific examples of the various types of risk are given to elucidate each risk’s importance. Management techniques and risk distributions for each individual risk are also reviewed. The chapter concludes with a quick reference table of risks, causes and management strategies.

2.2. OPERATING RISK

Operating risk occurs when a project does not operate as planned or costs more than envisaged to operate at an agreed capacity or efficiency. It comprises three main components, namely cost, management, and technical (Tinsley, 1999).
2.2.1. Cost Component

Operating cost overruns might negatively affect the financial performance of a project and consequently reduce the free cashflow available to service the project finance loans. Their occurrence can be due to many reasons such as “project design mistakes, mechanical or technical failures, excessive replacement of spare parts, low productivity of labour force, strike, and force majeure” (Buljevich and Park, 1999, p.152).

When assessing potential operating cost overruns in a project, attention should be paid to the quality and stability of the local labour pool, project location, complexity of environmental problems (Smith & Walter, 1997), history of industrial action, the cost of supporting infrastructures, and maintenance expenses (Mckechnie, 1990). In the case of offshore oil or natural gas projects, transportation cost is also taken into account as an important factor making up a significant portion of the delivered cost of the product, especially when the product competes in the international market.

Illustration 2.1: Impacts of Transportation Cost

Australian and Western Canadian thermal coal mines selling into the Japanese market, both have comparable costs, FOB mine and are a similar distance to Japan (hence, have similar ocean freight charges). However, Australian mines are relatively close to the coast while the Canadian production has to be transported across several mountain ranges. Consequently, Canadian production delivered cost to Japan is far more expensive than Australian.

\[ \text{(US$/tonne)} \]

<table>
<thead>
<tr>
<th>Location of mine</th>
<th>Western Canada</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of FOB mine</td>
<td>15-20</td>
<td>15-20</td>
</tr>
<tr>
<td>Ocean freight to Japan</td>
<td>8</td>
<td>6-8</td>
</tr>
<tr>
<td>Mine to port</td>
<td>10-20</td>
<td>5-10</td>
</tr>
<tr>
<td>Delivered cost to Japan</td>
<td>33-48</td>
<td>26-38</td>
</tr>
</tbody>
</table>


Similar to completion cost overruns, Buljevich and Park (1999, p. 153) suggest that operating cost overruns should be allocated to “the constructor and the operator by means of various penalties, liquidated damages, performance bonds, or indemnities). In addition, Tinsley (1999) recommends cost waivers and cost guarantee. Cost waivers are used to avoid paying tax or royalties to the host government for a period of time- often
until a project’s financing has been retired or payback has been achieved. Cost guarantees are used to obtain cost component guarantees from the suppliers on the unit costs that may result from their plant and equipment.

2.2.2. Management Component:

Management deficiency refers to the inability to market the project’s output, control the project’s operating costs, or run the project’s production facilities (Ross, 1999). To minimise problems associated with management, an experienced project team, which comprises marketing, financial and operational personnel, should be included in the binding contractual arrangement (Ross, 1999). “If none of the sponsors has adequate experience to manage, or provide management for a project, a project company must either appoint a group of reputable and experienced managers or otherwise outsource the management of a project to a reputable and experienced management company” (Buljevich and Park, 1999, p.153). In addition, the use of an employment contract or “key-man” insurance to ensure the continued involvement of the sponsor and of strategic individuals in a project is also essential (Tinsley, 1999).

2.2.3. Technical Component

Technical problems deal with the possibility that new or untested technologies being used in the project will not prove to be viable (Ross, 1999; Tinsley, 1999). Project failure for such reasons may place the lenders in jeopardy.

According to Stockwell (1995), lenders are not generally prepared to assume the risk of untried technology. They expect to see a satisfactory track record for the technology, experienced contractors and suppliers involved in the project, and adequate guarantees from the project company. Likewise, Buljevich and Park (1999) state that the lenders generally expect a project to employ reliable technologies, which allow completion and performance of a project facility in accordance with specifications and prevent operating
or technical failure causing construction cost overruns, construction delays or higher operating and maintenance costs.

**ILLUSTRATION 2.2: Humber Gas-Fired Combined Cycle Power Project in UK**

The Humber was arranged in 1994 by NatWest and Union Bank of Switzerland and ABB was a turnkey contractor. Manufacturers are continually pushing the boundaries of gas turbines to improve their efficiency, and ABB’s 13E2 combined cycle gas turbine represented one of the latest advances in the industry. Gas turbines are too big to justify building prototypes and running them for a couple of years, so they are sold based on factory testing. Taking advantage of this current technology, Natwest had to lean heavily on development experience at other projects for its technical assessment. Inevitably, while a higher level of efficiency can be achieved, “bedding down” problems can also occur. Banks will not typically take the risk of a first-ever order of a new-generation turbine. They generally want the comfort of knowing that by the time the plant they are financing is commissioned, there would have been a number of applications elsewhere, and the teething difficulties that may be encountered on new generation equipment would have been overcome by other prior purchasers (Davis, 1996).

To avoid the likelihood of technical risk, a number of methods have been suggested. Firstly, thorough technical and technological studies based upon the advice from experienced engineering consultants are necessary (Ross, 1999).

Secondly, using tested technology and strong performance guarantees are essential. According to Tinsley (1999, p. 5) project financiers should only take the technical risk if (1) the technologies used are known and proven, (2) the “facilities are projected to remain technologically competitive”, and (3) “project life is twice the funding life”.

Thirdly, various risk allocation structures such as technology guarantees, or technology insurance can also be applied to mitigate technical risk (Tinsley, 1999). Technology guarantees are used to ensure that the project is continuously upgraded with new technological developments. Financial penalties are applied if technology companies fail to do so. However, the lenders should be aware of the fact that many technology companies are weak financially and hence not able to meet such penalties. Technology insurance, therefore, is employed to cover technical risk, though it can be quite difficult to obtain for brand-new technologies.
2.3. ENVIRONMENTAL RISK

Environmental risk, in this context, refers to possible adverse environmental and social consequences of the project. As Buljevich and Park (1999, p.171) state:

Environmental risk may result in increased costs for a project. For example, an environmental issue may force a change in the project specifications. An additional capital investment may be required to solve an environmental problem. New environmental regulations may impose on project additional capital expenditures. Cleaning up liabilities, environmental fines and penalties may be charged to a project. Environmental problems may also cause significant unanticipated construction delays leading to delays of project completion.

Environmental risk was not an issue for project financing for many years, especially for projects conducted in third world countries. Now the environmental impact of a project plays an important role in deciding whether a project can proceed. Witnessing more environmental effects and being educated with more information and research in the field, environmental awareness has increased among nations and the tightening of environmental regulations is occurring in emerging markets. As Carter (1999, p. 27) states, “sponsors have been used to seeing projects scuppered, or at the very least delayed, by environmental pressure in developed countries, but now they can expect the same wherever they go in the world”.

**ILLUSTRATION 2.3: A Tantalum Smelter Project in Thailand**

In Phuket, Thailand, a tantalum smelter was due to be developed. Bankers were happy with the economics, good project partners were in place, even the IFC was willing to make a direct loan. One problem though – the locals did not share this enthusiasm. Worried about the smelter’s impact on the local environment they burned the plant to the ground (Carter, 1999, p.27)

Environmental issues might occur due to the physical risks a project presents to the environment or due to its location (eg. its close distance to a living area, wilderness, heritage, or native reserve areas). Environmental disputes around the development of
Jabaluka uranium mine located near Kakadu National Park in Northern Territory, Australia, are clear examples. Fearing that the project can potentially damage and pollute the World Heritage site of Kakadu National Park, Australian heritage organisation took the case to the World Heritage Tribunal, causing many disruptions and delays in the development of the project. In addition, environmental risk can be a consequence of the global relationship of one project to another or of other events, making a project harder to achieve. For example, “a petrochemical spillage in one country may make a similar project harder to bank in another” (Carter, 1999, p.28).

To reduce environmental risk on a project’s development and operation, several options have been recommended. For instance, rehabilitation can be employed to gain the support from local people and council in the area where a project is conducted (Tinsley, 1999). Advanced and clean technology can be used to minimise the impact of environmental risk (Carter, 1999). For project lenders in particular, independent environmental and social studies of a project should also be included to ensure that the previous studies carried out by the sponsors are reasonable under the circumstances (Buljevich and Park, 1998). In addition, insurance should be used to transfer environmental risk to the sponsors and give the lenders recourse should environmental problems affect the project’s cash flows and consequently debt service (Tinsley, 1999).

2.4. POLITICAL / REGULATION RISK

Political/regulation risk deals with adverse impacts of the host country’s political environment on the project’s viability. It can be political violence; nationalisation and expropriation of the property; changes in investment policies, taxation, trade barriers and tariffs; or foreign exchange transfer blockage and currency inconvertibility (Ross, 1999). Political violence occurs when a large scale of violence such as war, regional conflict, civil war, terrorism, or revolution happens in the host country. It prevents “either temporarily or permanently, the operation of a project and therefore may adversely affect its cash flow generation” (Buljevich and Park, 1999, p.163).
Expropriation of a project is realised when the host government “decides to expropriate the assets of a project or the shares of a project company in a discriminatory or arbitrary manner without a payment of fair compensation to the project company or the sponsors” (Buljevich and Park, 1999, p. 159). Asset expropriation and diversion, according to Spillers (1999), is much more likely to happen in the event of a sovereign default, or when the government lessens its commitment to the operations and obligations of local sponsors.

Currency inconvertibility arises when the host government “establishes currency exchange controls and, consequently, adopts convertibility restrictions that prevent the project company from converting its income (usually in local currency) into the hard currency required for the payment of debt service” (Buljevich and Park, 1999, p. 158). Inconvertibility risk is more likely to happen in emerging markets where financial markets have not yet been developed. For instance, Latin America central banks generally have substantial intervention in foreign exchange markets, such as restriction or prohibition of the purchase of foreign currencies, to achieve exchange rate and other policy objectives (Gibbons et al, 1999).

Changes in investment policies, law and tax since the time a decision was made to undertake a project are another key factor adversely affecting the project success. The following example is a clear indication of political risk caused by changes in investment policy of the host country.

> ILLUSTRATION 2.4: Power Projects in Pakistan

In March 1994, former Prime Minister Benazir Bhutto unveiled an incentive package including a bulk power tariff – designed to attract private investors into generation. 34 contracts were issued under the scheme and by the middle of 1997, 19 such projects had reached financial close. However, the new Sharif government declared itself unhappy with its predecessor’s initiative, claiming that the agreed tariff would bankrupt the offtakers, Wapda and the Karachi Electric Supply Corporation (KESC). In June 1988 the government publicly accused a number of independent power companies of corruption and of violating their project agreements, serving intent of cancellation notices to eight companies, and terminating the contract of a ninth. Six companies were put under a 90-day notice to answer unspecific corruption and kickback charges (Barker, 1999, p.20).
It should be noted that a project can be politically sensitive in a country considered to have low political risk since its risk profile may be quite different from that of the country as a whole. As a result, Smith and Walter (1997) suggested that factors such as project location, employment of nationals, and shifting of the government and interest group priorities should also be carefully considered when assessing political risk.

**ILLUSTRATION 2.5: Mineral Projects in Australia**

Investment in foreign countries is subject to a variety of political/ regulation risks such as expropriation, nationalisation, major changes in local tax regimes, and currency and foreign exchange problems. While perhaps not so obvious, political/ regulation risk exists here in Australia. In the mineral sector, for example, government decisions to limit the sale of uranium; to assume ownership of previously privately owned mineral rights, to end the mining of mineral sands on Fraser Island; and the Coronation Hill legal battle are all local examples. From 1993 Mabo legislation was another potential difficulty for future mineral development, as were changes to environmental legislation (Bruce et al, 1997, p. 340)

Political risk can be managed in a number of ways. Firstly, it can be covered by purchasing political risk insurance from government sponsored export credit agencies (eg. Eximbank, OPIC, or EFIC) and private insurance companies. For instance, “OPIC has participated in a number of major financing transactions in Argentina, providing both direct project financing and political risk insurance coverage against loss of investments due to expropriation, nationalisation; or confiscation and loss due to war, revolution, and politically motivated violent acts” (Fernandez and Kahale, 1998, p.13). Similarly, EFIC (Australia) is actively involved in project financing, providing a wide range of political risk insurance for Australian firms and banks having investments overseas (Ross, 1999).

In addition, according to Jorgensen and Guidera (1999) and Spillers (1999), having direct involvement of multilateral agencies (eg. The World Bank and the Asian Development Bank) as co-lenders also helps to mitigate currency inconvertibility, hard currency transfer, and moratoria in emerging markets. This is because the governments
in those markets normally try to avoid defaulting on this type of debt during periods of economic downturn as multilateral agencies are often the only lenders willing to lend additional funds. For instance, “the multilaterals and all those lending under their umbrella were specifically exempted from the Russian moratorium of August 17, 1998” (Jogensen and Guidera, 1999, p.48).

Furthermore, political risk can be minimised by obtaining assurance or a consent agreement from the host government in terms of investment law and regulations, foreign exchange consents, convertibility guarantees, work permits, import duty, or withholding tax concessions (Stockwell, 1995). Also, according to Stockwell, the involvement of local partners in the project as equity investors, construction contractors, or suppliers can help in reducing the risk of political interference.

Finally, offshore proceeds accounts are recommended by Tinsley (1999) as a means of reducing political risk. It provides temporary support, especially against currency inconvertibility since it ensures that all foreign exchange is kept offshore and that debt service is paid from this account.

2.5. MARKET RISK

Market risk deals with the possibility that “the project’s product may not be sold at a price sufficient to cover all the essential costs of the project and to repay the debt in full” (McKechnie, 1990, p. 313). It occurs when commodity prices decrease, market share is narrowed, demand for the project’s output drops (Tinsley, 1999), international markets collapse, and force majeure takes place (Buljevich and Park, 1999). Unfavourable movements in the market can sometimes be caused by changes in government policy. For instance, the deregulation of the US electricity market is turning this market into a higher risk sector since “electricity is becoming a commodity subject to the full forces of the market and this injects an element of unpredictability into the game that did not exist before” (Pugsley, 1999, p.43).
Market risk can be managed in a number of ways. Firstly, it can be overcome by constructing detailed market forecasts (Tinsley, 1999). However, predicting supply and demand over the years ahead might involve difficulties and errors.

**ILLUSTRATION 2.6: Iridium Global Satellite Communications System Project**

The Iridium US $800-million bridge financing was the final step in a 10-year effort by Motorola to create a global satellite communications system. Launches commenced in 1994 with the aim of creating a system of 66 low-earth-orbiting (LEO) satellites which last five years in polar orbit. When banks first evaluated the project, they were supplied with numerous cashflows and market targets. International call charges were set at US $4-7 per minute using handset that cost US $3,000 each. According to one media lender, bankers had teams of project and telecom lenders working side-by-side to evaluate the structure. “People spent a lot of time with the projects” but quickly came to accept the technology risk. “You don’t have to get that many subscribers for this deal to pay out at US $3 per minute per call”. However, the facts that the phones were heavy and call charges were expensive; Iridium handsets would not work inside a car or a building; and that the handset were unreliable in a city with tall buildings seem to have escaped the scrutiny of the analysts. The US $200 million advertising campaign was launched before the Kyocera handsets were ready for distribution. And not all of the roaming agreements (to connect with land-based phones and cellular phones) were then in place. Furthermore, inexpensive easy-to-use cell phones experienced explosive growth throughout the world. When Iridium collapsed in 2000, it had 20,000 subscribers in comparison to projected 500,000 subscribes that it would gain within the first year in service (Nevitt and Fabozzi, 2000, p. 15).

Secondly, market risk can be managed by obtaining take-or-pay commitments and long-term sales contracts (Buljevich and Park, 1999; Bruce et al, 1997; and Tinsley, 1999). However, the existence of long-term sales contracts, according to Pugsley (1999), does not always provide the lenders with guarantees against market risk. It is especially the case when long-term purchasers act as agents buying the project’s product at wholesale price and reselling it at a margin to consumers. Since the contract is based on a fixed price, the purchasers can go bankrupt when the price falls dramatically, leaving the sponsors in an unhedged situation and many bankers “weary of financing projects” with exposure to them. As Grandchamp (cited in Pugsley, 1999, p.44), states: “when financing a project involving these types of arrangements, you then have to carefully analyse third party risk as you are taking exposure on them”.

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Thirdly, market risk can be mitigated by obtaining sponsors’ guarantees to assume the risk in severe circumstances such as collapse of international markets, force majeure, and political risk (Buljevich and Park, 1999). Additionally, they suggest that sponsors’ guarantees to cover the risk (e.g. cash contribution agreements, output price floors, output minimum sales assurances, or performance guarantees) are also essential.

2.6. SPONSORS RISK

Sponsors risk is also known as credit risk or participant risk. It refers to the sponsors’ financial strength, technical competency, and experience in project financing (Tinsley, 1999) as well as the internal agreements among the sponsors (Buljevich and Park, 1999).

To assess the sponsors risk, thorough investigation of the sponsors’ financial strength and credit character is recommended by Ross (1999). Financial strength indicates the sponsors’ ability to carry out a project and to meet their commercial obligations, while credit character specifies the sponsors’ willingness to satisfactorily meet its contractual agreements. Considerable information can be obtained from the sponsors’ financial statements and credit history including references from project lenders with whom the sponsors have conducted business. In addition, the future macroeconomic climate, the trend, development and cycle of a project’s industry should be taken into account (Heffernan, 1996).

Buljevich and Park (1999, p.158) suggest that internal agreements associated with a project’s operation and administration should also be carefully studied. In particular, attention should be paid to the following matters:

- Shareholding structure and changes in the interest participations of the sponsors;
- Responsibilities and obligations of the sponsors, particularly in relation to equity contributions to the project company;
- Decision making mechanisms, particularly voting rights, minority rights and deadlock provisions;
• Internal policies and procedures for the administration of the project;
• Election of the board members and senior management of the project company;
• Creation of executive committees;
• Arms-length principle for transactions between the project company and sponsors;
• Dispute resolution mechanisms;
• Rules for transfers of equity participations and incorporation of new equity holders;
• Annual budget and account reports.

Sponsor risk can be managed by employing a number of risk allocation structures, such as contingent financial support or financial ratios agreement (Tinsley, 1999). Contingent financial support is arranged “to meet the completion risk or to provide ongoing support to the financing in the form of working capital maintenance agreements, cashflow/debt service deficiency agreements, and contingent equity underwriting agreements or guarantees from a strong parent” (p.8). The “financial ratios” agreement, on the other hand, is used to control and monitor the sponsors’ activities in terms of short-term and long-term debts, and liquidity.

2.7. COMPLETION RISK

Completion risk deals with the possibility that the project will not be completed in sufficient time, or on budget, due to delays in construction and cost over-runs (Ross, 1999). Such delays can increase the interest burden of a project during the construction period, causing more financial cost overruns than initially planned. The delays can also affect commencement of the operating phase and consequently commencement of the project revenue stream.

Completion risk may be caused by geographic problems, disputes among the workforce, unfavourable weather conditions, shortfalls of raw materials, defaults of construction contractors (Sapte, 1997), inflation, increases in prices of equipment and other supplies, increases in labour cost, engineering or design problems, changes in the technical
designs, technical defects, changes in law and taxes, strike, start-up related problems, and force majeure (Buljevich and Park, 1999).

ILLUSTRATION 2.7: Eurotunnel - A Disaster for Lenders

The 31-mile link under the English Channel between the UK and France is one of the most expensive projects in the world... Financed by a consortium of 225 banks, it is a project in which the construction phase, overall cost, and start-up revenues were all underestimated... In May 1987, construction was expected to be completed in May 1993. In 1990, construction was estimated to be completed by May 1994. Actual completion occurred in December 1994. In the 1987 budget, total cost to build and open the tunnel was estimated to be £4.9 billion. In 1990, the estimate was raised to £7.5 billion. Actual cost was £9.7 billion.

The equipment specification aspect was revisited during the construction period, with a cost increase to the project of £1 billion for fire safety on the rail shuttle cars. Yet, on 18 November 1996, the 21.42 train from Coquelles in France caught fire and the overall fire systems failed (compounded with human error), shutting down the system for six months. The traffic, already building slowly, was naturally put off by this disaster. In addition, successive British governments failed to upgrade the rail connection from London to Folkestone at the entry to the English side of the tunnel, whereas, the French have established their TGV express trains from the Coquelles portal to Paris. Until the fast connection is in place from London, the project will continue to have difficulty servicing its massive debt, which has been heavily restructured.

The serious risk aspects of completion, traffic, infrastructure, force majeure, and operating aspects were either ignored or seriously misjudged in the various scenarios and refinancings in evidence in this mega transaction, with its concomitant mega write-down (Nevitt & Fabozzi, 2000, p. 7)

Generally, completion risk is absorbed by the sponsors. As Fernandez and Kahale (1998, p. 13) state, “it is passed through to the project sponsors who reassure lenders that the project will be completed. This reassurance can be structured by granting the lenders recourse against the sponsors until project completion”. However, according to Buljevich and Park (1999), it may be difficult for lenders to allocate in full completion risk, especially in the case of large projects.

To minimise completion risk, various risk reduction and distribution mechanisms have been suggested. Firstly, detailed engineering studies, which “more closely specify the
tasks and costs involved to ensure that the project financing can withstand normal tolerances in construction time and cost”, are necessary (Ross, 1999). Likewise, Buljevich and Park (1999) indicate that the likelihood of construction risk can be reduced by obtaining independent advisers to conduct feasibility studies, using proven technology, and entering into a turnkey construction contract with a reputable constructor.

Secondly, completion guarantees and standby facilities are suggested (Tinsley, 1999). A completion guarantee requires the loan to be serviced by the sponsors if the project is not completed by a certain date. A stand-by facility is usually required from a strong parent or related companies as contingent funding to cover the potential cost overruns.

Thirdly, use of insurance is recommended to manage force majeure risk (Ross, 1999; Tinsley, 1999; and Buljevich and Park, 1999). For instance, unexpected natural disasters can be mitigated through the use of commercial insurance policies specially designed for such purposes, while uncontrollable political events can be covered by using political risk insurance. Sufficient funds needed for the project in the case of a force majeure risk should also be prepared in advance. These funds may be provided by insurance companies, by project sponsors, or project participants such as offtakers and constructors.

2.8. FOREIGN EXCHANGE RISK

Foreign exchange risk occurs where projects generate income in the local currency but have a portion of their costs denominated in foreign currencies. According to Buljevich and Park (1999, p. 514),

Currency exchange fluctuations may lead to a loss in value of the currency of the host country in relation to the foreign currencies, in which the project must honour its financing and/or operating costs. Consequently, the cash flows produced by the project may no longer be sufficient to pay such foreign currency-denominated obligations.
Governments, private sector contractors, and their financial and legal advisers are wondering who pays for the cost of a project bloated by currency devaluation. Gordon Wu is struggling with Bangkok’s transport system. In 1990, he came up with a modern mass transit system that could be partly financed by property development along the route. In 1997, however, that dream has soured: his US$3.5 billion Bangkok Elevated Road and Train System – only 20% constructed after 7 years and with more than US$500 million spent on it – has been cancelled by the Thai government. The July 2 devaluation of the baht and the slump in property prices added greatly to the cost of the project. Hopewell’s project is only the most visible in a series of infrastructure projects facing a hard time in Asia. The currency crises that have swept the region have raised a host of tricky questions, many of which drive to the core of what project finance is about. Indonesia, too, has postponed or put under review project to the tune of US$37 billion, some of which had started construction and reached financial close (Parsons, 1997, p. 83).

To minimise the impact of unexpected exchange rate fluctuations on a project’s success, Buljevich and Park (1999) suggest that a detailed analysis of devaluation and depreciation risk and thorough examination of the exchange rate assumptions used for the financial projections be conducted in advance. However, Buljevich and Park also point out that a distinction should be made between lending to domestic market-oriented projects and export-oriented projects. The former exposes the sponsors and the lenders to a much higher level of foreign exchange risk since their revenues are in local currency. The latter, on the other hand, have their revenues in a hard currency as products are sold in the international market, and are therefore not significantly exposed to foreign exchange fluctuations.

Foreign exchange risk can be hedged by using various derivative instruments such as swaps, futures, forwards, and options (Ross, 1999; Buljevich and Park, 1999; Tinsley, 1999; Smith and Walter, 1997). However, these instruments are not always available in emerging markets where the risk is more likely to occur. In these cases, the following techniques are recommended. Firstly, credit enhancement from the project sponsors and off-shore project accounts into which payment in respect to export receivables are directly deposited are necessary (Buljevich and Park, 1999). Secondly, the creation of a natural hedge by funding in local currency should be considered (Watkins, 1998). This
method has been increasingly used in Asia where projects have suffered from foreign exchange problems. Since most projects generate revenue in local currency, the use of local currency debt creates a natural hedge. However, according to Watkins, exploring the local option also creates a number of challenges for the lenders. For instance, local currency interest rates may be higher than those for US dollars or other hard currencies. Also, it can be difficult for foreign lenders to lock in interest rates due to a lack of hedging instruments.

2.9. SUMMARY

As reviewed in the chapter, project financing is different from other types of loans since its debt is secured by the project assets and cashflows, but not by the assets or credit of the project sponsors. Being involved in project financing, lenders are more exposed to a number of risks, namely: operating, environmental, political/ regulation, market, sponsors, completion, and foreign exchange. From a lender’s perspective, a successful project loan is the one, whose risks are well identified, assessed, effectively managed and distributed among the project’s participants, and built into pricing. Those risks together with causes and their management strategies are summarised in Table 2.1.

<table>
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<th>Table 2.1: SUMMARY OF PROJECT FINANCE RISKS</th>
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<tr>
<td><strong>RISK CATEGORY</strong></td>
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| Operating Risk    | - Project design mistakes  
|                   | - Excessive replacement of spare parts  
|                   | - Low productivity of labour force and strike  
|                   | - Technical failures  
|                   | - Deficiency in management  | - Allocating the risk to constructors and operators by means of penalties, performance bonds, liquidated damages.  
|                   |               | - Obtaining cost guarantee or cost waivers  
|                   |               | - Conducting thorough technical and technological studies, using tested and proven technologies  
|                   |               | - Obtaining strong performance guarantees and technology insurance  
|                   |               | - Having experienced management team and “key-man” insurance  |
| Environmental Risk                  | Conducting thorough forehand studies of environmental issues  
|                                   | Employing rehabilitation guarantees to gain supports of local people and council.  
|                                   | Dealing with all level of the host government department sensitively and effectively  
|                                   | Using clean and advanced technologies  
|------------------------------------|---------------------------------------------------------------------------------  
| Political / Regulation Risk        | Purchasing political risk insurance  
|                                   | Teaming with multilateral agencies  
|                                   | Obtaining assurance and consent agreements from the host government.  
|                                   | Having joint venture or involvement of local partners as equity investors or contractors  
|                                   | Setting up offshore proceeds accounts for debt service.  
|------------------------------------|---------------------------------------------------------------------------------  
| Market Risk                        | Conducting detailed market forecast  
|                                   | Obtaining long-term take or pay commitments  
|                                   | Obtaining the sponsors' guarantees to assume the risk in severe circumstances (eg. collapse of international markets, force majeure, and political risk)   
|------------------------------------|---------------------------------------------------------------------------------
<table>
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<th>Sponsors Risk</th>
<th>Completion Risk</th>
<th>Foreign Exchange Risk</th>
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</table>
| • Weak credit character and willingness of the sponsors  
• Internal conflicts among the sponsors and participants  
• Technical and financial weakness of the project’s sponsors and participants | • Thoroughly investigating the sponsors’ credit character and financial condition.  
• Conducting a detailed study into internal agreements relating to the administration and operation of the project.  
• Obtaining financial contingent financial support and financial ratio agreement from the project’s sponsors. | • Conducting detailed engineering studies  
• Using proven and tested technologies  
• Obtaining completion guarantees and standby facilities  
• Purchasing force majeure risk insurance  
• Putting aside sufficient funds needed for the project to continue in the case of force majeure |
| • Geographic problems  
• Shortfalls of raw materials  
• Defaults of construction contractors  
• Technical defects  
• Increases in labour cost and prices of equipment  
• Force majeure (earthquake, flood, cyclone, hurricanes, explosion, strike, civil war, revolution, insurrection, terrorism, embargo, blockage, etc) | | • Devaluation of local currency  
• Depreciation of local currency  
• Unexpected foreign exchange rate fluctuations | • Using derivative instruments (e.g., swaps, options, futures, forwards)  
• Obtaining credit enhancement from the sponsors  
• Setting up offshore project accounts to serve its financial obligations  
• Using natural hedge by funding in local currency |
Literature Review

3.1. INTRODUCTION

This chapter reviews the literature considered relevant to a better understanding of the project finance risk pricing decision. Since a general background of project finance risks has been provided in Chapter Two, this chapter focuses specifically on reviewing literature relating to the project finance risk pricing model (Figure 1.1). The chapter first looks at lending theory relating to project finance to set out the general state of knowledge on the relationship between loan risks and risk premiums. This is followed by a detailed assessment of the various studies relating to the model, namely:

- Literature relating to the five risk factors presented in the model (i.e. operating, environmental, political, market, and sponsors risks) and their interactions.
- Literature relating to the four non-risk pricing factors presented in the model (i.e. experience in project financing, expertise in a particular market, financial capacity, and competitive pressures).
- Literature relating to the risk pricing process including studies into self-insight of the human decision making process.

The chapter is concluded by a summary, setting out the basic theoretical framework for the study and highlighting the basic deficiencies in the literature that need to be addressed.

3.2. LENDING THEORY RELATING TO PROJECT FINANCE

The project finance risk pricing model (Figure 1.1) posits that the project finance risk pricing decision is mainly influenced by risk factors. Hence, a general understanding of the relation between risks and risk premiums is thought to be useful. The relation
between loan rate premiums and borrower risks has been addressed in the lending literature (Aguais, 1998; Bates, 1998; Flannery, 1985; Ferrari, 1992; Machauer and Weber, 1998; and Valentine, 1998). Generally, loans are priced according to the borrower risk. However, being able to correctly determine the magnitude of risks in order to charge an appropriate risk premium still remains challenging for lenders. Asking too high a premium can force lenders to be uncompetitive while charging too little will inadequately cover the bank for the risks involved. The literature review will examine both the interactive relationship between risks and risk premiums, and the challenges in assessing them.

Evidence that loan rate premiums is charged in accordance to borrower risks is found in Bates’s (1998) work. Bates suggests that different rates of premium should be applied to different risk-profile customers determined by the probability of their default. Lower risk premiums in the form of lower interest rates should be set for lower-risk customers, while high risk premiums would be set for higher-risk customers. Previously in 1985, Flannery suggested that a profitable loan contract rate must compensate the bank for two distinct types of costs, namely the “pure rate of interest” covering the time value of the funds advanced and the premium applied to compensate for the possibility of the default. However, according to Flannery, setting this premium appropriately requires a sophisticated assessment of the borrower’s financial future.

Ferrari (1992, p.56) indicates that risk is an important lending issue that cannot be ignored in a profitability model.

A basic fact of commercial lending is that some loans will not be repaid, and this default risk represents a basic cost of doing business for a bank... General pricing and investment theory recognises the correlation between risk and return, and this principle has traditionally served as the basis for pricing loans according to their risks. Higher rates are generally charged for loans perceived to have greater risks. Consequently, if a profitability analysis does not take risk into account, riskier loans would usually appear more profitable and desirable.
Ferrari goes on to state that failure to properly consider risk in the pricing process could result in banks undercharging for risky loans, which, in turn, will have substantial impacts on their performance. This view is supported by Valentine (1998, p.10) who is of the opinion that the Australian banks’ poor performance in the eighties was mainly due to their unwillingness to charge interest rates commensurate with the risks involved in a loan. “To some extent this reflected the general underestimation of the risk at the time, but also arose out of an unwillingness on the part of Australian banks to price according to risk”.

Additional evidence showing that loans are priced in relation to their risk levels is found in Machauer and Weber’s (1998) empirical research on bank behaviour and internal ratings of borrowers. Their analysis was based on data from five leading German banks and credit files of two hundred small and medium-sized firms from the year 1992 to 1996. Using regression analysis, the research focused on identifying factors, which explained (1) the interest rate premium firms had to pay, (2) the amount of collateral relative to the firm’s overall credit line, (3) the credit line relative to their balance-sheet total, and (4) the changes of interest rate premium from one credit analysis of the bank to the next. In relation to the interest rate premium, the results showed that riskier borrowers paid higher loan rate premiums and relied more on bank loans. While the findings from Machauer and Weber’s research provided valuable insight into the relation between loan rate premium and borrower risk, they were limited to German evidence, conventional loans, and small and medium sized firms.

In short, there is both theoretical and empirical support in the lending literature for the premise that risks and risk premiums have a strong and positive correlation. Being able to correctly determine the borrower risk in order to charge an adequate risk premium is a crucial part of lending. However, this relationship has not been tested in a project financing context. Project finance shares common lending principles with conventional lending, but it also has its own characteristics given that risks in project financing are not the usual company risks but the risks of the project itself. A more understanding of how this relationship operates in project finance is therefore essential.
3.3. STUDY INTO RISK PRICING FACTORS AND PROJECT RISK PRICING DECISIONS

This section frames an inquiry into the influence of the five risk pricing factors, namely operating, environmental, political/ regulation, market, and sponsors risks, on the project risk pricing decision. The interactions between these risk factors are also reviewed. Among them, political and market risks have attracted the most attention from the literature.

3.3.1. Political/ Regulation Risk

Research related to political/ regulation risk can be drawn from the project financing and cross border lending literature (Baughn and Mandich, 1983; Buljevich and Park, 1999; McKenchnie, 1990; Nevitt and Fabozzy, 2000; Smith and Walter, 1997; Sapte, 1997; Tinsley, 1999; Ramcharran, 1999; and Park and Zwick, 1985). However, the majority of this work tends to focus on providing general descriptions of political risk and its management strategies.

McKenchnie (1990) states that unfavourable political events, such as revolutionary social disruption, a restriction on the availability of foreign currency, or debt rescheduling, can severely impact the viability of a project and consequently the project’s repayment ability. Other types of actions occurring regularly in even the most highly rated countries, such as an increase in taxes and tariffs, can also jeopardise planned project payment. Buljevich and Park (1999, p.161-163) acknowledge the importance of political risk in project financing by giving lenders the following advice:

Lenders must carefully determine the likelihood of occurrence of foreign exchange controls or restrictions in the host country.... Lenders must evaluate expropriation and nationalisation risk within the general analysis of the political risks associated with a project.... Lenders must analyse the risk of political violence within the general political risks analysis of the host country and, if not satisfied, they must request the project company to reduce and distribute this risk to credit worthy parties using appropriate risk management techniques.
Empirical analysis of the impact of country risk on international bank lending to developing countries conducted by Ramcharran (1999) also provides some insight into political risk importance through its impact on the lending decision. He employed multiple regression analysis with cross section data for the years 1992, 1993, and 1994 on 33 countries located in Eastern Europe, Latin America, Asia, and Africa. The model included three independent variables, namely (1) political risk that influenced lending to less developing countries (LDC), (2) factors indicating LDC willingness to service foreign debt, and (3) LDC access to international capital market. The dependent variable was the amount of loan to those countries. Political risk in this context comprised repudiation and rescheduling, and currency controls on cash flows to parent companies of multinational firms and foreign creditors. The results showed that the independent variable – political risk was the only significant independent variable affecting international bank lending since a significant increase in bank lending was associated with a drop in political risk during that period. Although Ramcharran’s study provides considerable insight into political risk importance, it does not fully satisfy our inquiries. No indications of the influence of political risk importance on the lending risk premium have been found. Also, political risk in the study was limited to transfer risk, other risks such as political violence or expropriation and nationalisation were not considered.

While research into the influence of political risk on the project risk pricing decision has not been found in the academic literature, real case studies written in professional journals of project financing show that it does exist. For instance, evidence of the Asian Financial Crisis and political turmoil causing a wider spread in emerging market project bonds are found in Beale (1999, p. 18) where the author reviews the challenges of project financing in 1998.

Liquidity will return to the project bond and project loan markets in 1999, but these markets will not be as robust as they were early in 1998. Certain investors who were recently drawn to the higher spreads available from emerging market project bonds will not be returning to that asset class any time soon because of losses they have incurred. While emerging market project bonds have performed better than emerging market corporate bonds or sovereign bonds, they have nevertheless declined in value as spreads widened.
More importantly, practical cases written in professional journals of project finance have shown a strong link between political risk and currency fluctuations. This is especially the case in emerging markets. Government interventions such as currency inconvertibility or currency transfer blockage to control foreign exchange fluctuations are often seen in these markets. For instance, reviewing complexities of Latin American law for project financing, Gibbons et al (1999) reported that Latin American central banks generally had substantial discretion to restrict or prohibit the purchase of foreign currency in their jurisdiction. These interventions aimed to achieve exchange rate and other policy objectives.

Strong devaluation of local currency, on the other hand, can lead to economic and political turmoil in the host country where the project is operating, and consequently impact on the global project finance market. A clear illustration can be taken from Illarramendi’s report (cited in Chotrani, 1999, p. 31).

Since October 1997, partly because of Asian currency and debt crisis, commercial sources of financing for Latin America projects in all sectors started to deteriorate considerably...Borrowing costs for Latin America power and other infrastructure projects shot through the roof. Trading spread for Latin America 30-year sovereign bonds climbed to record highs during August and September 1998. Spread for Brazilian sovereign bonds hit a peak at about 1,400 basis points...By the end of October, financial markets began to differentiate between different issuers of Latin America debt. Borrowing costs in Brazil and Venezuela stated to rise again, partly due to their economic structures and substantially due to their domestic political situations. On the other hand, project financing costs in Argentina and Mexico were gradually lower. Then came the Brazilian currency crisis in January, when spread, once again, surged.

3.3.2. Market Risk

As with political risk, few indications of the influence of market risk on the project risk pricing decision are found in the academic literature. Hence, supporting the inquiry into the impact of market risk on the project risk pricing decision, this study examines the
importance of market risk expressed though its potential damage to loan value as well as challenges in assessing it.

The importance of market risk, as Buljevich and Park (1999) state, lies in the fact that it has a strong influence on future expected cash flows of a project and, hence, on the project's capacity to service its financial obligations. Drops in future demand and the sale prices of the output to be produced by a project will lead to a cash flow constraint, potentially causing default in repayment.

Coupled with this potential damage to lenders' loans, challenges in assessing the market risk increase its severity. According to Smith and Walter (1998), predicting supply and demand over the years ahead can always involve difficulties and errors since demand forecast very much depends on various factors such as price and income elasticities, competition, exchange rates, availability of substitutes, government policies, political developments, and environmental concerns. Similarly, McKechnie (1990) suggests that a renegotiation of contract terms might occur due to political and economic pressure in the host country.

3.3.3. Other Risks

While little evidence linking operating, environmental, and sponsors risks to project risk pricing decisions has been found, it is expected that they are taken into account when pricing a project's risks. This expectation is based on the importance of each of these to the project's success.

Operating risk has to be considered since it can hurt the lenders' investment in a project. As Tinsley (1999 and 2000) points out, substantial operating cost overruns deteriorate the financial performance of a project and consequently reduce the free cash flow available to service the project finance loans.
Similarly, factors associated with the sponsors' position such as their financial conditions, experience in project finance, and technical competence, have to be assessed thoroughly. These factors can affect the success of a project and consequently its ability to repay the debt.

Environmental risk has to be taken into account since it can potentially harm a project's cash generation. As Buljevich and Park (1999), and Carter (1999) report in Chapter Two, liabilities for environmental damage can be extensive and ruin the project's profitability.

3.3.4. Assessment

Overall, research into project finance risks tends to be limited to general descriptions and suggested management strategies. While there is some evidence of their importance to the project risk pricing decision, it is quite limited. This is especially the case for inquiries into the influence of risk interactions on the pricing decision. Much of the conventional wisdom set out in the professional project finance journals remains untested by scientific inquiry.

3.4. STUDIES INTO NON-RISK PRICING FACTORS AND PROJECT RISK PRICING DECISIONS

This section examines the impact of four selected non-risk pricing factors (ie. experience in project financing, market expertise, financial capacity, and competitive pressures) on the project risk pricing decision. In so doing, it suggests a more complete explanation of why the risk pricing decision for a project can vary among lenders.

It can be argued that the lender's experience in project financing would lead to better risk awareness, which would allow them to achieve better risk management and require a lower risk premium. Strength in financial capacity is also believed to impact the project risk pricing decision since it allows lenders to more comfortably commit their
financial resources to a project and enables them to obtain necessary skills to thoroughly assess and manage the project risks. Lenders with more market expertise are also expected to offer a lower risk premium as they tend to handle the situation with greater confidence. Likewise, lenders are expected to reduce project risk premiums charged in a more competitive environment. Each of above non-risk pricing factors is posited to affect the project risk pricing decision through their influence on the lender’s risk pricing process. Each factor is discussed below.

3.4.1. Experience in Project Finance

Experience in project finance is expected to influence the risk assessment and pricing process. Smith and Walter (1997) suggest that “as financial institutions develop a better understanding of the risks in particular types of projects, they seem increasingly prepared to accept a larger share of total project risks”. Smith and Walter go on to link the lender’s experience to the increased complexity of this type of lending. “Project financing has emerged as something of an oligopolistic market, in that it is dominated by those few major banks with financial and technical resources and the experience and expertise to evaluate the risks and devise suitable financing packages” (p.81). Likewise, Buljevich and Park (1999, p. 90) state that:

No precise formula or procedure exists to identify, evaluate, distribute and neutralise project risks. The art and the essence of project financing lies in the fact that all risks must be identified, evaluated, and, if necessary, distributed. No other possible solution exists. Since lenders typically do not have full recourse to project sponsors, any risk that has not been identified and properly managed will inevitably end up being a lenders risk. That is why project financing is a risky business, and many times, a dangerous one.

Reviewing the project finance literature has revealed the importance of experience in project finance. However, these indications have not yet been extended to how this experience influences the project risk pricing decision.
3.4.2. Expertise in a Particular Market

Local expertise is another factor expected to influence the risk evaluation and pricing process. According to Worenklein (cited in Davis, 1996, p.13), more expertise in a particular market leads to an increase in lenders’ risk tolerance. He goes on to give an example of recent power projects in Victoria, Australia, which shows that international power companies and lenders require less government support after gaining a better understanding of Australian power projects.

In 1992, equity investors and the lenders in Edison Mission Energy’s Loy Yang B project in Melbourne insisted on the support of the State of Victoria for the undertakings of the State Electricity Commission of Victoria (SECV). But several years later, state support was neither offered nor requested in connection with power plant sales. By then, SECV had been restructured into several power generating companies which became separate credits that could be analysed and investors had a better sense of what the deregulated environment might look like than they did in 1992.

Evidence of local expertise importance is also found in Smith and Walter (1997, p.75) who indicate that local expertise leads to more confidence in evaluating project finance risks in that market. “Lenders might be fairly comfortable evaluating the risks associated with a new production platform in the South China Sea or offshore Nigeria if they have done a number of similar deals in the past”. McKechnie (1990, p. 319) also acknowledges the importance of local expertise by advising lenders to thoroughly study the local economic, political and legal environment. “A project lender must seek to understand the political and legislative environment in which the project operates”.

3.4.3. Financial Capacity

Financial capacity is also thought to impact project lenders’ decisions of involvement in project finance. The importance of financial capacity is that it allows project lenders to commit a large part of their financial resources to capital intensive projects and enables
them to obtain necessary skills to be able to participate in this complicated lending activity. As Smith and Walter (1997, p.80) state:

Relatively few financial institutions seem to have the necessary legal, accounting, tax, and technical skills, either at their head offices or at strategically located regional offices, to become major players. When this constraint is combined with the need for large-scale financing power in various maturities, the capacity of effective syndicate leadership, and close sponsor contact, it is not surprising that the number of major participants is limited.

Research into the impact of the size and organisational structure of a bank (e.g. affiliated and unaffiliated) on its ability to lend conducted by Houston and James (1998) also provides some insight into the role of financial capacity. Houston and James used an affiliate sample consisting of 178 US multi-bank holding companies and an unaffiliated sample consisting of 4778 US unaffiliated banks to compare their lending behaviour. Their results showed that unaffiliated banks were more cash flow constrained – their loan growth was more highly correlated with internal cash flow and more influenced by the bank’s capital position and liquid assets. Affiliated banks, on the other hand, were less constrained in that their loan growth was less sensitive to cash flow, liquidity and their capital ratios.

Though Houston and James’s study supports the premise that bank size impacts upon its lending activity, further specification of the influence of financial capacity on the risk pricing process is required.

3.4.4. Competitive Pressures

According to Nevitt and Fabozzy (2000, p. 43), “any discussion of the risks which a lender may assume would not be complete without discussion of the increasing competition between banks and lending institutions over the past few years”. They go on to explain that:
Private commercial banks have traditionally been a major source of funds for project financings. New banks entering the field of project financing, and anxious to carve out new relationships, have been particularly aggressive in seeking loans. This has been especially true in the case of quasi-governmental banks, which are sometimes willing to accept greater risks than private commercial banks. This competition has led to erosion of pricing, lowering of collateral requirements, extension of maturities, and to lenders assuming greater credit risk.

Obviously, competitive pressures have forced project lenders to accept more exposure in project finance. Davis (1996, p.12) also reports that under competitive pressures, “more necessary than choice, lenders and investors are accepting longer financing terms and bearing more classic project finance risks such as construction risk and market risk”

Similarly, Buljevich and Park (1999) state: “increasing competition has led lenders to reduce risks, lower collateral requirements, extending maturities, and assuming more and more equity risks”.

The reviewed literature is consistent with the premise that the non-risk factors affect the project risk pricing decision. However, no specific studies linking these non-risk pricing factors to the project risk pricing decision have yet been presented in the literature.

3.5. STUDIES INTO THE RISK PRICING PROCESS

As the model suggested, project lenders assess risk factors with considerations of non-risk factors when pricing risk for a project. Based on the assessment, the project risk premium (often expressed as a spread over AS BBSW) will be determined, representing the degree of risk that lenders might be exposed to in a particular project. To gain a better understanding of this judgement process, the study first looks at self-insight of the human decision making process. Then, inquiries into the risk pricing process will be conducted.
3.5.1. Self-Insight of the Human Decision Making Process

Self-insight of the human decision making process is described by Mear and Firth (1987, p. 176) as follows:

An important dimension of human decision making is an individual’s ability to express the relative emphasis he or she places on information cues when generating judgements. This aspect of human judgement is known as self-insight, and it forms a distinct topic in the research literature. Self-insight is critical in judgement situations where a considerable degree of professional expertise is communicated verbally or “on the job” [Joyce, 1976]. Unless self-insight is adequate, a judge will communicate a distorted representation of his or her judgment model. Similarly, an absence of self-insight makes it difficult to correctly specify the information requirements of a particular judgement task.

Due to its importance, various investigations into self-insight within the business context have been conducted over the years. This includes earlier work by Ashton (1974); Joyce (1976); Slovic et al (1972), and Wright (1977), as well as further developments by Mear and Firth (1987), and Laswad and Roush (1996). However, the research results that have emerged are somewhat mixed.

A limited degree of self-insight was found in Ashton (1974), Joyce (1976), and Slovic et al (1972). These studies show that the perceived importance of relatively minor or major cues was frequently over or underestimated. Subsequently, a small number of cues could account for a substantial portion of the explained variance in judgements. For instance, in Slovic et al (1972) study on the use of information on investment decision, the subjective and objective weights made by thirteen stockbrokers did not closely relate to each other. More specifically, among nine factors given (ie. industry, resistant level, support level, volume trend, near-term prospects, profit-margin trend, P/E ration comparison, and E/S yearly trend), the subjective importance attributed to Industry and Volume was consistently overestimated.
Quite the opposite, Mear and Firth (1987), Wright (1977), and Laswad and Roush (1996) found a considerable degree of self-insight in decision-makers. Wright’s empirical research was on “self-insight into the cognitive processing of financial information”. An experiment was formulated where individuals processed financial information and provided estimates of changes in security prices. Subjects were 2nd year MBA students specialising in finance or financial accounting. The ability of subjects to express accurate subjective cue weights was assessed by comparing the subjective weights with objective cue weights based on their judgements. Subjective weights were measured by using the “100 point” method, while objective cue weights were obtained from actual subject judgements to the data given. An encouraging degree of self-insight was reported.

Mear and Firth (1987)’s empirical research on “cue usage and self-insight of financial analysts” was more complicated. The degree of self-insight were examined in three different aspects, namely: “the correlation between the objective and subjective weight themselves”, “the ability of subjective weight models to reproduce actual judgements”, and “the correlation between the predicted outputs of the subjective weight model and the individual’s optimal regression model”. The research subjects were professional security analysts, portfolio managers, and stockbrokers drawn from a wide variety of financial institutions throughout New Zealand. Each subject was given nine company-specific cues and one instrumental industry variable, and was asked to provide risk and return judgments of 30 equity securities. Their risk evaluations were recorded on a scale ranging from a score of one (“riskless”) to a score of nine (“extremely risky”). Subjects were also asked to allocate 100 points across the given cues in proportion to the perceived relative importance of each cue in formulating their judgements.

In relation to subjective and objective weights, the results showed that the subjective weight was distributed more constantly than the objective weights. In addition, similar to the findings obtained from Ashton (1974), Joyce (1976), and Slovic et al (1972), the importance of a number of minor cues was overestimated while that of the major cues was often underestimated. However, “these discrepancies between subjective and
objective weights did not significantly affect the subjects’ ability to reproduce actual judgment evaluations and to predict the outputs of the individuals’ optimal regression policies” (Mear and Firth, 1987, p.182). They, therefore, concluded that the subjects had a high degree of self-insight and “were able to express indications of their relative cue importance”.

In short, as self-insight has been studied mainly in the area of accounting and auditing, little is still known about the degree of self-insight possessed by project lenders when making project risk pricing decisions. The complexity in nature and sole reliance on the project’s future cashflows to meet financial obligations makes project risk pricing process highly important and challenging. As a result, more studies into this area are essential.

3.5.2. Risk Pricing Process

The framing for an inquiry into the risk pricing process conducted by project lenders is informed by Ross and Pike's (1997) empirical research which studies the impact of export credit risks on the trade credit offer. Ross and Pike (1) compared the influence of standard credit risks and export-specific credit risks on the trade credit decision for export sales and (2) investigated whether export credit managers process export credit risk cues configurally when assessing a foreign buyer’s overall creditworthiness. A $2^4$ fully factorial design was used to structure 16 short foreign buyer cases, each contained two standard credit risks (credit character and financial strength) and two export specific risks (country rating and foreign exchange risk). These cases were then judged by 88 practising export credit managers participating in the experiment.

The results show that while both export-specific and standard credit risks were important to the export credit decision, more attention had been paid to the standard risks of credit character and financial strength. In particular, financial strength was the most important factor, followed by credit character, country rating, and foreign exchange risk, respectively. The results also showed that “differing levels of export-specific credit
risks led managers to view the standard credit risks of foreign buyers differently” (p. 64), indicating that “export credit managers processed export credit cues configurally when assessing a foreign buyer’s overall creditworthiness”. More significantly, it was shown that while main effects accounted for more variation in the credit decision, configural cue processing was a substantial aspect of the decision. For instance, “a foreign buyer’s country rating affected the export credit manager’s perception of the foreign buyer’s financial strength”. Likewise, “the foreign buyer’s country rating served to classify the buyer into “better” and “worse” categories before the manager looked at the buyer’s credit character and financial strength” (p. 65). These findings of two-way and three-way interactions, according to Ross and Pike, exhibited “a substantial complexity in the export credit decision-making process” (p. 65).

While Ross and Pike’s findings were significant in providing a more understanding of the export credit decision, they were limited to the short-term export credit decision. Consequently, various questions related to the project finance risk pricing decision remain unanswered. It is still unknown whether project lenders would conduct a similar procedure when making the project risk pricing decision, whether the impact of project finance risks on the risk pricing decision would vary among the five risks, and whether risk interactions would influence the project risk pricing decision. More specific inquiries into the risk pricing decision should therefore be undertaken.

3.6. CONCLUSION

The project financing risk pricing model enjoys general support in the lending literature, which links the level of risk to the loan risk premium. Still, research to date has only viewed this relationship in the context of the conventional borrower risk assessment. No work has yet extended this relationship to the crucial project financing risk pricing decision. Likewise, while there is a growing literature addressing the role of specific individual project finance risks, no studies have yet extended to measure the relative importance of these various risks in project financing. Additionally, studies which
support the inclusion of non-risk factors in the risk pricing model have not yet been extended to show the relative influence of these non-risk factors on the project risk pricing decision.

Given this state of uncertainty, new work is required to support the basic components of the project finance risk pricing model. Key questions remaining to be tested include:

1. Which risks are most important in the project risk pricing decision?
2. Do risk interactions affect the project risk pricing decision? and
3. What role does the degree of self-insight play in the project risk pricing decision process?

Answers to these questions will take us further along the road to better understand the risk premium decision for the increasingly important project financing instrument.
4 Research Methodology

4.1 INTRODUCTION

The purpose of this chapter is to detail the research hypothesis and questions emanating from the research objectives posed in Chapter One and rooted in the literature discussed in Chapter Three as well as the means by which these research hypotheses and questions will be satisfied. The chapter first presents the research hypothesis and questions used to guide the inquiry by examining the project financing risk-pricing decision in terms of:

1. The influence of each of the five risk pricing factors on the project risk pricing decision;
2. The influence of risk interactions on the project risk pricing decision; and
3. The degree of self-insight into the project risk pricing decision.

Then, the research method is presented, including descriptions and applications of experimentation, factorial designs, fractional techniques, and within-subjects designs. This is followed by a review of the previous empirical studies using the same experimental designs and Analysis of Variance (ANOVA). Details of variable definition and measurement as well as discussions of the survey design and analysis are also reviewed in this section. Finally, the chapter concludes with the research implementation strategy.

4.2 RESEARCH HYPOTHESIS AND QUESTIONS

4.2.1 Risk Pricing Factors and Project Risk Pricing Decisions

Inquiry into the impact of the five risk pricing factors (i.e. operating, environmental, political/ regulation, market, and sponsors) on project risk pricing decisions is based on
the works referenced in Chapter Two and Section 3.4. For instance, Beale (1999) reported that the Asian financial and political turmoil caused a wider spread in emerging market project bonds. Similarly, Illarramendi (cited in Chotrani, 1999) stated that the Brazilian currency crisis occurring in January 1999 substantially increased borrowing costs for Latin America power and other infrastructure projects.

While the foregoing discussion provides a basic expectation that an increase in the level of project financing risks will increase the project risk premium charged, little can be said about how each of these individual risks impacts the project risk pricing decision. To address this problem, the following research question will be used:

**RQ1:** Which project financing risks are the most important in the project risk pricing decision?

### 4.2.2. Risk Interactions and Project Risk Pricing Decisions

Grounds for an investigation into risk interactions are drawn from the academic and professional literature referenced in Chapter Two and Chapter Three. It is expected that the interactions between these risks do exist and therefore might influence the project risk pricing decision. For instance, Carter (1999) suggested that environmental risk could affect a project’s revenue stream by causing various delays in its operation. Likewise, Buljevich and Park (1999, p. 163) stated that political violence could prevent “either temporarily or permanently the operation of a project and therefore may adversely affect its cash flow generation”.

Smith and Walter (1997) also advised that government interventions or regulations might sometimes have a substantial impact on the sale prices of a project’s outputs. This suggestion was supported by Pugsley's (1999) example of the US electricity market, where government deregulation had turned it into a higher risk sector.
Ross and Pike's (1997) empirical study on export credit risks and the trade credit offer made by Canadian export credit managers also showed that export credit managers processed export credit risk cues configurally when assessing a foreign buyer's overall creditworthiness. While this study was limited to the short-term credit decision, it is expected that project lenders are likely to process information in the same way. Based on this reasoning, it is hypothesised that:

- **H1.** Project lenders process project financing risks configurally when making the risk pricing decision.

### 4.2.3. Self-Insight and Project Risk Pricing Decisions

An investigation into the degree of self-insight possessed by project lenders is based on various empirical studies referenced in Section 3.6.1 (e.g. Ashton, 1974; Mear and Firth, 1987; Laswad and Roush, 1996; Joyce, 1976; Slovic et al, 1972; and Wright, 1977).

These studies showed that the subjects generally understood his/her own judgement process. However, the perceived importance of relative minor (major) cues was frequently over or under estimated by the decision-makers. A low degree of self-insight was found in Ashton (1974), Joyce (1976) and Slovic et al (1972), while a considerable degree was found in Mear and Firth (1987) Laswad and Roush (1996), and Wright (1977).

May this inconsistency be due to the fact that the degree of self-insight changes accordingly to the task given in each study? If this is the case, what is the degree of self-insight that project lenders have when judging project risks to make risk pricing decisions? Since the previous studies have not yet addressed the project financing decision, the following research question will be asked:

- **RQ2.** What is the average degree of self-insight experienced by project lenders when making the risk pricing decision?
4.3. RESEARCH METHOD

4.3.1. Overview of the Research Experiment

To answer research questions one and two and to test the research hypothesis, a factorial design was chosen since it allows the independent variables (i.e. the five project financing risks) to be simultaneously manipulated at various levels. The problem of having a large number of runs (32) created by the factorial design was managed by employing the additional techniques of a one-half fractional and a lower level (2) of testing the independent variables. A within-subjects design was also used to reduce the number of respondents required.

The decision to use a ½ repeated fractional factorial design with two levels of testing as the principal technique is supported by both the literature and previous empirical studies. Keppel et al (1992, p. 482) states that:

There are several solutions to this problem. One that we often see is the selection of a “minimal” factorial design, each variable being presented by only two levels — a $2^v$ design, where $v$ equals the number of independent variables… A second solution is the use of confounded factorial design…. Third, we could use a repeated-measures design, in which if each subject served in two conditions, for example, the total number of subject might be half those required if independent groups were used.

The technique has also been successfully used by numerous researchers in the area of business research over the years such as Slovic (1969), Slovic et al (1972), Ashton (1974), Chewning and Harrell (1990), Laswad and Roush (1996), and Dezoort (1998).

To gain a fuller understanding of the research experiment, the section proceeds with detailed descriptions and applications of the techniques and the variables used. It begins with the experimental design followed by the factorial design, the fractional factorial design, the within-subjects design, and a review of the use of experimental techniques
and ANOVA in business research. Then, detailed variable definition and measurement is discussed. The section concludes with discussions of the survey design and analysis.

4.3.2. Experimental Design

Experimentation is a research method “characterised by the manipulation of one or more independent variables and the control of all others” (Levin, 1999, p. 5). A major advantage of experimentation over other research techniques is its degree of control over the research situation. According to Cooper and Emory (1995, p. 352), with experimentation “contamination from extraneous variables can be controlled more effectively than with other designs”, helping the researcher to “isolate experimental variables and evaluate their impact over time”. They go on to say: "we said causality could not be proved with certainty, but the probability of one variable being linked to another could be established convincingly. The experiment comes closer than any primary data collection method to accomplish this goal". For this research, experimentation offers a powerful tool to achieve its objectives.

Limitations associated with experimentation have been pointed out by Cooper and Emory (1995). They are artificiality, generalisation from non-probability samples, and ethical issues. Artificiality of this experiment was created by specifying its degree of risk into two levels: a higher and a lower. In reality, project lenders are faced with unique sets of project risk pricing decisions drawn from a universe of potentially infinite levels of risk. Moving toward greater complexity in the factorial experiment in order to reflect the multitude of possible variations of the decision would prove to be unworkable, especially for this research with five risk factors involved. Even so, the two levels of treatments proposed enabled the research objectives to be achieved. This is especially so as the participants processed standard risk level data to make risk pricing decisions - something they do on a daily basis.

Generalisation from non-probability samples was not a major issue in this experiment. Its participants were not randomly chosen from a large population. Rather, most project
lenders working for large banking organisations in Sydney, Australia, were contacted and asked to participate in the study. As a result, using the study's findings to describe the project financing practices of project lenders in Sydney will be valid.

Ethical issues were also managed by the research's nature. The questionnaire was technical, requiring Australian project lenders to use only their project finance knowledge and experience to indicate how they would price risks. Data and information were guaranteed to be confidential with no name associated with any answers. Additionally, Australian project lending officers taking part in this experiment were fully informed and their participation was totally voluntary.

In short, choosing experimentation as a principal research technique certainly brings more power to address the thesis research hypothesis and questions. As Levin (1999, p. 4) recommend experimentation as “the best method for identifying specific factors as the causes of a particular behaviour”.

4.3.3. Factorial Design

Factorial design is an experimental design that “allows for the simultaneous manipulation of two or more independent variables at various levels” (Zikmund, 1997, p.318). The two most important advantages of the factorial design are (1) its ability to provide simultaneous manipulation of independent variables, and (2) its ability to evaluate interactions between independent variables. As Keppel et al (1992, p. 229) describe:

The essence of the factorial design is the joint manipulation of two or more independent variables. Two advantages result from this feature of factorial designs. The first is a relative richness in the experimental setting compared with the environment in which single-factor studies are normally observed... Furthermore, the factorial design permits a researcher to disentangle independent variables that are intertwined in the natural environment, and to establish the causal links between each of the variables and behaviour.
With these advantages, factorial experimental design appears to be the most appropriate and powerful tool for this research in seeking to uncover the relationships between project finance risk pricing factors and project risk pricing decisions. By using the factorial experiment, the five risk factors were simultaneously manipulated at various levels. As such, their main effects on the risk pricing decision was determined by observing different decisions attributed to each of these project finance risks considered separately. Their interaction effects were also measured to determine whether risk interactions are considered by project lenders when making project risk pricing decisions.

4.3.4. Fractional Factorial Design

Fractional factorial design includes only a fraction of full treatment combinations. There are two key points contributing to the use of the fractional factorial design. Firstly, it is employed to reduce the size of experiments by leaving out a large proportion of higher-level interactions. While the technique does not provide researchers with all combinations of factors as the full factorial design does, it gives researchers the ability to manage the size of experiments. Secondly, if the researcher specifically focuses on examining main effects and lower-level interactions, then the fractional factorial design is highly recommended. It saves the researchers costs in time, resources, and budget. Frigon and Mathews (1997, p. 163) state:

As the number of treatments to be evaluated in a full factorial experiment grows large, the costs in time, resources, and budget grow. The number of runs required to complete a full factorial quickly outgrows the resources of most experiments. As an example, completing a $2^3$ full factorial experiment requires 8 runs; completing an $2^8$ experiment requires 256 runs. The runs required to execute these full factorial experiments contain higher order interactions as well as main effects. The number of runs required to evaluate these interactions is a significant portion of the full factorial experiment. Where these higher order interactions are not clearly of concern, as is true in most experimental cases, information on main effects only or main effects and lower order interactions can be obtained from fractional factorial experiments with great savings in resources.
In this research, a one-half fractional factorial design \((2^{5-1})\) was chosen due to two reasons. Firstly, it helped to reduce the number of experiment runs to a manageable level (from 32 to 16 runs), while satisfying this thesis’s objectives of examining the impact of main effects and two-level interaction effects on the project risk pricing decision. Secondly, by keeping the number of runs at a reasonable level, it minimised carry-over effects and saved costs associated with the experiment.

4.3.5. Within-Subjects Design

Within-subjects design is an experiment in which “repeated measurements are taken and treatment effects are associated with differences observed with subjects” (Keppel, 1982, p. 365). The most advantage offered the within-subject design is its ability to control for all subject differences.

There is no need to be concerned that differences between conditions, for example, in age and gender of the subjects, will have effects that are confused or confounded with the effects of the independent variables. Because every subject serves in every condition of the experiment, and all subject variables are guaranteed to be equally distributed over all levels of the independent variable. In other words, subjects in a within-subject design serve as their own controls (Levin, p. 10).

Two main weaknesses associated with this design are “general practise effects” and “differential carry-over effects”. The first is referred by Keppel et al (1992) as changes in performance occurring when subjects progress through the entire experiment, while the second is the influence of residual effects from previous conditions on the responses of subjects to the currently administered treatments. Keppel et al, however, go on to say that these weaknesses can be reduced by “introducing a rest of sufficient length between successive tasks or by using highly motivating instructions and incentives” (p. 371). Additionally, they suggest that distortions caused by these deficiencies are not always a major concern since:

We can effectively disregard these effects when we have reason to believe that performance has effectively reached an asymptote so that additional practice on the task does not produce any further improvement. For instance, if we study sensory function or performance on motor tasks, which are highly learned, we ordinarily assume that general practice effect is not present.
In this study, the two deficiencies described above were effectively reduced due to three reasons. Firstly, the contents of this experiment strongly related to the participants’ areas of interest and expertise. Secondly, the experiment duration was relatively reasonable (about 20 minutes). Thirdly, the task of evaluating risk premiums for projects was a routine and highly learned function for Australian project lenders.

The advantages offered by within-subject design provided this study with more accurate results since the impact of unconsidered systematic differences among the project lenders was controlled. They also increased economy of this study. For instance, using a between-subject design, this research experiment would have required 16 different groups of individuals to complete the 16 different cases. Supposing a minimum of 5 individuals per group, a total of 90 individuals would have been needed. However, as the same number of individuals could take part in all conditions of the study by employing the within-subjects design, fewer participants were required (ie. 25 in this experiment).

4.3.6. Applications of ANOVA and Experimental Design

In this research experiment, ANOVA was employed as a principal statistical technique measuring the influence of the five project financing risks on the project risk pricing decision both singly (main effects) and jointly (interaction effects). Its applications described by Frigon and Mathews (1997, p. 93) are as follows:

ANOVA is an effective analysis tool that allows for the simultaneous comparison of populations to determine if they are identical or if they are significantly different. ANOVA is an important resource for the evaluation of existing data and as a tool to be used in conjunction with a Design Experiment. ANOVA tells us if the variance we see in our data is significant and measures that significance by gauging the variance of different treatments and treatment levels.

Academic literature in the area of accounting, auditing and business finance, such as that presented in Journal of Accounting Research, Accounting, Organizations and Society,
Journal of Business, and Journal of Accounting and Finance shows that the repeated fractional factorial technique and ANOVA have been widely employed by business researchers. It is especially the case for studies focusing on a decision making aspect of business.

In 1969, Slovic’s empirical research on stockbrokers’ decision process (cited in Libby and Lewis, 1977) employed $2^{11-4}$ fractional factorial design and ANOVA. As such, a set of 128 hypothetical cases represented by eleven financial factors normally available in Standard and Poor’s reference reports were given to subjects participating in the test. Each case was evaluated on a nine-point “recommendation to buy” scale. The number of subjects was two stockbrokers.

A substantial replication of the Slovic (1969) experiment was carried out by Slovic, Fleiss, and Bauman (1972) on their study on the use of information in investment decision making. In this study, the number of financial factors was reduced to eight, and 64 hypothetical cases were constructed using a $\frac{1}{4}$ fractional replication of a $2^8$ factorial. ANOVA was also employed to analyse the results. Evaluations were made on a nine-point capital depreciation scale with a time horizon of six to eighteen months. The number of subjects was eighteen including thirteen stock brokers and five MBA students. On the average, the brokers had about 4.5 years of experience and the range was six months to fifteen years.

Ashton (1974) used $2^{6-2}$ repeated fractional factorial design and ANOVA in “an experimental study of internal control judgements” to assess cue usage, decision rule form, subjective cue usage, and decision consistency of auditors’ judgements and decisions associated with internal control. Sixty-three practising auditors from four different firms were selected to participate in the experiment. A great majority of them had two to three years of experience. Thirty-two cases represented by six factors of internal control were given to each subject.
To examine "the effect of information load on decision makers’ cue utilisation levels and decision quality in a financial distress decision task", Chewning and Harrell (1990) used three different levels, namely: low, intermediate, and high information load represented by four, six, and eight cues, respectively. Each cue was manipulated at two levels, described as "top one third" or "bottom one third" of the firm's industry. The four cue distress cases incorporated a $2^4$ full factorial design (16 cases). The six cue cases incorporated a $2^{6-1}$ repeated fractional factorial design (32 cases). The eight cue cases incorporated of $2^{8-3}$ repeated fractional factorial design (32 cases). As such, eighty cases presenting a hypothetical firm were formed and given to each of eighty-four participants who were undergraduate accounting students, graduate accounting students, and practising auditors.

In 1996, Laswad & Roush used repeated factorial design to examine whether an investor is capable of exercising significant influence over an investee. Thirty-two combinations were generated from complete $2^5$ factorial design. Seventy-four (35%) financial controllers of New Zealand listed companies and the largest 100 unlisted public companies participated in the study. The respondents' average age and work experience were 52 years and 20 years, respectively. Five cues were divided into two levels (ie. "Yes" and "No"). Each combination was evaluated on a nine-point scale with one meaning "definitely not an associate" and nine meaning "definitely an associate".

In 1998, the technique was used by Dezoort to study the effect of experience on audit committee members' oversight judgements. Sixteen case judgments produced by a $\frac{1}{2}$ replicate of a $2^5$ fractional factorial design were presented to 87 participants (35%), who are audit committee members from the New York Stock Exchange, American Stock Exchange, and NASDAQ National Market System. Five cues were divided into two levels, namely: "Yes" and "No". The internal control evaluations were recorded on a scale ranging from a score of one ("weak") to a score core of six ("strong"). To analyse the results, ANOVA was employed.
Table 4.1. SUMMARY OF STUDIES USING ANOVA & EXPERIMENTAL DESIGN

<table>
<thead>
<tr>
<th>STUDY</th>
<th>PARTICIPANTS</th>
<th>TASK</th>
<th>MODELLING TECHNIQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slovic (1969)</td>
<td>2 young brokers</td>
<td>Recommendation of stock from 11 pieces of market and accounting data on 9 point scale</td>
<td>$2^{11-4}$ repeated fractional factorial design and ANOVA</td>
</tr>
<tr>
<td>Slovic et al (1972)</td>
<td>13 brokers &amp; 5 MBA students</td>
<td>Estimation of capital appreciation from 8 cues on 9 point scale</td>
<td>$2^{5-2}$ repeated fractional factorial design &amp; ANOVA</td>
</tr>
<tr>
<td>Ashton (1974)</td>
<td>63 auditors</td>
<td>Rating payroll internal control from 6 cues on 6 point scale</td>
<td>$2^{6-1}$ repeated fractional factorial design &amp; ANOVA</td>
</tr>
<tr>
<td>Chewning &amp; Harrell (1990)</td>
<td>67 accounting students, 17 auditors</td>
<td>Making financial distress decision under three levels of information load</td>
<td>$2^6$ full factorial design and $2^{6-1}$ &amp; $2^9$ repeated fractional factorial design</td>
</tr>
<tr>
<td>Laswad &amp; Roush (1996)</td>
<td>74 financial controllers</td>
<td>Processing investment judgements from 5 cues on 9 point scale</td>
<td>$2^9$ full factorial design &amp; ANOVA</td>
</tr>
<tr>
<td>Dezoort (1998)</td>
<td>87 auditors</td>
<td>Make oversight judgement from 5 cues on 6 point scale</td>
<td>$2^{9-1}$ repeated fractional factorial design</td>
</tr>
</tbody>
</table>

*The table design and information to 1974 originates from Libby and Lewis (1977, p. 252)*

In short, reviewing previous studies in the area of business research shows that the repeated fractional factorial design is a choice, especially for those studies containing numerous factors. The distinctive advantage of this technique is that it not only allows researchers to simultaneously manipulate numerous factors, but also keeps the experiment at a manageable size.

4.3.7. Variable Definition and Measurement

This research experiment contained five independent variables representing the five project finance risks, namely: operating, environmental, political/ regulation, market, and sponsors. These independent variables was simultaneously manipulated at two levels to determine the impact of their main effects and interactions on the project risk pricing decision.
To classify treatment levels for the project risks, this thesis repeated the same technique used by Ross and Pike's (1997) study. The five project risks were given two levels of treatment, namely "higher" meaning more risky than two of the last three project financing deals priced and "lower" meaning less risky than two of the last three project financing deals priced. This method aimed to capture points on the risk range that were less extreme and simultaneously offered project lenders participating in the experiment more ground for judgment.

To measure the quality rating given to each case by project lending officers participating in the experiment, a common evaluation method used in previous business studies (eg. Slovic, 1969; Slovic et al, 1972; Laswad and Roush, 1996; and Ross and Pike, 1997) was chosen. Each case was evaluated on a nine-point scale ranging from a score of one ("low risk") to a score of nine ("high risk"). In addition, participants were asked to indicate their view of the appropriate required yield for each case presented by basis points over A$ BBSW in order to indicate its risk premium amount. This was done in order to satisfy research question one and hypothesis one.

At the end of the experimental manipulations of the project financing risks, participants were asked to allocate 100 points across the five project financing risks in proportion to the perceived relative importance of each risk in formulating their decisions. By doing this, the importance of each of the five project financing risks perceived by the project lenders (subjective weights) would be calculated. These subjective weights were then compared with the objective weights representing actual judgements made by the project lenders to generally gauge the degree of self-insight into the project risk pricing decision possessed by the project lenders. This was done in order to satisfy research question two.

4.3.8. Discussions of the Survey Design and Analysis

The Design of Experiment (DOE) program from the statistical software package MINITAB was used to structure sixteen hypothetical risk-pricing cases. These cases
were designed by using the one-half fractional factorial design. As such, main effects were confounded with four-level interactions and two-level interactions were confounded with three-level interactions (see Table 4.2). This would be a problem for a study setting out to analyse all levels of interactions. However, it was not an issue in this study since it focused solely on main effects and the generally more powerful two-level interactions. The use of the one-half fractional factorial design resolution V, therefore fully satisfied the requirements of this study. The orders of the five project financing risks was randomised to avoid bias.

### Table 4.2. STRUCTURE DESIGN OF THE EXPERIMENT

<table>
<thead>
<tr>
<th>Factors: 5</th>
<th>Base Design: 5,16</th>
<th>Resolution: V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runs: 16</td>
<td>Replicates: 1</td>
<td>Fraction: 1/2</td>
</tr>
<tr>
<td>Blocks: none</td>
<td>Centre points: 0</td>
<td></td>
</tr>
<tr>
<td>Design Generators: E = ABCD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alias Structure:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I + ABCDE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A + BCDE</td>
<td>AB + CDE</td>
<td></td>
</tr>
<tr>
<td>B + ACDE</td>
<td>AC + BDE</td>
<td></td>
</tr>
<tr>
<td>C + ABDE</td>
<td>AD + BCE</td>
<td></td>
</tr>
<tr>
<td>D + ABCE</td>
<td>AE + BCD</td>
<td></td>
</tr>
<tr>
<td>E + ABCD</td>
<td>BC + ADE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BD + ACE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BE + ACD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CD + ABE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CE + ABD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DE + ABC</td>
<td></td>
</tr>
</tbody>
</table>

A = Environmental Risk, B = Market Risk, C = Operating Risk, D = Sponsors Risk, E = Political / Regulation Risk

Based on the design, each case was a combination of the five project financing risks. The level of risk in each case changed between -1 and +1 (-1 presenting "lower risk" and +1 meaning "higher risk"). “Lower risk” meant less risky than two of the last three project financing deals priced by the participants, while “higher risk” meant riskier than two of the last three project financing deals. The project risks would then be presented to the subjects participating in this experiment in the case format shown in Table 4.3. Presentation of the cases was made randomly to avoid presentation bias.
Table 4.3: EXHIBITION OF A HYPOTHETICAL PROJECT FINANCE RISK PRICING CASE

<table>
<thead>
<tr>
<th>ORDER</th>
<th>PROJECT FINANCE RISKS</th>
<th>RISK LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental Risk</td>
<td>Lower</td>
</tr>
<tr>
<td>2</td>
<td>Market Risk</td>
<td>Higher</td>
</tr>
<tr>
<td>3</td>
<td>Operating Risk</td>
<td>Higher</td>
</tr>
<tr>
<td>4</td>
<td>Sponsor Risk</td>
<td>Higher</td>
</tr>
<tr>
<td>5</td>
<td>Political/ Regulation Risk</td>
<td>Higher</td>
</tr>
</tbody>
</table>

Rating: (low risk) 1 2 3 4 5 6 7 8 9 (high risk)

Premium: $ A BBSW + basis points (bps)

A General Linear Model (GLM) - ANOVA from the MINITAB statistical software package was used to analyse the collected data. Various calculations were conducted to test the research hypothesis (H1) and to answer the research questions (RQ1 & RQ2). This section sets out to discuss these calculations in order to provide a better understanding of the results presented in Chapter Five.

- **Selecting the Alpha Level** ($\alpha$):
  For the level of significance, this research experiment selected $\alpha = .05$. This means the researcher was willing to take only a 5% chance of committing a Type I error.

- **Calculating the Omega Squared** ($\omega^2$)
  $\omega^2$, according to Hays (1973, p. 514), is an estimate of the "strength of association" measuring the proportion of variance in the dependent variable that is associated with levels of an independent variable. Hays goes on to indicate that:

  Estimates of strength of association are aids to the experimenter in trying to figure out what went on in the experiment and the meaning of the results. The F test per se is capable of indicating merely that something systematic seems to have happened. Only a careful examination of the data can make the meaning of the experiment clear and that is why estimation of association-strength forms an important and informative part of any experimental analysis.
It should be noted that the strength of association (or attribution) can also be measured by eta squared - $\eta^2$ (see Ross and Pike, 1997). However, this research chose $\omega^2$ - the technique introduced in Hays (1973) and repeated in Ashton (1974) and Laswad and Roush (1996). Ashton (1974) used $\omega^2$ to estimate the proportion of variance in judgement that was accounted for by specific main effects and interactions. Laswad and Roush (1996) used $\omega^2$ to measure the relative importance of the five within-subject factors on the judgement process. In this research, $\omega^2$ was used to estimate the proportion of variance in the risk pricing decision, which is represented by "risk level" and "risk margin", attributable to each of risk main effects and interactions found to be significant. The formula to compute $\omega^2$ for factor $X$ introduced in Hays (1973) is as follows:

$$\omega^2 = \frac{SSx - [d.f. (x) * MSE]}{SSx + MSE}$$

- $d.f. (x) =$ the degrees of freedom for factor $x$
- $MSE =$ the mean square error
- $SSx$ & $SSx =$ the sum of squares for factor $x$ and total, respectively

4.4. RESEARCH IMPLEMENTATION STRATEGY

This section sets out the implementation of the study design through its application to the substantive elements and relations in the project risk pricing decision. To do so, the section sets out in 4.4.1 the study population and sample selection, details in 4.4.2 the pilot study, and describes in 4.4.3 the delivery of the research instrumentation delivery.

4.4.1. Study Population and Sample Selection

This study population was project lenders working for commercial banks, consulting firms, and superannuation funds in Sydney, Australia. These organisations are actively involved in project finance and advisory work. The participants were asked to work independently. They were also assured that they were not being evaluated by their employing firms. Confidentiality and anonymity of the responses were maintained by
having the completed questionnaires returned in unmarked envelopes. No names of the participants or their organisations were shown on the survey questionnaire or envelopes. The experiment considered each participant as an independent individual without taking factors associated with their firms into account. All the responses were then combined to provide the final results.

Limiting the study population to project finance lending officers aimed to ensure that the results truthfully reflected the thinking of project lending officers and hence applications of the research’s findings to the area of project finance would be valid. Project finance shares common lending principles with conventional lending, but also has its own characteristics as risks in project financing are not the usual company risks but the risks of the project itself. Given this unique nature of project financing, its risk pricing process becomes much more complicated than that in the conventional lending decision. As such, limiting the study population solely to project finance lenders would provide more relevant results.

Choosing an Australian based study was mainly due to the fact that little research into the area of project finance has been done in Australia despite the rapid growth of its project financing loan market. In addition, the choice of Australian project lenders based in Sydney would be convenient for the researcher who is based in Sydney and thus most familiar with the Australian banking and finance system.

4.4.2. Pilot Study

A pilot study was conducted to test the research instrument. This pilot survey instrument was undertaken through series of individual, one to two hour interviews with project lending officers working in three different organisations in Sydney. Piloting of the research instrumentation by mail was not done as personal delivery of instrument allowed the researcher to observe the respondent’s behaviour and to clarify confusing aspects of the instrumentation. During the pilot, the project lenders were asked to “think aloud” as they worked through the research instrument. This provided three benefits.
Firstly, the process of sitting down with the project lenders as they worked through the instrumentation allowed the researcher to identify areas of confusion and ambiguity in the instrument. For instance, the risk levels in this experiment have been changed from "better" and "worse" to "lower" and "higher" (respectively) since it was suggested by two respondents that the latter provided a clearer indication.

Secondly, the pilot study assisted the researcher in structuring more relevant risk pricing cases. For instance, foreign exchange risk has been put aside after learning that project lenders working in Australia are mainly involved in domestic projects. Overseas projects are usually evaluated by their overseas representatives.

Thirdly, the piloting process allowed the researcher to gauge the amount of time that would be required for respondents to actually participate in this risk pricing experiment. The time recorded was about 20 minutes.

4.4.3. Research Instrumentation Delivery

It is a one-stage survey. Based on a list of international project financiers and information available (i.e. company websites and industry journals), names and contact phone numbers of organisations involved in project finance were gathered. A short fax was then sent to these organisations (see appendix one). It contained a brief introduction of the researcher's position, descriptions of the research experiment, and a note letting these organisations know that they would be contacted shortly. Two days later, various phone calls were made to these organisations to ask for their participation in the experiment. If they voluntarily agreed, short meetings would then be arranged to deliver the survey questionnaire. Alternatively, a package of the survey questionnaire (see appendix two) would be posted to them if they preferred this method. The survey package included:

1. A cover letter summarising the survey’s purpose, acknowledging the participants’ contributions, ensuring the confidentiality of their replies, and an offer to send the survey results to participants who were interested.
2. The survey's content containing sixteen hypothetical cases and two additional questions.

3. A plain language statement for participants outlined by the Human Research Ethics Committee at the University of Western Sydney (UWS), including the committee's postal address and contact phone number. If the participants had any complaints concerning the manner in which the research study was conducted, they would be able to contact and inform the committee.

For the return of completed questionnaires, each participant was given a return postage paid envelope with the researcher's university address, aiming to reduce unnecessary inconvenience that they have to take and to ensure the confidentiality of their answers. After two weeks, a follow-up letter (see appendix three) was sent to all participants with a friendly reminder to those from whom completed questionnaire has not yet been received.

Despite the substantial amount of funds used in project finance, it is a small community with only large Australian banks, consulting firms, and Australian arms of multinational investment banks being able to participate in this complicated lending activity. As a result, this method of phoning and meeting with participants was chosen to achieve a high level of participation. Of the sixteen banking and consulting organisations contacted, fourteen voluntarily agreed to take part in the experiment. While the majority were happy to meet with the researcher and to have the questionnaire delivered in person, some preferred to have it posted. Of the fifty-four questionnaires mailed and personally delivered, twenty-five (47%) were completed and returned. This return rate was relatively high in comparison to that of other research studies, such as Laswad & Roush (1996) or Dezoort (1998). This high response rate was, perhaps, due to the survey method. The researcher, instead of sending the experiment package out randomly, chose to contact every single banking organisation known to be involved in project finance.
Results

5.1. INTRODUCTION

This chapter sets out the findings of the research experiment. It starts with an overview of the experiment. Then, the findings related to the relative importance of each of the five project-financing risks on the project risk pricing decision will be discussed. It is followed by the results associated with risk interactions. Finally, the chapter presents the data related to the degree of self-insight possessed by project lenders when making the risk pricing decision.

5.2. OVERVIEW OF THE EXPERIMENT

5.2.1. Participants

The participants' responses to a debriefing questionnaire indicated substantial variation in their age, years of experience, and expertise. Of the 25 participants, 3 were female.

- **Age:**
  Of the 24 responses to this question, ages ranged from 28 to 51 years with the average of 37.64 years.

![Chart 5.1: AGE OF PARTICIPANTS](image)
Years of Experience in Project Finance:
The result was derived from the question asking the participants to indicate their years of experience in project finance. Of the 25 responses, years of experience in project finance varied from 2 to 21 years with the average of 8.32 years. This indicates that most of the project lenders participating in this experiment were highly experienced and knowledgeable in the field. A high level of validity and consistency was therefore expected to be obtained from their responses.

Chart 5.2: YEARS OF EXPERIENCE

Expertise:
Based on the first reference indicated by the participants, their project finance activities were mainly in four sectors, namely oil and gas, mining, infrastructure (eg. toll roads, hospitals, airports, rail lines), and power/telecommunication.

Chart 5.3: PARTICIPANTS DIVIDED BY SECTORS
5.2.2. Validity of Experiment

To determine the validity of this research instrument, two additional questions were included in the experiment measuring (1) the degree of confidence possessed by the participants when making the risk pricing decision and (2) the degree of variation in the decision should more information be provided.

- **Degree of Confidence**
  To measure the degree of confidence in making the risk pricing decision, the participants were asked to indicate the extent to which they felt confident that they had made the right decision in the cases presented. They indicated this by circling any number from the 1 to 9 scale given with 1 = "not confident" and 9 = "very confident".

<table>
<thead>
<tr>
<th>(Not confident) 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9 (Very confident)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Confidence</td>
<td>Moderate Confidence</td>
<td>Considerable Confidence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The result was quite positive with mean = 5.88 and s.d = 1.65, demonstrating that the participants, in general, were confident that the decisions they made were the right ones. Of the 24 responses to this question, 8% specified little confidence when making the risk pricing decision by choosing grade 3, 50% indicated moderate confidence by choosing a grade 4-6, and 42% were very confident, selecting 7 and 8.

**Chart 5.4: DEGREE OF CONFIDENCE IN MAKING THE RISK PRICING DECISION**
This results suggests that the participants (ie. project lending officers) considered the experimental data presented to them to be sufficient to make confident decisions - a necessary condition for the experiment to be a valid representation of the risk pricing decision.

**Degree of Variation**

To measure the degree of variation, the participants were asked to indicate whether their decisions would be different if additional information had been provided by choosing any number from the 1 to 9 scale with 1 = "not different" and 9 = "very different". The participants were also asked to specify the information needed to make the decision differently.

1. Please indicate the extent to which your answer would be different if you had more information

<table>
<thead>
<tr>
<th>(Not different) 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9 (Very different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Difference</td>
<td>Moderate Difference</td>
<td>Considerable Difference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Please specify the information you might need to make the decision differently

Overall, the participants indicated that they were likely to change their decisions if more information was provided, (mean = 6.58, s.d = 1.77). Of 24 responses to this question, 4% indicated a little change in their risk pricing decisions. 42% chose a grade of 4-6, specifying a moderate change, and 54% selecting a score between 7 and 9, stating a considerable change should more information be given.

**Chart 5.5: VARIATION IN THE RISK PRICING DECISION WHEN MORE INFORMATION IS PROVIDED**
This result suggests that the information given in the sixteen risk cases was too brief to completely reproduce actual project financing cases usually priced by the participants. Based on their answers to the second part of the question, additional information needed to make the pricing decision differently was specified as follows:

- Market conditions and specific project details such as sectors, sponsors, and timing;
- Political risk insurance, independent sign-offs;
- Competitive pressures and syndication risk;
- Industry, geography, key contacts and core business of sponsors; and
- Nature of the project, financing structure, and credit ratings.

This lack of information is expected to create certain difficulties for the participants when making the risk pricing decision. Their risk judgements to a degree had to rely on various assumptions made in these hypothetical cases. The pricing decision therefore would be systematically more specified and the risk margin given each case would not be exactly identical to that in a real project. Nevertheless, these adverse effects have been minimised due to the following reasons:

Firstly, a wide range of assumptions and explanations were given in the first page of the experiment to assist the participants in understanding these hypothetical risk pricing cases. For instance, a clear description for each risk was given to avoid the possibility of misunderstandings due the use of different terms or definitions in each organisation. Missing information, which would normally be available in actual projects such as locations, sectors, and timing, was overcome by suggesting the participants use the three last project financing deals priced as a benchmark for these hypothetical risk pricing cases. For example, "higher market risk" meant the market risk in this situation is more risky than that the last two of three project financing deals priced by the participants. Similarly, “lower market risk” meant the market risk in this situation is less risky than that in the last two of three project financing deals priced by the participants. These assumptions were highly essential in helping the participants to capture the situation and price more accurately. As a result, while real project financing cases could not be
replicated and a certain variation in basis points might occur, the risk margin given to
the hypothetical cases still reflected the magnitude of risk observed by the project
lenders in those cases.

Secondly, the participants involved in this experiment were not students or general
lending officers, but project lenders with fairly substantial experience in project finance
(the average of 8.3 years). They therefore are expected to have had little difficulty in
understanding the hypothetical cases as well as in absorbing the necessary and
assumptions needed to make the risk pricing decision for each case.

Thirdly, two measures of experimental validity, together with recollections from the
pilot study and various discussions with the project lending officers, indicated that the
risk pricing cases used in this experiment provided the right kind of information needed
to make the decisions, but probably less than that desired by the participants. However,
moving toward greater complexity in order to overcome the artificiality of the
experiment and to reflect the multitude of possible variations of the decision would
prove to be unfeasible in this study. It would create numerous risk-pricing cases and
subsequently lengthen the experiment's duration, causing various difficulties both in
attracting participants and in obtaining high quality responses from them. Interestingly,
the participants' specifications of the information needed to make the decision
differently show that a fair proportion of this information fits in the second aspect of the
model (ie. non-risk pricing factors) which was not tested in this research study. These
specifications, however, will open a new research direction as further investigations in
those areas be needed.

5.3. INDIVIDUAL RISKS AND PROJECT RISK PRICING DECISIONS

To measure the influence of the five project finance risks (ie. operating, environmental,
political/regulation, market, and sponsors) on the risk pricing decision, General Linear
Model (GLM) - ANOVA from the MINITAB statistical software package was
employed. Various calculations of main effects in relation to "risk level" and "risk
margin" were conducted. In particular, the F and P values and the judgement mean of each of the main effects were computed. Two indications of the relative importance of each individual risk on the project risk pricing decision were also calculated to answer research question one (RQ1). The first indication was the magnitude of effects based upon the degree to which the mean judgement shifted as the levels of a factor varied (Slovic et al, 1972, p. 293). The second indication was $\omega^2$, measuring the attribution of each of main effects to the response variation (Hays, 1973, p. 513). These five values including F, P, judgement means, magnitude of effect, and effect attribution, are presented in Table 5.3.

Table 5.1. **EFFECTS OF INDIVIDUAL RISKS ON PROJECT RISK PRICING DECISIONS**

<table>
<thead>
<tr>
<th>PROJECT FINANCE RISKS</th>
<th>F-</th>
<th>P</th>
<th>Judgement Mean</th>
<th>Magnitude of Effect</th>
<th>Effect Attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low Risk: -1</td>
<td>High Risk: +1</td>
<td>Difference</td>
</tr>
<tr>
<td>Operating Risk</td>
<td>201.6</td>
<td>0.000</td>
<td>4.77</td>
<td>6.35</td>
<td>1.58</td>
</tr>
<tr>
<td>Environment Risk</td>
<td>27.17</td>
<td>0.000</td>
<td>5.27</td>
<td>5.85</td>
<td>.58</td>
</tr>
<tr>
<td>Political/Reg. Risk</td>
<td>97.72</td>
<td>0.000</td>
<td>5.01</td>
<td>6.11</td>
<td>1.10</td>
</tr>
<tr>
<td>Market Risk</td>
<td>438.4</td>
<td>0.000</td>
<td>4.39</td>
<td>6.72</td>
<td>2.45</td>
</tr>
<tr>
<td>Sponsors Risk</td>
<td>186.6</td>
<td>0.000</td>
<td>4.80</td>
<td>6.32</td>
<td>1.52</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.23</td>
</tr>
</tbody>
</table>

**Main Effects Measured by Risk Level (N= 25)**

<table>
<thead>
<tr>
<th>PROJECT FINANCE RISKS</th>
<th>F-</th>
<th>P</th>
<th>Judgement Mean</th>
<th>Magnitude of Effect</th>
<th>Effect Attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low Risk: -1</td>
<td>High Risk: +1</td>
<td>Difference</td>
</tr>
<tr>
<td>Operating Risk</td>
<td>79.13</td>
<td>0.000</td>
<td>161.50</td>
<td>193.60</td>
<td>32.10</td>
</tr>
<tr>
<td>Environment Risk</td>
<td>16.99</td>
<td>0.000</td>
<td>170.10</td>
<td>185.00</td>
<td>14.90</td>
</tr>
<tr>
<td>Political/Reg. Risk</td>
<td>48.88</td>
<td>0.000</td>
<td>164.90</td>
<td>190.10</td>
<td>25.20</td>
</tr>
<tr>
<td>Market Risk</td>
<td>195.6</td>
<td>0.000</td>
<td>152.30</td>
<td>202.80</td>
<td>50.50</td>
</tr>
<tr>
<td>Sponsors Risk</td>
<td>69.68</td>
<td>0.000</td>
<td>162.40</td>
<td>192.60</td>
<td>30.20</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>152.90</td>
</tr>
</tbody>
</table>

**Main Effects Measured by Risk Margin (N=24)**

5.1 The difference is the degree to which the mean judgement changes as the level of factor(X) changes = Judgement Mean of X at Higher Risk - Judgement Mean of X at Lower Risk

5.2. Magnitude of Effect for factor X = \[ \frac{\text{Difference in Judgement Mean of } X}{\text{Sum of Difference}} \]

5.3. Effect Attribution of factor X expressed by % = \[ \frac{\omega^2 (X)}{\text{Sum (}\omega^2 \text{ of main effects } + \omega^2 \text{ of interactions)}} \]
5.3.1. Risk Main Effects Measured by Risk Level

The first part of Table 5.3 presents the main effects of the five project-financing risks measured by "risk level". These effects were calculated based on the one-nine risk scale representing the project lenders' judgements of the projects' overall riskiness. As shown in the Table, they were all significant at .05. Based on the magnitude of effect and the effect attribution of these risk main effects, their relative importance was revealed providing a clear answer to RQ1.

The magnitude of effect measurements for each of the risk main effects was based on variations in mean judgements of the projects' overall riskiness when the risk level given to each of the risks changed. As can be seen in the Table, the overall riskiness given to the project rose by 2.45 points when market risk shifted from a lower level to a higher level. Similarly, 1.58, 1.52, and 1.10 point increase in the mean judgements of the projects' overall riskiness was recorded when operating, sponsors, and political/regulation risk, respectively, moved in the same direction. A marginal increase of 0.58 was observed when environmental risk increased. Taken together, the magnitude of effect shows that market risk accounted for 34% of the deviation in the mean overall riskiness judgments, followed by operating, sponsors, and regulation/political risks with 22%, 21%, and 15%, respectively. Changes in the risk level of environmental risk had the least impact, accounting for only 8%.

The effect attribution was another value used to measure the relative impact of these risks on the project lenders' assessment of the projects' overall riskiness. It was achieved by computing the degree to which each risk influences the project lenders' judgements of the projects' riskiness. Since two-level risk interactions had very little impact on this risk judgement (see 5.2), the calculation was technically based on the risk main effects. It shows that 46% of the decisions were contributed to by market risk, 21% by operating risk, 20% by sponsors risk, and 10% by political/regulation risk. Once again, environmental risk had the least impact on the projects' overall riskiness judgment, accounting for only 3%. The results are graphically presented in Graph 5.1:
These two indications (i.e. the magnitude of effect and the effect attribution), though derived from the two different computing methods, consistently showed that market risk accounted for the largest proportion in the project lenders’ judgements of the projects’ overall riskiness, followed by operating, sponsors, political/regulation, and environmental risks. It is therefore can be concluded that in the project risk pricing decision measured by "risk level", market risk was the most important factor, while environmental risk the least important. Also, operating and sponsors risks possessed a relatively similar degree of influence on the risk pricing decision.

5.3.2. Risk Main Effects Measured by Risk Margin

The second part of Table 5.3 presents the main effects of the five project financing risks measured by "risk margin" on the project risk pricing decision. "Risk margin" is the required yield expressed by basis points over A$ BBSW. Similar to the main effects
measured by "risk level", these main effects were found to be significant at .05. Measurements of their magnitudes of effect and effect attribution provided a second answer to RQ1 which set out to study the relative importance of these risks on the risk pricing decision.

Measurements of the magnitude of effect for each of these risk main effects were based on the mean variations in the yield required by the project lenders, which result from changing the risk level from "less risky" to "riskier" for each of the five project financing risks. As shown in Table 5.1, when these five risks all moved from a less risky level to a riskier level, the mean of required yield rose by 152.90 basis points (bps). Among them, an increase of 50.5 bps was caused by the movement of market risk, 32.10 bps by operating risk, 30.20 bps by sponsors risk, 25.20 pbs by political/ regulation, and 14.90 bps by environmental risks.

This measurement is important since it clearly demonstrates how sensitive the risk margin required by the project lenders would be when each of the five project financing risks shifted from a lower level to a higher level of risk. Altogether, as the magnitude of effect shows, market risk accounted for 33% of the deviation in the risk margin mean, followed by operating risk 21%, sponsors risk 20%, regulation/political risk 16%, and environmental risk 10%.

The second value used to measure the relative impact of these project financing risks on the risk margin was the effect attribution. This was achieved by computing the proportion attributed by each risk to the overall yield required by the project lenders. Since the effect of risk interactions on the risk margin was not significant (see 5.2), this calculation was based solely on the main effects. It showed that 48% of the pricing decisions were determined by market risk, 19% by operating risk, 17% sponsors risk, 12% by political/ regulation risk, and 4% by environmental risk. As observed earlier, market risk was once again the most important factor in the risk pricing decision, while environmental risk was the least important. The results are graphically presented in Graph 5.2.
Based on the magnitude of effect and the effect attribution measurements associated with risk margin, it can be concluded that market risk was the most influential factor in the risk pricing decision, followed by operating, sponsors, regulation/political, and environmental risks.

5.3.3. Assessment

Research question one (RQ1) set out to measure the relative importance of each of the five project financing risks on the project risk pricing decision. A clear answer has been obtained, based on the results derived from the two different independent variables, namely risk level and risk margin. These results consistently show that market risk was the most important factor, followed by operating, sponsors, and political/ regulation risk, while environmental risk was the factor with the least importance.
To provide more insight into the findings, two issues should be discussed. Firstly, it should be noted that there was very little difference in the magnitude of effect for each of the five project financing risks measured by risk level and risk margin. Likewise, the proportion of each of the five project financing risks on the project risk pricing decision measured by both risk level and risk margin was very similar. As a result, it can be concluded that these two dependent variables highly correlated with each other. It means that the number of basis points given to the projects was very much based on the riskiness of these projects judged by the project lenders. This conclusion is confirmed by the Pearson correlation measurement showing that the correlation of risk level and risk margin was around 0.7.

Secondly, the reason for a lower level of significance in political/ regulation risk was possibly due to the fact that these project risk cases are domestic, conducted in Australia where the political environment is quite stable and familiar to the project lenders. While the participants do finance projects overseas, these are mainly in New Zealand, where the political condition is very similar to that in Australia. It is therefore expected that the participants do not have to experience unstable political/ regulatory situations such as political violence, nationalisation and expropriation of the property, or foreign exchange transfer blockage and currency inconvertibility. As a result, a higher level of significance in political risk might be observed for project risk cases conducted in developing countries with much less political stability. As mentioned earlier, this experiment focused mainly on domestic projects since project lenders working in Australia are predominantly involved in domestic projects. Overseas projects are usually taken care of by their overseas representatives.

5.4. RISK INTERACTIONS AND PROJECT RISK PRICING DECISIONS

As with the individual risks, General Linear Model (GLM) - ANOVA from the MINITAB statistical software package was employed to measure the impact of two-level risk interactions on the project risk pricing decision. Various calculations
associated with two dependent variables, namely "risk level" and "risk margin", were carried out. Specifically, the F and P values of each interaction were computed to test hypothesis one (H1) considering that the project lenders process project financing risks configurally when making the risk pricing decision. To provide more insight in the discussion, the effect proportion of those found to be significant were also calculated. The information related to the impact of risk interactions on the risk pricing decision is presented in Table 5.2.

<table>
<thead>
<tr>
<th>PROJECT FINANCE RISKS</th>
<th>F-Value</th>
<th>P</th>
<th>Effect Attribution *</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interactions Measured by Risk Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Risk * Market Risk</td>
<td>0.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Environmental Risk * Operating Risk</td>
<td>0.98</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>Environmental Risk * Sponsors Risk</td>
<td>0.07</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Environmental Risk * Regulation/Political Risk</td>
<td>1.36</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Market Risk * Operating Risk</td>
<td>0.81</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>Market Risk * Sponsors Risk</td>
<td>0.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Market Risk * Regulation/Political Risk</td>
<td>0.13</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Operating Risk * Sponsors Risk</td>
<td>0.07</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Operating Risk * Regulation/Political Risk</td>
<td>2.33</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Sponsors Risk * Regulation/Political Risk</td>
<td>4.27</td>
<td>0.04</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Interactions Measured by Risk Margin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Risk * Market Risk</td>
<td>0.77</td>
<td>0.38</td>
<td></td>
</tr>
<tr>
<td>Environmental Risk * Operating Risk</td>
<td>0.01</td>
<td>0.91</td>
<td></td>
</tr>
<tr>
<td>Environmental Risk * Sponsors Risk</td>
<td>1.46</td>
<td>0.23</td>
<td></td>
</tr>
<tr>
<td>Environmental Risk * Regulation/Political Risk</td>
<td>0.66</td>
<td>0.42</td>
<td></td>
</tr>
<tr>
<td>Market Risk * Operating Risk</td>
<td>1.07</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Market Risk * Sponsors Risk</td>
<td>1.39</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>Market Risk * Regulation/Political Risk</td>
<td>0.18</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Operating Risk * Sponsors Risk</td>
<td>0.05</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>Operating Risk * Regulation/Political Risk</td>
<td>0.02</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>Sponsors Risk * Regulation/Political Risk</td>
<td>0.58</td>
<td>0.45</td>
<td></td>
</tr>
</tbody>
</table>

\[ SS \text{ Interaction } (x,y) = \frac{SS \text{ Interaction } (x,y) - (df(x) \cdot df(y) \cdot MSE)}{SS \text{ total } + MSE} \]

5.4. \( \omega^2 \) of interaction \((x\&y)\) =

5.5. Effect Attribution of \((x\&y)\) = \( \frac{\omega^2 \text{ (X} \& \text{Y)} }{\text{Sum (} \omega^2 \text{ of main effects} + \omega^2 \text{ of interactions))} \)

81
Table 5.2 shows that among the ten risk interactions measured by risk level and risk margin, only the interaction between sponsors and political/regulation (measured by risk level) was found to be significant. This finding is considered as a very weak support for H1 that project lending officers process project financing risks configurally when making the risk pricing decision.

In addition, as shown in the Table, the F value and the effect attribution of two-level risk interactions, including the one found to be significant, were extremely small. The effect attribution of the interaction between sponsors and political/regulation risk was only 0.3% in comparison to 3% in environmental risk - the least influential individual risk factor. Based on this result, it can be concluded that the two-level risk interactions had very little influence on the project risk pricing decision.

There might, however, be speculation that a low degree of significance found in two-level risk interactions could be due to the small sample size (25 participants) obtained by this experiment. Since very few previous studies into this area have been found, an accurate comparison could not be made and this speculation therefore remains untested. However, the P values for other interactions presented in Table 5.2 were not near 0.05 and their F values were extremely small, suggesting a small impact of two-level interactions even if a considerably larger sample size were obtained.

5.5. SELF-INSIGHT AND PROJECT RISK PRICING DECISIONS

The evidence of the project financing risk weightings employed by the project lenders participating in this experiment is presented in Table 5.3. It included:

1. Subjective weights (S): the self-reported project finance risk weightings, which represent the perceived relative importance of each project financing risk averaged across all individual cases. This judgement process was conducted at the end of the experiment, where participants were asked to allocate 100 points cross the five given
risks in proportion to the perceived relative importance of each risk in formulating their decisions.

2. Objective weights (O): the effect attribution representing actual judgements to the data made available when the participants generated the judgements. Since they are not subjective assertions, they are referred to as objective weights. Two values of objective weights measured by risk level and by risk margin were presented in Table 5.3. These calculations were bases solely on the risk main effects since the two-level risk interactions had very little impact on the risk pricing decision (see 5.2).

Table 5.3. PROJECT FINANCE RISK WEIGHTING

<table>
<thead>
<tr>
<th>METHOD</th>
<th>Operating Risk</th>
<th>Environmental Risk</th>
<th>Political/Reg. Risk</th>
<th>Market Risk</th>
<th>Sponsors Risk</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subjective Weight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (S)</td>
<td>22%</td>
<td>11%</td>
<td>18%</td>
<td>30%</td>
<td>19%</td>
<td>100%</td>
</tr>
<tr>
<td>S.D</td>
<td>7.22</td>
<td>4.16</td>
<td>6.35</td>
<td>10.39</td>
<td>9.92</td>
<td></td>
</tr>
<tr>
<td>Range (L-H)</td>
<td>(10-40%)</td>
<td>(0-20%)</td>
<td>(9-30%)</td>
<td>(8-65%)</td>
<td>(10-60%)</td>
<td></td>
</tr>
</tbody>
</table>

Comparison of Subjective and Objective Weights
(Response is RISK LEVEL, N=25)

| Effect Attribution (O)     | 21%            | 3%                 | 10%                 | 46%         | 20%           | 100% |
| Difference (S-O)           | 1%             | 8%                 | 8%                  | -16%        | -1%           | 0    |

Comparison of Subjective and Objective Weights
(Response is RISK MARGIN, N=24)

| Effect Attribution (O)     | 19%            | 4%                 | 12%                 | 48%         | 17%           | 100% |
| Difference (S-O)           | 3%             | 7%                 | 6%                  | -18%        | 2%            | 0    |

The first thing to note is that the self-reported project finance risk weighting supports the conclusion made earlier on the relative importance of the five project financing risks. It once again shows that market risk was the most important factor in the risk pricing decision accounting for 30%, followed by operating risk (22%), sponsors risk (19%), political/ regulation risk (18%), and environmental risks (11%). However, the relatively
high standard deviation for market risk (10.39%) and its wide range of reported weightings (8-65%) indicate that not all of the project lenders surveyed perceived the market risk to be the most important factor.

Additionally, the subjective weights were distributed much more evenly across the five project financing risks than the objective weights. For instance, the difference between the most important risk (market risk) and the least important risk (environmental risk) observed in the subjective weights was 19% in comparison to that of 43% and 44% recorded in the objective weights measured by risk level and by risk margin, respectively. However, within the objective weight distribution, the weight given to each risk measured by both risk margin and risk level was almost identical, confirming a high level of correlation between these two measurements. Distributions of subjective and objective weights among the five project financing risks are graphically illustrated in Graph 5.3:

The second research question (RQ2) set out to study the degree of self-insight possessed by the project lenders when making the risk pricing decision. To answer this question, various comparisons of subjective weights and objective weights were conducted.
5.5.1. Comparison of Subjective & Objective Weights

(With Objective Weights Measured by Risk Level)

Taken from Table 5.3, the subjective weights and objective weights measured by risk level are presented as follows:

Table 5.4: COMPARISON OF SUBJECTIVE AND OBJECTIVE WEIGHTS

(With Objective weights measured by Risk Level)

<table>
<thead>
<tr>
<th>WEIGTHS</th>
<th>Operating Risk</th>
<th>Environmental Risk</th>
<th>Political/Regulation Risk</th>
<th>Market Risk</th>
<th>Sponsors Risk</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective (N=25)</td>
<td>22%</td>
<td>11%</td>
<td>18%</td>
<td>30%</td>
<td>19%</td>
<td>100%</td>
</tr>
<tr>
<td>Objective (N=25)</td>
<td>21%</td>
<td>3%</td>
<td>10%</td>
<td>46%</td>
<td>20%</td>
<td>100%</td>
</tr>
<tr>
<td>Difference (S-O)</td>
<td>1%</td>
<td>8%</td>
<td>8%</td>
<td>-16%</td>
<td>-1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

As can be seen, the relative importance of several risks was over or underestimated by the project lenders. Subjectively, environmental risk and political/regulation risk were considered to be quite important, accounting for 11% and 18% respectively. However, the objective measurement shows that their actual impacts on the project lenders’ risk pricing decisions were less, accounting for only 3% and 10%, respectively. Hence, it can be stated that environmental risk and regulation/political risk were overestimated by the project lenders.

Market risk, on the other hand, produced much greater influence on the risk pricing decision-making process than the project lenders generally thought. The difference between its subjective and objective weight was quite substantial, accounting for 16%. More consistent judgements were found in operating and sponsor risks with only 1% variation. Comparisons of the subjective and objective weights are graphically presented in Graph 5.4.
5.5.2. Comparison of Subjective & Objective Weights
(With Objective Weights Measured by Risk Margin)

Taken from Table 5.3, the subjective weights and objective weights measured by risk margin are presented as follows:

Table 5.5: COMPARISON OF SUBJECTIVE AND OBJECTIVE WEIGHTS
(With objective Weights Measured by Risk Margin - bps over BBSW)

<table>
<thead>
<tr>
<th>WEIGHTS</th>
<th>Operating Risk</th>
<th>Environmental Risk</th>
<th>Political Regulation Risk</th>
<th>Market Risk</th>
<th>Sponsors Risk</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective</td>
<td>22%</td>
<td>11%</td>
<td>18%</td>
<td>30%</td>
<td>19%</td>
<td>100%</td>
</tr>
<tr>
<td>(N=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objective</td>
<td>19%</td>
<td>4%</td>
<td>12%</td>
<td>48%</td>
<td>17%</td>
<td>100%</td>
</tr>
<tr>
<td>(N=24)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>3%</td>
<td>7%</td>
<td>6%</td>
<td>-18%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>(S-O)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Table shows that the relative importance of the five project financing risks was, to some extent, misjudged by the project lenders. Overall, the result was quite consistent
with the previous finding using the risk level measurement. Environmental risk and political/ regulation risk were overestimated by 7% and 6%, respectively. It once again showed that the project lenders, while quite concerned about these risks in general, did not place a lot of emphasis on them when it came to the risk pricing decision making process.

In contrast, market risk had much more impact on the project lenders’ decision than they generally believed. In fact, the importance of market risk was underestimated by 18%. Once again, more consistency has been found in the estimation of operating and sponsors risks with a variation of only 2% and 3%, respectively. A graphic comparison of the two estimations is presented in Graph 5.5.

![Graph 5.5: SUBJECTIVE AND OBJECTIVE WEIGHTS (Measured by Risk Margin)](image)

### 5.5.3. Assessment

Overall, it can be concluded that while a number of project finance risks were over or underestimated by the project lenders, their degrees of self-insight into the risk pricing decision were relatively high. Variations between the subjective and objective weights observed in this experiment were not substantial, except for market risk. This indicates that the project lenders were quite insightful, in general, about their risk pricing
decisions. Although the impact of experience was not tested in this research experiment, it is expected that this positive result might partly be due to the amount of experience in the project finance possessed by the project lenders participating in this experiment. As recorded in Section 5.2.1, their average years of experience in project finance was 8.3 years.

To provide more insight into this finding, further discussions of environmental risk and market risk should be made. An overestimation of environmental risk’s importance may have been due to public sensitivity related to this issue. As discussed in Chapter Two, while environmental risk was not an issue in project financing for many years, the public is more environmentally conscious and is well aware of environmental disasters caused by poorly implemented and managed projects. More tightening of environmental regulations has also been seen. As well, the parties found to be responsible for environmental impacts, including banks, might have to face substantial penalties and damage to their public reputation. As a result, more environmental cautions have been taken by the project lenders. However, when it comes to the pricing process, as long as all the environmental regulations have been covered, environmental risk is a less important factor as it usually does not directly impact the revenue generated by the project and subsequently its ability to repay the debt.

In contrast, market risk has a substantial impact on the project's revenue. The project's future cash inflows are solely dependent on the demand of the project's outputs, its market share, and commodity prices. Accordingly, the importance of market risk was acknowledged by the project lenders and believed to be the most influential factor in the risk pricing decision accounting for 30% of the subjective weight. This finding is also consistent with various indications given by the project lenders in numerous discussions during the pilot phase. However, during the actual risk pricing process, when the project lenders have to thoroughly assess the project's future cashflows to test its ability to repay the debt, the importance of market risk becomes much greater and hence more emphasis is put on it.
Discussion & Conclusions

6.1. INTRODUCTION

The chapter first discusses the findings in conjunction with the lending and project finance literature. It then sets out the limitations of this thesis in terms of its scope and design. It also presents a number of suggestions for new research emanating from this work. The chapter finishes with several concluding remarks concerning the thesis' accomplishments in terms of both the advancement of knowledge and the researcher's appreciation of the research process.

6.2. DISCUSSIONS OF THE THESIS' FINDINGS

As reviewed in Chapters One and Three, despite its importance, project finance has attracted very few research studies. This thesis addresses this deficiency in the literature by presenting empirical research on the project finance risk pricing decision by Australian lenders. In particular, it tackles three issues directly related to the risk pricing process. They are (1) the relative importance of project finance risks on the project risk pricing decision, (2) the influence of risk interactions on the project risk pricing decision, and (3) the degree of self-insight into the risk pricing process possessed by Australian project lenders.

6.2.1. Risk Main Effects and Project Risk Pricing Decisions

This first part of the research experiment sets out to study the relative importance of each of the five project finance risks on the project risk pricing decision. The results firstly show that risk margin and risk level were positively correlated. Very little difference in the magnitude of effect of each of the five project financing risks measured
by risk level and risk margin was recorded. Similarly, the effect attribution of each of the five project financing measured by risk level and risk margin was quite identical. It means that the number of basis points given to each risk pricing case was highly dependent on its riskiness judged by the project lenders. This finding supports the lending literature reviewed in Section 3.2 (eg. Aguais, 1998; Bates, 1998; Flannery, 1985; Ferrari, 1992; Machauer and Weber, 1998; and Valentine, 1998) suggesting that risks and risk premiums have a strong and positive connection.

Secondly, the results show significant impacts of the five risk main effects on the risk pricing decision, supporting the project finance literature (eg. Buljevich and Park, 1999; Bruce et al, 1997; Davis, 1996; McKechnie, 1990; Nevitt and Fabozzy, 2000; Sapte, 1997; Smith and Walter, 1997; and Tinsley 1999 and 2000), in which the importance of these risks were repeatedly mentioned.

This research experiment, however, has taken the literature further by measuring the relative importance of these risks, which has not been scientifically tested previously. Evidence drawn from the magnitude of effect and the effect attribution of these risks revealed that market risk was the most influential factor, followed by operating, sponsors, and political/regulation risks, while environmental risk was the factor with least effect. This finding is relatively consistent with the information obtained from various discussions with the project lenders during the pilot-study process and the information provided in the project finance literature where importance of market risk was often emphasised.

However, it should noted that the importance of political/regulation risk measured in this experiment was relatively small in comparison to the importance placed on it in both the academic project finance literature and in professional project finance journals (eg. Beale, 1999; Ramcharran, 1999; Gibbons et al, 1999; and Illarramendi cited in Chotrani, 1999). A lower level of significance in political/regulation risk observed in this research experiment might be due to the fact that these hypothetical cases were domestic, conducted in Australia where the political environment is quite stable and
familiar to the project lenders. As a result, it is expected that a much higher level of significance in political risk would be found for projects conducted in developing countries where political violence, nationalisation and expropriation of the property, or foreign exchange transfer blockage and currency inconvertibility often occur.

6.2.2. Risk Interactions and Project Risk Pricing Decisions

This second part of the research experiment set out to investigate the impact of risk interactions on the project risk pricing decision. The results showed that among the ten risk interactions tested, only the interaction between sponsors and political/regulation was found to be significant. This is very weak support for the hypothesis (H1) that project lenders process project financing risks configurally when making the risk pricing decision. This support is further weakened by the extremely small effect attribution of this interaction (accounted for only 0.3% of the whole decision).

This figure is minuscule when compared to various effects of cue configurality measured in Ross and Pike's (1999) study into the export credit risks where 62% of the decision was affected by the risk main effects and 38% was by the risk interactions. It should be acknowledged that the effect attribution in Ross and Pike was measured by $R^2$ while in this study it was measured by $\omega^2$. However, as the difference in the two findings is quite substantial, it cannot be solely contributed by the different computing techniques. This argument is also supported by the fact that in Ross and Pike's study significance was found in all two-level interactions and even in a number of three-level interactions, while in this study only the sponsors*political interaction was significant. In fact, the P values show that none of the other interactions were near the necessary level of significance.

Based on the results, it is concluded that, despite the evidence supporting the hypothesis that project lenders do process project financing risks configurally when making the risk pricing decision, the actual impact of risk interactions on the project risk pricing decision was extremely small.
6.2.3. Self-Insight and Project Risk Pricing Decisions

This final part of the research experiment sets out to investigate the degree of self-insight into the project risk pricing decision. It compared the subjective weights and objective weights to obtain a general measurement of the degree of self-insight possessed by project lenders.

Firstly, the results show that the distribution of the subjective weights was much more even across the five project financing risks than that of the objective weights. For instance, the difference between the most important risk (ie. market risk) and the least important risk (ie. environmental risk) observed in the subjective weights is 19% in comparison to that of 43% and 44% recorded in the objective weights measured by risk level and by risk margin, respectively. This finding is consistent with Mear and Firth's (1987) study, where more consistency in the subjective weight distributions were also recorded.

Secondly, similar to the findings of Mear and Firth (1987) and Wright (1977), and Laswad and Roush (1996), an encouraging level of self-insight into the project risk pricing decision was recorded in this study. The difference between the subjective and objective weights observed in this experiment was relatively small, except for market risk. In fact the objective and subjective weights given to operating and sponsors risks were almost identical. This indicates that the project lenders were quite insightful in making their risk pricing decisions. Interestingly, the results also reveal that the project lenders, very much like the subjects in the previous research studies (eg. Ashton, 1974; Hoffman, 1960; Joyce, 1976; Mear and Firth, 1987, Slovic et al, 1972) in that they overestimated the importance of some minor cues (eg. environmental risk and political/regulation risk) and underestimated the importance of some major cues (eg. market risk).
6.2.4. Assessment

These research findings are useful to project lenders and banking educators. Firstly, the findings provide new insights in the area of project finance, which has received little attention in the finance and lending literature. Secondly, the findings offer a deeper understanding of the project financing risk pricing decision - a critical component in the lending process. In particular, the findings explored various crucial issues directly related to the risk pricing decision such as the relative importance of project financing risks, the influence of risk interactions, and the degree of self-insight into the project risk pricing decision.

6.3. LIMITATIONS

This section set out to discuss various limitations associated with this study in terms of its scope and design.

6.3.1. Limitations in Scope

This research experiment contains a number of limitations associated with the model and the survey population. In terms of the model, its first aspect concentrates mainly on the risk factors most frequently cited in the literature and particularly related to the operating phase of domestic projects (i.e. projects conducted in Australia). Expanding the model to include other project financing risks would prove to be unworkable for this research experiment since a large number of hypothetical cases would have been created causing various difficulties both in attracting project lenders' participation and in obtaining high quality responses. Similarly, focusing solely on the operating phase aims to achieve more accurate risk pricing results since the operating and completion phases of a project are often priced separately and differently. The decision to concentrate solely on the domestic projects was made after the pilot studies showed that most projects financed by Australian lenders were conducted in Australia. The second part of the model,
incorporating non-risk factors, is limited to those directly related to an individual project. The importance of other factors associated with loan portfolio management (eg. interest rates, loan diversifications, and availability of funds) fall outside the specific research scope of this study.

In terms of the research population, this experiment was limited to Australian commercial banks, superannuation funds, institutional investors, and Australian arms of multinational banks. Other organisations involved in project lending activities such as export credit agencies (eg. EFIC) or aid organisations (eg. AUSAID) were not included. Once again, this selection was made to achieve a high level of accuracy for this experiment. While commercial banks, export credit agencies, and aid organisations are all involved in the project financing activity, they have different mandates. For instance, commercial banks look to project finance as additional and profitable lending activities, whereas export credit agencies might be involved in projects to support and promote local sales, and AUSAID might provide funds to projects to fulfil Australia's social and economic commitments to developing countries. As a result, different types of organisations might price quite differently when faced with the same level of risk. So, to obtain more accurate responses, the experiment focused solely on the commercial banking organisations - the largest and most active party in project finance.

6.3.2. Limitations in Design

The first concern is artificiality of the research experiment since the degree of risk in this experiment was limited to two levels: "lower risk" meaning less risky and "higher risk" meaning more risky. Moving toward greater complexity in the factorial experiment in order to reflect the multitude of possible variations of the decision would prove to be unfeasible, particularly as this research involving numerous factors. Nevertheless, confidence is gained as the two levels of treatment chosen have enabled the study's objectives to be achieved.
The second concern is generalisation of the study’s findings to other than Australian project lending officers. It might be problematic since the study used Australian samples and focused on the Australian environment. Nevertheless, its contribution is substantial as the degree to which discrepancies may arise in the use of risk assessment techniques and risk management strategies in project financing for both Australian lenders and non-Australian lenders is expected to be limited. This argument is based on the global nature of the project finance lenders and the frequent movement of lending officers among the various nations and multinational banks operating in Australia.

6.4. NEW RESEARCH DIRECTIONS

The limitations in the scope and design of this thesis serve also to identify new directions for research into the project finance risk pricing decision.

6.4.1 New Research Directions in Scope

Firstly, new research should be directed to understand more about the impact of other project finance risks on the risk pricing decision. If projects conducted in developing countries are considered, foreign exchange risk and other issues related to political risk (eg. political violence, nationalisation and expropriation of the property, or foreign exchange transfer blockage and currency inconvertibility) should be included. Alternatively, studies into how risks associated with the completion phase are judged and priced by project lenders would also be necessary.

Secondly, further investigation into the second part of the model (ie. non-risk factors) is important since it would provide more insight into the risk pricing decision. These factors are highly associated with syndication risk and funding risk faced by project lenders when involved in a project. Various discussions with the project lenders during the pilot study period show that syndication risk tends to be of a larger concern to the banks with less financial capacity and expertise than to the major players in the field.
The survey data also show that the project lenders might make the risk pricing decision differently if this information was available. Other factors associated with loan portfolio management, such as portfolio exposure, portfolio diversifications, interest rate movements, and availability of funds, should also be considered since they could affect the risk pricing decision.

6.4.2. New Research Directions in Design

Firstly, the research findings associated with the risk pricing decision would be strengthened and enhanced by additional research studies which move from the restricting artificial risk level used in the hypothetical cases to the real project financing cases experienced by the project lenders. Alternatively, studies concentrating on different project financing sections, namely natural resources, media, telecommunication, infrastructure, and utility, would also help to obtain a deeper understanding of the risk pricing process.

Secondly, a comparative analysis of the risk pricing decision among different countries or different types of organisations (eg. export credit agencies, aid organisations, and a banking sector) would be useful. This analysis would provide more insight into the risk pricing decision, which might be affected by the unique characteristics of each nation or the nature of each business sector. Additionally, it would help to offset the limitations in design caused by the use of just Australian project lenders in the banking sector.

6.5. SOME CONCLUDING REMARKS

This thesis has brought various lending and project financing literature into a general model of the project finance risk pricing decision for Australian lenders. It has provided a deeper understanding of the project risk pricing decision by investigating the relative importance of individual risks and their interactions, and the degree of self-insight possessed by Australian project lenders. Nevertheless, shortcomings in the thesis's
design and scope require replication and extension of the work to increase the level of confidence in its findings. Additionally, this research, like other high quality research, fails to provide a complete understanding of the decision making process. It has, however, provided an incremental step towards the goal. New areas for research have now been opened which hold the promise for a substantial enhancement of project finance risk pricing and assessment.

For the author, this thesis is a personal contribution to the area that the author is very passionate about. It has also offered the author invaluable opportunities to gain a deeper understanding of project finance as well as to increase research competence.
Reference List


Project Finance, (1999), All Sector League Tables from January 1998 to September 1999, Issue 192, April, pp. 46.


Zikmund W., (1997), Business Research Methods, the Dryden Press, Fort Worth.
Glossary

1. Environmental Risk:
   Environmental risk is the possibility of adverse impacts on a project’s cash generation caused by environmental and social regulations in the host country (Buljevich and Park, 1999).

2. Experimental Design
   A method which allows researchers to manipulate one or more independent variables while controlling all others. Manipulation means creating discrete levels of a variable and comparing responses across levels. Control means holding an extraneous variable constant across levels of the independent variable (Levin, 1999, p. 5)

3. Factorial Design
   Factorial design is an experimental method allowing “two or more independent variables to be simultaneously manipulated at various levels” (Zikmund, 1997, p.318).

4. Fractional-Factorial Design
   Fractional factorial designs are factorial designs with only a fraction of full treatment combinations included in an experiment. It provides useful information on independent variables but not as much as one obtains from a complete factorial experiment (Frigon and Mathews, 1997).

5. Limited Recourse Financing:
   The lenders have the benefit of some form of support from outside the project, which is often performance guarantees by one or more of the project sponsors (Terry, 1990).
6. Market Risk:

Market risk is the possibility that the project’s product cannot be sold at a price sufficient to cover all the essential costs of the project and to repay the debt in full (McKechnie, 1990).

7. Non-recourse Financing:

There are no sponsor guarantees. The lenders have to totally rely on the cashflows and assets of the project to cover their initial capital investments (Bruce et al, 1997).

8. Off-Take Agreement:

Contract to purchase from the project company a certain quantity and quality of project outputs for a certain period of time, at certain pre-established prices (Buljevich and Park, 1999).

9. Operating Risk:

Operating risk includes technical, operating cost, and management issues (Tinsley, 1999). Technical problems refer to the unfeasibility of new or untested technologies used in the project. Operating cost overruns relate to inputs, productivity, and operating expenses of labour and materials. Management issues relate to the project manager’s ability to run the project efficiently.

10. Project Finance:

“The financing of a project where the servicing and repayment of the funding depends on the revenue stream or capital value of the completed project rather than on the covenant of the borrower or on a charge over other assets. Typical projects would be the construction of airports, roads, bridges, tunnels, ports, telecommunication systems, railways, power stations and oil refineries” (Holliwell, 1997, p. 136).
11. Project Company:
The project-company is a "special purpose legal entity created for purposes of the
development of the project". The determination of the best type of legal entity to
undertake a project (eg. corporation, partnership, joint venture, trust) is dependent
upon certain significant factors, such as proportion of debt and equity investments,
tax considerations, credit impact, regulatory issues (Buljevich and Park, 1999).

12. Political/ Regulation Risk:
Adverse impacts of a country's environment on the project's viability caused by
political, economic, or legal factors including war, civil conflicts, expropriation,
foreign exchange problem and changes in investment and taxation policies (Ross,
1999).

13. Self-insight:
"An individual's ability to express the relative emphasis he or she places on
information cues when generating judgements" (Mear and Firth, 1987, p. 176).

14. Sponsors Risk:
Sponsors risk refers to the impact of the stature of the sponsors both financially and
technically on the project (Tinsley, 1999).

15. Within-Subject Design:
Within-subjects design is an experiment where 'repeated measurements are taken
and treatment effects are associated with differences observed with subjects" (Keppel, 1982, p. 365).
Appendices

1. Fax Letter
2. Covering Letter
3. Survey Contents
4. Following-up Letter
5. Survey Design Structured by DOE - MINITAB
6. Survey Results Produced by GLM – MINITAB
7. International Project Finance Directory
Appendix 1: Fax Letter (using the UWS’s letter head)

12th February, 2001

Name
Position
Address

Re: Project Financing Research Study

Dear...,

The Financial Services Research Group (FSRG) of the University of Western Sydney is conducting a study into the project finance risk pricing decision because we believe that it will be highly beneficial to Australian project lenders and banking educators. Our initial work into the area was presented at the 13th Annual Australasian Finance and Banking Conference held recently in Sydney. More important findings are expected from this research.

Since this research questionnaire plays a crucial role in our study, your and your colleagues’ inputs will be highly valuable and appreciated. We will be phoning you in the next day or so to ask for your participation in this important study.

On behalf of the FSRG, we thank you for your time and look forward to speaking with you shortly.

Yours faithfully,

Hanna Nguyen, MAF
Financial Services Research Group
Faculty of Management
University of Western Sydney
Phone: (02) 9852 4123
Email: Hanna.nguyen@lycos.com

Dr. Don Ross
Associate Professor of Finance
Faculty of Management
University of Western Sydney
Phone: (02) 9852 4197
Email: d.ross@uws.edu.au
Appendix 2: Covering Letter (using the UWS's letter head)

19 February, 2001

Dear Sir/Madam,

Project financing is widely used as a fund raising instrument for capital intensive projects here in Australia and overseas. Being involved in a project, Australian lenders often carry a share of various risk factors. Little has been done, however, to explain the influence of these risks on the project risk pricing decision.

The Financial Services Research Group (FSRG) of the University of Western Sydney has undertaken this study into the project finance risk pricing decision because we believe that it will be beneficial to Australian project lenders and banking educators. Since this survey questionnaire plays a crucial role in our study, your input will be highly valuable and appreciated.

You are assured of complete confidentiality. No individual replies will ever be released. The aggregated results of this study will be published in journals. If you would like to receive a copy of the results of this study I would be pleased to send one to you when it has been completed. Please forward your request, separately from the questionnaire, by email, phone, or fax. I would also be pleased to answer any questions you might have.

Thank you for your assistance,

Yours faithfully,

Researcher: Hanna Nguyen, MAF
College of Law & Business
University of Western Sydney
Phone: (02) 9852 4123
Email: hanna.nguyen@lwcos.com

Supervisor: Dr. Don Ross
Associate Professor of Finance
College of Law & Business
University of Western Sydney
Phone: (02) 9852 4197
Email: d.ross@uws.edu.au

COMPLAINTS MECHANISM:
The university requires that all participants are informed that if they have any complaints concerning the manner in which a research project is conducted it may be given to the researcher, or if an independent person is preferred, to:
The Executive Officer, Human Research Ethics Committee
Research and Consultancy Unit
University of Western Sydney – Hawkesbury
Locked Bag 1 Richmond NSW 2753
Phone (02) 94570 1688
Appendix 3: Survey Content

PART A: PROJECT FINANCE RISK PRICING CASES

I. INSTRUCTION

Your task is to price project-financing risk for each of the following domestic project financing cases based on the individual risk ratings given:

- Rating:
  1. "LOWER RISK" means less risky than two of your last three project finance deals
  2. "HIGHER RISK" means more risky than two of your last three project finance deals

- Your risk judgement will be measured by:
  1. Overall Risk: low risk 1 2 3 4 5 6 7 8 9 high risk
  2. Margin: Spread over BBSW.

(If your organisation uses a different standard rate, please indicate below and point out the difference in basis points between rat and BBSW)
(a) Standard Rate (b) Number of basis points ______ Higher/ Lower than BBSW

- It is important that you maintain a consistent frame of reference and "style" of judgement throughout the study. Therefore, please do not discuss the way you are making judgements with anyone until after you have finished.

II. RISK DEFINITIONS

- Operating Risk means technical problems, operating cost overruns and management deficiencies.
- Environmental Risk means possible adverse environmental and social consequences of the project such as cleaning up costs and environmental penalties.
- Market Risk means the possibility that a project's products cannot be sold at a sufficient price or in sufficient quantity.
- Sponsors Risk means problems associated with the sponsors' financial position, technical competency, and experience.
- Political/ Regulation Risk means the possibility of adverse political actions or changing regulations.
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PART B: ADDITIONAL QUESTIONS

1. Please indicate the relative importance of the following risks in your project risk pricing decision by ALLOCATING 100 points among them
   
   ______ Environmental Risk
   ______ Market Risk
   ______ Operating Risk
   ______ Sponsors Risk
   ______ Political/ Regulation Risk

   TOTAL = 100 points

2. Please answer the following questions by filling in or checking the blank as appropriate.
   
   A. Year of Birth: 19__
   B. Your Sex: M/F
   C. Years of project financing experience: ___ years
   D. Type of projects you frequently finance:
      - The most frequently: _______________________
      - The 2nd most frequently: ___________________
   E. Countries you frequently finance:
      - The most frequently: _______________________
      - The 2nd most frequently: ___________________

3. Please indicate the extent to which you feel confident that the price you gave for these cases was the right price
   (Not confident) 1 2 3 4 5 6 7 8 9 (Very confident)

4. Please indicate the extent to which your answer would be different if you had more information
   (Not different) 1 2 3 4 5 6 7 8 9 (Very different)

5. Please specify the information you might need to make the decision differently

ALL REPLIES WILL BE KEPT IN STRICTEST CONFIDENCE. NO INDIVIDUAL RESPONSES WILL EVER BE RELEASED

Thank You for Participating!
Appendix 4: **Following-up Letter** (Using the UWS's letter head)

7th March, 2001

**Name**
Position
Address

**Re: Project Financing Research Study**

Dear..., 

About two weeks ago, following our telephone conversation, I sent five copies of the survey questionnaire for completion of yourself and your colleagues. If you have already completed and returned it, please accept our sincere thanks. If not, please do so today.

The Financial Services Research Group (FSRG) of the University of Western Sydney is conducting a study into the project finance risk pricing decision because we believe that it will be highly beneficial to Australian project lenders and banking educators.

We are writing to you again because of the significance each completed questionnaire has to the usefulness of this study. For the results of this study to be truly representative of the opinion of Australian project lending officers, your and your colleagues' inputs will be most valuable and appreciated.

In the event that the questionnaires sent to you have been misplaced, please find the enclosed five copies of the survey questionnaires and postage paid envelopes.

On behalf of the FSRG, we thank you for your support and look forward to receiving the completed survey questionnaires from you and your colleagues.

Yours faithfully,

Hanna Nguyen, MAF  
Financial Services Research Group  
Faculty of Management  
University of Western Sydney  
Phone: (02) 9852 4123  
Email: Hanna.nguyen@lycos.com

---

Dr. Don Ross  
Associate Professor of Finance  
Faculty of Management  
University of Western Sydney  
Phone: (02) 9852 4197  
Email: d.ross@uws.edu.au
Appendix 5: Survey Design (by DOE - MINITAB)

Well come to Minitab, press F1 for help.

**Fractional Factorial Design**

Factors: 5  
Base Design: 5,16  
Resolution: V  
Runs: 16  
Replicates: 1  
Blocks: none  
Centre points: 0  

Design Generators: E = ABCD

Alias Structure: I + ABCDE

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<th>Operating Risk</th>
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Appendix 6: Survey Results (by GLM – MINITAB)

1. General Linear Model: risk level versus Subject, En. Risk, ...

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<th>Type</th>
<th>Levels</th>
<th>Values</th>
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</table>

1.1. Analysis of Variance for risk lev, using Adjusted SS for Tests

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<th>Adj SS</th>
<th>Adj MS</th>
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<th>P</th>
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1.2. Least Squares Means for risk level

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2. General Linear Model: Risk Margin versus Subject, En. Risk, ...

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<th>Levels</th>
<th>Values</th>
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<tbody>
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2.1. Analysis of Variance for Risk Mar, using Adjusted SS for Tests

<table>
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2.2. Least Squares Means for Risk Mar

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3. Correlations: Risk Margin, risk level

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P-Value = 0.000

4. Descriptive Statistics:

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10/08/01 10:30:49
Appendix 7: International Project Finance Directory 2001
AUSTRALIA

Fuji International Finance (Australia) Limited
Level 28, AON Tower, Maritime Trade Towers, 201 Kent Street, Sydney, NSW, Australia
Tel: (61 2) 9251 2322 Fax: (61 2) 9235 1750

Fuji International Finance Australia has successfully secured lead arranging roles in a diverse range of Australian project and infrastructure financing for over 15 years. Our project finance team is the largest and most experienced amongst those of Japanese Banks in Australia.

Contact
Paul Kellahan
Group Head of Project Finance
Tel: (61 2) 9274 9220
Fax: (61 2) 9235 1750
pkellahan@lfa.com.au

Ken Fujikawa
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PROJECT FINANCE RISK PRICING

DECISION:

Australian Evidence

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2002
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and the best possible result has been obtained.
PROJECT FINANCE RISK PRICING DECISION:

Australian Evidence

An Empirical Study of the Project Finance Risk Pricing Decision Made by Australian Project Lenders in Terms of Project Finance Risk Weighting and Degree of Self-Insight.

Huyen T. Nguyen

Submitted for the Degree
of Master of Commerce (Hons)

College of Law and Business
University of Western Sydney

2002

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The work presented in this is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in whole or in part, for a degree at this or any other institution.

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Abstract

This thesis presents empirical research into the project risk pricing decision undertaken by Australian project lenders for domestic project finance. It addresses questions about the relative importance of various project finance risks on the project risk pricing decision; the impact of risk interactions; and the degree of self-insight possessed by Australian project lenders when making this decision.

To gather the required data, five project financing risk most frequently cited in the literature, namely: operating, environmental, market, political/regulation, and sponsors, were selected. A one-half fractional factorial design \((2^{5-1})\) was chosen to structure sixteen hypothetical risk pricing cases, which were completed by twenty-five project lenders working in Sydney. Analysis of Variance (ANOVA) from the MINITAB statistical software package was employed to examine the collected data.

The results show that the five project financing risks had strong impacts on the project risk pricing decision. Among them, market risk is the most influential factor, followed by operating, sponsors, and political/regulation risks, while environmental risk was the factor with least effect. Very little support, however, was provided for the hypothesis that risk interactions impact the project risk pricing decision. Among the ten two-level risk interactions tested, only the interaction between sponsors and political/regulation was found to be significant. In relation to the degree of self-insight, various comparisons between subjective and objective weights demonstrated that the project lenders, in general, were quite insightful about their project finance risk pricing decisions.