API 148
*Advanced Risk Management and Infrastructure Finance*

**SYLLABUS**
August 31, 2010

Akash Deep
COURSE DESCRIPTION

This course presents an advanced treatment of the theory of financial risk management and its applications in infrastructure finance. The theory presents tools for pricing of currency, commodity and interest rate derivatives, dynamic and long-term hedging, measuring credit risk, credit enhancement and hedging, and evaluating risk exposure. Applications, discussed in the form of cases, will cover issues related to project finance, public private partnerships for infrastructure, project cash flows, capital structure, development impact, cost of capital, infrastructure funds, valuation of brownfield and greenfield projects, risk allocation, and structured finance.

AUDIENCE

The class is primarily intended for students who wish to acquire a better understanding of risk management and its application to infrastructure finance. The primary vehicle for motivation, analysis and discussion will be cases about the development, valuation, financing and management of infrastructure projects. The course will also benefit those who wish to deepen their knowledge about the instruments and techniques of risk management and corporate finance.

PREREQUISITE

It will be assumed that students will have taken a basic course in finance (e.g. API-141 or an equivalent introductory course in finance). Students must be familiar with basic mathematical and statistical techniques, and comfortable with using spreadsheets for analysis.

Students with concerns about their background are welcome to speak to the instructor.
REQUIREMENTS

The course must be taken for credit. Auditors will not be allowed.

Attendance and participation

The course uses the case method extensively. The case method relies on two prerequisites:

- A careful reading of the case, as well as the other assigned readings, and answering of the study questions before coming to class.
- An alert, inquisitive and participative presence during the case discussion.

To facilitate this, the classroom will have assigned seating and attendance will count for part of the grade. Laptops, mobile phones and other electronic devices cannot be used in the class.

Assignments

Students will be asked to complete weekly assignments that are designed to illustrate, reinforce and test the concepts and cases discussed in class. Students are strongly encouraged to do the analysis and discussion work related to these assignments in small groups. However, the writing and submission has to be individual.

Final exam

Students will be required to appear for a final exam at the end of the course that will be based on material that is assumed as a prerequisite as well as that covered in the course.

GRADING

- Attendance and class participation: 30%
- Assignments: 20%
- Final exam: 50%

MATERIALS

Readings and cases are available for purchase in the form of course packets from the Course Materials Office at the Harvard Kennedy School. Some of the material may be available online to be accessed from the course web page. The course packet is also available for reference at the Harvard Kennedy School Library.

Note: You are required to do the readings for the first day of class, September 2, in advance. These are in the first reading packet, available for purchase at the Course Materials Office, or for reference at the Harvard Kennedy School library. The first reading packet contains required readings for the first four class sessions.
BOOKS

There is no required textbook for the course.

However, there are various books that can be recommended for the material that will be covered in the course. These can be split into three broad domains:

Risk management and derivatives:


Infrastructure finance:


Finance:


In addition, and especially if you want to review background concepts that will be assumed for this class, you might find it useful to consult selected chapters from the following texts:


Copies of all these books are on reserve at KSG library.
# TOPICS AT A GLANCE

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<th>Day</th>
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<td>Tue</td>
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<td>The theory and relevance of risk management</td>
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<td>Thu</td>
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<td>Projects, players and processes (<em>Completing the Trans-Java Highway</em>)</td>
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<td>Tue</td>
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<td>Project finance: Managing political risk (<em>Petrolera Zuata</em>)</td>
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<td>Thu</td>
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<td>How risky is project finance: Measuring credit risk statistically (<em>Basel II</em>)</td>
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<td>Tue</td>
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<td>Sculpting cash flows: Capital structure for risk management (<em>Poland A2 Motorway</em>)</td>
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<td>Thu</td>
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<td>Leverage: Measuring credit risk structurally (Lecture)</td>
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<td>Sep 28</td>
<td>Risk allocation: The role of residual risk (<em>Poland A2 Motorway, session 2</em>)</td>
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<td>Thu</td>
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<td>Leasing: Adjusting structure for changing risk (<em>Barracuda &amp; Caratinga oil project</em>)</td>
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<td>Tue</td>
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<td>Valuing development impact: Social and private value (<em>Nghe An Tate &amp; Lyle</em>)</td>
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<td>Thu</td>
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<td>Valuation techniques and the cost of capital (Lecture)</td>
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<td>Valuation for privatization: Country risk (<em>The Sale of Rio Light</em>)</td>
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<td>Valuation for regulation: Market risk (<em>Transener</em>)</td>
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<td>Valuation for financing: Leverage risk (<em>Texas High Speed Rail</em>)</td>
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<td>Tue</td>
<td>Oct 21</td>
<td>Hedging long-term risks (Lecture)</td>
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<td>Tue</td>
<td>Oct 26</td>
<td>Credit derivatives: Pricing credit risk (<em>First American Bank</em>)</td>
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<td>Thu</td>
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<td>Credit enhancement: Financing municipal infrastructure (<em>TNUDF</em>)</td>
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<td>Tue</td>
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<td>Swaps: Static hedging of long-term currency risk (<em>Sutton Bridge Power Station</em>)</td>
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<td>Thu</td>
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<td>Infrastructure funds: Pooling risk (<em>Miami Port Tunnel: Journey to Meridiam</em>)</td>
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<td>Tue</td>
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<td>Guest lecture: Thomas H. Green, Infrastructure Finance, Citigroup</td>
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<td>Tue</td>
<td>Nov 16</td>
<td>Rolling futures: Dynamic hedging of long-term commodity risk (<em>Metallgesellschaft</em>)</td>
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## Risk

| Thu  | Oct 21 | Hedging long-term risks (Lecture)                                    |            |
| Tue  | Oct 26 | Credit derivatives: Pricing credit risk (*First American Bank*)      | 7          |
| Thu  | Oct 28 | Credit enhancement: Financing municipal infrastructure (*TNUDF*)      |            |
| Tue  | Nov 2  | Swaps: Static hedging of long-term currency risk (*Sutton Bridge Power Station*) | 8          |
| Thu  | Nov 4  | Infrastructure funds: Pooling risk (*Miami Port Tunnel: Journey to Meridiam*) |            |
| Tue  | Nov 9  | Guest lecture: Thomas H. Green, Infrastructure Finance, Citigroup   |            |
| Tue  | Nov 16 | Rolling futures: Dynamic hedging of long-term commodity risk (*Metallgesellschaft*) | 9          |

## Structure, value and risk: public, private, or PPP?

| Thu  | Nov 18 | The Public Sector Comparator: Value for Money? (*Partnerships Victoria*) |            |
| Tue  | Nov 23 | The discount rate: Valuing risk transfer (*Partnerships Victoria, session 2*) | 10         |
| Tue  | Nov 30 | Review of infrastructure finance                                       |            |
| Thu  | Dec 2  | Review of risk management                                              | 11         |
| Fri  | Dec 10 | Final exam (morning)                                                  |            |
INTRODUCTION

Infrastructure finance


The theory and relevance of risk management


Projects, players, and processes

- Case: *Completing the Trans-Java Highway*, World Bank Institute Case (draft)
  The Government of Indonesia was keen to develop the Solo-Kertosono highway, which constituted the last 187 kilometers of the 900-kilometre Trans-Java Toll Road that still lacked a signed concession agreement. It felt that comprehensive reforms in the toll road sector as well as specific support provided for this project should have addressed most of the concerns of potential investors, including those related to land acquisition and financial viability. The Government had reinforced its commitment by naming this project one of the ten model projects to be implemented under the new Public Private Partnerships scheme in Indonesia. But the preferred bidder, an Australian construction company called Thiess Contractors, refused to sign a concession agreement until all the issues that it had raised were adequately dealt with.

STRUCTURE

Project finance: Managing political risk

- Case: *Petrolera Zuata Petrozuata C.A.*, Harvard Business School Case 9-299-012
  Petrozuata is a proposed $2.5 billion oil-field development project in Venezuela. The case is set in 1997 as the project sponsors, Conoco, Inc. and PDVSA (Venezuela's national oil company), are planning to meet with various development agencies and rating agencies regarding the proposed financial structure. The sponsors hope to raise a portion of the $1.5 billion debt in the capital
markets, which will require an investment-grade rating. The key questions are how to structure and finance the project.

- Project / infrastructure finance glossary
  http://www.people.hbs.edu/besty/projfinportal/glossary.htm

How risky is project finance: Measuring credit risk statistically

- Hull, John C., 2009, “Credit risk”, Chapter 22 in Options, Futures, and Other Derivatives, 7th edition, Prentice Hall (Section 22.1 to 22.5).

In June 1999, the Basel Committee on Banking Supervision announced plans to revise the capital standards for banks. The Basel Committee believed that project loans were significantly riskier than corporate loans and, therefore, warranted higher capital charges under the new proposal (known as Basel II). Bankers, fearing that higher capital charges would damage project lending by lowering profits and driving borrowers to nonbank competitors, formed a consortium to oppose the proposal by studying the actual default and loss characteristics of their combined portfolios of project loans. The study showed that project loans were not riskier than corporate loans. Armed with this data, the consortium sent a letter to the Basel Committee in August 2002 trying to convince them to lower the proposed capital charges on project finance loans.

Sculpting cash flows: Capital structure for risk management

- Case: Poland’s A2 Motorway, Harvard Business School Case 9-202-030

Autostrada Wielkopolska S.A. (AWSA), a consortium of 18 firms, has won a concession to build and operate Poland’s first private toll road. In June 2000, AWSA’s chief financial officer is preparing for a meeting with the projects’ lead bankers to discuss concerns they have regarding the traffic forecasts and revenue projections. Based on their concerns, the bankers are asking the sponsors to inject a sizeable amount of additional equity into the deal. This request presents a serious problem for AWSA because the concession is scheduled to expire in six weeks if financing has not closed and because he has very few options available to address the problem.

Leverage: Measuring credit risk structurally

- Hull, John C., 2009, “Credit risk”, Chapter 22 in Options, Futures, and Other Derivatives, 7th edition, Prentice Hall (Section 22.6 onwards)

Risk allocation: The role of residual risk

- Case: Poland’s A2 Motorway, Harvard Business School Case 9-202-030 (see above)

Leasing: Adjusting structure for changing risk

- Fowkes, David, Nasir Kahn, 2000, Don Armstrong, "Leasing in project financing", Journal of Project Finance, Vol. 6, Issue 1 (Spring)
- Case: The Barracuda & Caratinga Oil Project Financing, KSG case (draft)

In July 1998, Petrobras awarded Deutsche Bank, Merrill Lynch and two Japanese trading firms the mandate to structure a long-term financing for the development of the Barracuda & Caratinga Oil Fields. The financing proposal envisaged debt in an amount of $2.5 billion from a combination of sources including capital markets and syndicated bank loans. However, the Russian debt crisis of August 1998 triggered financial
turmoil across international financial markets and the capital market option had to be dropped. As some team members walked away from the mandate, the remaining ones, together with Petrobras, devised an innovative project structure, and explored alternative sources of financing. They approached a variety of lenders from across the globe that included commercial and investments banks, as well as Brazil's BNDES and the Japan Bank for International Cooperation. But in the already reeling Latin American lending market, the Real devaluation of January 1999 dealt a blow that threatened to dry up the availability of funds from the bank syndicate market as Brazil's country risk shot up, driving lenders and investors away.

VALUE

Valuing development impact: Social and private value

- Gomez-Ibanez, Jose, *Note on the Differences Between Social Benefit-Cost Analysis, Financial, and Regional Income Analyses*.
- Case: *Nghe An Tate & Lyle Sugar Company*, Harvard Business School Case 9-202-054
  The International Finance Corp. (IFC) was considering lending up to $45 million to finance a $90 million sugar mill in northern Vietnam in 1998. Its main concerns were whether the plant was commercially viable and whether it had support from the government. The IFC also needed to assess the project's developmental impact. It only supported projects that contributed to sustainable development, and one of the key determinants of sustainability was the degree to which the project was "fair" to all parties involved. Thus, the IFC needed to assess not only the private returns, but also the social returns as measured by the project's economic rate of return (ERR). To do so, it would have to consider the various groups affected by the project and, where possible, quantify the impact on them.

Valuation techniques and the cost of capital


Valuation for privatization: Country risk

- Case: *The Privatization of Light – Servicios de Eletricidade, SA: Preparing the Terms of Sale*, Kennedy School of Government Case 1540.0.
  In early March 1996, the response from possible bidders for the largest electricity distribution company in Rio de Janeiro had been hostile. Within a few weeks, the company, Servicios de Eletricidade, S.A, was to be auctioned in a much awaited and publicized bid. But investors had been very critical of several aspects of the structure of the sale, particularly the minimum asking price. If the sale went forward under its current structure and conditions, there was a serious chance that it would be a failure. On the one hand, there was enormous political pressure for the sale to take place as soon as possible without any significant changes to the conditions of sale. Many saw the future of the entire Brazilian privatization program as hinging on the success of this auction.

Valuation for regulation: Market risk

Case: Transener (B): The First Tariff Review, Kennedy School of Government Case Program. Case No. 1636.0.
Transener, the private firm forged from a formerly public corporation in 1993 to operate Argentina's national high-voltage transmission grid, had been consistently profitable and had embarked on a major expansion program. But as the case unfolds in 1998, there are clouds on Transener's horizon. ENRE, Argentina's national electricity regulatory agency, is reviewing the tariffs that Transener can charge for transporting electricity. ENRE regulates the tariffs on the grounds that the high voltage transmission system is a natural monopoly. Transener's initial tariffs had been set before the company's sale in 1993, and are to be reviewed every 5 years, starting in 1998. ENRE has begun Transener's first review by proposing a schedule of tariffs that would substantially reduce Transener's future revenues.

Valuation for financing: Leverage risk

Case: Texas High-Speed Rail Corp., Harvard Business School Case 9-293-072.
The finance director of the Texas High-Speed Rail Corp. (THSRC) is considering modifications to the financing program designed to support the development, construction, and operations of THSRC's planned high-speed rail system. The current plan achieves many objectives, including raising $6.5 billion from private sources, but a few problems remain to be addressed. These include temporary over-funding, unutilized tax losses, and certain important contingencies.

RISK

Hedging long term risks


Credit derivatives: Pricing credit risk

Charles Bank International is interested in making a $50 million loan to a client. The motivation for the loan is not the fees or return that the bank expects to earn. Instead, this is a major client and the bank wishes to make the loan to keep the client's business. The problem is that Charles bank has already holds $100 million in loans to this client and the additional $50 million would exceed its exposure limit with respect to a single client. How could the bank prevent the possibility of damaging an existing client relationship without violating its internal lending statutes?

Credit enhancement: Financing municipal infrastructure:

- Case: Tamil Nadu Urban Development Fund, KSG case (draft)
The second phase of the Tamil Nadu Urban Development Project (TNUDP II) project had come to a close in March 2005, and the World Bank was actively considering the sanction of a repeater
program, TNUDP III. The most innovative component of the plan had been the Tamil Nadu Urban Development Fund (TNUDF), one of the first efforts in the developing world to establish public-private collaboration in the funding and management of a local urban infrastructure intermediary. The “backbone” of TNUDF had been the $80 million line of credit provided by the World Bank. TNUDP III proposed a similar but slightly smaller fund to be supported by $110 million of World Bank credit. In its Country Strategy for India (2004), the World Bank had described its objective as: “…to support the urban reform agenda…improve governance, incentives and financing capacities of urban local governments… encourage improvements in local finances and revenue mobilization making cities less dependent on state and central flows and enabling them to gradually access sustainable forms of finance; and facilitate private sector participation.” Supported by urban reform at the national level, TNUDF had contributed to these objectives. But the recent experience of the fund had also raised concerns about its performance, suitability and sustainability.

Swaps: Static hedging of long-term currency risk

- Case: The Sutton Bridge Power Station Project, Kennedy School of Government Case Program.
  In May 1997, a £280 million ($454 million) debt issue backed by utility bill revenue was expected out of London for the Sutton Bridge Power Station. With only 13% equity, the sponsors would spend about $300 million to construct the station that was expected to start generation in March 1999. But financiers of the Sutton Bridge Power project were planning to seek 25-year financing for the project in summer of 1997, almost two years before the completion of construction. With all of its inherent risks, financial managers responsible for structuring the issue were concerned about stretching the U.K investor's appetite for risk to its limit. A dollar tranche, to tap the more sophisticated market for project debt in the United States, was being considered but this would expose the already risky project to exchange rate risk.

Infrastructure funds: Pooling risk

- McLean, Bethany, 2007, Would You Buy a Bridge from This Man? Fortune, October 2.
- Lawrence, Martin and Stapledon, Geoffrey, 2008, "Infrastructure Funds: Managing, Financing and Accounting In Whose Interests?", RiskMetrics Group (April)
- Case: Port of Miami Tunnel: Journey to Meridiam, Kennedy School of Government Case (draft)
  When Bethany Mclean, a journalist credited with first raising the alarm about Enron’s accounting practices, published the provocatively titled article “Would you Buy a Bridge from this Man?” in 2007, she was referring to not just one seller but an entirely new class of private equity investors called “Infrastructure funds”. Three years earlier, such a fund, pioneered by Macquarie Bank of Australia, had paid the City of Chicago $1.8 billion for a 99-year lease on a 7.8-mile toll road in the city. Infrastructure funds have emerged over the past decade as a distinct and significant funding source for infrastructure projects in many developed and developing countries. It is estimated that over $110 billion of equity infrastructure funds would be present in the market by the end of 2010, of which more than $30 billion would be targeted towards emerging markets. Suitably levered with debt, such funds could channel an additional half a trillion dollars of investments into the infrastructure sector.

Rolling futures: Dynamic hedging of long-term commodity risk

  “To avoid being ambushed, top managers and directors of those firms need not become derivatives experts … but they must understand the essential logic behind their firm’s marketing and hedging strategies and the long term commitments needed to make the programs work. Otherwise, their firms may encounter not the classic gambler’s ruin problem … but an insidious new phenomenon of the derivatives age: an economically sound hedging program may be liquidated prematurely because highly visible rollover costs and temporary cash drains might be construed by top management as gambling losses. Perhaps we might call this new phenomenon ‘hedger’s ruin’.” (Extract from article)
STRUCTURE, VALUE AND RISK: PUBLIC, PRIVATE OR PPP?

The Public Sector Comparator: Value for money?

- Case: Partnerships Victoria, Kennedy School of Government Case 1822.0

The government of the State of Victoria in Australia has been a pioneer in using the private sector to provide public infrastructure through "public-private partnerships" (PPPs). Under PPP programs the government contracts with a private company not just to build a facility but to operate it over its expected life, as well. PPPs are used for "social" infrastructure such as courthouses and hospitals as well as for "economic" infrastructure such as toll roads or public transport. The Department of Treasury required that agencies pursuing a PPP demonstrate that the PPP would save money compared to traditional procurement options. But critics argued that the Treasury's guidelines for such cost comparisons were flawed. The debate raised issues about how to compare the risks assumed by the government under different procurement options and how the differences in risks should be reflected in the discount rates.

The discount rate: Valuing risk transfer

- Case: Partnerships Victoria, Kennedy School of Government Case 1822.0 (see above)