April 21, 2003 (Edited by World Bank)

Case 3. The Eje Vial Del Cono Sur Highway Project in Uruguay

Alberto Barreix, Glenn P. Jenkins, and Mario Marchesini[*]

The Eje Vial del Cono Sur is a project to develop a road in Uruguay from Colonia to Rio Branco on the northern border with Brazil that will run across in the south. The road would form part of an important transportation link between Buenos Aires in Argentina and Sao Paulo in Brazil. The implementation of this project depends on the construction of a bridge to link Colonia to Buenos Aires. Without this bridge, most of those involved believe that the levels of traffic on the road between Colonia and Rio Branco would not justify the project at this time. It is being proposed that the Eje Vial del Cono Sur Highway would be a toll road. The initial plan of the government of Uruguay is to award a concession to a domestic investor to finance, develop, maintain, and operate this road.

Southern Cone Common Market

Any major transport infrastructure project in Uruguay has to be planned within the context of the Southern Cone Common Market (Mercosur). Signed in 1991, Mercosur is a regional customs union arrangement among Argentina, Brazil, Paraguay, and Uruguay. It involves a market of more than 200 million consumers with an income per capita of more than US$4,000. Mercosur is intended to promote economic growth and to stimulate trade and investment among the member countries. Its objectives include:

[*] The authors are grateful to the Inter-American Development Bank (IADB) for supporting this work. The suggestions and comments of George P. Montalvan, IADB senior management analyst; Jaime Sujoy, IADB senior economist; and Christian Santelices, IADB infrastructure engineer, have considerably improved the quality of the case study. We appreciate the collaboration of G. P. Shukla, Fernando Fernholz and of Ellen Seidensticker at the Harvard Institute for International Development for their valuable inputs on earlier drafts. The assistance of Pablo Genta from the Buenos Aires-Colonia Bridge Bi-National Commission with the preparation of the demand model is greatly appreciated. This teaching case was developed for an IADB training program and does not reflect any endorsement of the Eje Vial or of the Buenos Aires-Colonia bridge projects by the IADB or Harvard University.

- Enlarging the member countries’ domestic markets and easing their access to regional markets;
- Promoting the member countries' economic development through a more efficient use of resources;
- Improving the transportation and communication networks;
- Coordinating the macroeconomic polices.

As a customs union arrangement, Mercosur does not involve the establishment of any supernational institutions, but does have an administrative secretariat, based in Montevideo. It has established a schedule for reducing tariff duties and removing nontariff barriers among member countries, and for defining a common external tariff. These measures are complemented by common rules on foreign investment within the region.

Between 1990 and 1996, intra-Mercosur trade grew at an average annual rate of almost 30 percent, from a total of US$5 billion to about US$17 billion.[1] In 1996 this intraregional trade represented 20 percent of external trade. Foreign direct investments also grew sharply, from a total of US$3.4 billion in 1991 to more than US$7.5 billion in 1996. Table 3.1 shows the growth rates of external trade for the Mercosur member countries. The growth rate of exports between Mercosur countries has been particularly strong for Argentina and Brazil.[2]

[1] The growth rate for world trade during this period was 9.3 percent.
[2] However, uncertainty about the future growth of intraregional trade is considerable. The Mercosur countries have not yet met the targets for tariff reductions and have maintained many exceptions. Moreover, any economic instability in the region constitutes a threat.

Table 3.1. Annual Growth Rate of External Trade, Mercosur Countries, 1991-95

Country	Annual growth rate (%)
Argentina	
Exports to Mercosur	36.0
Exports to rest of the world	9.1
Brazil	
Exports to Mercosur	27.7
Exports to rest of the world	8.3
Paraguay	
Exports to Mercosur	15.7
Exports to rest of the world	-7.2
Uruguay	
Exports to Mercosur	15.5
Exports to rest of the world	2.4

Source: Gaceta Mercantil LatinoAmericana, 1997.

Regional cooperation for concerted development of transport infrastructure is essential to facilitate intra-Mercosur trade. In addition to the Eje Vial del Cono Sur project, the most significant multinational transport projects currently under appraisal include

- The Buenos Aires-Colonia (BAC) bridge, a 41-kilometer (km) bridge across the River Plata estuary connecting Argentina to Uruguay,
- The Hidrovia Parana-Paraguay, a shipping link of 3,440 km over the River Parana and its tributary the River Uruguay from Buenos Aires to Asuncion, and ultimately to Caceres in Mato Grosso in Brazil. The project involves five countries: Argentina, Bolivia, Brazil, Paraguay, and Uruguay.

Uruguay’s Transportation Sector

Before turning to the analysis of the Eje Vial del Cono Sur Highway project, a short overview of the transportation sector in Uruguay is needed in order to have an understanding of the relative importance of this particular project.

Roads

Road transport has progressively become the dominant mode of transportation. Passenger transport is estimated at 5.6 billion passenger-kilometers.[3] Automobile ownership is relatively low compared to other countries with a similar level of per capita income: one car per seven people, compared to one car per two or three people in countries of the Organization for Economic Co-operation and Development. Automobile ownership is, however, growing at more than 4 percent per year and is expected to reach one car per four people in 2010. Freight transport is estimated at about 3 million ton-kilometers. Argentina and Brazil are either the origin or the destination of about 90 percent of this freight transport.

Uruguay has about 9,000 km of primary roads and 66,000 km of secondary roads. About 9,000 km of national and municipal roads (12.7 percent of the total) are paved. Given Uruguay's population of about 3.2 million people, the length and density of the road network are sufficient. According to the Ministry of Transport and Public Works, 75 percent of national roads are in satisfactory condition. Estimates indicate that an additional investment of more than US$13 billion is needed for asset maintenance and renewal. Annual government expenditure for road construction and maintenance amounts to about US$100 million. The government is therefore seeking private investment and management to bridge the financing gap through concession agreements and tolling. Motorway construction should be undertaken where economically justified, taking other road priorities into account. Staged construction also needs to be further explored.

Railways

The railway network comprises about 3,000 km of route length and 43 stations. Considering the low population density, this network is extensive. However, large numbers of locomotives, wagons, tracks, and other assets are either obsolete or require repair. This decline in quality of the railways has reduced their importance as a transport mode. The vast majority of railway

[3]About two-thirds of this figure corresponds to travel by car and one-third to travel by bus. Less than 50 percent of travel is undertaken for business reasons.

transport consists of bulk freight transport. The annual volume of freight transported has remained relatively stable since 1988 and is estimated at about 1 million tons.

Civil Aviation

The airports handle about 1.2 million passengers per year. Carrasco International Airport in Montevideo is the most important, with about 1 million passengers per year. Punta del Este is second in importance, with about 200,000 passengers. Traffic is steadily declining in Colonia, the country's third airport mainly because of the competition from fast-ferries shuttling to and from Buenos Aires.

A US$120 million project to modernize and expand Carrasco International Airport is planned. This project would enable air transport in Uruguay to be independent of the airport at Buenos Aires. The government of Uruguay plans to award a concession to a private consortium to finance and make the improvements and to operate the airport.

Ports and Waterways

Passenger traffic on waterways amounted to more than 2 million passengers in 1995 (Colonia and Montevideo account for 62 and 32 percent of the traffic, respectively), with an annual growth of 88 percent from 1990 to 1995. The volume of cargo transported amounted to 5 million tons in 1994, and has also experienced rapid growth.

Modal Distribution of Exports

Table 3.2 shows the distribution of Uruguayan exports by transport mode. The pattern of distribution correlates with the destination of exports. The great majority of exports to Mercosur countries are by road, while exports outside Mercosur, which account for more than half of total exports, are primarily by ship.

Table 3.2. Modal Distribution of Exports, 1994

Mode	Tons	Percentage of total
Road	832,000	41
Railways	95,000	5
Inland waterways and maritime ships	1,071,000	53
Air	24,000	1
Total	2,022,000	100

Source: Ministry of Transport and Public Works, (1995).

The Eje Vial del Cono Sur Road Project

The Eje Vial del Cono Sur is a project to develop a highway connecting Colonia to Rio Branco. Currently, most of the freight traffic between Sao Paulo, Brazil, and Buenos Aires, Argentina, travels over a road that runs west from Sao Paulo and across the Rio Uruguay without passing through Uruguay. That road is largely in a poor state and requires repair. The proposed route of the Eje Vial del Cono Sur would be more direct than the road currently used. Construction of the BAC bridge has been thought to a necessary condition for the economic and financial feasibility of the Eje Vial project.

The proposed highway is divided into five sections. One section requires the construction of a new road, while the other four consist of the rehabilitation and expansion of already existing routes.

Section 1: Route 1, Colonia to Ecilda Paullier (km 0–74). This section involves the construction of a parallel second road. Because of the traffic originating from the BAC bridge, this section would attract the most significant volume of traffic, projected at about 6,900 vehicles per day in 2003.

Section 2: Route 11, connector from Route 1 to Canelones (km 74–160). Sections 2 and 3 provide a by-pass around Montevideo. This section involves an expansion of the existing two-lane road that is currently in reasonably good condition. The traffic on this section is estimated to be about 4,830 vehicles per day in 2003.

Section 3: Route 11, from Canelones to Connector Route 8 (km 160–285). This section involves an expansion of the existing two-lane road and rehabilitation of the shoulders. A traffic volume of about 4,260 vehicles per day is projected for this section in 2003.

Section 4: Route 8, Minas to Treinta y Tres (km 285–457). This section provides a by-pass around the town of Minas, and involves the construction of a bridge and the expansion of the existing two-lane road. The traffic volume on this section is estimated to reach at about 1,780 vehicles per day in 2003.

Section 5: Route 8, Treinta y Tres to Rio Branco (km 457–587). This section provides a by-pass around the town of Rio Branco, and involves the construction of a bridge over the Rio Tacuari and the expansion of the existing two-lane road. A traffic volume of about 1,650 vehicles per day is projected for 2003.

The total cost of the Eje Vial project is estimated at nearly US$275 million in 1999 prices. The cost estimates are based on a feasibility study developed for the government of Uruguay by Traffic and Feasibility Studies (BCEOM), a French consulting firm (BCEOM 1988). Table 3.3 shows the investments in the various components of the project. The construction phase is expected to last three years.

Table 3.3. Project Costs
(1999 US$ thousands)

Item	**Cost**
Road construction	
Labor	108,264
Machinery	68,014
Materials	37,534
Miscellaneous	60,390
Total	274,202
Toll booths	611
Total investment cost	**274,813**

Source: Ministry of Transport and Public Works, (1995).

Considering the low level of country risk, this study sets the debt-equity ratio, required for the project to operate, at 70 to 30 percent. The terms of the debt financing assumed in the base case are as follows:

- Amortization period: 10 years,
- Disbursement period: 3 years,
- Grace period: 1 year,
- Interest rate: 10 percent (approximately corresponding to LIBOR plus 300 to 400 basis points),
- Capitalization of accrued interest will be made during the construction.

Comparing Alternative Scenarios for the Eje Vial Project

The economic appraisal of any transport infrastructure project is typically performed by comparing different alternatives for the provision of the transport services in question. The economic evaluation of the Eje Vial project presented in this study is carried out by comparing the following two scenarios:

- The BAC bridge with the implementation of the Eje Vial project.
- The BAC bridge without the implementation of the Eje Vial project. This scenario is based on the current level of operating and maintenance costs for existing routes that the Eje Vial project would rehabilitate and expand.

The need for the Eje Vial project is affected by the construction of the BAC bridge. This is because without this bridge, the levels of traffic on the road between Colonia and Rio Branco would be much lower during the foreseeable future. Therefore, this study does not include an appraisal of the Eje Vial project in the absence of the BAC bridge. The financial and economic results of the Eje Vial project without the construction of the BAC bridge are, however, assessed as a part of the sensitivity analysis.

The previous financial and economic appraisal of the BAC bridge was made under the assumption that the Eje Vial project would not be implemented. The analysis shows that the project would be both financially viable from the standpoint of the bridge concessionaire and economically beneficially for Argentina and Uruguay (International Institute for Advanced Studies, Inc., 1997).

Traffic Projections

The annual traffic along the Eje Vial can be divided into the two broad categories of (a) without project, and (b) generated traffic. Then, the annual traffic volume along the Eje Vial is projected according to:

- The type of vehicle (cars, buses, trucks with two or three axles, and trucks with four or more axles),
- The section of the Eje Vial road,
- The nationality of users (Argentinean, Brazilian, or Uruguayan).

Without Project Traffic

For the "without project" scenario, the projections include the traffic that would occur using the existing routes and the traffic that would arise following completion of the BAC bridge. As construction of the BAC bridge is a necessary condition for the Eje Vial project, the sum of the two components constitutes the traffic along the Eje Vial, and is considered to exist in the "without project" situation.

The traffic demand model starts the traffic projections on the Eje Vial in 2003, the assumed opening-year of the BAC bridge and of this project. The volume of traffic along the Eje Vial without the implementation of this project is projected on the basis of information available for 1996. Projections for traffic generated due to the construction of the BAC bridge are taken from the demand study for the BAC bridge project (developed by Cambridge Systematics and used in the appraisal of the BAC bridge project developed by the International Institute for Advanced Studies). The average annual growth rate of local and BAC bridge traffic along the Eje Vial,[4] per type of vehicle, was estimated on the basis of the traffic growth trends for the past five

[4] The model assumes annual growth rates for local traffic of 6.4 percent for cars, 2.4 percent for buses and 4 percent for trucks. It also projects an annual growth rate for BAC bridge traffic of 4.8 percent, 2.2 percent, and 7 percent,

years and of the gross domestic product (GDP) growth rates for Argentina, Brazil and Uruguay, which are assumed to be a steady 4 percent per year for each country. The annual traffic growth rates take into account the estimated elasticities of traffic growth with respect to GDP growth per type of vehicle, local or BAC bridge traffic, and nationality of users.[5] The annual projections of local and BAC bridge traffic along the Eje Vial are estimated on the basis of the price elasticity of demand for transport services, and we assume a price elasticity of demand of -0.25 for all categories of vehicles. Table 3.4 shows the forecast of the without project local and BAC bridge traffic.

Table 3.4. Forecast of Without Project Local and BAC Bridge Traffic

Year	2003	2007	2011	2015	2019	2020	2021	2022
LOCAL TRAFFIC								
Cars	280,124	359,019	460,133	589,726	755,817	804,189	855,657	910,419
Buses	16,246	17,862	19,640	21,594	23,743	24,313	24,896	25,494
Trucks (2 or 3 axles)	48,348	56,560	66,168	77,407	90,555	94,177	97,944	101,862
Trucks (4 or more axles)	29,336	34,318	40,148	46,967	54,945	57,143	59,428	61,806
BAC BRIDGE CROSSING TRAFFIC								
Cars	153,971	185,731	224,042	270,255	326,001	341,649	358,049	375,235
Buses	7,734	8,437	9,205	10,042	10,955	11,196	11,443	11,694
Trucks (2 or 3 axles)	35,591	45,987	59,501	77,083	99,975	106,708	113,901	121,587
Trucks (4 or more axles)	131,250	170,869	222,603	290,183	378,494	404,521	432,352	462,111
TOTAL								
Cars	434,095	544,750	684,175	859,981	1,081,818	1,145,839	1,213,706	1,285,654
Buses	23,980	26,300	28,844	31,636	34,698	35,509	36,339	37,188
Trucks (2 or 3 axles)	83,939	102,547	125,669	154,490	190,530	200,885	211,845	223,449
Trucks (4 or more axles)	160,585	205,188	262,751	337,150	433,439	461,664	491,780	523,916

Generated Traffic

In this study, generated traffic includes both the change in usage by those already using the road and the change in traffic volume created by those who were previously using other routes and will now travel on the Eje Vial. This study assumes that the Eje Vial project will bring about an overall reduction in the generalized cost of the trip, which is the sum of the toll, the vehicle

respectively. The impact of divergences from the assumed estimates on the financial and economic viability of the project is tested in the sensitivity analysis.

[5] The elasticities of local traffic growth with respect to GDP growth in Uruguay are 1.6 for cars, 0.6 for buses, 1.0 for trucks with two or three axles and 1.0 for trucks with four or more axles. The elasticities of the BAC bridge traffic growth with respect to GDP growth in Argentina and Uruguay are 1.2 for cars and 0.55 for buses. The elasticity of BAC bridge traffic growth with respect to GDP growth in Argentina and Brazil is 1.75 for trucks with two or three axles and trucks with four or more axles.

operating costs, and waiting time.[6] Table 3.5 shows the different components of the generalized cost in Ur$/km for different categories of vehicles with and without the project.

Table 3.5. Generalized Cost
(Ur$/Km)

Category	**Vehicle operating costs**	**Cost of time**	**Toll**	**Total**
Without project				
Cars	3.0	1.11	n.a.	4.11
Buses	6.8	3.70	n.a.	10.50
Trucks (2 or 3 axles)	6.3	2.82	n.a.	9.12
Trucks (4 or more axles)	15.7	3.73	n.a.	19.43
With project				
Cars	2.43	0.92	0.43	3.78
Buses	6.27	3.19	0.68	10.14
Trucks (2 or 3 axles)	5.36	2.42	0.97	8.75
Trucks (4 or more axles)	14.83	3.20	1.27	19.30

n.a. Not applicable.
Note: In 1999 the exchange rate was Ur$11.2 to the U.S. dollar.

Financial Analysis

The financial analysis is the first component of an integrated investment appraisal and provides the foundation on which the other modules of the analyses are built.

Public-Private Partnership

The initial plan is to implement the Eje Vial del Cono Sur project with private sector participation. Private sector participation in road projects can take different forms depending on the allocation of risks and responsibilities between the public and private sectors, the duration of the arrangement, and the ownership of assets. However, all these forms involve a partnership between the government and the private sector. The option for private sector participation considered in this study (and in BCEOM's preliminary feasibility study) is the build-operate-

[6] Information on vehicle operating costs and waiting time is from BCEOM, 1998.

transfer (BOT). In a typical BOT arrangement, a private firm or a consortium undertakes to construct the facility and operate it for a given number of years. At the end of the contract the consortium will relinquish all rights to the public sector. Uruguay already has several BOT projects, including the Interbalnearia toll road between Montevideo and Punta del Este and the Laguna de Sauce Airport.[7] BOT projects are often awarded through a bidding process: the bidder that proposes to build and operate the facility for the lowest and most efficient toll structure wins the concession. The concession is governed by a contract that sets out such conditions as:

- The main performance targets,
- The criteria for monitoring and sanctions for failure to meet targets,
- The mechanisms for tariffs adjustment,
- The arrangements for arbitrating disputes
- The valuation of assets in case of early termination of the contract.

A careful review of the project's risks is critical to the structuring of any BOT project. In order to succeed, it is essential for a project to identify the risks clearly and to allocate such risks in an efficient manner between the private and public sectors.

Assumptions

The following are the main parameters used in the financial analysis and summarized in the table of parameters (table 3.6) below.

- *Costs of routine and periodic maintenance and of operating inputs (1999 price level).* The routine annual maintenance costs with and without the project are estimated at Ur$51,000/km and Ur$56,000/km (about US$4,500/km and US$5,000/km) respectively. Periodic maintenance costs are projected at Ur$1.14 million/km and Ur$1.4 million/km (about US$100,000/km and US$125,000/km) every 10 years. The costs of operating inputs are expected to remain constant, in real terms, throughout the life of the project.

[7] Uruguay also has experience with other options for private sector participation including operations and maintenance contracts and full divestiture.

- *Income tax*. We assume that the concessionaire will pay corporate income tax of 30 percent on profits.
- *Capital costs*. Capital costs exclude the interest during construction.
- *Project life*. We estimate that the project will have a useful life of 20 years and assume that the fixed assets will be 100 percent depreciated, in real terms, by the end of the project's life.
- *Average collection period*. We assume that the user toll is collected immediately.
- *Accounts payable.* We assume that accounts payable are equal to one month (8 percent) of the operating expenses.
- *Cash balance*. We assume that the desired stock of cash balances to be held as working capital is 2 percent of the sales revenues.
- *Inflation rates.* We assume an 8 percent inflation rate for Uruguay and a 2 percent rate of foreign inflation.
- *Nominal exchange rate (in 1999).* The nominal exchange rate is Ur$11.2 per U.S. dollar. We assume that the real exchange rate remains constant during the project life. The nominal exchange rate will, therefore, adjust over time depending on the differential between the rates of inflation in the United States and Uruguay.
- *Real return on equity*. The real return on equity is taken as 15 percent, which corresponds to a nominal rate of 17.3 percent. The required nominal return on invested capital may vary from 15 percent to more than 20 percent, depending on the availability of government guarantees.

Table 3.6. Table of Parameters

Project Timing			**Operating Expenses**		
Initial Construction year	2000	Year 1	Percentage of Net Revenues	5%	
Period of Construction (years)	3		Labor	45%	
First year of operation	2003		Skilled	25%	
Life of Project (years)	20		Semi-skilled	75%	
Construction schedule	33.33%	Year 1	Miscellaneous	55%	
	33.33%	Year 2	Incremental oper. exp. w/ and w/o project	10%	of w/project operating expenses
	33.33%	Year 3			
			Investment Financing		
			Equity	30%	
Construction Costs (1999 price level)			Loan	70%	
1. Road Construction (1,000 Pesos/Km)			Foreign	100%	
Labor	2,066		Domestic	0%	
Machinery	1,298		Loan Repayment (years)	10	
Materials	716		Grace period (years)	2	
Miscellaneous	1,152				
Total	**5,232**		Nominal Interest Rate on Foreign Loan	10.00%	
2. Toll Booth (1,000 Pesos/Booth)			Real reurn on Equity	15.00%	
Number of Booths	5				
Labor	479				
Machinery	137		**Working Capital**		
Materials	547		Accounts Receivable	0.0%	of Sales Revenues
Miscellaneous	205		Accounts Payable	8.0%	of Operating Expenses
Total	**1,369**		Cash Balance	2.0%	of Sales Revenues (Diverted Traffic)
Cost Overrun factor	0.00%				
			Taxes		
Maintenance Costs (1999 price level)			Value Added Tax	23%	
1. Routine Maintenance with Project (1,000 Pesos/Km/Year)			Corporate Income Tax	30%	
Labor	23		Straight Line Depreciation	20	Years
Machinery	10				
Materials	9				
Miscellaneous	10	*Total w/o Project*	**Macroeconomic Parameters**		
Total	**51**	***56***	Uruguayan Inflation rate	8.0%	
2. Periodic Maintenance with Project (1,000 Pesos/Km every 10 Years)			Real Exchange Rate	11.20	Pesos/US$
Labor	460		Annual Depreciation	0.0%	
Machinery	225		Foreign inflation rate	2.0%	
Materials	209		GDP Growth Rates		
Miscellaneous	246	*Total w/o Project*	Uruguay	4.0%	
Total	1,140	***1,250***	Argentina and Brazil	4.0%	
BAC Bridge Timing					
Scheduled 1st Year of Operation	2003		**National Parameters**		
Delay in Opening (years)	0		Economic Cost of Capital	10.50%	
Actual First Year of Operation	2003		Foreign Exchange Premium	10.94%	

Toll Structure

Table 3.7 presents the proposed toll structure for the Eje Vial. The structure reflects the explicit objectives of the government of Uruguay to charge a relatively higher toll on sections 1 and 5, which are at the extremes of the Eje Vial, and to have truck, particularly the drivers of trucks with four or more axles, contribute relatively more to the concessionaire's revenues. The vast majority of trucks with four or more axles that travel on the road do not begin their trip in Uruguay.

Table 3.7. Proposed Toll Structure
(1999 Ur$)

Project section	Cars	Buses	Trucks (2 or 3 axles)	Trucks (4 or more axles)
1	64	111	143	210
2	46	74	95	115
3	42	63	87	110
4	39	62	73	91
5	59	88	170	217
Total	*250*	*398*	*217*	*743*

Note: The proposed toll structure includes value added tax.
Source: BCEOM (1998).

In general terms, the proposed toll structure appears to address some of the usual objectives of toll design, including:

- Covering the construction, maintenance and operating costs, and also allowing the concessionaire to generate an adequate return on capital.
- Varying the toll according to the number of axles on vehicles. This approach is generally adopted because it can act as a proxy for the damage that different vehicles inflict on the pavement.

Most concession agreements include a toll escalation formula that is related to the consumer price index (and often also to the foreign exchange rate), and allows for regular toll increases either every year or every few years. This study assumes that the toll is adjusted for inflation annually.

Project Evaluation Perspectives

The financial analysis is developed from the point of view of the project concessionaire, who has to determine whether the project is financially viable and sustainable. The financial benefits and costs that are relevant from the perspective of the concessionaire are the actual cash flows that will occur following project implementation.

The cash flow statement of the project from the point of view of the concessionaire is developed from the total investment and the equity holder's perspectives. The analysis from the total investment point of view does not consider the financing decisions associated with the project, except for the estimation of income tax liabilities. This perspective enables the analyst to assess the project's ability to generate cash flow regardless of the source of project financing. In contrast, the equity holder's perspective examines the project's cash flow profile when debt financing is employed. The cash flow statement from the equity holder's view includes loans, if any, as sources of funds and the loan repayments as cash outflows (for a complete discussion, see Harberger and Jenkins 2001, chapter 3).

From the standpoint of Uruguay's economy, the relevant flows are those that are incremental to what would have occurred without the project. We also derive an incremental financial cash flow statement in order to perform the stakeholder analysis.

Methodology

We conduct the financial analysis of the project in both nominal and real prices to account for the different effects of inflation, which also has both direct and indirect impacts on a project's financial viability. The direct impact of inflation on the project returns takes place through changes in the real value of accounts payable and the cash balances (this project does not have accounts receivable). The indirect impact takes place through changes in the real value of the corporate income tax liability (see Haberger and Jenkins 2001, chapter 6). Then, we deflate the nominal cash flow statement, item by item, to arrive at the real cash flow statement.

We estimate the financial viability of the project from the perspective of the concessionaire by calculating its net present value (NPV) and by examining the sensitivity of its financial performance to the project's key variables. Finally, we calculate the project's NPV by discounting its real net cash flow from the equity holder's perspective at the real rate of return on equity of 15 percent.

Results

Tables 3.8 and 3.9 show the projected real cash flow statements for the Eje Vial project in the "with project" scenario from the total investment and the equity holder's points of view, respectively. The project appears to be viable, as its NPV from the equity holder's perspective is almost Ur$91 million.

Table 3.8. Real Cash Flow Statement from the Total Investment Point of View (thousands of Ur$)

Year	2000	2001	2002	2005	2008	2011	2014	2017	2020	2021	2022	2023
RECEIPTS												
Toll revenues (Without Project Traffic)												
Cars	0	0	0	257,100	304,674	361,221	428,463	508,456	603,656	639,261	676,999	0
Buses	0	0	0	22,120	23,710	25,414	27,241	29,200	31,300	32,033	32,783	0
Trucks (2 or 3 axles)	0	0	0	93,775	108,575	125,919	146,281	170,229	198,447	208,939	220,029	0
Trucks (4 or more axles)	0	0	0	241,613	290,277	349,179	420,535	507,047	612,014	651,775	694,197	0
Toll revenues (Generated Traffic)												
Cars				5,202	6,164	7,308	8,669	10,287	12,213	12,934	13,697	0
Buses				190	204	218	234	251	269	275	282	0
Trucks (2 or 3 axles)				939	1,056	1,188	1,336	1,503	1,691	1,758	1,829	0
Trucks (4 or more axles)				412	497	600	724	876	1,060	1,130	1,205	0
Total Inflow	0	0	0	621,350	735,156	871,048	1,033,484	1,227,849	1,460,649	1,548,105	1,641,020	0
EXPENDITURES												
Construction Costs												
Road Construction	1,023,687	1,023,687	1,023,687	0	0	0	0	0				
Toll Booths	2,281	2,281	2,281	0	0	0	0	0				
Routine Maintenance	0	0	0	30,126	30,126	30,126	30,126	30,126	30,126	30,126	30,126	0
Periodic Maintenance	0	0	0	0	0	0	0	0	0	0	669,462	0
Operating Expenses	0	0	0	24,984	29,562	35,030	41,566	49,387	58,757	62,277	66,017	0
Value Added Tax	0	0	0	116,187	137,468	162,879	193,253	229,598	273,130	289,483	306,857	0
Corporate Income Tax	0	0	0	21,384	74,955	134,999	203,694	262,119	318,872	339,941	161,378	0
Change in Accounts Payable	0	0	0	(248)	(295)	(351)	(417)	(497)	(594)	(630)	(668)	4,890
Change in Cash Balance	0	0	0	1,528	1,814	2,157	2,567	3,060	3,651	3,873	4,110	(30,074)
Total Outflow	1,025,968	1,025,968	1,025,968	193,960	273,630	364,840	470,789	573,792	683,942	725,070	1,237,281	(25,184)
NET CASH FLOW	(1,025,968)	(1,025,968)	(1,025,968)	427,390	461,526	506,208	562,695	654,057	776,708	823,035	403,739	25,184

Table 3.9. Real Cash Flow Statement from the Equity Holder's Point of View (thousands of Ur$)

Year	**1999**	**2000**	**2001**	**2002**	**2005**	**2008**	**2011**	**2014**	**2017**	**2020**	**2023**
RECEIPTS											
Toll revenues (Without Project Traffic)	0	0	0	0	0	0	0	0	0	0	0
Cars	0	0	0	0	257,100	304,674	361,221	428,463	508,456	603,656	0
Buses	0	0	0	0	22,120	23,710	25,414	27,241	29,200	31,300	0
Trucks (2 or 3 axles)	0	0	0	0	93,775	108,575	125,919	146,281	170,229	198,447	0
Trucks (4 or more axles)	0	0	0	0	241,613	290,277	349,179	420,535	507,047	612,014	0
Toll revenues (Generated Traffic)	0	0	0	0	0	0	0	0	0	0	0
Cars	0	0	0	0	5,202	6,164	7,308	8,669	10,287	12,213	0
Buses	0	0	0	0	190	204	218	234	251	269	0
Trucks (2 or 3 axles)	0	0	0	0	939	1,056	1,188	1,336	1,503	1,691	0
Trucks (4 or more axles)	0	0	0	0	412	497	600	724	876	1,060	0
Loan	0	718,178	718,178	718,178	0	0	0	0	0	0	0
Total Inflow	0	718,178	718,178	718,178	621,350	735,156	871,048	1,033,484	1,227,849	1,460,649	0
EXPENDITURES											
Construction Costs											
Road Construction	0	1,023,687	1,023,687	1,023,687	0	0	0	0	0	0	0
Toll Booths	0	2,281	2,281	2,281	0	0	0	0	0	0	0
Routine Maintenance	0	0	0	0	30,126	30,126	30,126	30,126	30,126	30,126	0
Periodic Maintenance	0	0	0	0	0	0	0	0	0	0	0
Operating Expenses	0	0	0	0	24,984	29,562	35,030	41,566	49,387	58,757	0
Loan Repayment	0	0	0	0	0	0	0	0	0	0	0
Interest	0	0	0	0	265,433	198,176	121,592	32,860	0	0	0
Principal	0	0	0	0	166,547	208,889	261,995	328,602	0	0	0
Value Added Tax	0	0	0	0	116,187	137,468	162,879	193,253	229,598	273,130	0
Corporate Income Tax	0	0	0	0	21,384	74,955	134,999	203,694	262,119	318,872	0
Change in Accounts Payable	0	0	0	0	(248)	(295)	(351)	(417)	(497)	(594)	4,890
Change in Cash Balance	0	0	0	0	1,528	1,814	2,157	2,567	3,060	3,651	(30,074)
Total Outflow	0	1,025,968	1,025,968	1,025,968	625,941	680,695	748,426	832,251	573,792	683,942	(25,184)
NET CASH FLOW	0	(307,790)	(307,790)	(307,790)	(4,591)	54,461	122,622	201,233	654,057	776,708	25,184
Net Present Value =	**90,908**										
Internal Rate of Return =	**16.47%**										

The sustainability of the project and of the proposed financing structure does not, however, appear to be solid. The average of the annual debt service coverage ratios is 1.12, with a minimum value of 0.99 in 2005, the first year of repayment (table 3.10). The debt service capacity ratios for the entire period that the debt is outstanding is only 1.10 when evaluated as of year 2005. In the sensitivity analyses which follows, different financing structures will be evaluated to determine if the debt service coverage ratios of the project can be improved in this way.

Table 3.10. Debt Service Coverage Ratios

Year		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Real interest rate	7.84%										
NET CASH FLOW in real terms before debt finance		427,390	437,661	449,028	461,526	475,193	490,071	506,208	11,011	583,221	562,695
Debt repayment in real terms		431,981	423,510	415,206	407,065	399,083	391,258	383,586	376,065	368,691	361,462
PV of remaining net cash flows @ 7.84%		2,973,604	2,779,437	2,559,772	2,311,510	2,031,279	1,715,403	1,359,873	960,322	1,024,630	521,772
PV of remaining debt repayments @ 7.84%		2,707,421	2,487,787	2,259,397	2,021,398	1,772,874	1,512,840	1,240,236	953,923	652,675	335,174
RATIOS											
Annual Debt Service Coverage Ratios		0.99	1.03	1.08	1.13	1.19	1.25	1.32	0.03	1.58	1.56
Debt Service Capacity Ratios		1.10	1.12	1.13	1.14	1.15	1.13	1.10	1.01	1.57	1.56

Table 3.11 shows the projected incremental real cash flow statement for the Eje Vial project from the total investment point of view (it reports the incremental cash flows that would occur as a consequence of the project). As the economic analysis is developed in incremental terms, this financial statement is necessary for developing the distributive analysis.

Table 3.11. Incremental Real Cash Flow Statement from the Total Investment Point of View (thousands of Ur$)

Year	1999	2000	2001	2002	2005	2008	2011	2014	2017	2020	2023
RECEIPTS											
Toll revenues (Without Project Traffic)											
Cars	0	0	0	0	257,100	304,674	361,221	428,463	508,456	603,656	0
Buses	0	0	0	0	22,120	23,710	25,414	27,241	29,200	31,300	0
Trucks (2 or 3 axles)	0	0	0	0	93,775	108,575	125,919	146,281	170,229	198,447	0
Trucks (4 or more axles)	0	0	0	0	241,613	290,277	349,179	420,535	507,047	612,014	0
Toll revenues (Generated Traffic)	0	0	0	0	0	0	0	0	0	0	0
Cars	0	0	0	0	5,202	6,164	7,308	8,669	10,287	12,213	0
Buses	0	0	0	0	190	204	218	234	251	269	0
Trucks (2 or 3 axles)	0	0	0	0	939	1,056	1,188	1,336	1,503	1,691	0
Trucks (4 or more axles)	0	0	0	0	412	497	600	724	876	1,060	0
Total Inflow	0	0	0	0	621,350	735,156	871,048	1,033,484	1,227,849	1,460,649	0
EXPENDITURES											
Construction Costs	0	0	0	0	0	0	0	0	0	0	0
Road Construction	0	1,023,687	1,023,687	1,023,687	0	0	0	0	0	0	0
Toll Booths	0	2,281	2,281	2,281	0	0	0	0	0	0	0
Routine Maintenance	0	0	0	0	(2,746)	(2,746)	(2,746)	(2,746)	(2,746)	(2,746)	0
Periodic Maintenance	0	0	0	0	0	0	0	0	0	0	0
Operating Expenses	0	0	0	0	(2,498)	(2,956)	(3,503)	(4,157)	(4,939)	(5,876)	0
Value Added Tax	0	0	0	0	116,187	137,468	162,879	193,253	229,598	273,130	0
Corporate Income Tax	0	0	0	0	21,384	74,955	134,999	203,694	262,119	318,872	0
Change in Accounts Payable	0	0	0	0	(248)	(295)	(351)	(417)	(497)	(594)	4,890
Change in Cash Balance	0	0	0	0	1,528	1,814	2,157	2,567	3,060	3,651	(30,074)
Total Outflow	0	1,025,968	1,025,968	1,025,968	133,606	208,240	293,435	392,194	486,594	586,437	(25,184)
NET CASH FLOW	0	(1,025,968)	(1,025,968)	(1,025,968)	487,744	526,916	577,613	641,290	741,256	874,212	25,184

Sensitivity Analysis of Financial Results

We conducted a sensitivity analysis to identify the variables that are likely to affect the financial outcomes of the project and to quantify the extent of these impacts. Tables 3.12 through 3.20 present the results of the sensitivity analysis for the following variables: domestic inflation rate; percentage change in the tariff structure; investment cost overruns; the real exchange rate; the real return on equity; delay in implementation of the BAC bridge project; divergence from the estimated traffic growth rate; the GDP growth rates in Argentina, Brazil, and Uruguay; and the nominal interest rate on the foreign loan. Tables 3.20 and 3.21 show the impact of the duration of the amortization period and loan interest rates on the debt coverage ratios for the first three years of debt repayment.

INFLATION RATE. The net impact of an increase in the expected rate of inflation from 8 to 10 percent results in a Ur$12 million reduction in the NPV, corresponding to a change of about 13 percent (table 3.12). The overall impact of inflation on the project outcome is, therefore, considerable. As the Eje Vial project does not require significant working capital (there are no accounts receivable), the impact of inflation on the project's viability takes place through changes in the real present value of the concessionaire's income tax liability.

Table 3.12. Sensitivity of Financial NPV to Inflation Rate

Percentage change in inflation	Financial NPV (Ur$ thousands)
7	97,771
8	90,908
9	84,604
10	78,798
11	73,434
12	68,854

TARIFF STRUCTURE. Increasing the tariff will reduce the volume of both the existing and the newly generated traffic. The volume of traffic is, however, inelastic with respect to cost of travel, hence, the financial outcome of the project turns out to be highly sensitive to the tariff structure.[8] Table 3.13 shows that a flat 10 percent increase across all the tariff structure will almost double the financial NPV, increasing it to about Ur$167 million.

Table 3.13. Sensitivity of Financial NPV to a Percentage Change in Tariff Structure

Percentage change in tariff structure	Financial NPV (Ur$ thousands)
80	-133,056
90	-217
100	90,908
110	166,638
120	235,486
130	298,011
140	354,399

COST OVERRUNS. As is typical for capital-intensive transport infrastructure projects, the project's financial viability is extremely sensitive to the likelihood of a higher than anticipated investment

[8] The price elasticity for both the existing and generated traffic is taken as –0.25.

cost. As table 3.14 confirms, a cost overrun of 10 percent reduces the financial NPV by about 160 percent, bring it a negative figure of Ur$55 million. Therefore, any significant cost of overruns can make the project financially not viable.

Table 3.14. Sensitivity of Financial NPV to Cost Overruns

Percentage change in divergence from original cost estimate	Financial NPV (Ur$ thousands)
-20	383,030
-10	236,969
0	90,908
10	-55,154
20	-201,328
30	-348,677
40	-497,575

REAL EXCHANGE RATE. As table 3.15 indicates, changes in the real exchange rate also have an important impact on the project's outcome. A flat annual real depreciation of one percent would reduce the project's NPV by about 74 percent to Ur$24 million. The foreign exchange risk is typically present in such capital-intensive transport infrastructure projects, since foreign loans are often a substantial component of the financing structure but the project revenues are normally set in domestic currency.

Table 3.15. Sensitivity of Financial NPV to the Real Exchange Rate

Percentage change in real exchange rate appreciation or depreciation	Financial NPV (Ur$ thousands)
-2	211,215
-1	153,323
0	90,908
1	23,609
2	-48,960
3	-127,217
4	-211,614

REAL RETURN ON EQUITY. The project's financial viability is also highly sensitive to the required return on equity. As table 3.16 shows, an one percent increase in the real cost of equity reduces the project's NPV by about 73 percent bring it down to Ur$27 million. The return shareholders require is likely to depend, among other factors, on the availability of government guarantees, particularly against traffic volume risk.

Table 3.16. Sensitivity of Financial NPV to the required Real Return on Equity

Percentage change in real return on equity	Financial NPV (Ur$ thousands)
13	256,656
14	166,786
15	90,908
16	26,724
17	-27,660
18	-73,811
19	-113,030

IMPLEMENTATION OF THE BAC BRIDGE PROJECT. This study assumes that when the Eje Vial begins operations the BAC bridge will have already been built. Any delays in implementation of the BAC bridge project wil result in a lower traffic volume for the Eje Vial and will affect the project negatively. Table 3.17 shows that a delay of as little as one year would reduce the project's NPV to Ur$12 million. The sensitivity analysis supports the Uruguayan government's decision to make the implementation of the Eje Vial project dependent on construction of the BAC bridge. It confirms that without the bridge, the level of traffic on the route between Colonia and Rio Branco would not justify the project from a financial standpoint.

Table 3.17. Sensitivity of Financial NPV to a Delay in Implementation of BAC Bridge Project

Delay in the BAC Bridge (of years)	Financial NPV (Ur$ thousands)
0	90,908
1	11,731
2	-61,459
3	-133,300
4	-201,991
5	-265,168
6	-323,168
7	-376,274

DIVERGENCE FROM THE ESTIMATED RATE OF TRAFFIC GROWTH. Table 3.18 suggests that the outcome of the project is highly sensitive to the traffic growth rate. A 20 percent increase from the base case rate would raise the NPV to almost Ur$295 million. The base case rates were estimated be using the assumption of a four percent annual real GDP growth rate in Argentina, Brazil, and Uruguay. However, both traffic volume and international trade among the countries in the 1990's grew more rapidly than the economies themselves. In addition, since the present auto ownership level in Uruguay seem to be relatively low, a surge in auto ownership might occur in the near future, which will raise the traffic growth rate. On the other hand, the four percent projected growth rate of GDP over the life of the project may be rather optimistic.

Table 3.18. Sensitivity of Financial NPV to Divergence from Estimated Traffic Growth Rate

Percentage change in divergence from traffic growth rate	Financial NPV (Ur$ thousands)
-40	-237,730
-20	-85,156
0	90,908
20	294,723
40	530,752
60	805,188

GDP GROWTH RATE. Table 3.19 reveals that the outcome of the project is highly sensitive to the growth rate of Uruguay's GDP, as this country a large influence on the traffic growth. A steady annual GDP growth of 3 percent, instead of the base case of 4 percent, would make the project not financially viable, resulting in an negative NPV of Ur$139 million. Argentina and Brazil's growth rates are major determinants of the truck traffic that will cross the BAC bridge and proceed along the Eje Vial, and, therefore, the economic growth of both countries will significantly affect the project's viability. A steady annual GDP growth of 3 percent, instead of the base case of 4 percent, would make the project not financially viable with a negative NPV of Ur$10 million. It is expected that while the future growth rates of Argentina, Brazil and Uruguay will eventually improve, against the current deep recessions in Argentina and Uruguay. This assumption makes the base case projections appear somewhat optimistic, at least, for the years in the immediate future.

Table 3.19. Sensitivity of Financial NPV to GDP Growth in Uruguay and in Argentina and Brazil

GDP growth in Uruguay (%)	Financial NPV (Ur$ thousands)	GDP growth in Argentina and Brazil (%)	Financial NPV (Ur$ thousands)
1	-352,222	1	-30,953
2	-254,410	2	-20,793
3	-138,616	3	-10,432
4	90,908	4	90,908
5	259,791	*5*	102,881
6	464,337	6	115,092

NOMINAL INTEREST RATE ON FOREIGN LOAN. Table 3.20 shows that a 1 percent decrease in the nominal interest rate on the foreign loan to 9 percent would increase the project's financial NPV to Ur$142 million. Since 2000 the financial crisis in the region has caused nominal interest rates on US dollar loans to rise substantially.

Table 3.20. Sensitivity of Financial NPV to Nominal Interest Rate on Foreign Loan

Change in nominal interest rate	Financial NPV (Ur$ thousands)
8.5	166,983
9.0	142,280
9.5	116,925
10.0	90,908
10.5	64,216
11.0	36,840

DEBT FINANCING REPAYMENT. The project's ability to repay the loan does not appear to be robust. As table 3.21 shows, even assuming a repayment period of 15 years, the annual coverage ratio for the first year of debt repayment does not rise beyond 1.22. Similarly, table 3.21 illustrates that, assuming a nominal interest rate as low as 8 percent (but with a repayment period of 10 years), the coverage ratio for the first year of debt repayment is equal to 1.09.

Table 3.21. Sensitivity of the Debt Coverage Ratio for First Three Years of Debt Repayment to Loan Amortization Period

Loan amortization period (years)	Debt coverage ratio for 2005	Debt coverage ratio for 2006	Debt coverage ratio for 2007
10	1.10	1.01	1.57
11	1.17	1.08	1.69
12	1.23	1.15	1.80
13	1.29	1.21	1.90
14	1.34	1.27	1.98
15	1.39	1.32	2.07

Table 3.22. Sensitivity of Debt Coverage Ratio for First Three Years of Debt Repayment to Nominal Interest Rate Changes

Nominal Interest Rate (percent)	Debt coverage ratio for 2005	Debt coverage ratio for 2006	Debt coverage ratio for 2007
10.5	1.07	1.09	1.10
10.0	1.10	1.12	1.13
9.5	1.13	1.15	1.17
9.0	1.16	1.18	1.20
8.5	1.20	1.22	1.24
8.0	1.23	1.26	1.28

Economic Analysis

The measurement of economic benefits and costs is based on the information developed during the financial appraisal, using the domestic currency at the domestic price level as a numeraire.

The economic analysis requires calculating the value of the national economic parameters (cost of capital and cost of foreign exchange), the economic value of the transportation services provided, and the economic conversion factors for all the inputs used. Then, we use the estimated conversion factors to transform the financial cash flow statement into the statement of economic benefits and costs. (Estimates for the economic cost of foreign exchange and capital are taken from International Institute for Advanced Studies 1997; for a full discussion on the economic cost of foreign exchange and the estimation of the economic cost of capital see Harberger and Jenkins, 2000).

National Parameters

The estimated economic exchange rate (E^e) exceeds than the market exchange rate (E^m) by 10.94 percent. This foreign exchange premium is due to the impact of net import tariffs and export taxes in Uruguay.

The economic cost of capital for Uruguay is estimated to be 10.5 percent. It is calculated as a weighted average of the rate of time preference to savers, the gross-of-tax returns on displaced investment, and the marginal cost of foreign capital inflows.

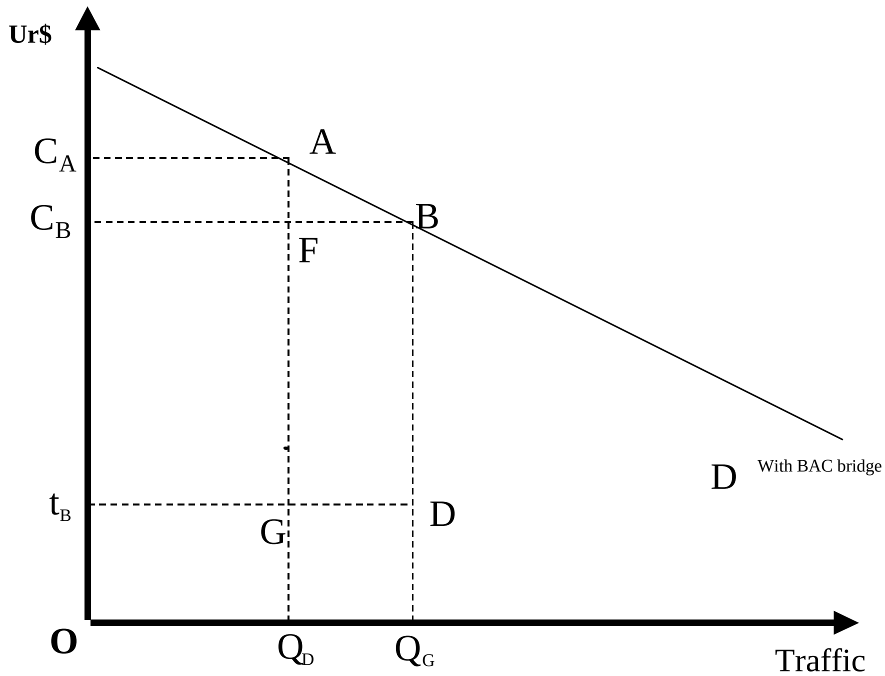
Economic Value of the Eje Vial Project's Transportation Services

Methodologies to evaluate the economic benefits of transport infrastructure projects differ depending on whether a new project completely substitutes for previous modes of transport. As the Eje Vial project is an upgrade and expansion of the existing transport infrastructure, it completely replaces the previous mode. Thus, the methodology that we use to value the economic benefits of the Eje Vial project pertain to the general case of new transport infrastructure replacing previous infrastructure.[9]

Figure 3.1 is a graphical representation of the transport-related benefits of the Eje Vial project. The demand function for the Eje Vial infrastructure project is represented by curve D. This demand curve is derived under the assumption that the BAC bridge project is implemented. The price that each successive unit of traffic would be willing to pay to use the highway is measured on the vertical axis. Without the Eje Vial project, the generalized cost per km (vehicle operating costs and time costs) by type of vehicle is C_A and the traffic level is Q_D, including all the traffic units willing to pay C_A or more. Point Q_D includes both the traffic originating locally and from the BAC bridge. With the Eje Vial project, the vehicle operating and time costs by type of vehicle will decrease, implying that the overall generalized cost (including the toll charged by the project) will also fall to C_B, and the traffic volume will expand to Q_G.

[9] The BAC bridge is an example of a transport infrastructure project that does not displace previously existing modes, such as the ferry transport services.

Figure 3.1. Benefits of Eje Vial Project at Each O/D Pair and by Type of Vehicle



The economic benefits of the Eje Vial highway project considered in this study include the following:[10]

- The economic benefits of the existing traffic originating in Uruguay,
- The net economic benefits of the generated traffic originating in Uruguay,
- The tolls paid by diverted and generated traffic originating in Argentina and Brazil, plus the foreign exchange premium on the toll,
- The economic benefits arising because of the complementarity with the BAC bridge project,
- The economic value of the reduced maintenance and operating costs for various road users resulting from implementation of the project.

[10] Additional economic benefits, such as those arising from a reduced congestion on the alternative Uruguayan routes, are not considered in this study because of a lack of information.

The economic benefits accruing to the without project traffic of Uruguayan origin consist of the difference in vehicle operating and time costs between the without and with Eje Vial scenarios, shown in figure 3.1 as [(OC_AAQ_D)–(t_BC_BFG)]. They can be expressed algebraically as

$$[VOC_A + TC_A - (VOC_B + TC_B)] * Q_D$$

where,

VOC_A is the value of vehicle operating costs before the road improvement,

TC_A is the total value of time costs before the road improvement,

VOC_B is the value of vehicle operating costs after the road improvement,

TC_B is the total value of time costs after the road improvement.

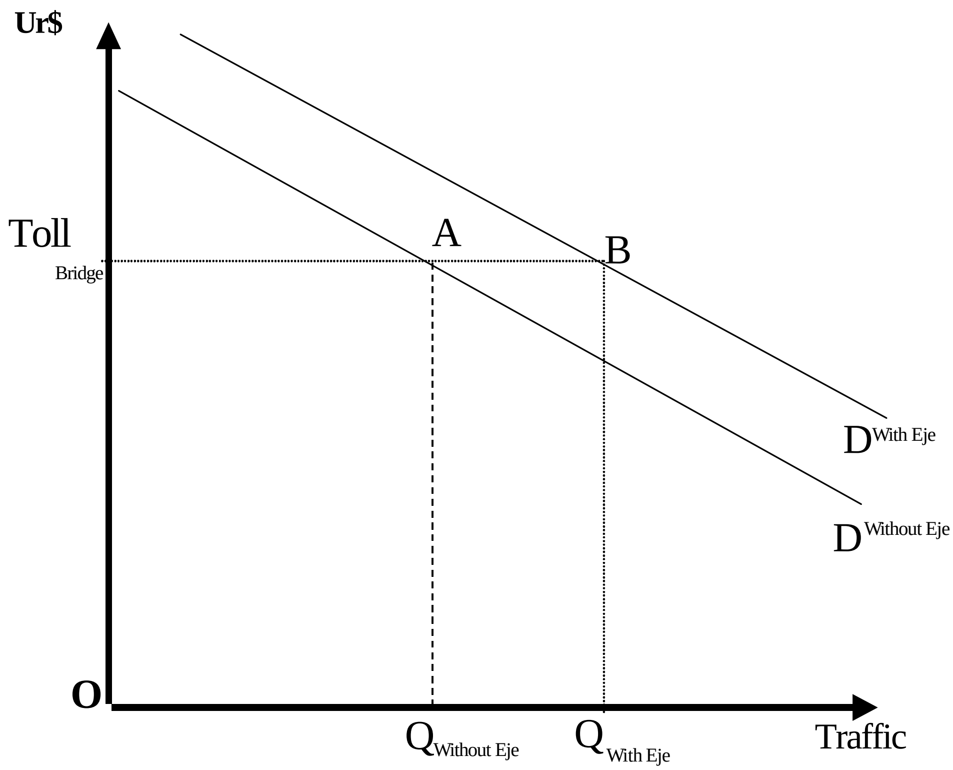
The net economic benefits arising from the generated traffic of Uruguayan origin are measured by the willingness to pay of new users of the road, represented in figure 3.1 by the area below the demand curve for the generated traffic (ABQ_GQ_D), minus the resource value of the vehicle operating and time costs (GFBD). They can be expressed algebraically as

$$\frac{1}{2} * (C_B + C_A) * (Q_G - Q_D) \ - \ (VOC_B + TC_B) * (Q_G - Q_D)$$

Savings in the vehicle operating and time costs incurred by vehicles of Argentinean and Brazilian origin do not count as economic benefits from the standpoint of Uruguay's economy. The tolls paid by the diverted and generated traffic of other than Uruguayan origin plus the foreign exchange premium on the tolls are, however, economic benefits if the concessionaire of the Eje Vial highway is a domestic firm. But if the concession to build and operate the highway is awarded to a foreign consortium then the increase in the after-tax profits, which may be remitted abroad, should not be included in the economic benefits accruing to Uruguay. These additional profits represent a resource cost from the perspective of the Uruguay's economy.

Figure 3.2 illustrates the economic benefits of the Eje Vial project arising from the complementarity with the BAC bridge project. This figure shows the demand functions for the passage via the bridge "with" (assuming an overall generalized cost of a trip over the Eje Vial of C_B) and "without" (assuming a higher generalized cost of C_A) the Eje Vial project.

Figure 3.2. Complementarity between Eje Vial and BAC Bridge Projects



The total demand for trips across the BAC bridge that includes the new traffic units which are, attracted by the Eje Vial project, is represented by the demand curve $D_{With\ Eje}$. The difference in the quantity of trips demanded $Q_{With\ Eje} - Q_{Without\ Eje}$ is shown by the distance at the current level of the tolls.

The willingness to pay of the generated traffic to use the BAC bridge because of the Eje Vial project, with its reduction in the overall generalized cost, is given by the toll actually paid by different types of vehicles. This is because the generated traffic consists of users who, prior to the improvement of the road, were indifferent between making the trip and crossing the BAC bridge or not making the trip. As the marginal cost of making an additional trip over the BAC bridge is virtually equal to zero, the toll paid by the marginal traffic unit is equivalent to the additional profit received by the BAC bridge concessionaire, resulting from the implementation of the Eje Vial project. This profit will be divided among the owners of the bridge and the governments who will tax these profits. The additional economic benefits of the Eje Vial project include:

- The additional income tax liability of the BAC bridge concessionaire that accrues to the government of Uruguay (as specified in the Argentina-Uruguay BAC bridge treaty, the income tax liability of the concessionaire is split between the governments of (B) Uruguay and (1 – B) Argentina or $A * (B * t_{Uruguay})$.
- The after tax (both Uruguayan and Argentinean) earnings of the Uruguayan shareholder of the BAC bridge concessionaire, or $A * [(1 - B * t_{Uruguay} - (1 - B)\, t_{Argentina}) * C$,
- The gain in foreign exchange premium on the additional income tax liability and after tax profits of the Uruguayan shareholder of the BAC bridge concessionaire, net of the loss in foreign exchange premium on the toll paid by the generated traffic over the BAC bridge of Uruguayan origin, or

  $FEP * [A*(B*t_{Uruguay})] + FEP * \{A*[(1 - B * t_{Uruguay} - (1-B)\, t_{Argentina})] * C\} - FEP * D$

  where A is the change in the BAC bridge concessionaire's profits, B is the share of taxable profits that is taxed by Uruguay, $t_{Uruguay}$ is the income tax rate in Uruguay, $t_{Argentina}$ is the income tax rate in Argentina, C is the percentage of Uruguayan BAC bridge ownership, D is the BAC bridge toll paid by vehicles of Uruguayan origin, and FEP is the foreign exchange premium.

Estimating Vehicle Operating and Time Costs

The vehicle operating costs typically include fuel, oil, tire wear, repair and maintenance, and depreciation. Table 3.22 presents the estimates of operating costs for the kinds of vehicles used in the model.

Table 3.22. Vehicle Operating Costs
(Ur$/km)

Category	Cars	Buses	Trucks (2-3 axles)	Trucks (4 or more axles)
Without project	3.00	6.80	6.30	15.70
With project	2.43	6.27	5.36	14.83
Gain	0.57	0.53	0.94	0.87

Source: BCEOM (1998).

The calculation of travelers' time costs is typically based on individuals' hourly income and as follows:

- *Cars*. This study assumes an average of three passengers traveling per car, 1.5 of whom are in the labor force. Assuming an average monthly income per passenger of approximately US$1,000, the time cost per hour for working passenger is US$5.0 (based on 25 working days per month and 8 working hours per day). The time cost per hour per vehicle is, therefore, US$7.5.
- *Buses*. We assume an average of 35 passengers per bus, 23 of whom are employed. Assuming an average monthly income of about US$190 per working passenger, the time cost per hour per passenger is US$0.95. The time cost per hour per bus is, therefore, US$21.9.
- *Trucks*. The calculation of the time cost for the trucks is based primarily on the drivers' hourly incomes and on the time value of the capital tied up in vehicles and their cargos. We estimate the time costs for trucks with two or three axles to be Ur$171.2/hour, and for trucks with four or more axles to be Ur$226.1/hour (BCEOM 1998).

Economic Prices for Inputs

A preliminary step in calculating the economic cost of project inputs is computing the economic prices for the basic components of the investment and operating costs. These items are first divided into tradable and nontradable goods. The economic prices and conversion factors for each of the items are then estimated, including those factors for different types of labor employed in the project, administrative, skilled, unskilled, and foreign (see Harberger and Jenkins 2000, chapters 7-9, 13).

After determining the basic conversion factors, we calculate the economic cost of the project inputs as a weighted average of the economic value of the basic components. The weights are given by the shares of the basic items in the total cost.

The conversion factor for changes in cash balances is taken to be equal to 1. The conversion factor for changes in accounts payable, equal to 0.872, which is the weighted average of the conversion factors for the operating and maintenance costs.

Results

The statement of economic benefits and costs for the Eje Vial project is obtained by adjusting the real incremental financial cash flow statement from the total investment point of view. As discussed earlier, the different components of the project's economic benefits are estimated and included in the benefits side of the statement of economic benefits and costs. The profile of economic values for each line item on the cost side is obtained by multiplying the corresponding line item in the real financial cash flow statement by the appropriate conversion factors.

As table 3.24 shows, the economic NPV of the project, using the economic cost of capital of 10.5 percent, is equal to almost Ur$3.51 billion. This is, about 114 percent of the initial investment costs. The project would, therefore, be generally beneficial to the economy of Uruguay.

Table 3.24. Incremental Statement of Economic Benefits and Costs (thousands of Ur$)

Year	Conv. Factor	1999	2000	2001	2002	2005	2008	2011	2014	2017	2020	2023
BENEFITS												
Vehicle Operating Costs Savings (Urug. Vehicles)												
Cars						116,787	140,028	167,926	201,417	241,630	289,920	0
Buses						8,230	8,829	9,472	10,162	10,902	11,695	0
Trucks (2 or 3 axles)						46,127	51,887	58,365	65,653	73,851	83,072	0
Trucks (4 or more axles)						23,445	26,372	29,665	33,369	37,536	42,222	0
Time Savings (Urug. Vehicles)												
Cars						52,576	63,041	75,602	90,682	108,789	130,533	0
Buses						9,295	9,972	10,698	11,477	12,314	13,211	0
Trucks (2 or 3 axles)						20,557	23,124	26,011	29,259	32,913	37,022	0
Trucks (4 or more axles)						15,009	16,883	18,991	21,362	24,030	27,030	0
Net Benefit on Generated Traffic												
Cars						3,391	4,066	4,876	5,849	7,017	8,419	0
Buses						133	143	153	164	176	189	0
Trucks (2 or 3 axles)						614	690	777	874	983	1,105	0
Trucks (4 or more axles)						66	76	89	103	120	140	0
Toll Rev. on w/o Proj. and Gen. Arg. and Br. Traffic												
Cars						112,701	131,506	153,515	179,289	209,485	244,878	0
Buses						6,069	6,489	6,937	7,416	7,929	8,477	0
Trucks (2 or 3 axles)						37,058	44,776	54,154	65,555	79,424	96,303	0
Trucks (4 or more axles)						203,180	247,077	300,623	365,964	445,720	543,100	0
FEP on Toll by Argent. And Brazil. Vehicles (w/o Project Traffic)						39,171	46,903	56,223	67,467	81,040	97,437	0
FEP on Toll by Argent. And Brazil. Vehicles (Generated Traffic)						327	381	445	519	607	710	0
BAC Revenue due to complementarity BAC - Eje												
Income tax liability of Uruguayan shareholder						2,025	2,331	2,685	3,095	3,570	4,122	0
After tax earnings of Uruguayan shareholder						4,726	5,439	6,265	7,221	8,330	9,617	0
Net FEP						222	255	294	339	391	451	0
Total Benefits						701,709	830,268	983,767	1,167,238	1,386,754	1,649,654	0
COSTS												
Construction Costs												
Road Construction		0	924,078	924,078	924,078	0						
Toll Booths		0	2,089	2,089	2,089	0						
Routine Maintenance	0.872					(2,395)	(2,395)	(2,395)	(2,395)	(2,395)	(2,395)	0
Periodic Maintenance	0.897					0	0	0	0	0	0	0
Operating Costs		0	0	0	0	(2,188)	(2,589)	(3,068)	(3,640)	(4,325)	(5,146)	0
Value Added Tax	0.000	0	0	0	0	0	0	0	0	0	0	0
Corporate Income Tax	0.000	0	0	0	0	0	0	0	0	0	0	0
Change in Accounts Payable	0.872					(217)	(257)	(306)	(364)	(434)	(518)	4,265
Change in Cash Balance	1.000					1,528	1,814	2,157	2,567	3,060	3,651	(30,074)
Total Costs		0	926,167	926,167	926,167	(3,272)	(3,427)	(3,612)	(3,832)	(4,094)	(4,408)	(25,809)
NET BENEFITS		0	(926,167)	(926,167)	(926,167)	704,980	833,695	987,379	1,171,070	1,390,849	1,654,062	25,809
Net Present Value		**3,509,750**										

Sensitivity Analysis of Economic Results

A sensitivity analysis is conducted to identify the variables likely to affect the project's outcome from the economic perspective. Tables 3.25 through 3.30 present the results of the sensitivity analysis for the following variables: investment cost overruns; percentage change in the tariff structure; delay in implementation of the BAC bridge project; divergence from the estimated traffic growth rate; the GDP growth rates of Argentina, Brazil, and Uruguay; and divergence from the estimated vehicle operating costs with the project and from the estimated vehicle speeds with the project.

COST OVERRUNS. The project's economic viability is relatively sensitive to investment cost overruns. As table 3.25 shows, a cost overrun of 20 percent would reduce the economic NPV by 13 percent, down to Ur$3,053 billion.

Table 3.25. Sensitivity of Economic NPV to Investment Cost Overruns

Divergence from original cost estimate (%)	Economic NPV (Ur$ millions)
-20	3,966.4
-10	3,738.0
0	3,509.8
10	3,281.4
20	3,053.1
30	2,824.8
40	2,596.5

TARIFF STRUCTURE. As noted earlier, the tolls paid by vehicles of the Uruguayan origin do not constitute an economic benefit, with the exception of the tolls paid by the newly generated traffic. However, the tolls (including the foreign exchange premium) paid by Argentinean and Brazilian vehicles are economic benefits from the standpoint of Uruguay's economy. Therefore, an increase in the tariffs would be beneficial to Uruguay. However, such an increase will reduce the volume of both existing and new traffic, thereby, at some point, affecting the economic viability negatively. Raising the tariff structure has two impacts on the economic NPV, acting in opposite directions. Table 3.26 shows that an increase in the tariff structure up to 50 percent would have a modest positive impact on the economic NPV, but an rise of 60 percent or more would be detrimental to the project from the economic point of view, because the economic impact of reduced traffic would outweigh the incremental toll revenue from Argentinean and Brazilian vehicles.

Table 3.26. Sensitivity of Economic NPV to a Change in Tariff Structure

Percentage change in tariff structure	Economic NPV (Ur$ millions)
–10	3,463.9
0	3,509.8
10	3,528.1
20	3,544.2
30	3,558.0
40	3,568.2
50	3,573.7
60	3,544.2

IMPLEMENTATION OF BAC BRIDGE PROJECT. Table 3.27 shows that a delay in implementing the BAC bridge project would have a significant impact on the Eje Vial project's economic viability. If the Eje Vial project was implemented without the BAC bridge (which corresponds to a delay of 20 years in the table) then the project's economic NPV would drop to Ur$696 million. While the project is not financially feasible without the bridge traffic, the economic analysis suggests that regardless of the implementation of the BAC bridge project, the current route from Colonia to Rio Branco should be rehabilitated. The cost of this improvement would have to be financed, at least partially, from general government revenues.

Table 3.27. Sensitivity of Economic NPV to a Delay in Implementation of BAC Bridge Project

Delay in the BAC bridge (years)	Economic NPV (Ur$ millions)
0	3,509.8
4	2,762.6
8	2,123.0
12	1,574.2
16	1,102.6
20	696.5

TRAFFIC GROWTH RATES. Table 3.28 shows that the project's economic outcome is sensitive to the traffic growth rate. An increase in the traffic growth rates of 20 percent from the base case rate would raise the economic NPV to Ur$4,274 million.

Table 3.28. Sensitivity of Economic NPV to a Divergence from Estimated Traffic Growth Rates

Divergence from traffic growth rate (%)	Economic NPV (Ur$ millions)
-40	2,299.9
-20	2,857.8
0	3,509.8
20	4,274.0
40	5,172.6
60	6,232.3

GDP GROWTH RATES. The project's economic outcome is quite sensitive to the growth rate of Uruguay's GDP, which, as mentioned earlier, has a large bearing on traffic growth. Table 3.29 shows that a steady annual GDP growth of 3 percent, instead of the base case of 4 percent, would reduce the economic NPV by 23 percent to Ur$2,707 million. The GDP growth rates in Argentina and Brazil have a weaker impact on the project's viability, but nevertheless are a major determinant of the truck traffic along the Eje Vial. Also, a steady annual GDP growth of 3 percent, instead of the base case of 4 percent, would reduce the economic NPV by about 10 percent to Ur$3,165 million. A drop in the long term growth rate of Uruguay's economy to one percent would cause the economic NPV to drop by about 45 percent.

Table 3.29. Sensitivity of Economic NPV to GDP Growth in Uruguay and in Argentina and Brazil

GDP growth in Uruguay (percent)	Economic NPV (Ur$ millions)	GDP growth in Argentina and Brazil (percent)	Economic NPV (Ur$ millions)
1	1,956.5	1	3,085.7
2	2,296.6	2	3,125.1
3	2,707.1	3	3,165.4
4	3,509.8	4	3,509.8
5	4,128.1	5	3,556.5
6	4,890.5	6	3,604.2

VEHICLE OPERATING COSTS AND SPEED. Table 3.30 shows that the economic NPV is extremely sensitive to divergences of the estimates about vehicle operating costs. A flat increase of just 10 percent reduces the economic NPV by about 33 percent to Ur$2,341 million. Divergences from the estimated vehicle speed after the implementation of the Eje Vial project also have a significant impact on the project's economic performance. A decrease of 10 percent in the time savings, brought about by the project, reduces the economic NPV by about 15 percent, down to Ur$2,982 million.

Table 3.30. Sensitivity of Economic NPV to Divergences from Estimates in Vehicle Operating Costs and Vehicle Speeds with Eje Vial Project

Divergences from estimates in vehicle operating costs with the project (%)	Economic NPV (Ur$ millions)	Divergences from estimated vehicle speeds with the project (%)	Economic NPV (Ur$ millions)
-20	5,905.8	-20	2,326.8
-10	4,698.2	-10	2,982.1
0	3,509.8	0	3,509.8
10	2,340.5	10	3,943.7
20	1,190.5	20	4,306.9
30	59.7	30	4,615.3
40	-1,052.0	40	4,880.4

Stakeholder Analysis

A stakeholder analysis is carried out to identify which particular segments of society reap the benefits of the project and which, if any, stand to lose. The stakeholder analysis of any project builds on the following relationship:

$$P^e = P^f + \Sigma E_i \quad (3.1)$$

where P^e is the economic value of an input or output, P^f is the financial value of the same item, and ΣE_i is the sum of all the externalities that make the economic value of the item different from its financial value. In other words, the economic value of an item can be expressed as the sum of its financial price plus the value of externalities, i.e. taxes, tariffs, or consumer or producer surplus.

On the basis of identity (3.1), the following relationship also holds:

$$NPV^e_e = NPV^f_e + \Sigma PV_e\ (EXT_i) \quad (3.2)$$

where NPV^e_e is the NPV of the net economic benefits at the economic discount rate, NPV^f_e is the NPV of the net cash flow at the economic discount rate, and $\Sigma PV_e\ (EXT_i)$ is the sum of the present values of all the externalities generated by the project.

Generally speaking, all projects generate two types of net benefits: financial net benefits, which accrue directly to a project's shareholders, and distributive impacts or externalities, that are allocated to different segments of society. Relationship (3.2) holds for any discount rate. In this case, we use the economic opportunity cost of capital of Uruguay, estimate to be Ur$ 2,549,464 thousand at 10.5 percent. According to equation (3.2), we find that:

Economic NPV	=	Financial NPV)	+	Sum of Externalities
Ur$3,509,750 thousand		Ur$960,286 thousand		Ur$2,549,464 thousand

The stakeholder analysis requires the following steps:

- Identifying the stakeholder impacts of the project, item by item, by subtracting the financial cash flow statement from the economic statement of benefits and costs,[11]
- Calculating the present value of each line item's flow of distributive impacts, using the economic cost of capital as the discount rate,
- Allocating the present value of the externalities to the appropriate groups in the economy.

The implementation of the Eje Vial project affects the following stakeholders:

- The government of Uruguay
- The Uruguayan vehicles using the Eje Vial who are broken down further into owners of cars, buses, two- or three-axle trucks, and four-axle or more trucks
- The Uruguayan shareholders of the BAC bridge project.

Using Figure 3.1 again, we can show the project's distributive impact on Uruguayan vehicle users. As noted earlier, the economic benefits from the transport services provided are equal to savings in the vehicle operating costs and waiting time gained by the diverted traffic (OC_AAQ_D) – (t_BC_B FG), plus the gain in the consumer surplus of the newly generated traffic (AFB), plus the financial toll revenue from the generated traffic (Q_DGDQ_G). The financial benefits of the project are equal to the toll revenues from the diverted and generated traffic

$(OT_BGQ_D) + (Q_DGDQ_G)$. Thus, the distributive impact to the vehicle users is given by savings in vehicle operating costs and waiting time gained by the diverted traffic $(OC_AAQ_D) – (t_BC_BFG)$, plus the gain in the consumer surplus of the generated traffic (AFB), minus the toll revenues paid by the diverted traffic (OT_BGQ_D). This can be expressed as

$$\text{Economic benefits} = (OC_AAQ_D) - (t_BC_B\ FG) + AFB + (Q_DGDQ_G)$$

This is equal to

$$(Ot_BGq_D) + (t_BC_BFG) + (C_BC_AAF) – (t_BC_B\ FG) + AFB + (Q_DGDQ_G)$$

or

$$(Ot_BGq_D) + (C_BC_AAF) + AFB + (Q_DGDQ_G) \qquad (3.3)$$

$$\text{Financial benefits} = (OT_BGq_D) + (Q_DGDQ_G) \qquad (3.4)$$

$$\text{Externalities } (3) – (4) = (C_BC_AAF) + AFB.$$

(C_BC_AAF)+AFB equals the change in consumer surplus of traffic of Uruguayan origin

The category of users who gain the most from the implementation of the Eje Vial project are car users, who will realize a gain of Ur$571 million (table 3.31). Note that about 89 percent of these car users are travelers who would use the route even if the BAC bridge were not built. Users of trucks with two or three axles, mostly Uruguayan nationals, would reap a significant gain of Ur$93 million from the implementation of the project. Of all the types of vehicle users, the trucks with four or more axles appear to benefit the least from the implementation of the project, with a gain of only Ur$8.4 million. This finding is consistent with the toll structure proposed by BCEOM, which is designed so that users of trucks with four or more axles contribute relatively more to the concessionaire's revenues. We need to keep in mind that the vast majority of trucks with four or more axles are not of Uruguayan origin.

[11] Because both the economic and financial analyses are conducted at the domestic price level, the stakeholder impacts of a project can be calculated as the difference between these two net resource flows.

Table 3.31. Distribution of Project Net Benefits
(Ur$ millions)

Stakeholders	NPV of externalities at economic discount rate (9.3%)
Government	1,822.0
Car users	570.6
Bus users	18.4
Truck (2-3 axles) users	93.0
Truck (4 or more axles) users	8.4
Uruguayan Shareholders of BAC bridge	36.7
Total	**2,549.1**

The government would be the major beneficiary of the project, with a gain of Ur$1,822 million. The most significant component of this fiscal gain originates from income taxes on the concessionaire's earnings and the value added tax on vehicle tolls (Ur$1,652 million). In addition, the government would realize approximately Ur$239 million from duties on the investment and operating and maintenance cost items, and another Ur$349 million from the premium on foreign exchange earned from the toll paid by Argentinean and Brazilian users. However, the government would lose about Ur$417 million in taxes and duties foregone, because of reduced vehicle operating costs.

The toll paid by the generated traffic over the BAC bridge is not a financial benefit from the perspective of the Eje Vial concessionaire. The additional economic benefits of the Eje Vial project because of the complementarity with the BAC bridge are, therefore, equivalent to its distributive impacts. Of the additional income tax liability of the BAC bridge concessionaire, 50 percent (Ur$15.7 million) is allocated to the Uruguayan government. The after-tax earnings of the Uruguayan shareholder of the BAC bridge concessionaire (Ur$36.7 million) accrue to the BAC concessionaire. The net gain in the foreign exchange premium remains with the government (Ur$1.7 million, which is already included in the figure given for the government in table 3.30).

Risk Analysis of Financial and Economic Returns

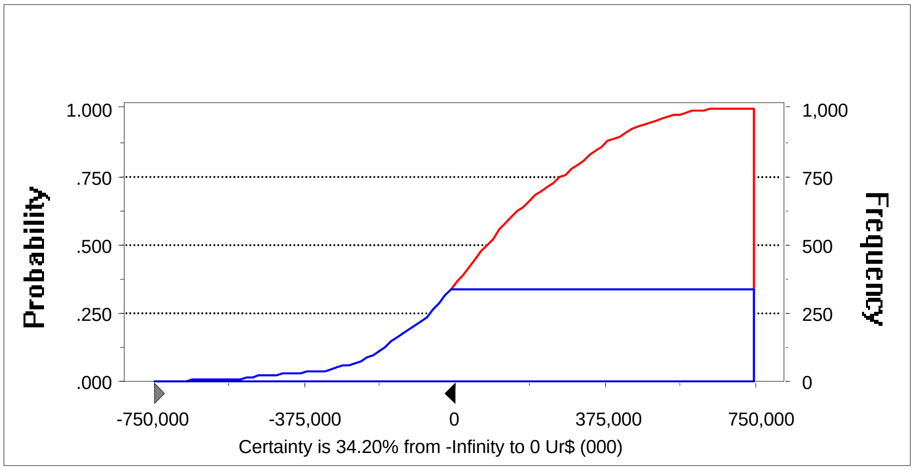
The main drawback of the deterministic analysis is the implicit assumption that the single values selected for all variables are known with a 100 percent certainty, and consequently, that the estimated NPV for the project is 100 percent certain. We conducted a risk analysis to overcome this shortcoming. First, we identified a number of risk variables on the basis of the sensitivity analysis. Then, we specified a distribution and range of values for these variables and defined possible correlations between variables into the model. The expected values of all distributions are the base values used in the deterministic financial analysis. The risk analysis produces a probability distribution for project returns showing the range of possible returns and the probabilities of their occurrence (table 3.31). A positive correlation of 0.80 has been modeled between the divergence from estimated vehicle operating costs and the divergence from estimated vehicle speed. If vehicle speed increases, vehicle operating costs are likely to rise.

Table 3.31. Risk Variables, Probability Distributions, and Range Values

Risk variable	Base value (%)	Probability distribution	Minimum value (%)	Maximum value (%)
Divergence from vehicle operating costs with project	0	Triangular	–30	+30
Divergence from speed with project	0	Triangular	–25	+25
Divergence from traffic growth rate	0	Triangular	–50	+50
			Range value (%)	**Probability (%)**
Investment cost overruns	0	Step	–15 to –5	20
			–5 to 5	70
			5 to 35	10

Figure 3.3 shows that the expected (mean) value of the financial NPV is Ur$97.8 million, which is close to the deterministic value of Ur$90.9 million. The risk analysis confirms the riskiness of the project from the financial standpoint, as the probability of the project having a negative outcome turns out to be equal to 34.2 percent.

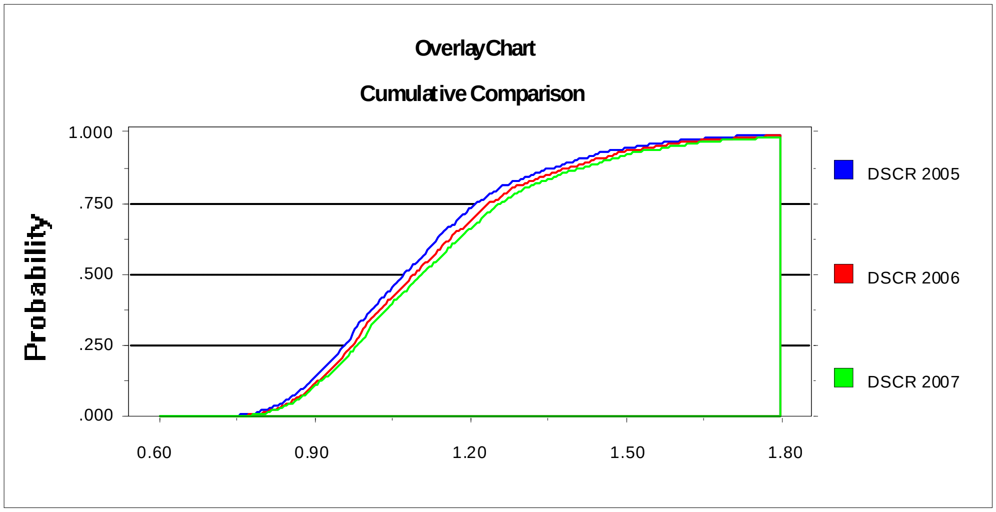
Figure 3.3. Results of Risk Analysis: Financial NPV



Statistics	**Value**
Trials	1,000
Mean	97,807
Median	86,218
Standard deviation	248,622
Range minimum	-769,422
Range maximum	754,234
Range width	1,523,656

The debt coverage ratios for the first three years of debt repayment do not go beyond a maximum value of 3.09 (figure 3.4). The risk analysis confirms that there is uncertainty over the project's ability to repay the loan.

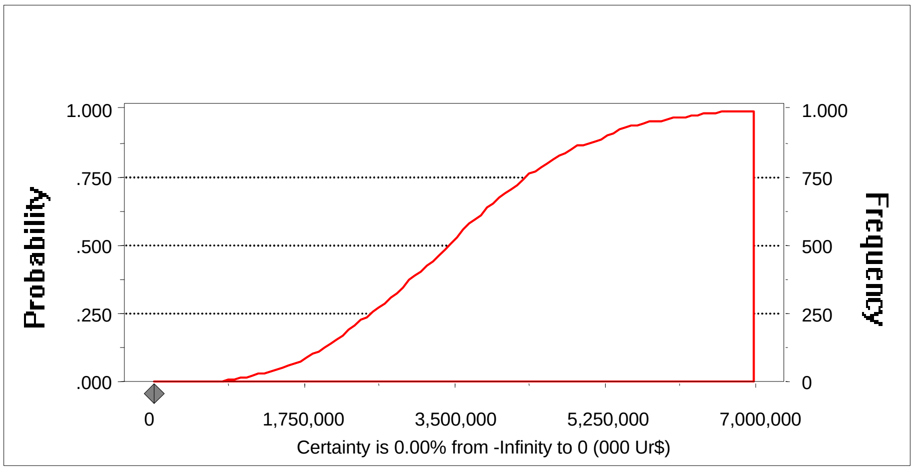
Figure 3.4. Results of Risk Analysis: Debt Coverage Ratios (DCRs)



Statistics	DSCR(2005)	DSCR(2006)	DSCR(2007)
Trials	1000	1000	1000
Mean	1.11	1.13	1.15
Median	1.07	1.10	1.11
Standard deviation	0.23	0.23	0.24
Range minimum	0.67	0.68	0.69
Range maximum	2.93	3.01	3.09
Range width	2.26	2.33	2.40

The expected (mean) value of the economic NPV is Ur$3,528 million (figure 3.5), which is also close to the deterministic value of Ur$3,510 million. The risk analysis confirms that the project is economically robust, since it has a zero probability of the project having a negative NPV.

Figure 3.5. Results of Risk Analysis: Economic NPV



Statistics	**Value**
Trials	1,000
Mean	3,527,677
Median	3,483,374
Standard deviation	1,315,268
Range minimum	352,554
Range maximum	8,737,966
Range width	8,385,412

Conclusions

This case study shows the results of an integrated financial, economic, and distributive appraisal of the Eje Vial del Cono Sur toll road in Uruguay. An integrated analysis allows the decision-makers to explore the project's feasibility from different perspectives, thereby providing information that can help improve the project's sustainability and likelihood that it will achieve its objectives. This case is illustrative of situations where project is strong economically, but is difficult or impossible to finance solely through user charges.

The Eje Vial del Cono Sur is likely to have a large beneficial impact on Uruguay's economy even with very low growth projections for Uruguay and the other countries in the region. The results of the economic analysis suggest that the government of Uruguay should, regardless of the implementation of the BAC bridge project, consider the rehabilitating the current route from Colonia to Rio Branco.

The financial analysis indicates, however, that the Eje Vial project presents substantial risks in regard to both its sustainability and viability. It clearly shows that in financial terms the Eje Vial project depends on the construction of the BAC bridge and the traffic that will cross the bridge. This may increase the project's regulatory and political risk. As the average of the annual debt coverage ratios is only 1.12, project designers should take care to structure the debt financing to improve the project's debt service capacity. In addition, the risk analysis shows that there is a 34 percent probability that the project may perform below the expectations.

The stakeholder analysis shows that the distributional impacts of the project on the different types of vehicle users, while significant, are not large. Car owners appear to gain the most from the implementation of the Eje Vial project. Therefore, there is some margin for redesigning the tariff structure so that the tolls capture a portion of the benefits road users receive. The stakeholder analysis shows, however, that the government would be the major beneficiary of the project through its fiscal impact. The government of Uruguay should consider the possibility of providing a form of public sector financing that could recycle some of the tax revenues created by the project. For example, the government might take a larger equity position in the project company. This could reduce the risk that the private concessionaire faces.

Bibliography and References

Traffic and Feasibility Studies (BCEOM), 1998. “Estudio de Factibilidad Eje Vial del Cono Sur Parte Uruguaya.” Montevideo, Uruguay.

Harberger, Arnold C. 1976. “Cost-Benefit Analysis of Transportation Projects.” In *Project Evaluation, Collected Papers.* Midway Reprint. University of Chicago Press, Chicago.

Harberger, Arnold C., and Glenn P. Jenkins. 2000. Manual for Cost Benefit Analysis of Investment Decisions. Cambridge, Massachusetts: Harvard Institute for International Development.

International Institute for Advanced Studies, Inc. 1997. “Financial and Economic Appraisal of the Buenos Aires-Colonia Bridge.” Prepared for the Argentina-Uruguay Binational Commission.

Ministry of Transport and Public Works, 1995. *Plan Quinquenal de Transporte del Uruguay, 2000-2005.* Montevideo, Uruguay.