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COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 7.3.2005
SEC(2005) 323

COMMISSION STAFF WORKING PAPER

***<u>Annex to the</u>* :**

**Communication from the Commission
to the Council and the European Parliament**

European Initiative for Growth
EU loan guarantee instrument for TEN-Transport projects

{COM(2005)75 final}
{COM(2005)76 final}

Table of contents

1. INTRODUCTION

The aim of this working paper is to provide further information on the technical details of the EU guarantee instrument for TEN-T projects.

Following the introduction, section 2 provides an overview of existing public financing programmes, which support transport infrastructure investments. Section 3 describes the main risks inherent to transport infrastructure projects and section 4 provides background information on stand-by credit lines in order to better understand the functioning of the EU loan guarantee instrument. Section 5 and 6 describe the indicative main features of the proposed guarantee instrument as well as the provisioning model which was developed internally by the Commission services in collaboration with the EIB. Section 7 outlines the main tasks of the managing agent.

Annex 1 shows the aide-mémoire used during the market testing exercise as a discussion paper. Annex 2 provides an indicative breakdown of potential budgetary needs for the period 2007-2013 and Annex 3 is the technical paper on the provisioning and pricing.

This working paper should be read in conjunction with the Communications from the Commission COM(2005)75 final and COM(2005)76 final of 7.3.2005.

2. PUBLIC FINANCING OF TRANSPORT INFRASTRUCTURE PROJECTS

The principal source of financing of most transport infrastructure projects remains national budgets. In the less developed regions the European Regional Development Fund and the Cohesion Fund are the additional suppliers of resources. The PHARE programme has supported investments in transport infrastructure in the CEEC. The ISPA (instrument for structural policies for pre-accession) was designed to assist the accession countries to meet the EU requirements in the fields of environment and transport.

An estimate, published in the report of the Van Miert High Level Group, shows the following figures:

€ Billion	*1993-1999*	*2000-2006 EU 15*	*2000-2006 EU 25*
TEN Budget	2.2	4.2	4.4
Cohesion Funds	7.6	9	12.8
ERDF	5	6	6
ISPA	--	2.1	na
Total	14.8	21.3	23.2

On the whole, Community participation in the current European Union (all instruments combined but not including loans from the European Investment Bank) reaches approximately € 20 billion for the period 2000-2006. In principle, this aid is supposed to induce a 'leverage effect' reaching up € 100 billion over the period. It is a principle of Community policy that its contribution covers only a limited part of the financial needs.

The coexistence of various financial instruments, each with their own logic, causes asymmetry of the support available between those countries and regions eligible for the structural instruments and those eligible only for the budget of the Trans-European network. Consequently, work on the corridors connecting the peripheral countries to transit countries encounters an excessive delay on the territory of the latter, being little encouraged to invest in infrastructure benefiting in the first instance their neighbours.

(a) Trans European Networks (TENs)

The new guidelines for the Trans-European Transport Network were adopted on the 21 April by the European Parliament, one week after the adoption by the Council of Ministers. The guidelines include a list of 30 priority projects which are declared to be of European interest and have a strong focus on the enlargement of the Union. The new Guidelines follow up the report by the high-Level Group on the TEN-T chaired by Mr Karel Van Miert in 2003. The extension of major European axes to the future Member States should help to make enlargement a success and provide the Union with a new opportunity to reduce congestion, improve accessibility and encourage intermodality. The list of projects also aims at ensuring modal shift and more sustainable mobility patterns by focussing investments in rail and waterborne transport. Strong focus is put on cross-border projects as these are typically the most difficult ones to implement.

The estimated cost of carrying out these 30 projects will be around € 235 billion by 2020. The total cost of completion of the trans-European transport network, including the projects of common interest not identified as priority projects, will be € 600 billion.

On the basis of experience and forecasts made in national plans, the Group has considered "that, at best, between 10% and 30% of the overall amount of the priority project costs could be ensured by the private sector in the field of land transport. Of course, the share varies considerably from one project to another. It is advisable to adopt an approach on a case by case basis to accurately measure the potential contribution of private investors".

(b) European Investment Fund

The EIF was established in 1994 with the primary objective of facilitating investment in TENs through the provision of guarantees. Between 1994 and 2000 it issued guarantees of over € 2 billion to some 40 TEN projects. From mid-2000, following its reform, EIF concentrated its guarantee activity entirely on the provision of guarantees on portfolios of SME loans and management of the EIF portfolio was subsequently transferred to the EIB.

The EIF's guarantees covered loans (from EIB and commercial institutions) as well as bond instruments against all risks of default. EIF guarantees were issued without obligatory risk sharing arrangements with the Member States although the Member States or their agencies were involved in other ways in the projects financed. The EIF's pricing of guarantees was intended to reflect the risk of default on individual projects as well as covering costs and providing an appropriate rate of return as required by its Statutes.

The EIF only guaranteed investment grade projects operating in the energy, telecommunications or transport sector. However it did provide some higher-risk guarantees on subordinated debt instruments in a few projects, alongside and with the comfort of a much bigger and growing portfolio of lower-risk guarantees on senior debt financings that provided acceptable portfolio risk management. Its prudential rules limited its exposure to individual projects to EUR 170 million and required 50% of the risk on any financing to be taken by another institution.

(c) Existing national schemes

Many of the Member States have provided guarantees for certain individual projects. One noteworthy example is the Øresund project which was financed by raising loans on capital markets in both domestic and foreign currency. All loans and other financial instrument are subject to joint and several guarantees from the Swedish and Danish governments. The two States divide the liability on 50/50 basis. Due to these guarantees, the underlying loans achieved the highest possible rating from Standard & Poor's which is a higher rating than given to the two States individually.

Not many Member States have used guarantee schemes to support the development of transport infrastructure projects. Hereunder is a non-exhaustive list of some existing schemes:

In Italy a law decree[1] adopted in 2002 allows the creation of a guarantee fund to cover revenue shortfalls. The budget dedicated to this guarantee fund amounts to EUR 1 billion and its aim is to increase the level of private funding and reduce the State contribution. However, the operational rules are not yet in place.

The Irish National Development Finance Agency Act, which was adopted end-2002, allows the National Development Finance Agency (NDFA) the provision of guarantees. This option has not yet been used.

In the UK[2], the government plans to test the use of a new way to finance certain PFI projects, such as a Credit Guarantee Finance scheme. Under this scheme, the government will provide loans which shall be guaranteed by the private sector i.e. financial institutions or monoline insurers.

Outside of the EU, the Transport Infrastructure Finance and Innovation Act of 1998 (TIFIA) in the United States authorises the provision of three forms of assistance to large infrastructure projects. This assistance can be in the form of secured direct loans, loan guarantees and stand-by lines of credit to surface transportation projects of national or regional significance. Projects may include highway, transit, passenger rail and intermodal facilities. Generally, under current law, project costs must equal or exceed $100 million. Between 1999 and 2003, 11 projects benefited mainly from TIFIA direct loans. Only one credit line over $ 600 million was guaranteed by TIFIA, however this credit line has not been drawn.

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[1] La Legge Finanziaria 2003, Artiche 71 (Legge n. 289 del 27 dicembre 2002).

[2] PFI: Meeting the Investment Challenge" explains the Private Finance Initiative programme's role in the delivery of the Government's investment plans for public services.

3. RISKS INHERENT IN TRANSPORT INFRASTRUCTURE PROJECTS

One may distinguish three main periods of a transport infrastructure project after its study phase: the pre-construction, construction and post-construction period. The various participants in the financing of a project are usually best equipped to assume differing roles, depending on the project status, with a view to ensure the most efficient risk allocation and the overall "bankability" of projects.

Pre-construction period: During the pre-construction period, both the responsibility for delays and risk thereof are usually shared between the public and the private sector. While the responsibility for right-of-way acquisition[3], environmental compliance and other public domain requirements can only be covered by the public sector, the risks related to the choice of the technical solution and other planning risks, which may cause delays and cost overruns during the project development are covered by the private sector.

Construction period: Since discrepancies between planned and actual construction costs and schedules are quite common, the financing of the construction stage requires flexibility and timely decisions. Equity shareholders can only partly cover the total financial burden related to the construction costs. Commercial bank loans appear to be the best choice for construction financing, as banks have expertise in assessing, mitigating and managing construction risks[4].

Post-construction period: Notwithstanding their advantages in construction financing, commercial banks have a limited ability and willingness to commit for the very long maturities that are needed to ensure financial equilibrium of transport infrastructure projects. This is valid especially to greenfield projects for which traffic forecasts, availability of corridors and possible interoperability, systems' integration and all types of operational and technical incompatibilities lead to increased level of risks. In particular, the early years of the post-construction phase, the so-called ramp-up period, are regarded as the most risky period of the post-construction phase, because the revenue flows are rather uncertain. In general, commercial bank loans rarely exceed 15 years, including the construction period, whereas most infrastructure projects require 20 to 30 years of amortization after their construction. As a result, once the project has successfully reached the operational phase, project sponsors often refinance bank debt with private placements or public bond issues with longer maturities.

The aim of structuring the overall financing package of a project is to combine various financial instruments that appropriately allocate risks throughout the various development stages of a project to the appropriate participants.

[3] Right-of-way is a strip of property that includes the corridor plus the parkway (area between the corridor and private property). The Right-of-way acquisition is the process of acquiring private property needed for projects, including drainage improvements, roadway or rail improvements, parks, etc.

[4] A small group of experienced lenders can more easily react to unexpected events than a large group of inexperienced bondholders. Moreover, bank loans can be incrementally disbursed according to the actual funding requirements of the project, while bonds are usually issued in one tranche.

4. STAND-BY CREDIT LINES

Stand-by credit lines are often structured in project finance transactions to provide a cushion for unexpected shortfalls in the cash flow available for debt service. In this respect, such lines are considered as additional revenue sources for the purpose of the calculations of the senior debt service coverage, thereby helping the senior debt receive a better, possibly investment grade, rating. Stand-by lines are sometimes mandatory under the terms of concession agreements as they reduce the possibility of financial distress, particularly during a project's construction and ramp-up phases[5].

The maximum amount that can be drawn under these lines represents around 10% of the total senior debt and can go up to 20% in certain cases depending on the scale and uncertainty of project revenues and costs. It is possible that different credit lines are made available, some covering the construction period, others activated only upon satisfactory completion of construction works according to contractual arrangements. In principle, the availability of a stand-by credit line might be tied to specific events, for example a change in legislation that has material economic impact on the project or a traffic shortfall relative to specified levels. However, excessively restrictive conditions for utilisation may hamper the very role that the credit line is supposed to play and credit lines that are available for general purposes have the highest value to the project. Rather than accepting too restrictive conditions for utilisation, borrowers are often willing to grant a priority for reimbursement to amounts drawn under the stand-by credit line. Thus, should the borrower have sufficient revenue to reimburse the line during the following year, it would have to reimburse the amount drawn. In case of further negative developments, the line can be drawn again until its maturity. Should there be an outstanding amount at maturity, there would be a need to re-finance the stand-by credit line or a guarantee could be called.

5. INDICATIVE MAIN FEATURES OF THE GUARANTEE INSTRUMENT

The main features are summarised hereunder and at a later stage those have to be formalised by a term sheet.

Aim of the guarantee: The Guarantee would be designed as an EC commitment backing a subordinated facility made available to a TEN project during the "ramp up" period of the project, i.e. from the end of the construction to the stabilization of the cash-flows (typically between 3 and 5 years). It will be issued in respect of "liquidity", "working capital" or other stand-by credit lines, negotiated by the borrower to ensure service of senior debt in the presence of shortfalls in cash-flow available for service of the senior debt of the borrower during the availability period. These credit lines would be subordinated to senior debt, in order to provide a credit enhancement to the latter, and are intended to be activated following a reduction in cash-flows that is imputable to either lower traffic, or availability/performance risk.

[5] The early years of the operational phase of a transport project are called 'the ramp-up period'. This period is regarded to be the most risky period of the post-construction phase, because the revenue flows are rather uncertain.

Eligible projects: All projects that are eligible for support for a TEN grant, and in particular TEN priority projects, are also eligible for support by the TEN-T guarantee instrument. The senior loans granted for the project should achieve a creditworthiness that is close to investment grade on a standalone basis. It is therefore expected that establishment of EU-guaranteed subordinated lines of credit will allow senior debt to attain investment grade creditworthiness. The project should demonstrate the commitment of national/regional authorities to financially support it and the project should demonstrate an appropriate level of private participation in the form of equity and debt depending on the type of the project (greenfield or brownfield, road or rail).

Guarantee rate: The guarantee would cover up to 100% of a stand-by credit line. The stand-by credit line should not exceed 20% of the total amount of the senior debt committed at financial close and still outstanding at the starting date of the ramp-up period.

Availability of the EU guarantee: The guarantee would be part of the overall financing package i.e. the guarantee agreement would be signed between the applicant and the agent in the beginning of the construction period. The EU guarantee would become effective only at the start of the operations which has to be certified by an appropriate body to the agent. If no amounts are drawn under the stand-by credit line at its expiration, the guarantee would also expire.

Dedicated revenue sources: Project financing must be repayable, in whole or in part, from tolls, user fees, availability payments or other dedicated sources.

Flexibility: The guarantee should be transferable from one beneficiary to another, for example in the case of restructuring of the financing package or in case the concessionaire is changed. This would cover instances of debt restructuring, the stepping in of the capital markets in a project and possibly let the banks use the released funds for further infrastructure financing.

Call on the guarantee: If the stand-by credit line was drawn and the project were unable to service outstanding amounts, the guarantee can be called. In this case, the EU would, irrespective of an actual default by the borrower, subrogate into the rights of the stand-by credit provider, and acquire a subordinated claim on the project cash-flows.

Pricing of the guarantee is twofold:

– A commitment fee for the guarantee;

– If the guarantee were called: The borrower will have to pay interest, which is set taking into account the subordinated ranking of the EU claim. This interest will, in all cases, exceed the corresponding interest paid on senior debt and will be priced taking into account the underlying risk.

Reimbursement of the outstanding amount: The reimbursement schedule of the principal would be based on cash-flow forecasts. In the case that it is deemed to be necessary for an optimal sharing of the risks, flexible reimbursement mechanisms could be envisaged.

Risk-weighting: The underlying stand-by credit line guaranteed by the guarantee instrument would benefit from a zero risk weighting for regulatory purposes.

Prepayment: The EU subordinated claim can be prepaid in whole or in part at any time without penalty.

An illustration of a possible financing structure during the operational phase of the project after the grant contributions of the national authorities and EU could be as follows:

Senior Debt, 30 years maturity	*90%*
(Stand-by credit line to cover debt service shortfalls, 5 years maturity, guaranteed by the EU)	*(20% of the senior debt)*
Equity, open ended	*10%*

In the case that the stand-by credit line would be fully drawn at its expiration, the EU would subrogate into a subordinated financial claim thus leading to the following financing structure after 5 years of operations. In this illustration, 100% of the stand-by credit line would be drawn (excluding interest and other possible charges):

Senior debt, still 25 years maturity	*72%*
Sub-ordinated loan (to be reimbursed when the revenues can cover more than the operational costs and the reimbursement of the senior debt)	*18%*
Equity (dividends would be distributed when revenues can cover more than the operational costs and the reimbursement of the senior debt), open ended	*10%*

6. PROVISIONING

The Commission services developed a provisioning model, which can be found in Annex 3 (pdf-file). On the basis of the model and of the current estimated cost for TEN priority projects, it appears that during the Financial Perspective 2007-2013 a budget allocation of EUR 1 billion in total is needed. Annex 2 gives further details on how such an amount is determined and a proposed annual breakdown of indicative budget allocations.

7. TASKS OF THE MANAGING AGENT

The managing agent should have an in-depth knowledge of project financing, together with appropriate credit risk management systems in place in order to assess the project risks and to manage the provisioning system and the liquidity fund in the long-term. It should also have in-house legal expertise and the appropriate front office staff to interface with financial institutions, monoline insurers, venture capital funds, national authorities and/or shareholders.

The managing agent could be expected to also be a major provider of senior debt to many of the projects. It would be therefore essential to ensure that appropriate mechanisms would be put in place so that that the additional benefits of the EU guarantee, i.e. risk reduction, would be shared equally among all senior lenders. No additional benefits would accrue to the managing agent.

The managing agent's tasks could encompass in particular:

(d) The evaluation of eligibility for the guarantees, due diligence and risk assessment of the projects;

(e) Negotiation of the detailed terms under each guarantee contract;

(f) Monitoring and controlling the financial performance of the projects;

(g) Defending Community interests in the event of restructuring of the financing package;

(h) Reporting to the Commission;

(i) Opening and maintaining a trust account for the liquidity fund;

(j) Provisioning of the budgetary funds for the individual projects and the management of the liquidity fund and the subsequent treasury operations under the mandate;

(k) Charging of fees and other receivables from the beneficiaries, making payments, verifying guarantee calls, collecting reimbursements.

ANNEX 1 AIDE-MÉMOIRE

POSSIBLE EU GUARANTEE INSTRUMENT TO SUPPORT TEN TRANSPORT PROJECTS

(Please note that this aide-mémoire is based on the initial proposal following the Commission Communication of November 2003. It was used during the market testing exercise in Spring 2004. This is not the final proposal for the design of the instrument.)

Within the framework of the European Initiative for Growth, the European Council of 12 December 2003 invited the Commission, in co-operation with the Member States, to examine the idea of developing a specific EU guarantee instrument for certain post-construction risks in TEN transport (TEN-T)[6] projects, to report on the results of the examination, and, if appropriate, to present a proposal in this regard. It is essential that the guarantee instrument should provide a workable response to the needs of market operators who will finance and manage the projects concerned. The Commission has therefore started a process of market testing with interested parties.

The Guarantee instrument

Aim: The Facility would offer guarantees covering specific commercial risks. The aim of the instrument is to

- leverage private sector funding of TENs
- reduce the financing cost of projects
- to accelerate the conclusion of financial packages.

Risk covered: The EU guarantee instrument would focus on post-construction risks in projects such as the risk of traffic and/or revenue shortfalls.

Period covered: The guarantee would partially cover shortfalls measured relative to an agreed break-even base scenario during an initial period (3-5 years) of the post construction phase.

Eligible projects: The guarantee would be available to TEN-T projects that are economically sound and cost-effective and, after grant aid, have an acceptable prospect of financial viability. An investment grade rating could be certified by an independent third party (e.g. rating agency). A priority would be given to cross-border projects, in line with the Quick Start programme[7] of the European Initiative for Growth;

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6 The legal basis for the TEN-T is provided in the Treaty of the European Union. On July 1996 the European Parliament and the Council adopted a Decision on Community guidelines for the development of the trans-European network (TEN-T). These guidelines comprise roads, railways, inland waterways, airports, seaports, inland ports and traffic management systems which serve the entire continent, carry tye bulk of the long distance traffic and bring the geographical and economic areas of the Untion closer together. These guidelines are a general reference framework for the implementation of the network and identification of projects of common interest (TEN-T projects).

7 Following a request by the European Council in October 2003, the Commission and the EIB established a list of projects in an enlarged Union meeting the following criteria: high level of maturity, trans-

Beneficiaries: The guarantee would be available to debt providers who would benefit from appropriate debt-service for the initial period of the post-construction phase. Loans backed by EU guarantees would benefit from a 0% risk weighting.

Guarantee type: As a debt-service guarantee the instrument would work in a similar way to the insurance offered by monoline insurers. The guarantee instrument would provide the beneficiary with a time-limited substitute for the revenue sources that would normally support regular debt repayments. The guarantee would therefore not cover acceleration of debt repayment.

Guarantee rate: The guarantee instrument would cover a share of the annual debt service over the respective period (3-5 years), the remainder to be taken by the Member State(s) and the private sector.

Risk premium: The intention is to charge the beneficiary a premium calculated on a risk basis.

Risk sharing with Member States: The Commission would expect the Member States to offer at least comparable support to the project as that offered by the instrument.

Risk sharing with the private sector: A portion of the risk would be borne by the private sector.

Event of default: The event of default would be defined as the shortfall measured relative to an agreed break-even base scenario.

Issues for discussion

(a) Whether the EU guarantee would respond to market demand.

(b) Alternative ways of leveraging private sector investment.

(c) Impact of the EU guarantee on the financing costs of projects.

(d) Whether the EU guarantee could substantially facilitate the conclusion of financial packages.

(e) Appropriateness of a debt service guarantee.

(f) Added value vis-à-vis monoline insurers.

(g) Minimum critical mass.

(h) Reasonable risk sharing between Private sector/Member States/Community.

(i) Whether non-commercial post construction risk, such as failure to meet contractual commitments by public authorities, are adequately covered by other legal or market mechanisms (insurance).

(j) Applications of risk sharing techniques on the management of the portfolio.

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frontier dimension, impact on growth and innovation in the enlarged EU and benefits to the environment. In addition to transport sector, the Quick Start list includes projects related to research, innovation and development as well as broadband networks.

ANNEX 2 INDICATIVE ANNUAL BUDGET ALLOCATIONS

The Commission proposal for a Regulation of the European Parliament and of the Council determining the general rules for the granting of Community financial aid in the field of trans-European transport networks and energy and amending Council Regulation (EC) N° 2236/95 (COM(2004)475 final of 14.7.2004) states that *"The financial requirements of the 30 priority projects identified in annex III of the guidelines for trans- European transport networks by the Council and the Parliament alone account for EUR 225 billion, the largest part of which falls in the period 2007-2013 - about EUR 140 billion."* Furthermore, *"the Van Miert Report considered that the private sector could contribute up to 20% of the total cost of these projects but under certain conditions"*. Consequently, the total private sector contribution can be estimated at around EUR 28 billion. A majority of this contribution is expected to take the form of senior debt, EUR 20-25 billion, with equity and quasi-equity making up the balance.

A precise quantification of the annual budget allocations for the EU Loan Guarantee Instrument is difficult at this stage, due to limited availability of projections of eligible projects that are expected to involve private sector participation. A working assumption, consistent with the overall Van Miert objectives, is to consider a flow of private sector debt financing of the order of EUR 3 billion per year in the period 2007-2013, with all the TEN priority projects receiving private support.

Based on the provisioning model in Annex 1, the table below presents a scenario requiring a total budget allocation of around EUR 1 billion, with a specified annual breakdown. It should be noted that, while the exact amount needed and the timing will vary, front-loading of approximately one third of the total budget in the first year would be needed for the following reasons. Firstly, as the portfolio effect builds up only gradually, the level of provisioning needed for the first project is almost twice as large as the amount needed for the last one. Secondly, as interest accumulates on the early budget allocations, the overall need for budget allocation in the later years is further diminished.

These indicative calculations do not take into account the fees paid by the beneficiaries for the guarantee, nor the management costs of the guarantee instrument.

Amounts in millions of EUR

	Private sector lending		**Number of projects**	**Provisioning Calculation**				**Interest**	**Budgetary needs**	
Year	Annual	Cumul.	Cumul.	Rate	Cumul.	Cumul. Buffer	Cumul. total	*)	Annual	Request
2007	3,000	3,000	5	10.3%	309	0	309	0	309	**310**
2008	3,000	6,000	10	7.1%	426	43	469	15	144	**150**
2009	3,000	9,000	15	6.2%	558	56	614	23	122	**120**
2010	3,000	12,000	20	5.7%	684	68	752	31	108	**120**
2011	3,000	15,000	25	5.5%	825	83	908	38	117	**120**
2012	3,000	18,000	30	5.5%	990	99	1,089	45	136	**120**
2013	3,000	21,000	35	5.3%	1,113	111	1,224	54	81	**80**
	21,000								1,017	**1,020**

'Cumul.' means cumulative figures

*) Provisioned amounts are capitalised at a 5% annual rate

Annex 3 Technical paper

1 Executive summary

This paper covers the technical assessment of the feasibility of creating an EU guarantee instrument to support the senior debt of TEN transport (TEN-T) projects.

The results show that the essential value added of the instrument is for projects rated close to investment grade and that a guaranteed amount of a small fraction of senior debt is adequate to give sufficient security to senior debt.

A methodology to set provisioning rates is derived, taking into account the diversification obtained through the portfolio effect and consistent with a AAA rating of the instrument. It appears that a portfolio of a limited number of projects is enough to reap most of the diversification benefits. Results show also that for a global portfolio of 30 projects, the provisioning rates correspond to a leverage effect of Community funds close to 1 to 20.

Furthermore, the pricing of the instrument will ensure that costs are covered on an expected basis, taking into account the risk borne.

Finally, it appears that the results are essentially sensitive to two characteristics of the projects: firstly, the probability distribution of actual revenues compared with base case revenues; secondly, the correlation of the ramp-up revenues of the projects. Further work will have to be carried out to establish these two parameters more firmly for the TEN-T projects targeted by this instrument.

2 Introduction

The Community Guarantee Instrument is intended to cover certain post-construction risks in TEN transport (TEN-T) projects which are near to investment grade. The Community guarantee will support senior debt through the partial cover of a stand-by credit line focusing on a specific risk of the post-construction period of the project, such as traffic shortfall risk and/or revenue shortfall risk for a limited time period. At the expiration date of the EU guarantee, the guaranteed portion of the outstanding amount of the stand-by credit line would be paid by the Community, up to a predetermined cap rate, and possibly up to a nominal ceiling. Consequently, the Community would have a claim which would have to be repaid by the project at a later stage. In principle, the Community claim would rank subordinated to the senior debtors, but senior to the equity shareholders. Interest will be charged according to the risk taken, until the Community subordinated claim is reimbursed. A commitment fee will also be charged when the guarantee is signed or becomes effective, reflecting the risk borne. Figure 1 presents the project and guarantee instrument life cycle.

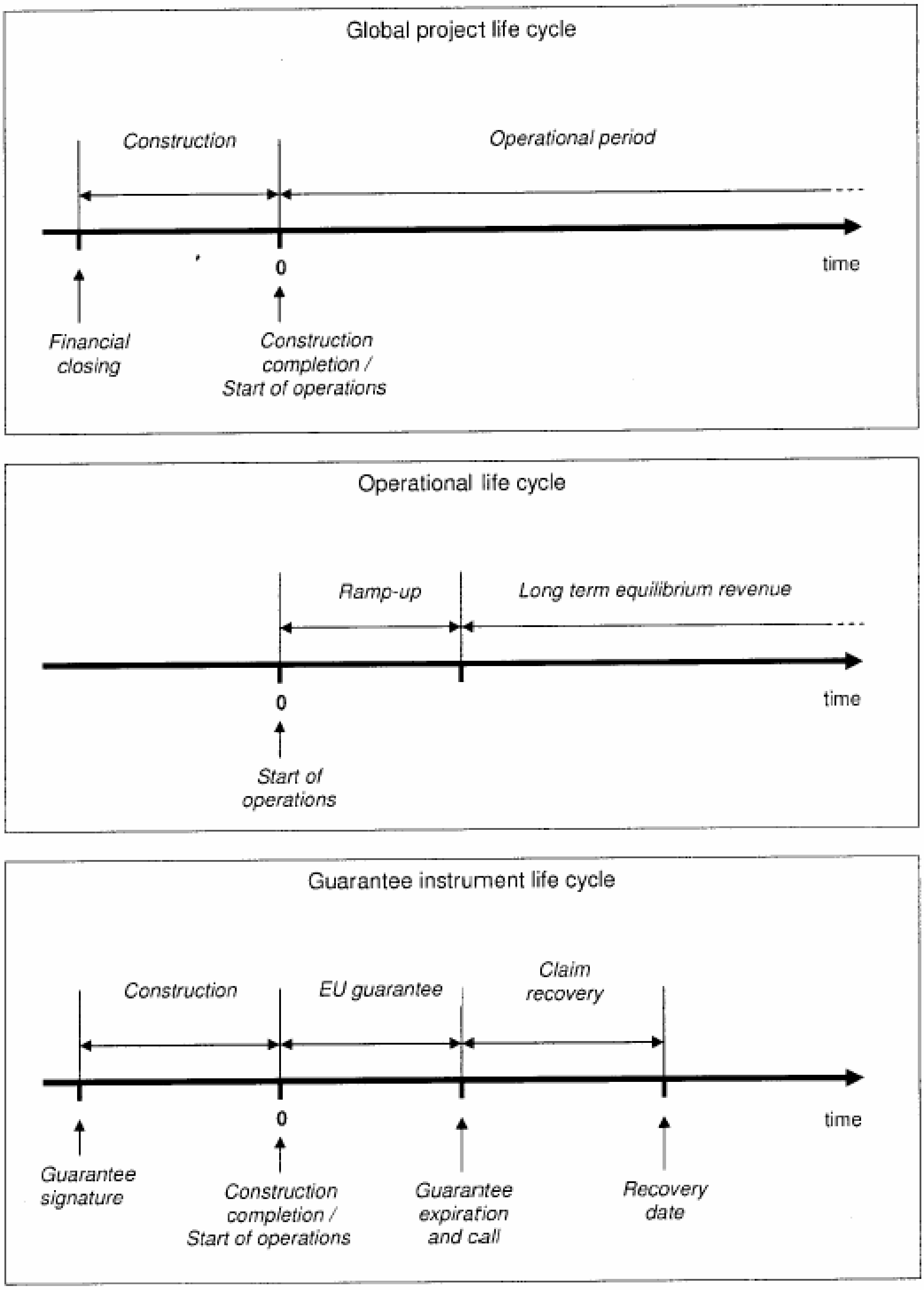

Figure 1: Project and guarantee instrument life cycle

3 Individual project

3.1 Financial credit strength

The primary quantitative measure of a project's financial credit strength, at the time of financial closing i.e. prior to construction, is the debt service coverage ratio (DSCR). The DSCR is the ratio of cash from operations (CFO) to principal and interest obligations. CFO is calculated by taking cash revenues and subtracting taxes and expenses other than interest and principal. To simplify, we will use the word *revenue* for CFO. Table 1, based on Standard & Poor's (S&P) project rating criteria, gives typical values of minimum DSCR (denoted by $DSCR_{min}$) and average DSCR (denoted by $DSCR_{av}$) for projects around investment grade. Ratings at or below BB are considered below investment grade. Ratings at or above BBB are considered investment grade.

Long term credit rating	$DSCR_{min}$	$DSCR_{av}$
A	3.0	5.0
BBB	1.5	2.0-3.0
BB	1.2	1.5-2.5
B	1.0	1.1-1.5

Table 1: DSCR and long term credit rating

3.2 Revenues

For an initial analysis, revenue forecasts are generally disaggregated into three principal components:

- projected revenue at service start-up;
- the ramp-up period, i.e. the time taken for early growth trends to mature;
- long-term revenue growth.

Revenues per unit of time, available for the senior debt service, are modelled according to the following equation:

$$R(t) = \left[R_\infty(1 - e^{-rt}) + R_0 e^{-rt}\right] e^{yt} , \qquad (1)$$

where

$t = 0$ represents the service start-up, i.e. project construction completion date;
r = ramp-up revenue growth rate;
R_0 = revenues at service start-up;
R_∞ = revenues after ramp-up, excluding long term growth trend;
y = long term revenue growth rate.

Note that for t large, the ramp-up effect disappears, so that:

$$\lim_{t\to\infty} R(t) = R_\infty e^{yt} .$$

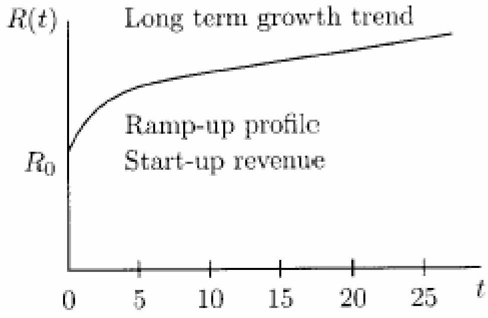

Figure 2: Revenue as a function of time

Figure 2 displays revenues per unit of time as a function of time, according to equation (1).

The financing of a project is generally structured on the basis of a base case scenario of revenues:

$$R^b(t) = \left[R^b_\infty(1 - e^{-r_b t}) + R^b_0 e^{-r_b t}\right] e^{yt} , \tag{2}$$

where

$$R^b_\infty = (1 + b)R^b_0 . \tag{3}$$

Using (3), (2) can be rewritten:

$$R^b(t) = R^b_0 r^b(t) e^{yt} , \tag{4}$$

where

$$\begin{aligned} r^b(t) &= (1 + b)(1 - e^{-r_b t}) + e^{-r_b t} \\ &= (1 + b) - be^{-r_b t} . \end{aligned} \tag{5}$$

The parameters b and r_b have to be calibrated to make equation (2) realistic. For example, a value for b of $\frac{1}{2}$ corresponds to R^b_0 equal to 67% of R^b_∞ . In this case, a value of r_b of 70% corresponds to a ramp-up period close to 2 years. Typical values for y, the long term growth trend, are between 1% and 3%. In this paper, a conservative value of 1% is used.

Inevitably, actual revenues are different from base case revenues:

$$R^a(t) = \left[R^a_\infty(1 - e^{-r_a t}) + R^a_0 e^{-r_a t}\right] e^{yt} , \tag{6}$$

with some long term catch up, so that

$$\lim_{t\to\infty} \frac{R^b(t) - R^a(t)}{R^b(t)} = \eta \frac{R^b_0 - R^a_0}{R^b_0} ,$$

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or

$$\frac{R^b_\infty - R^a_\infty}{R^b_\infty} = \eta(1 - r^a_0)\,, \tag{7}$$

where $r^a_0 = \frac{R^a_0}{R^b_0}$.

Typically $\eta = \frac{1}{3}$, according to available empirical evidence. This means that if an initial revenue shortfall of 30% occurs, the long term shortfall will only be 10%.

If b and η are fixed, actual revenues are determined by two parameters: the initial revenues R^a_0 and the revenue growth rate r_a.

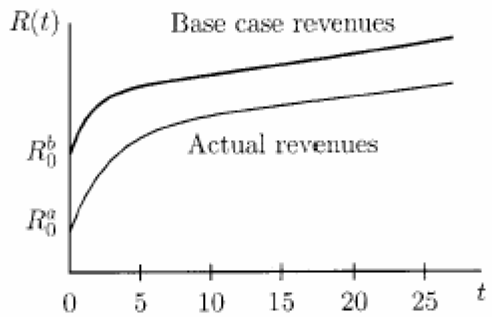

Figure 3: Base case scenario and actual revenues

Figure 3 displays the base case scenario and an example of a realization of actual revenues.

Using (7) and (3), we have:

$$r^a_\infty \equiv \frac{R^a_\infty}{R^b_0} = (1+b)\left[1 - \eta(1 - r^a_0)\right]\,.$$

Equation (6) can now be rewritten:

$$R^a(t) = R^b_0 r^a(t) e^{yt}\,,$$

where

$$r^a(t) = r^a_\infty(1 - e^{-r_a t}) + r^a_0 e^{-r_a t}\,.$$

S&P, in a recent publication (Infrastructure Finance, Traffic Forecasting Risk: Study Update 2003, November 06, 2003), has given an estimate for the probability distribution of r^a_0 based on a sample of 68 projects. This probability distribution is given in Table 2, columns (1) to (4). Column (5) gives the value of the revenue growth rate used for the simulations. An example of the actual revenue paths implied by the parameters of Table 2 is provided in Figure 4.

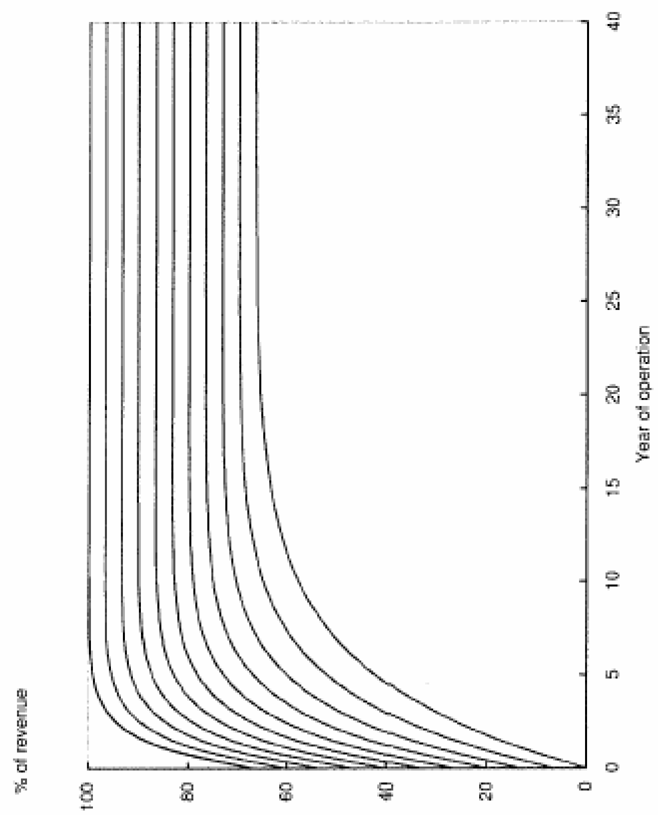

Figure 4: Revenue paths, without long term growth

Scenario (1)	Pr (2)	Cumul (3)	r_0^a (4)	r_a (5)
0	0.21	0.21	≥ 1.0	≥ 0.70
1	0.11	0.32	0.9	0.65
2	0.14	0.46	0.8	0.60
3	0.14	0.60	0.7	0.55
4	0.14	0.74	0.6	0.50
5	0.09	0.83	0.5	0.45
6	0.09	0.92	0.4	0.40
7	0.04	0.96	0.3	0.35
8	0.04	1.00	0.2	0.30
9	0.00	1.00	0.1	0.25
10	0.00	1.00	0.0	0.20
	1.00			

Table 2: Probability distribution of actual/base case revenues

3.3 Debt service

Arranging banks structure the debt service per unit of time $S(t)$ so that it can be met by the revenues available under the base case scenario with an appropriate DSCR. Let us assume that the debt service is structured on the basis of constant payments so that $S(t) = S \, \forall \, t$. Figure 5 displays the base case revenues and the debt service.

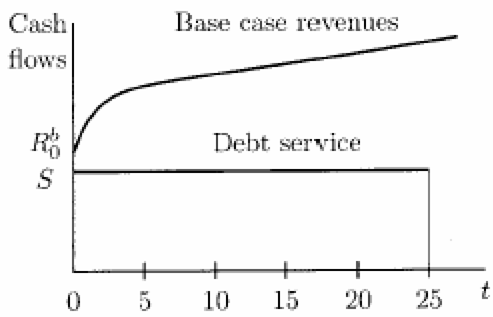

Figure 5: Base case scenario and debt service

As the present value of the debt service is necessarily equal to the total senior debt of the project, we have:

$$\int_0^T S e^{-it} \, \mathrm{d}t = D \, ,$$

where

$$i = \text{ long term interest rate applicable to the senior debt;}$$
$$D = \text{ total senior debt of the project;}$$
$$T = \text{ maturity of the senior debt.}$$

Calculating the integral, we have:

$$S = uiD\,, \tag{8}$$

where

$$u = \frac{1}{1 - e^{-iT}}\,.$$

The debt service rate is:

$$\frac{S}{D} = ui\,. \tag{9}$$

Table 3 gives the values of u for various values of i and T. For example, for $i = 5\%$ and $T = 25$ years, we have $u = 1.40$.

i	T			
	20	25	30	∞
4%	1.82	1.58	1.43	1.00
5%	1.58	1.40	1.29	1.00
6%	1.43	1.29	1.20	1.00

Table 3: Values of u

We can now calculate the instantaneous DSCR:

$$DSCR(t) = \frac{R^b(t)}{S}\,. \tag{10}$$

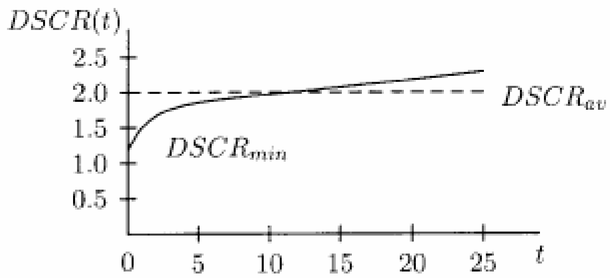

Figure 6: Debt service coverage ratio

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Figure 6 displays DSCR as a function of time. DSCR is typically minimum at time $t = 0$ and then increases with time. The average DSCR is also displayed.

Let us denote by q the minimum DSCR. We have:

$$DSCR_{min} = q = \frac{R_0^b}{S} . \tag{11}$$

Using (11) and (8), we have:

$$R_0^b = quiD .$$

This equation gives the relation between the level of senior debt and the revenue level at service start-up, in the case of a debt service structured on the basis of constant payments. Actual revenues are calculated as follows:

$$\begin{aligned} R^a(t) &= R_0^b r^a(t) e^{yt} \\ &= quiDr^a(t)e^{yt} , \end{aligned}$$

and the actual revenue rate is:

$$\frac{R^a(t)}{D} = quir^a(t)e^{yt} . \tag{12}$$

The average DSCR is given by:

$$DSCR_{av} = \frac{R_{av}^b}{S} ,$$

where R_{av}^b is the average base case revenue.

Using Table 1, one can deduce the values of q and b for typical projects (see details in annex). Table 4 gives the values of the two parameters for the central value of $DSCR_{av}$.

Credit rating	q	$\frac{DSCR_{av}}{DSCR_{min}}$	b
A	3.0	1.67	0.49
BBB	1.5	1.67	0.49
BB	1.2	1.67	0.49
B	1.0	1.30	0.15

Table 4: Values of q and b

3.4 Stand-by credit line

If the actual revenues $R^a(t)$ are smaller than the debt service S, the stand-by credit line must be drawn upon by an amount $C(t) = S - R^a(t)$ per unit of time. Figure 7 illustrates the situation where the stand-by credit line must be drawn upon.

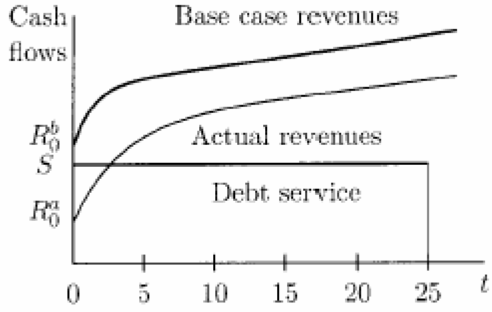

Figure 7: Draw-down of the stand-by credit line

The draw-down rate of the stand-by credit line, per unit of time, is:

$$c(t) \equiv \frac{C(t)}{D} = \frac{S}{D} - \frac{R^a(t)}{D}.$$

Using (9) and (12), the draw-down rate is:

$$c(t) = ui\left[1 - gr^a(t)e^{yt}\right] \tag{13}$$

with

$$r^a(t) = r_\infty^a(1 - e^{-r_a t}) + r_0^a e^{-r_a t},$$
$$r_\infty^a = (1+b)\left[1 - \eta(1 - r_0^a)\right].$$

Let us denote by s the interest rate applicable to the stand-by credit line. We are interested in calculating the outstanding amount of the stand-by credit line at time t. This outstanding amount is the sum of the future values at rate s, at time t, of the draw-downs of the stand-by credit line. The outstanding rate at time t, per unit of debt, denoted by $o(t)$, is:

$$o(t) = \max\left[\int_0^t c(v)e^{s(t-v)}\,\mathrm{d}v, 0\right]. \tag{14}$$

The outstanding rate $o(t)$ reaches a maximum at t_{max} such that:

$$so(t_{max}) + c(t_{max}) = 0.$$

Figure 8 displays a possible realization of the outstanding rate $o(t)$ as a function of time t for a BB project.

Table 6 gives the probability distribution of the outstanding rate for projects rated A, BBB, BB and B for $t = 3$, 5, 7 and 9 years. Computations are done with $s = 5\%$. The mean (μ), standard deviation (σ) and value at risk (VaR) are also given. Value at risk is calculated with a 100% confidence level.

It appears that the stand-by credit line is almost never used for investment grade projects (A and BBB). Hence, the Community Guarantee Instrument

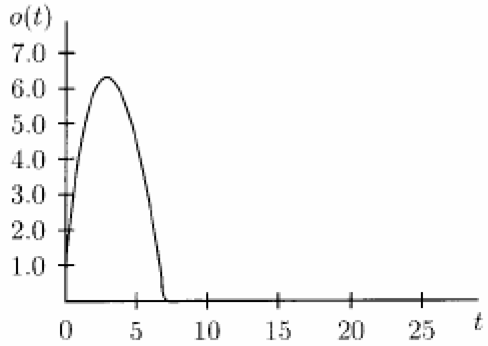

Figure 8: Outstanding rate of the stand-by credit line (in %)

would have no value-added for investment grade projects. It also appears that the stand-by credit line reaches high levels for B projects. This would lead to substantial exposure for the guarantee instrument. Hence, it is reasonable to assume that the B projects fall outside the scope of this instrument. Consequently, the rest of the paper will focus exclusively on projects near investment grade, i.e. rated BB.

In order to cover the full spectrum of BB projects, Table 5 shows the parameters which are used in line with Table 1 DSCRs:

Credit rating	q	$\frac{DSCR_{av}}{DSCR_{min}}$	b
BB+	1.2	2.08	0.88
BB	1.2	1.67	0.49
BB-	1.2	1.25	0.11

Table 5: Values of q and b for the spectrum of BB projects

3.5 Guarantee call and recovery

At the expiration date of the EU guarantee, denoted by τ, the guaranteed portion of the outstanding amount of the stand-by credit line is paid by the Community, up to a predetermined cap rate c. This amount will then be repaid to the EU. Let us denote by $t_{rec\tau}$ the date at which the amount is fully recovered by the Community.

The guarantee call rate, i.e. the amount to be paid at time τ by the EU for the project, per unit of guaranteed debt, denoted by $l(\tau)$, is:

$$l(\tau) = \min\left[o(\tau), c\right] . \tag{15}$$

Table 7 provides the probability distribution of $o(t)$ for $t = 3$, 5, 7 and 9 years, calculated using (14), respectively for projects rated BB+, BB and BB-.

Scenario	Pr	Cumul	r_0^a	A				BBB				BB				B			
				t = 3	t = 5	t = 7	t = 9	t = 3	t = 5	t = 7	t = 9	t = 3	t = 5	t = 7	t = 9	t = 3	t = 5	t = 7	t = 9
0	0.21	0.21	>1,0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.11	0.32	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.14	0.46	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0
3	0.14	0.60	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.7	1.7	0.2
4	0.14	0.74	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.8	5.8	5.4
5	0.09	0.83	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	9.0	10.2	10.9
6	0.09	0.92	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	9.4	12.5	14.9	16.8
7	0.04	0.96	0.3	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	6.3	4.4	0.1	0.0	11.7	16.3	20.0	23.3
8	0.04	1.00	0.2	0.0	**0.0**	0.0	0.0	6.1	**2.4**	0.0	0.0	9.8	**10.3**	8.3	4.5	14.3	**20.5**	25.7	30.6
9	0.00	1.00	0.1	0.0	0.0	0.0	0.0	10.7	10.4	6.6	0.1	13.5	16.7	17.4	16.4	17.0	25.0	32.2	38.9
10	0.00	1.00	0.0	6.7	0.0	0.0	0.0	15.6	19.2	19.6	17.3	17.4	23.7	27.8	30.2	19.9	30.2	39.6	48.6
	1.00																		
			μ	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.9	0.6	0.3	0.2	3.8	4.6	5.1	5.4
			σ	0.0	0.0	0.0	0.0	1.2	0.5	0.0	0.0	2.3	2.2	1.6	0.9	4.1	5.8	7.1	8.4
			VaR	0.0	0.0	0.0	0.0	6.1	2.4	0.0	0.0	9.8	10.3	8.3	4.5	14.3	20.5	25.7	30.6

Table 6: Probability distribution of the outstanding rate (%) for projects rated A, BBB, BB and B

Scenario	Pr	Cumul	r_0^3	BB+							BB							BB-						
				t = 3	t = 5	t = 7	t = 9	max	t_{max}	t_{rec5}	t = 3	t = 5	t = 7	t = 9	max	τ_{max}	t_{rec5}	t = 3	t = 5	t = 7	t = 9	max	τ_{max}	t_{rec5}
0	0.21	0.21	>1,0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	-
1	0.11	0.32	0.9	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	-
2	0.14	0.46	0.8	0.0	0.0	0.0	0.0	0.1	0.0	-	0.0	0.0	0.0	0.0	0.1	0.0	-	0.0	0.0	0.0	0.0	0.1	0.0	-
3	0.14	0.60	0.7	0.0	0.0	0.0	0.0	0.3	0.3	-	0.0	0.0	0.0	0.0	0.4	0.3	-	0.0	0.0	0.0	0.0	0.7	1.0	-
4	0.14	0.74	0.6	0.0	0.0	0.0	0.0	0.7	0.5	-	0.0	0.0	0.0	0.0	1.0	0.8	-	1.6	0.0	0.0	0.0	1.9	2.0	-
5	0.09	0.83	0.5	0.0	0.0	0.0	0.0	1.5	0.8	-	0.0	0.0	0.0	0.0	2.1	1.3	-	4.1	3.5	1.7	0.0	4.1	3.3	11.5
6	0.09	0.92	0.4	0.0	0.0	0.0	0.0	2.6	1.3	-	3.0	0.0	0.0	0.0	3.7	2.0	-	6.7	7.6	7.2	6.1	7.6	5.3	22.0
7	0.04	0.96	0.3	3.0	0.0	0.0	0.0	4.4	1.8	-	6.3	4.4	0.1	0.0	6.3	3.0	9.0	9.5	12.0	13.3	13.7	13.7	9.5	28.8
8	0.04	1.00	0.2	6.9	**3.5**	0.0	0.0	7.1	2.5	7.3	9.8	**10.3**	8.3	4.5	10.4	4.3	15.5	12.5	**16.9**	20.0	22.2	27.5	20.5	n.a.
9	0.00	1.00	0.1	11.1	10.9	7.1	0.4	11.5	3.8	12.5	13.5	16.7	17.4	16.4	17.4	6.8	25.8	15.7	22.3	27.5	32.0	59.6	25.0	n.a.
10	0.00	1.00	0.0	15.5	19.0	19.2	16.7	19.5	6.0	21.3	17.4	23.7	27.8	30.2	31.4	12.0	n.a.	19.2	28.3	36.2	43.4	98.9	25.0	n.a.
	1.00																							
			μ	0.4	0.1	0.0	0.0				0.9	0.6	0.3	0.2				2.1	2.1	2.1	2.0			
			σ	1.5	0.7	0.0	0.0				2.3	2.2	1.6	0.9				3.4	4.3	4.8	5.2			
			VaR	6.9	3.5	0.0	0.0				9.8	10.3	8.3	4.5				12.5	16.9	20.0	22.2			
			σ / μ	3.7	4.9	-	-				2.5	3.7	4.8	4.9				1.6	2.0	2.3	2.6			
			VaR / μ	17.5	25.0	-	-				10.7	17.5	24.7	25.0				6.0	7.9	9.4	11.2			

n.a. : the recovery is not possible unless the project is restructured

Table 7: Probability distribution of the outstanding rate (%) for projects rated BB+, BB and BB-

Following market consultations, it appears reasonable to set the expiration date of the EU guarantee τ at 5 years. Table 7 also provides the maximum value of the outstanding rate together with its time of occurrence, denoted by t_{max}. Finally, the Table provides for $\tau = 5$ the time t_{rec5} at which the EU will have fully recovered the amount paid out. The recovery times are calculated assuming that available revenues after debt service payment are equally shared between equity providers and the EU. Note that for projects rated BB-, recovery may happen after a very long time or may not even be possible unless the project is restructured. For that reason, it would appear legitimate to consider that projects rated BB- fall outside the scope of the instrument.

3.6 Cap rate

The probability that $o(\tau) \leq$ VaR is 1 by definition, as VaR is calculated here with a confidence level of 100% . At a 5 year horizon, VaR is 3.5% for projects rated BB+, 10.3% for projects rated BB and 16.9% for projects rated BB-. Consequently, it would be legitimate to set the cap rate c close to these levels, which are consistent with market practice. In the rest of this paper we will assume that $c =$ VaR.

It is important to stress that these cap rates are derived on the basis of generic assumptions. In practice, however, cap rates will be determined on a project by project basis.

Let us now turn to the assessment of a portfolio comprising several individual projects.

4 Portfolio mathematics

Let us start with a slightly modified version of equation (15) which gives the guarantee call rate per unit of guaranteed debt, for an individual project j:

$$l_j = \frac{L_j}{gD_j} .$$

The subscript j indicates that the equation relates to project j. The reference to the guarantee period τ is dropped for the sake of simplicity. The guarantee rate g of the Community Guarantee Instrument is constant for all projects. L_j is the guarantee call of project j and D_j is the total senior debt of project j.

The guarantee call of a portfolio comprising n projects, denoted by L_p, is then:

$$L_p = \sum_{j=1}^{n} L_j \,, \\ = g \sum_{j=1}^{n} D_j l_j \,, \\ = g D_p \sum_{j=1}^{n} w_j l_j \,,$$

where

$D_p = \sum_{j=1}^{n} D_j$ is the total debt of the projects included in the portfolio;

$w_j = \dfrac{D_j}{D_p}$ is the weight of project j in the portfolio; $\sum_{j=1}^{n} w_j = 1$.

In order to obtain an adequate diversification of the portfolio, the w_j , $\quad j = 1, \ldots, n$, should not exceed prudential limits to be determined.

Let us denote by $l_p = \frac{L_p}{g D_p}$ the guarantee call rate of the portfolio, per unit of guaranteed debt. We have:

$$l_p = \sum_{j=1}^{n} w_j l_j \,.$$

In matrix notation, this can be written:

$$l_p = \mathbf{w}'\mathbf{l} \,,$$

with

$$\mathbf{w}'\mathbf{1} = 1 \,,$$

where

$$\mathbf{w} = \begin{pmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{pmatrix} , \qquad \mathbf{l} = \begin{pmatrix} l_1 \\ l_2 \\ \vdots \\ l_n \end{pmatrix} , \qquad \mathbf{1} = \begin{pmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{pmatrix} .$$

The expected value of the guarantee call rate of the portfolio is:

$$\mathrm{E}[l_p] \equiv \mu_p = \mu \,, \tag{16}$$

where $\mu = \mathrm{E}[l_j]$, $\quad j = 1, \ldots, n$ is given in Tables 6 and 7.

The value at risk of the portfolio, per unit of guaranteed debt, denoted by VaR_p is simply:

$$\mathrm{VaR}_p = \mathrm{VaR} \,, \tag{17}$$

where VaR is the value at risk of the projects as given in Tables 6 and 7.

The variance of the guarantee call rate of the portfolio is:

$$\mathrm{Var}[l_p] \equiv \sigma_p^2 = \mathbf{w}'\boldsymbol{\Sigma}\,\mathbf{w},$$

where $\boldsymbol{\Sigma}$ is the variance-covariance matrix of the vector $\mathbf{l}$.

The standard deviation of the guarantee call rate of the portfolio is:

$$\sigma_p = \sqrt{\mathbf{w}'\boldsymbol{\Sigma}\,\mathbf{w}}. \tag{18}$$

Equations (16), (17) and (18) are the fundamental equations describing the behavior of the guarantee call rate of the portfolio of projects.

Let us assume that the ramp-up revenues of projects are correlated with a common correlation coefficient ρ. Then Σ can be written:

$$\boldsymbol{\Sigma} = \sigma^2\left[\rho\mathbf{1}\mathbf{1}' + (1-\rho)\mathbf{I}\right],$$

where $\sigma^2 = \mathrm{Var}(l_j)\,, \quad j = 1,\ldots,n$ as given in Tables 6 and 7 and $\mathbf{I}$ is the unit matrix. Equation (18) becomes:

$$\sigma_p = \sigma\sqrt{\rho + (1-\rho)\mathbf{w}'\mathbf{w}}. \tag{19}$$

If we further assume that the projects are equally weighted in the portfolio, i.e. $w_j = \frac{1}{n}, \quad j = 1,\ldots,n$, then (19) becomes:

$$\sigma_{pn} = \sigma\sqrt{\rho + \frac{1}{n}(1-\rho)}. \tag{20}$$

If n is large, equation (20) becomes:

$$\sigma_{p\infty} = \sigma\sqrt{\rho}\,.$$

This equation gives the lower bound of the portfolio standard deviation, assuming a positive correlation between projects.

The ratio $k_n = \frac{\sigma_{pn}}{\sigma}$ is of interest. It shows how quickly the standard deviation of the portfolio decreases when the number of projects n increases. Using (20), we have:

$$k_n = \frac{\sigma_{pn}}{\sigma} = \sqrt{\rho + \frac{1}{n}\,(1-\rho)}\,. \tag{21}$$

Figure 9, displays the value of k_n as a function of n for various values of ρ. Note that a limited number of projects are enough to reap most of the diversification benefits.

As may be noted, the value of ρ is critical in order to determine the portfolio effect. In the more general framework, the variance-covariance matrix $\boldsymbol{\Sigma}$ plays a crucial role. Estimating and monitoring this parameter will be one of the tasks of the manager of the facility.

It is however useful at this stage to consider a possible value of ρ. The correlation of actual revenues $R^a(t)$ during the ramp-up period is driven by the correlation of initial revenues R_0^a and by the correlation of the ramp-up growth

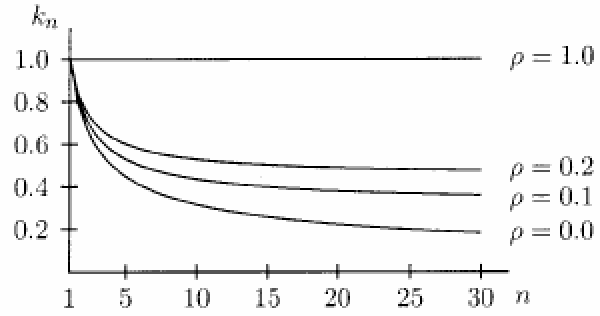

Figure 9: Values of k_n as a function of ρ and n

rates r_a. These two parameters relate almost exclusively to local conditions. Consequently, it is legitimate to assume that a portfolio comprising a number of geographically and/or temporally well diversified projects will have a very low correlation coefficient for ramp-up revenues. An overall average value of $\rho = 0.1$ can reasonably be considered. It goes without saying that projects opened at the same time in the same transport corridor should be considered as one project for portfolio purposes.

Figure 10 illustrates how the probability distribution of the guarantee call of the portfolio changes when the number of projects increases from 1 to 30, for $\rho = 0.1$. It appears that the portfolio effect decreases the probability of incurring high calls while at the same time decreasing the probability of incurring no calls.

5 Provisioning methods

5.1 Provisioning for the expected call

Let us assume that the projects are uncorrelated (i.e. $\rho = 0$) and that the number of projects in the portfolio is very large. In that case, $\sigma_p = 0$ and $l_p = \mu$. The provisioning rate, i.e. the amount to provision per unit of guaranteed debt, required to cover the potential calls, denoted by PR_E, is simply:

$$PR_E = \mu. \tag{22}$$

The above conditions are sometimes assumed for large diversified portfolios of SME loans and equation (22) is then applied. Though not applicable for a portfolio of TEN-T projects, this equation provides nevertheless a *lower bound* for the provisioning rate. It goes without saying that this risk cannot be eliminated through diversification.

In the case of our TEN-T projects, we have $PR_E = 0.1\%$ for BB+ projects, $PR_E = 0.6\%$ for BB projects and $PR_E = 2.1\%$ for BB- projects.

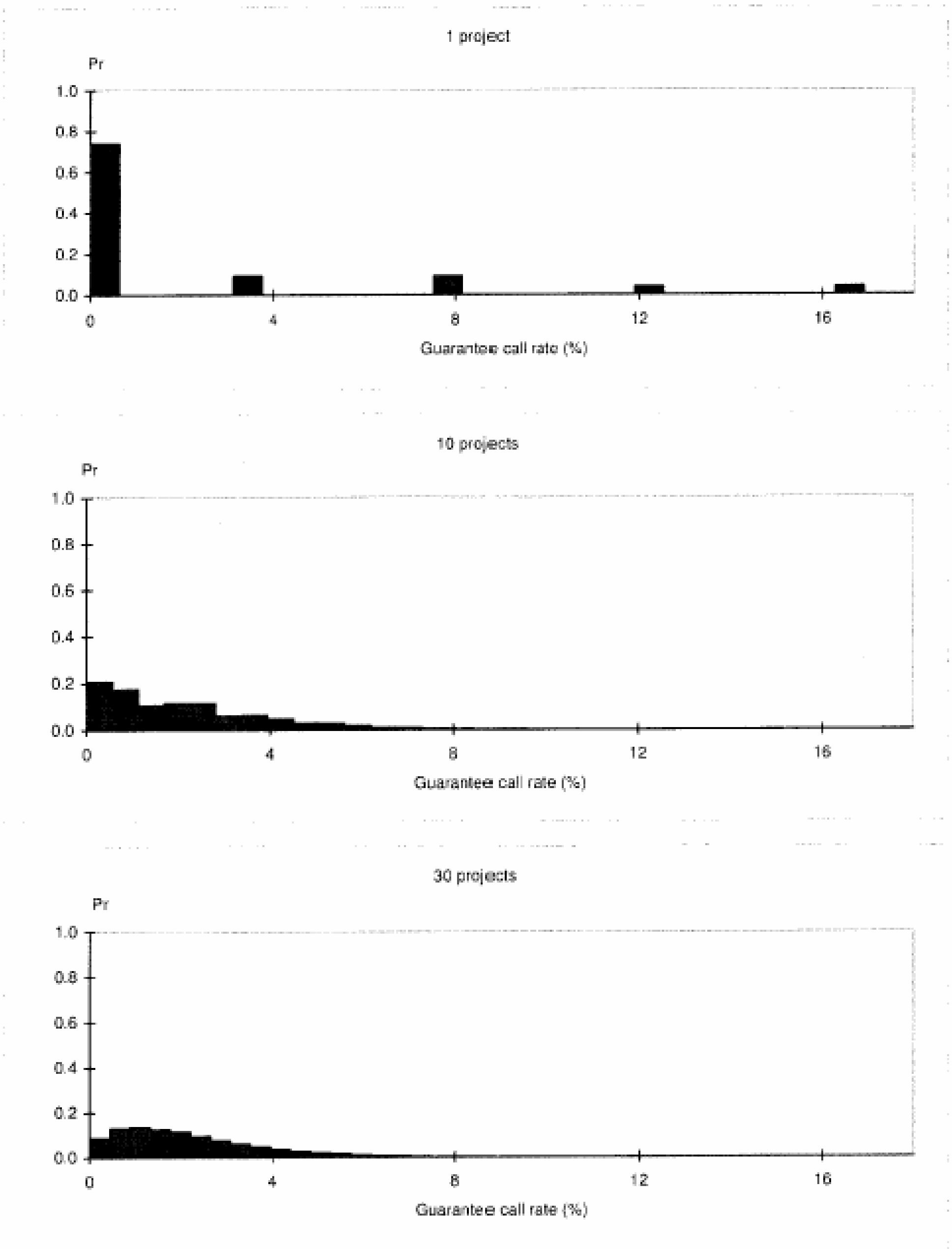

Figure 10: Probability distribution of the portfolio guarantee call (BB- projects, $\rho = 0.1$)

5.2 Provisioning under VaR

As VaR is calculated with a confidence level of 100% on the actual probability distribution of the outstanding rate, if we provision VaR we are certain that the guarantee call will never be larger than the provisioned amount. If we denote that provisioning rate by PR_{VaR}, we have:

$$PR_{\mathrm{VaR}} = \mathrm{VaR}. \tag{23}$$

This provisioning rate corresponds to the provisioning rate applicable for an individual project. It does not take into account any portfolio diversification effect. Hence, it represents an *upper bound* for the provisioning rate.

The provisioning rate is often expressed as a multiple β of the expected call μ. It is useful to rewrite equation (23) as follows:

$$PR_{\mathrm{VaR}} = \beta\mu\,,$$

where

$$\beta = \frac{\mathrm{VaR}}{\mu}\,.$$

Table 8 gives the values of β and PR_{VaR} for BB+, BB and BB- projects.

	BB+	BB	BB-
β	25.3	17.5	7.9
$PR_{\mathrm{VaR}}(\%)$	3.5	10.3	16.9

Table 8: Provisioning under VaR

5.3 Provisioning under Normal probability distribution

If we assume that l_p is normally distributed, we have:

$$\left(\frac{l_p - \mu_p}{\sigma_{pn}}\right) \sim N(0,1).$$

where $N(0,1)$ is the Standard Normal distribution.

The assumption of normality is only valid in specific conditions not met here i.e. a sufficiently large number of uncorrelated projects. It is, however, useful because it aids the understanding of the provisioning mechanism, in particular why the provisioning rate decreases when the number of projects increases.

The provisioning rate PR_N, required to cover the potential calls with a confidence level α is:

$$PR_N = \mu_p + \gamma_N \sigma_{pn}, \tag{24}$$

where γ_N is such that $\int_{-\infty}^{\gamma_N} N(0,1) = \alpha$.

Table 9 gives the values of γ_N for various values of α, for the Standard Normal distribution.

$\alpha(\%)$	γ_N
95.00	1.645
97.50	1.960
99.00	2.326
99.50	2.576
99.90	3.090
99.99	3.719

Table 9: Standard Normal distribution

A provisioning consistent with a 5-year AAA rating of the EU guarantee instrument would require at least $\alpha = 99.9\%$, hence $\gamma_N = 3.09$.

Using equations (16) and (21), (24) can be rewritten:

$$PR_N = \beta\mu\,,$$

with

$$\beta = 1 + \gamma_N \frac{\sigma}{\mu} k_n\,.$$

Table 10 gives the values of β and PR_N for BB+, BB and BB- projects and for $\rho = 0.1$.

n	BB+		BB		BB-	
	β	$PR_N(\%)$	β	$PR_N(\%)$	β	$PR_N(\%)$
1	25.3	3.5	17.5	10.3	7.9	16.9
5	9.0	1.2	7.0	4.1	4.3	9.2
10	7.6	1.0	5.9	3.5	3.7	8.0
15	7.1	1.0	5.5	3.3	3.5	7.5
20	6.8	0.9	5.3	3.1	3.4	7.2
30	6.5	0.9	5.1	3.0	3.2	7.0
∞	5.8	0.8	4.6	2.7	3.0	6.4

Table 10: Provisioning under Normal probability distribution ($\rho = 0.1$)

5.4 Provisioning under the actual probability distribution

Simulations have been run using the actual probability distributions for BB+, BB and BB- projects with a common correlation coefficient $\rho = 0.1$. Table 11 gives the multiplier β and the provisioning rates PR_A consistent with a 5-year AAA rating of the EU guarantee instrument (confidence level of 0.1%), for various portfolio sizes. It also gives the values of γ_A where:

$$\gamma_A = \frac{PR_A - \mu}{\sigma_{pn}}\,.$$

It should be recalled that, under the assumption of Normal distribution, we have $\gamma_N = 3.1$. Finally, estimates of the possible PR_A for $n = \infty$ have been added in order to give an indication of the relevant lower bounds.

n	BB+			BB			BB-		
	β	$PR_A(\%)$	$\gamma_A(\%)$	β	$PR_A(\%)$	$\gamma_A(\%)$	β	$PR_A(\%)$	$\gamma_A(\%)$
1	25.3	3.5	5.0	17.5	10.3	4.5	7.9	16.9	3.4
5	20.3	2.8	7.4	12.0	7.1	5.7	5.8	12.5	4.5
10	15.2	2.1	6.7	10.5	6.2	6.0	5.0	10.8	4.6
15	13.5	1.9	6.4	9.7	5.7	5.9	4.7	10.1	4.6
20	13.9	1.9	6.9	9.4	5.5	6.0	4.5	9.7	4.6
30	13.5	1.9	7.1	9.1	5.3	6.1	4.2	9.1	4.5
∞	11.8	1.6	7.0	8.1	4.7	6.1	3.1	6.6	4.4

Table 11: Provisioning under the actual probability distribution ($\rho = 0.1$)

Table 12 shows the provisioning rates expressed as a fraction of VaR. It appears that the reduction in provisioning due to the portfolio effect is substantial. Furthermore, the profiles of provisioning reduction are very similar, irrespective of the creditworthiness of the project.

n	BB+	BB	BB-
1	1.00	1.00	1.00
5	0.80	0.69	0.74
10	0.60	0.60	0.64
15	0.56	0.55	0.60
20	0.55	0.53	0.57
30	0.53	0.52	0.54
∞	0.47	0.46	0.39

Table 12: Provisioning as a fraction of VaR ($\rho = 0.1$)

Figure 11 shows the impact of ρ on the reduction in provisioning for BB projects.

It is useful to compare these provisioning rates with market practice. For example, a publication of the US Department of Transportation prepared by the rating agency Fitch (A risk assessment model for federal credit, 03/15/1999) states "[...]Fitch has concluded that for start-up infrastructure projects, a multiple of four to five times expected loss is needed to provide our highest credit standard of AAA[...]. It should also be noted that the capital charge methodology [...] applies to a large and diversified portfolio of loans [...]. Fitch would require considerably more capital to assign a rating of AAA to a private company insuring only a small, non diversified portfolio of loans[...]".

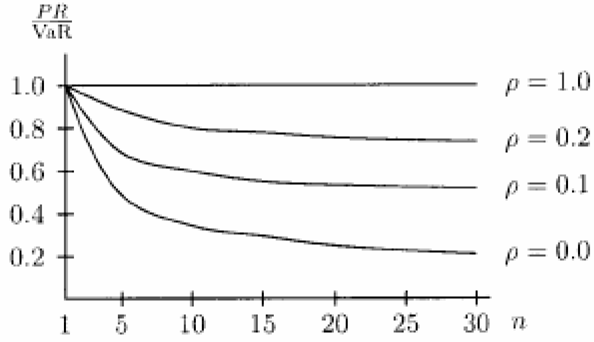

Figure 11: Impact of ρ on provisioning rates

In summary, for a portfolio comprising a small number of projects, the provisioning rates are equal to the applicable VaR, i.e. 3.5% for BB+ projects, 10.3% for BB projects and 16.9% for BB- projects. If one considers a global portfolio of 30 projects, the rates to apply could be around 1.9%, 5.3% and 9.1% respectively. For a portfolio comprising BB projects, thanks to the substantial portfolio effect, the leverage is close to 1 to 20, assuming an average correlation coefficient of 0.1. Finally, taking into account the interest earned on the amounts provisioned further increases the leverage effect of Community funds.

6 Portfolio rating migration

The portfolio calculations presented above are made under the assumption that individual project ratings are maintained at their initial level throughout their life cycle. In practice, it is evident that this will not always be the case and the ratings of some projects may vary over time. For example, empirical evidence from European structured finance deals shows that for a project starting with a BB rating, over a 5 year period there is a 37% probability of it being upgraded, a 37% probability of it staying at the same rating and a 26% probability of it being downgraded. While the probability of all the projects within the portfolio being downgraded is close to zero, there is a possibility that the portfolio experiences some global downgrading. It will be the task of the manager of the facility to monitor the projects' rating variation and to adapt provisioning amounts accordingly. For that reason, it is prudent to keep a permanent additional buffer on top of the projects' provisioning. A reasonable level for this buffer could be of the order of 10% of the provisioned amount. In any case, the level of this buffer will have to be monitored, taking into account the composition of the actual portfolio.

To conclude, taking into account both the 10% buffer and the interest earned on the amounts provisioned, it appears that the leverage of Community funds remains at 1 to 20 for a portfolio comprising BB projects.

7 Pricing of the instrument

The Community guarantee will not be free of charge. Firstly, a commitment fee will be charged when the guarantee is signed or becomes effective, reflecting the risk borne. This commitment fee, expressed as a fraction of the guaranteed amount, is paid at time $t = 0$, the project construction completion date.

Secondly, interest will also be charged on the Community claim, until the subordinated claim is reimbursed, at a rate equal to s plus a margin according to the risk taken.

The pricing will be set in such a way that the instrument breaks even on an expected basis and on a present value basis, taking into account the administration costs and the probability that the subordinated claim will not be reimbursed in full.

8 Conclusions

We find that the essential value added of the instrument is for projects rated close to investment grade i.e. BB. In this case, it appears that a guaranteed amount of a small fraction of senior debt is adequate to give sufficient security to total senior debt. Results also show that for a global portfolio of 30 projects, the provisioning rates correspond to a leverage effect of Community funds of 1 to 20.

However the results are very sensitive to two characteristics of the projects: firstly, the probability distribution of actual revenues compared with the base case revenues; secondly, the correlation of the revenues of the projects included in the portfolio.

Concerning the probability distribution of revenues, although the data used for this assessment are based on those compiled and published by a rating agency (S&P), further work will have to be carried out to establish these data more firmly for the TEN-T projects targeted by this instrument.

Finally, further work will also be needed to assess more precisely the correlation of ramp-up revenues for the specific TEN-T projects targeted by the instrument.

Annex: Determination of the value of b

Firstly we need to establish the value of R^b_{av}. By definition, we have:

$$R^b_{av} = \frac{1}{T}\int_0^T R^b(t)\mathrm{d}t.$$

Using (4) and (5), we have:

$$\begin{aligned} R^b_{av} &= \frac{1}{T}\int_0^T R^b_0 r^b(t) e^{yt}\mathrm{d}t \\ &= \frac{R^b_0}{T}\int_0^T \left[(1+b) - be^{-r_b t}\right] e^{yt}\mathrm{d}t \\ &= \frac{R^b_0}{T}(1+b)\int_0^T e^{yt}\mathrm{d}t - \frac{R^b_0}{T}b\int_0^T e^{(y-r_b)t}\mathrm{d}t \\ &= R^b_0\left[(1+b)I(y) - bI(y-r_b)\right] \end{aligned}$$

where the function I(.) is defined as follows:

$$I(x) = \frac{1}{T}\int_0^T e^{xt}\mathrm{d}t = \frac{e^{xT}-1}{xT}.$$

The ratio $\frac{DSCR_{av}}{DSCR_{min}}$ can now be easily derived:

$$\begin{aligned} \frac{DSCR_{av}}{DSCR_{min}} &= \frac{R^b_{av}}{R^b_0} \\ &= (1+b)I(y) - bI(y-r_b), \end{aligned}$$

and b is given by:

$$b = \frac{\left(\frac{DSCR_{av}}{DSCR_{min}}\right) - I(y)}{I(y) - I(y-r_b)},$$

where

$$I(x) = \frac{e^{xT}-1}{xT}.$$

For $y = 1\%$, $r_b = 70\%$ and $T = 25$ years, we obtain $I(y) = 1.136$ and $I(y - r_b) = 0.058$. For each value of the ratio $\frac{DSCR_{av}}{DSCR_{min}}$, on can deduce the corresponding value of b (see Tables 4 and 5).