The French Multimodal Fund Case Study, Annex 4 to REVENUE Project Deliverable 4, "Report on the Implementation of Interurban Case Studies"

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REVENUE
Revenue Use from Transport Pricing

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Executive summary

In December 2003, the French government decided to implement an ambitious transport programme with 35 major road and rail infrastructure projects, representing an overall investment of €20 billion between 2005 and 2012. In order to finance part of this programme a new funding agency with an independent budget, known as AFITF ("Agence pour le Financement des Infrastructures de Transport de France") was created on the 1st January 2005. Initially AFITF was expected to provide €7.5 billion of the €20 billion required for the programme with a borrowing capacity on the capital market based on revenues from paid-off State-owned toll motorway companies. However this revenue source might be threatened by the ongoing privatisation of motorway companies. The remaining financing needs (€12.5 billion) were expected to be met by external partners (local governments, European Union, private sector with public-private partnerships).

AFITF is the fourth transport investment fund to be created in France since 1995. The first, the FITTVN ("Fonds d'Investissement pour les Transports Terrestres et les Voies Navigables") was created in 1995 to re-launch public investment in transport infrastructure but was abolished in 2001. Two other funds were created in 2002 to develop intermodal transport in France and the Alpine region. However, these two funds never had a real existence.

The first part of the case study is devoted to the investment funds feasibility question through the FITTVN example.

When it was created, the FITTVN symbolised a new policy trend aimed at promoting regional development and intermodal transport. Funded from specific taxes, it was intended to be independent from the general budget and get around the budget constraint issue. The fund was financed by the "taxe d'aménagement du territoire" which was expected to provide a permanent source of finance. The fund has financed several major transport links, including motorways, the Mediterranean TGV line and some stretches of inland waterways.

Initially the fund had several advantages: it was launched by a political leader, with the support of elected representatives (the Senate), grounded in the roots of the electoral system, and based on a "cash cow" revenue source (motorway users who have no real capacity to organise themselves as a structured interest group). However, the FITTVN had several weaknesses: firstly the regional development and intermodality objectives were not clearly defined; secondly, as a consequence of this imprecision as regards objectives, faced with an overall public budget constraint a kind of "communicating vessels" operation naturally occurred by which the fund replaced the general budget of central government instead of providing new financing capacity.

These weaknesses were exploited by several interest groups and the fund was abolished in 2001 while the motorway tax was maintained. The main conclusions from this experience are as follows: there is a need for a clear definition of the objectives and scope of this kind of fund and a strong legislative and institutional basis in order to resist pressures, be they political or financial; sound initial design and functional operation are required in order to manage the interest groups and avoid the formation of excessively powerful opposition coalitions: this means addressing not only legislative aspects but also efficiency and equity; the conditions of euro-compatibility for this kind of fund must be defined i.e. pricing rules and revenue use (which part of user revenue can be allocated to finance which modes).

This succession of investment funds underlines the persistent need for permanent (or "sustainable") financing of transport investment with the aim of opening up less developed areas.

The second part of the case study addresses a number of issues related to cross-financing as an alternative to public subsidies and pricing rules as a revenue source and demand management tool. It assesses the efficiency of a multi-modal transport fund financed mainly by toll motorway users. Cross-financing from existing motorways to new motorway or rail projects as an alternative to direct public subsidies is evaluated. Issues of pricing efficiency in connection with cross-financing are also addressed.

In the following assessment the investment programme is not questioned: this means that the use of money for purposes other than transport infrastructure is not discussed. Only alternative ways of financing this programme and the pricing of transport infrastructure are considered.

This evaluation is based on two studies. The first involves the financing and pricing of a programme of ten new motorway projects. The second study involves the cross-financing of the Lyon-Turin rail link from Alpine motorways.

The first study has assessed regulation schemes on a programme of 10 new motorway projects distributed in the French metropolitan territory.

The first rationale is to address the issue of optimal financing with the three schemes below: in the first scheme the current pricing and revenue use scheme is applied to the *new* motorway projects. The second scheme introduces cross-financing and add a funding completed by public subsidies if necessary. The third scheme adds mark-ups to tolls planned for the new motorway projects in order to reduce the need for public subsidies from this new projects.

Alternative schemes	Pricing	Revenue use
Planned tolling scheme + public subsidies	Tolling scheme as originally planned for the new projects	Revenues from road tolls on each new motorway go to the motorway concessionaire. Additional public subsidies to cover new motorway construction costs.
Planned tolling scheme + transport fund + public subsidies	Tolling scheme as originally planned for the new projects	Revenues from road tolls on each new motorway go to the motorway concessionaire. Tax on existing toll motorways goes to the transport fund. The transport fund subsidises new motorways. Additional public subsidies when needed.
Optimised tolls + transport fund + public subsidies	Optimised tolls (only on new projects)	As above

Overview of financing schemes

The second rationale is to address the issue of optimal pricing comparing a pure short-run marginal cost pricing (SMCP) with tolls originally planned for the new projects. This SMCP is applied simultaneously on (planned) motorways and on their competing existing (currently free) highways. Central (fuel) taxes are suppressed.

Alternative schemes	Pricing	Revenue use
Planned tolling scheme	Tolling scheme as originally planned for the new projects	Revenues from road tolls on each new motorway go to the motorway concessionaire. No public subsidies
Pure SMCP	SMCP pricing on new motorway projects and their free highway alternatives	No transport fund. No public subsidies.

Overview of pricing schemes

The third rationale is to combine an optimal financing with an optimal pricing. This scheme is compared to the reference one combining tolls originally planned for the new projects and a financing with public subsidies.

Alternative schemes	Pricing	Revenue use
Planned tolling scheme + public subsidies	Tolling scheme as originally planned for the new projects	Revenues from road tolls on each new motorway go to the motorway concessionaire. Public subsidies when needed.
Pure SMCP + transport fund + public subsidies	SMCP pricing on the new motorway projects and their free highway alternatives	Tax on existing toll motorways go to the transport fund. Transport fund subsidises the new motorways. Public subsidies when needed.

Overview of pricing and cross-financing schemes

The Molino model is used in a “two roads, passenger/freight” configuration and compares a new project, i.e. a new tolled motorway, with a locally existing competing alternative, i.e. a parallel highway (not tolled except for the existing tolled A1 alternative to A24). Given the location of these projects it is assumed that network effects on demand between the new projects are negligible. Thus each project is assessed in this Molino configuration, independently of the others. The only interaction is a financial one, by the means of public or fund subsidies.

The performance of regulation schemes can differ widely across the projects evaluated. It is obvious that the specific framework of each project, above all its construction cost and the competitiveness of its alternative, determines the conditions of its regulation.

The results yield a conclusion in three points regarding the motorway programme.

The first lesson from this motorway programme analysis relates to the financing issue. When compared with public subsidies from the general budget, cross-financing from existing motorways to new motorways slightly increases the level of welfare for all the projects (except for one project where the level of welfare is more than doubled). This overall result is a consequence of the fact that public subsidies bear a levy cost in the economy (i.e. the Marginal Cost of Public Funds) while a lower levy cost is associated with subsidies from a transport fund (when revenues come from a mark-up on tolls as in our study). Moreover the sensitivity of welfare improvement depends directly on the level of the Marginal Cost of Public Funds. Note that, because of this difference in levy cost, this only shows the advantage of direct earmarking of additional taxes on tolls, whether transiting through a transport fund or not, compared to public subsidies coming from the general levy of public money.

Secondly, with regard to optimal pricing, SMCP permits a slight increase in overall welfare when compared with the planned tolling scheme, despite the low forecast level of congestion on the

studied projects. This can mainly be explained by the fact that road traffic will increase since the overall costs borne by the road users would be reduced by 65% when switching from fuel taxes plus planned tolls to SMCP. However because of the low level of congestion, pure SMCP cannot solve financing problems. It must be supplemented by subsidies from a transport fund or from central (or local) governments. This does not mean that new investments are not justified. Indeed, motorway projects are planned mainly not to reduce congestion but to improve the quality and safety of road transport. This improvement and especially the expected time savings induce a socio-economic rate of return high enough to motivate the interest of the community to achieve these projects.

Therefore, while pure SMCP is more efficient as regards pricing (without considering financing problems) and cross-financing appears to be more efficient as a means of financing new motorway projects, the combination of the two rules would increase overall welfare. Indeed for all projects the scheme that combines pure SMCP with cross-financing provides the greatest increase in overall welfare of all the alternative schemes.

The assessment of rail projects is made through the Lyon-Turin rail link due to its importance, the ease to identify a parallel road competing option and data availability.

The assessment focuses on the cross-financing of new rail infrastructures by road revenues with five different pricing and financing schemes summarised below. A specific transport fund is considered here which is slightly different from that described in the previous section: this is a kind of “Alpine fund” where only the two Alpine motorway crossings (Mont-Blanc and Fréjus) which compete with the Lyon-Turin rail link would be a possible source of cross-financing.

Concerning the rail-road study, the assessment of the Lyon-Turin rail project shows the limited impact on welfare of cross-financing rail by road by the means of toll mark-ups on alternative Alpine motorways. However there would be a higher redistribution toward low income passengers compared with high income ones and the financial balances of the rail operator and manager would be improved while the rail mode share would increase.

It should be stressed that while public subsidies amount to 88% of the construction costs in the first scheme (no cross-financing) this level of public subsidies decreases by 14% and 24% with cross-financing by motorway toll mark-ups of respectively 25% and 80%.

The introduction of the same national transport fund as in the road case study would yield some advantage when combined with the alpine fund supplied by toll mark-ups, by achieving the complete coverage of the subsidy need while keeping the improvement of the financial balances of the rail operator and manager and of the rail mode share.

Alternative pricing and funding schemes	Pricing	Revenue use
Current motorway tolling scheme + public subsidies	Current tolling scheme on alpine motorways	Rail revenues go to rail operator or manager. Toll revenues go to motorway operator. Public subsidies for the rail link. No cross-financing.
Increase in alpine motorway tolls by 25% + transport fund + public subsidies	Mark-ups (25%) on current tolling scheme on alpine motorways	Rail revenues go to rail operator or manager. "Base" toll revenues go to motorway operator. Additional surplus of alpine motorways goes to the Alpine fund which subsidises the rail link. Public subsidies when needed.
Increase in alpine motorway tolls by 80% + transport fund + public subsidies	Mark-ups (80%) on current tolling scheme on alpine motorways	As above.
Current motorway tolling scheme + transport fund	Current tolling scheme on alpine motorways.	Tax on existing toll motorway (whole national network) goes to the transport fund. The transport fund subsidises the rail link. Rail revenues go to rail operator or manager.
Increase in alpine motorway tolls by 25% + transport fund	Mark-ups (25%) on current tolling scheme on alpine motorways	Tax on existing toll motorway (whole national network) goes to the transport fund. The transport fund subsidises the rail link. Additional surplus of alpine motorways goes to the Alpine fund which subsidises the rail link. Rail revenues go to rail operator or manager.

Overview of alternative pricing and financing schemes for the Lyon-Turin rail link

Moreover, the revenues from road toll mark-ups only consider traffic crossing the Franco-Italian border through the Mont-Blanc and Fréjus tunnels. The toll mark-up base could be widened to all traffic using the Alpine motorway network, on the premise that this traffic would benefit from lower road congestion resulting from modal transfer to rail: this would yield much higher revenues. However this option raises policy and equity issues which require more thorough analysis.

1. Introduction

In December 2003, the French government decided to implement an ambitious transport programme with 35 major road and rail infrastructure projects, representing an overall investment of €20 billion between 2005 and 2012. In order to finance part of this programme a new funding agency with an independent budget, known as AFITF ("Agence pour le Financement des Infrastructures de Transport de France") was created on the 1st January 2005. Initially AFITF was expected to provide €7.5 billion of the €20 billion required for the programme with a borrowing capacity on the capital market based on revenues from paid-off State-owned toll motorway companies. However this revenue source might be threatened by the ongoing privatisation of motorway companies. The remaining financing needs (€12.5 billion) were expected to be met by external partners (local governments, European Union, private sector with public-private partnerships).

AFITF is the fourth transport investment fund to be created in France since 1995. The first, the FITTVN ("Fonds d'Investissement pour les Transports Terrestres et les Voies Navigables") was created in 1995 to re-launch public investment in transport infrastructure but was abolished in 2001. Two other funds were created in 2002 to develop intermodal transport in France and the Alpine region. However, these two funds never had a real existence.

This succession of investment funds underlines the persistent need for permanent (or "sustainable") financing of transport investment with the aim of opening up less developed areas.

We have a double approach to study French multi-modal transport funds. The first one will focus on acceptability through the analysis of FITTVN while the second will address efficiency and equity issues an evaluation based on two studies. The first study involves the financing and pricing of a programme of ten new motorway projects while the second considers involves the cross-financing of the Lyon-Turin rail link from Alpine motorways.

This double approach can be summarised through criteria of assessment (see Table 1):

Table 1: Criteria of assessment

Criteria	Indicator
Efficiency	Impacts of toll variations on welfare, profit and subsidy needs (Molino model)
Equity	Welfare indicators for categories of users (Molino model)
Acceptability	Exploitation of the overview of FITTVN and expert know how of the case study team to realise a qualitative analysis.

Part 1: Acceptability and feasibility of transport funds

2. The investment funds feasibility question through the FITTVN example

2.1 Methodology

The feasibility of the FITTVN from the point of view of policy and acceptability is analysed using mainly parliamentary reports and Accounting Office reports. The question concerning the financing of transport investment is recurrent, often developed in annual “finance law projects” and Members of Parliament feel concerned by this issue. Moreover, we used information from Transport Ministry and European Commission.

2.2 Overview of the FITTVN

The FITTVN creation in 1995 symbolises the come back of transport investments funds to finance large-scale projects. If we take into account AFITF, three kinds of funds will follow the FITVVN between 1995 and 2005. FDIT and FDIPTMA were created in 2002 but had never really existed. So in this study we will focus on the FITVVN.

The investments funds' implementation in the mid 90's correspond to an increasing need of financing in an economic crisis context. Faced with a debt and re-election constraint[1], politicians considered investments funds as an interesting solution to implement their transport policy with large-scale projects implementation without rising public debt. Each actor or group of actors implied in FITTVN used this fund as a tool to favour its own interest and therefore to maximise its discretionary power.

The main questions to be addressed concerning the FITTVN, and its actors involve, are about its functioning, its features, its weakness…What were the reasons leading to the creation of the FITTVN? Who favoured its implementation? Why did FITTVN disappear after only 5 years? In this overview it will be shown how some actors doomed the ambitious FITTVN's to failure.

FITTVN was created in February 1995 by the "Pasqua[2] Law" in favour of land development[3] to implement new transport infrastructures. This law, at the request of Senators, symbolised the Right-wing coming into the government. Senators are indeed elected by local representatives and therefore they feel more concerned by the inequalities reduction between regions. The "Pasqua Law" was the first one to introduce the idea of Land development since the decentralisation law in the 80's. The land development policy implemented in 1995 created the national scheme and regional schemes for land development. These schemes had many objectives, among them economic efficiency improvement, spatial and regional disparities reducing…They were based on principles like revenues sharing between poor and rich local authorities, "equality of opportunities"[4] for urban and rural areas inhabitants…

[1] FITTVN was implemented in February 1995 by right-wing just before presidential election in May 1995.
[2] Pasqua was then Minister of the French Government.
[3] Art. 37 from law n°95-115 (Land development planning law), 1995 4th February.
[4] Art. 1 from law n°95-115 (Land development planning law), 1995 4th February.

Therefore transportation infrastructures were central to the land development and guiding schemes corresponding to each transport mode separately (road, rail, inland waterways) were created. According to the land development law " there is not land development without transport infrastructures" and "in 2015 each part of the national territory will be at a short way (below 50 kilometres) of a motorway or a high-speed rail link". Therefore it foresaw an equal development for each region with the financing of new land transport infrastructures. Indeed, this law was aimed at implementing free-roads to favour the development of enclosed areas.

The "Pasqua law" had been revised in 1999 by the "Voynet law"[5] which modified national and regional schemes for land development, strengthening the sustainable development policy. The "Voynet law"[6] implemented 9 "collective services schemes" (schémas de services collectifs) to guarantee public utilities in less developed areas and to favour a sustainable development policy. Among them, a multimodal scheme for freight transport and another for passengers transport. These two multimodal transport schemes replaced mode-related schemes from the "Pasqua law", which were not at the top of the agenda. The main objective of the mutimodal services schemes, still applied, is to used the more appropriated mode to answer the needs of transport for the next 20 years, taking into consideration the economic, social and environmental constraints.

FITTVN which had allowed to finance a part of transport infrastructures in less developed areas was therefore considered as the symbol of a balanced land development. Beyond this symbolic aspect FITTVN can be seen as a tool to finance this policy.

FITTVN was implemented in 1995 during an economic crisis period. The beginning of the nineties were characterised by a low economic growth and debt budgetary constraint due to Maastricht criteria. Therefore money became scarce for investments. General budget couldn't finance the Land development policy and the Ministry of Transport's budget was mainly allocated to functioning spending. A transport investment fund appeared as the best solution to implement this policy. It allowed to increase transport investments in an economic crisis context. FITTVN was all the more interesting for the government since it showed the ambitious transport policy of the government without increasing the Transport Ministry's budget. Indeed, FITTVN was independent of the State budget. It was a special account in public funds (account n°902-26), that meant total expenses could not be higher than available receipts. The revenues of the FITTVN came from motorways users and the firms producing hydroelectric power like "Compagnie Nationale du Rhône" or the public firm EDF[7]. They financed FITTVN with two taxes :

- Motorways users contributed to the financing with the "Land Development Tax" (LDT). This tax is collected by tolled motorway societies and paid by drivers using motorways (cars and HGV). Nowadays, this tax still exists. It adds up to € 0.007 per kilometre on motorways in 2000 but is not very visible for users. We can notice the amount of the LDT had doubled between 1995 and 1996 and went from € 0.003 per km to € 0.006. So, the Land Development Tax returned € 0.32 billion in 1996. The increase of the receipt generated by the LDT can be explained by the increase of the amount of the LDT in one hand. On the other hand, it can result of an increase of traffic in motorways due to the economic upsurge after the mid 90's.
- The other tax concerned public firms producing hydroelectric power, mainly EDF ("Electricité de France") and "Compagnie Nationale du Rhône". This tax was created to have inland waterways financed by firms which used waterpower electricity. EDF and "Compagnie Nationale du Rhône" had to pay the tax according to the level of their production. While the tax

[5] Law n°99-533, June 1999.

[6] D. Voynet (Green Party) was minister of the Leftwing government.

[7] Motorways users and public firms producing hydroelectric power were considered as "milk cow" because they were interesting financing sources.

amounted to € 0.006/kw per hours in 1997, it added up to € 0.012 in 1998/kwh, owing to the abandoning of "canal Rhin-Rhône" project which could have been financed by EDF. It was a kind of user-pay policy but this tax has disappeared the 1st January 2003.

Between 1995 and 2000, receipts from the LDT and the tax on hydroelectric power production were constantly increasing and amounted to € 710 million in 2001. On the whole FITTVN had € 3 billion of allocation mainly supplied by the land development tax. As it is shown in next maps, this fund enabled to finance a part of the " Mediterranean TGV " implementation, to launch the "TGV Est" between Paris and Strasbourg in the best conditions, to modernise the rail network and to develop combined transport. FITTVN was used to implement free-road like motorways "A 20" and "A75" or national road "RN 7 extension" to open up the Massif Central area. It allowed to subsidise a part of the "Route Centre Europe Atlantique" (RCEA), the "Estuaires" motorway (West of France), and a part of navigable rivers restoration. In spite of these investments a problem arose : the implementation of FITTVN became incompatible with the spirit of Land development Law, on the one hand, and with European Union directives on the other hand.

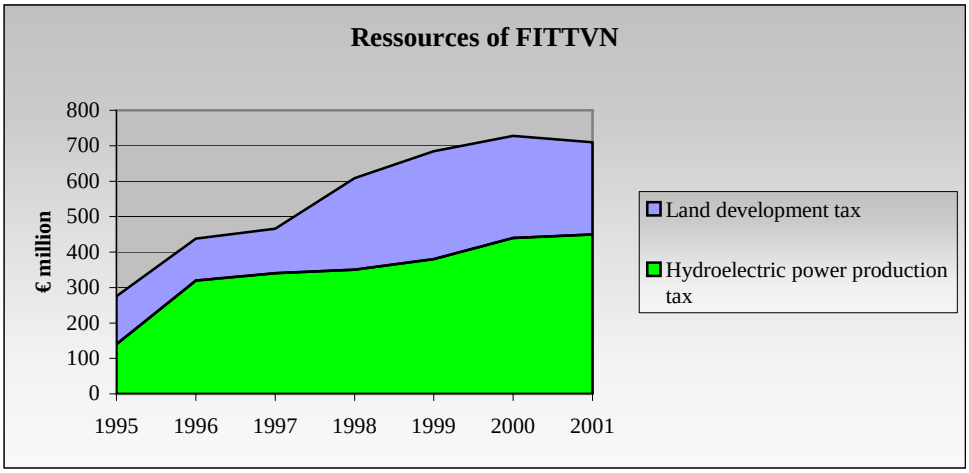
Figure 1: Projects financed by the FITTVN

Mainly road and rail projects partly financed by the FITTVN

Origin : CIADT, december 2003
Legend :
- "TGV Est" project
- "Mediterranean TGV" implementation

Origin : Transport Ministry
Legend :
- Centre Europe Atlantique Road
- A 75 motorway
- A 20 motorway
- National Road RN 7
- Estuaires Motorway

Figure 2: Resources of the FITTVN



Origin : Mission interministérielle "Companie Nationale du Rhône", mai 2001. Union routière de France

2.3 A fund turned away from its first purpose

As the years went by, FITTVN's functioning became inconsistent with its initial aim. It favoured land development with the implementation of new transport infrastructures, but to the detriment of Ministry of Transport's budget and European Commission rules. So the French multimodal fund was criticised both by the Accounting Office and the National Assembly. Only the Transport Ministry and the Senat, which had created the FITTVN, defended its role. In this part it will be explained why a lack of efficiency and a lack of conformity with European directives doomed FITTVN to failure.

- An inefficient functioning

Most of critics on the FITTVN functioning concerned the lack of separation between the fund and the General Budget. This lack of specificity of the investment fund appeared in the characteristics of projects implemented owing to FITTVN and projects implemented by the General Budget, on the one hand. On the other hand the interdependence appeared in the financing scheme with the "communicating vessels" principle.

The FITTVN was implemented to open up less developed areas and to favour intermodal transportation with fluvial, rail and road constructions. Nevertheless investments financed by FITTVN were the same as investments financed by the General Budget and the "land development" and "intermodal" dimensions of the investment fund had never really existed[8]. No "land development" and "intermodal" schemes were really planned at the FITTVN's creation. The "land development" and "intermodal" concepts were imprecise as it is shown in the "Pasqua law"[9]. Therefore the FITTVN's investment program had not enough specificity. For example, FITTVN had permitted to buy trains for regional transport or had contributed to finance the French Environment and Energy control Agency called ADEME with € 305 000 while it was not in its action field. Many projects financed by FITTVN had a credit line in the section "road and land transports" of the General Budget like free-road implementation in the Massif Central area. We can

[8] IDIARD J.L., "Le FITTVN ne finance aucune politique spécifique". Projet de loi de finance pour 2000.
[9] Law n° 95-115, art 1.

imagine that even if FITTVN had never been implemented these projects would have been realised. They would have been financed by the General Budget.

The lack of separation between FITTVN and the State Budget appeared in the decrease of public infrastructures spending. Between 1996 and 2000, the amount of public infrastructures spending decreased from € million 1400. For successive governments, the interest of the FITTVN was mainly to reduce investments financed by the General Budget. Transferring projects implementation to FITTVN, the State reduced its own budget. This is the "communicating vessels" principle.

Nevertheless, it can be noticed the amount of projects financed owing to the FITTVN increased of € million 434 between 1996 and 2000 while the amount of public infrastructures financed by the general budget decreased from € million 1400. Therefore, between 1996 and 2000, in spite of FITTVN infrastructures investments had decreased of € million 1000. This decrease may be explained by the necessary restriction of public spending due to Maastricht criteria on public debt[10] and FITTVN implementation may not the only reason of a decrease of State spending. Nevertheless this decrease is in opposition to the "Land Development law" from 1995.

At the origin, FITTVN was a tool to increase transport investments but in reality it allowed the State to decrease its own spending. According to the Accounting Office, FITTVN generated confusion on the role of each source of financing.

The second aspect of the crisis of efficiency concerned the economic context. FITTVN was implemented in 1995 during an economic crisis period. The Government was faced with a budgetary constraint. Nevertheless with an investment fund to finance transport infrastructures, the main part of the budgetary constraint disappeared and "additional resources" from LDT and hydroelectric tax can be used to implement high-scale projects. So what is paradoxical in the FITTVN, is that in spite of important revenues allocated to the FITTVN, only a part of them were used[11]. It can be explained by the fear of an increasing public debt. Indeed FITTVN partly financed projects but the other part had to be financed by the General Budget. Therefore the government was obliged to borrow in order to finance these new implementations. Due to Maastricht criterion on debt, governments had to limit their indebtedness. Sometimes government may have preferred no implement a project instead of running into debt.

The efficiency crisis can be characterised by the "communicating vessels" problem about projects financing and by the economic situation. The crisis context limited the level of indebtedness and FITTVN's resources were not all used. Critics of Accounting Office and Parliament on the FITTVN efficiency were strengthen by the lack of conformity of the fund to European Union directives.

- FITTVN : a French exception ?

The second reason explaining the end of FITTVN concerns the relation between the FITTVN's functioning and European Union directives. In a first point the European commission criticised taxation of motorway societies[12] (with the LDT), especially because the State imposed the payment of the LDT by motorways companies before they had passed this tax on their tariffs. Moreover, for European Commission, an increasing toll can impact on motorway traffic, reducing motorway concessionaires revenues.

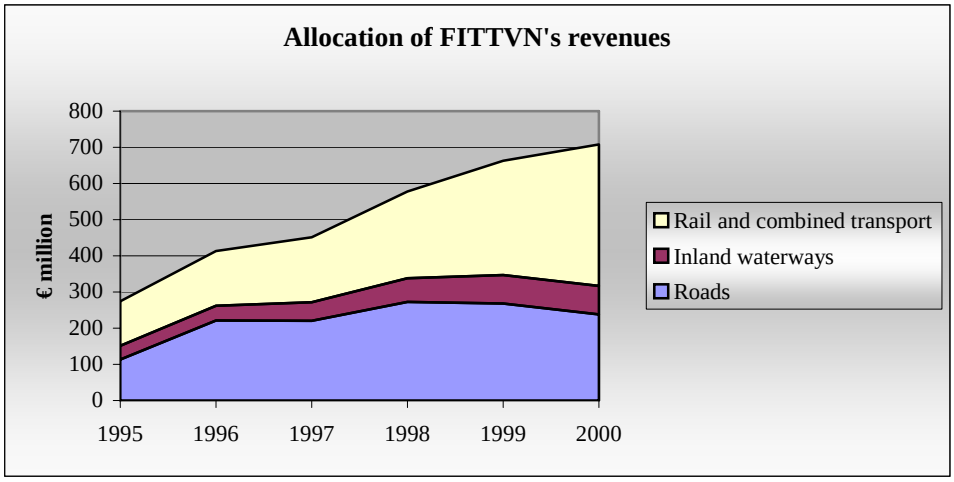
[10] See explanation top of page 6.

[11] Between 1995 and 1999.

[12] Assemblée Nationale, Commission des finances, de l'économie générale et du plan, compte-rendu n°7, 13 octobre 1999.

In a second point European Union directives stipulated that revenues had to be re-allocated to the mode they came from[13]. FITTVN's revenues came from the motorways users with Land development tax (between 56% in 1999 and 73% in 1995) and the "inland waterways users" with the hydroelectric power production tax. So, referring to the European Commission FITTVN had to finance mainly road investments. But the FITTVN functioning underlined the non-discrimination issue between modes. Indeed the part of road investments in FITTVN's revenues is inferior or equal to 50%. Moreover, the more LDT is increasing, the less road investments are important.

Figure 3: Allocation of FITTVN's revenues



Origin : Lois de finance initiale, Direction Générale de la comptabilité publique in Les Transport en 1999 and Les Transport en 2000 (37ème et 38ème rapport de la Commission des comptes des transports de la nation)

FITTVN was faced with a dilemma. Indeed, if it had followed European Union directives, it would have been into contradiction with its function of "intermodal fund" but if it had financed rail or inland waterways investments with road tolls, it wouldn't have respected European rules. As we can see in the previous scheme, in fact FITTVN had given € 228 million to road investments while its budget amounted to € 655 million. In 2000, only 35% of FITTVN's subventions were allocated to road network while the Land Development Tax had generated about 60% of FITTVN's revenues.

Nevertheless since 2001 the European Commission had revised its position concerning transport investments funds. In the White Paper "European Transport Policy for 2010 : time to decide", the Commission proposed solutions based on a pooling of transport revenues " to open up the possibility of allocating part of the revenue from user charges to construction of the most environmentally-friendly infrastructure"[14] in the same area.

Referring to this part, we can notice the important role played by political leaders and institutions on the implementation and on the end of the FITVVN. It seems to be interesting to focus on the analysis of politico-economic interrelationships between actors involved in the FITTVN

[13] "The revenue from tolls and user charges must be ploughed back into maintenance of the road infrastructure on which the tolls are levied and into the transport sector as a whole". Directive of the European Parliament and of the Council amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures.

[14] White Paper : "European Transport Policy for 2010 : time to decide". 2001

2.4 Actors involved in the FITTVN

In this part we will review actors involved in FITTVN and their "attitude" toward this fund (viz. if they are in favour or opposed to FITTVN) before explaining how interrelationships between these actors and the political context doomed this fund to failure. This analysis can be seen as a tool to anticipate the relationships between actors involved in AFITF's.

We can distinguish two groups of actors involved in FITTVN : political leaders and institutions or organisations.

- The main politician involved is Charles Pasqua. He was a main leader of the right-wing in the first half of nineties and created FITTVN in February 1995 while he was Home Secretary and Land Development Minister[15]. Beyond the political idea of spatial inequalities reductions, FITTVN was a tool for Pasqua to reinforce its bonds with the Senat in order to continue his political carrier at the Senat presidency. He tried to gain the Senators confidence. Implementing a new fund to finance transport infrastructures in less-developed areas, Pasqua had showed he felt concerned by rural regions. Pasqua was involved in FITTVN to reach his own main however in our study will be more focused on institutions. Therefore, the name of Pasqua won't appeared in the rest of the text.

Main groups of actors are institutions or organisations :

- The Senat's members are elected by local representatives and they feel more concerned by the inequalities reduction between regions than other politicians. The Senat is more turned towards rural areas because of a French electoral specificity which lend more weight to rural areas representatives for the Senators election. Therefore Senators were interested by the Pasqua Law which defended less-developed areas. As politicians, Senators were under the re-election and the budget constraint. So, voting the Pasqua Law, first they developed their regions and so increased their chance of being re-elected and secondly they favoured the implementation of new transport infrastructures without increasing general taxes for most of their (direct and indirect) voters. The Pasqua Law was supported the more it allowed new transport infrastructures, viz. noticeable results. Indeed, politician are sensible on the "visible aspect" of results. As it is said by Weck-Hannemann[16] in 1999 "benefits are preferred to be noticeable and costs should be as invisible as possible". Pasqua and the Senat's members had not the same purpose (to attain to the Senat's presidency for Pasqua and to be re-elected for the Senators) but the means to reach their aim were the same. A sort of alliance was created between Pasqua and the Senators. Each part maximised its utility in a "co-operative" context.

- Although it did not intervene directly in the FITTVN creation, the Ministry of Transport was one of the main beneficiary of this investments fund. Indeed, this investments fund represented an independent source of financing for the Ministry. FITTVN was seen as a "pool" where the Ministry could dip into to finance transport infrastructures without referring the matter to the Treasury. FITTVN allowed the Ministry to get round the budget constraint and to increase its discretionary power (viz. an increase of transport investments) without increasing public spending. The Transport Ministry gained on independence toward the Treasury. Its own interest

[15] Up until 1997, the Land development was attached to the Home Affair. In 1997, it was attached to the Environment Ministry which became the Land development and Environment ministry.
[16] Weck-Hannemann H., *Acceptance of pricing instruments in the Transport Sector*. 1999

converged on Pasqua and Senate's members ones. Nevertheless the FITTVN implementation had generated a power struggle between the Ministry of Transport and the Treasury.

- The Treasury function is to manage receipt and public expenditures by means of the General Budget. It wants to increase its discretionary power increasing the General Budget amount and therefore its superiority on other Ministries. The Ministry of Transport and the Treasury interests were different. The Treasury tried to limit independent investments fund like FITTVN and wanted to centralise resources in the General Budget in order to keep the control on every spending. The more investments funds were, the less the discretionary power of the Treasury was. So, as the years went by, the Treasury reduced the Ministry of Transports budget. Therefore, the Transports Ministry had to finance a part of functioning spending with FITTVN, initially dedicated to the infrastructures investments financing and this became inconsistent with FITTVN initial aim. The Treasury was one of the main opponent to FITTVN.

- The Environment Ministry did not intervene in the FITTVN implementation but it played a leading role in its functioning in particular with the Left-wing coming into the government in 1997 and with "collectives services schemes" in 1999. As it said before, in 1997 the Environment Ministry became the Land development and Environment ministry. Between 1997 and 2001 this ministry was managed by Dominique Voynet, leader of the "Green party". The increase of the Environment Ministry influence appeared in the increase of rail investments financed by FITTVN since 1997 (+ 33% between 1997 and 1998 and "only" +20% for road investments in the same period). The Environment Ministry was a "powerful ally" for the Ministry of Transport.

- Another group of actors involved in the FITTVN creation was composed of actors which financed FITTVN. They can be divided into two groups : motorways users and public firms producing hydroelectric power (viz. EDF and Compagnie Nationale du Rhône).
    - Motorway users financed FITTVN with the Land Development Tax (LDT). The LDT amounted € 0.006 for kilometres covered in motorway.
    - Public firms producing hydroelectric power financed FITTVN with an "hydroelectric tax" which amounted € 1.3 for kw/h produced.

In this group we can add motorways companies. Although they didn't finance FITTVN directly, they collected taxes from motorway users and paid them to the State. It was an uncomfortable situation especially because the State imposed the payment of the LDT by motorways companies before they

These two first of actors were seen as "milk cow". Indeed, motorway users are considered as "under-taxed" and EDF was a public firm (viz. under the State control) and its revenues were high. Nevertheless motorways users were not obliged to use the motorway network and therefore to pay the LDT. On the contrary firms producing hydroelectric power had to pay the "hydroelectric tax". They did not have alternative solutions.

- The last group of actors was not really involved in the FITTVN implementation but it played a leading role in the re-election process. This group was composed of citizens that is to say citizens as such voters, citizens as such transport users and to a lesser extend citizens as taxpayers.
    - The citizens did not vote directly the Senators but local representatives who voted the Senators. This is an indirect suffrage. Nevertheless, the more investments financed by FITTVN were noticeable, the more they were tempted to re-elect their political representatives.

- A part of citizens had benefit from investments financed by FITTVN. These agents lived in areas which benefited from new transport infrastructures.
- Citizens as taxpayers did not financed FITTVN. Not only general taxes did not increase but FITTVN favoured a decrease in the use of Ministries budget and therefore a decrease of general taxes.

Two institutions have played a minor role in the FITTVN implementation : the European Commission and the members of the "Assemblée Nationale".

- The European Commission were initially not in favour of such an investments fund. Indeed the FITTVN functioning went against its directives. For example the fund reallocated to alternative modes revenues from road while the Council amending Directive 1999/62/EC stipulated that revenues had to be re-allocated to the mode they came from.

- The members of the "Assemblée Nationale" did not play a leading role in the implementation of FITTVN because the creation of this fund was a request of the Senators. Nevertheless at first they were not opposed to the fund which "had represented a progress at its beginning "[17]. The "Assemblée Nationale" started to criticised FITTVN when its majority changed and became on the left. The new majority asked the "Mission d'Evaluation et de Contrôle" (MEC) of the "Assemblée Nationale" to implement an audit on FITTVN. The conclusions of this evaluation had resulted in the end of FITTVN. To summarise the "Assemblée Nationale" position, we can say this institution had supported FITTVN as much as its majority was on the same wing as Senate's one.

We can illustrate the repartition of these different actors or group of actors in Table 2, underlying groups which benefit from FITTVN and others and those which benefit from the end of this fund.

[17] Didier Migaud (Member of "Assemblée Nationale"), 20 october 2000.

Table 2: Beneficiaries and losers of FITTVN's functioning and FITTVN's end

	During FITTVN's functioning	After the end of FITTVN
"Beneficiaries"	• Most of the Senators • Ministry of Transport • Environment and Land Development Ministry • Taxpayers • Citizens in beneficiary areas	• Treasury • "Assemblée Nationale"
"Losers"	• Treasury • Tolled-motorways users • EDF and “Compagnie Nationale du Rhône”.	• Senators • Ministry of Transport and Land Development • Tolled-motorway users • EDF and “Compagnie Nationale du Rhône”.

In bold types is underlined the coalition between Senators and some Ministries, in italics the other one with the Treasury and the "Assemblée Nationale".

At the FITTVN creation, each group tried to defend its own interest. A coalition appeared between Senators, Ministry of Transport and Environment and Land Development Ministry which benefit from the implementation of a transport investment fund. Two other groups of citizens were in favour of FITTVN : citizens as taxpayers and citizens living in beneficiaries areas. While most of Senators and Ministries wanted to increase their discretionary power, for citizens FITTVN was a mean to increase their surplus. Indeed they benefit directly from new transport infrastructure for their transport consumption and these new infrastructures attract new users in less-developed areas. As the years went by, the opponents seemed to take the advantage, the Treasury was the main institution benefiting from the end of the fund. Indeed tolled-motorway users and EDF or CNR criticised an increase of their taxes but they were not so powerful to stop the fund. Moreover they continued to be taxed after the end of FITTVN. The abolition of FITTVN was mainly due to the coalition between the Treasury and the "Assemblée Nationale".

During the FITTVN functioning there was a struggle between the Ministry of Transport and the Treasury to have the discretionary power. This struggle appeared mainly in the "tests of strength" during the yearly budget negotiations. The Treasury was very influent and placed the Ministry of Transport under its control. It was the Treasury which supplied Ministries and a transport investments fund was seen, for the Treasury, as, a lack of "co-operation" of the Transport Ministry. Indeed FITTVN represented a loss of information for the Treasury. While this Ministry had all the information and all revenues from transport pricing and other taxes, with FITTVN it had only a part of the information and of the revenues.

Treasury was one of the main "institution" opposed to FITTVN and had an ally with the "Assemblée Nationale" after 1997. Indeed the end of FITTVN can be explained by another sort of

political game : the change of government party. FITTVN was created by the Right-wing party in 1995 but in 1997, the Left-wing came back into the government and had the majority in the "Assemblée Nationale" after the dissolution of this institution. The Left-wing party did not criticised the idea of an investments fund but the FITTVN implementation because it came back from the Right-wing. Moreover, in 2002 it will create two other intermodal investments fund. The Left-wing was in the Treasury side concerning the FITTVN issue. The Treasury wanted to stop FITTVN to increase its power (viz. its domination on the Ministry of Transport and the budget it managed) and the Left-wing wanted the end of the fund for two reasons :

- first because the left party was opposed to the Senate which had traditionally right-wing Senators.
- secondly because the "Assemblée Nationale" members, at this time favoured to the Left-wing, wanted to exert a democratic control on transport investments. They agreed with the Treasury which wanted to limit spending.

2.5 Conclusion

At its creation, FITTVN symbolised a new political trend aimed at land development and intermodal transport. It represented a tool to get round the budget constraint. Supplied with specific taxes, it was expected to be independent of the General Budget. Moreover these taxes, i.e. a tax on toll motorway users and a hydroelectric tax, were expected to provide a “sustainable” financing source. At the end the fund was suppressed while the motorway tax was maintained.

Initially the fund had several advantages: launched by a political leader, with the support of elected representatives grounded in the roots of the electoral system, and based on “milk cow” revenue sources which had no real capacity to organise themselves as structured interest groups.

However the development of FITTVN was subject to several weaknesses:
- a lack of clear definition of land development and intermodality promotion objectives;
- from this fuzziness of objectives the natural development faced with a budget constraint was a communicating vessels functioning which substituted the fund to the central government general budget rather than adding a new funding capacity;
- a lack of European support because of the then absence of clear definition of an “eurocompatible” functioning of this kind of fund.

These weaknesses were exploited by several interest groups which gathered in a somewhat improbable coalition, like the one between the “Assemblée Nationale” and the Treasury.

The main conclusion from this experience would be that there is a need for:
- a clear definition of objectives and scope of this kind of fund, and a strong legislative and institutional background, in order to resist to pressures, be they political or financial ones;
- a sound initial design and functioning operation in order to manage the interest groups and avoid the formation of too strong opposition coalitions: this means addressing legislative but also efficiency and equity aspects;
- the definition of conditions of euro-compatibility of this kind of fund: pricing rules, revenues use (e.g. which part of revenue users can go to finance which modes), etc.

Obviously the two first points refer to central or local government levels while the third one refers to the European level.

Part 2: Assessment of regulation schemes for new transport infrastructure projects

This part is devoted to the assessment of regulation schemes for the programme of transport infrastructure projects decided in December 2003 by the French government. These projects include interurban motorway and rail projects.

The modelling tool (Molino) used for this assessment allows to evaluate demand reaction and welfare by comparison of different transport options (e.g. peak/off-peak, rail / road choice, tolled / non-tolled route choice), for different classes of traffic, passenger and freight.

The programme of infrastructure projects include new motorway sections and rail lines (see maps below). Data on traffic and construction costs forecast are much more readily available for motorway projects than for rail projects. In fact, regarding rail projects, data availability is sufficient only for the Lyon-Turin project. Moreover the geographical configuration of the new projects indicate that the market competition of new motorway sections is rather with existing free parallel highways.

These considerations, technical capabilities of the modelling tool, data availability and reality of market competition, make it relevant to separate the study into two parts. The first one addressed the assessment of regulation schemes only on the motorway projects while the second one assesses regulation schemes on the Lyon-Turin rail link jointly with the existing alpine parallel motorway crossings.

In the following assessment the investment programme will not be questioned: this means that the use of money for purposes other than transport infrastructure is not discussed. Only alternative ways of financing this programme and the pricing of transport infrastructure will be considered.

This evaluation is based on two case studies. The first, described in the next section, involved the financing and pricing of a programme of ten new motorway projects. The other case study is described in Section 4 and involves the cross-financing of the Lyon-Turin rail link from Alpine motorways. Finally some conclusions are drawn from the results of these two case studies.

3. The financing and pricing of new motorway projects

Ten new motorway projects were selected from the entire governmental programme, based on data availability which depends on how far planning has advanced. Table 3 gives an overview of the physical characteristics of these projects with basic financial data such as construction costs and the expected level of public subsidies. Moreover results of the studies about traffic forecast, tolls levels originally planned and the economy of these projects are taken for granted.

The first stage was to address the issue of financing by comparing various financing schemes involving public subsidies with partial financing by a transport fund. Since money from public subsidies bears a cost (the marginal cost of public funds, MCPF) the sensitivity of the welfare computation to the level of the MCPF is briefly evaluated. The next stage was to vary the pricing, in particular to study the introduction of Short-run Marginal Cost Pricing (SMCP)**.** Although it is known that SMCP is not optimal in the presence of financing constraints, it is nevertheless a useful

benchmark. Finally the combination of the advantages of SMCP and cross-financing from a transport fund have been evaluated.

In all this study the new projects are taken as granted since the political decision about their advantage for the general welfare has already been taken: no assessment is made of the opportunity of achieving or not such or such project. Only are assessed within this program frame alternative ways of financing and pricing the use of infrastructure.

Box 1
The current tolling scheme on French motorways

The French Revolution of 1789 abolished tolls on paths, bridges and city entrances ("péage d'octroi") and introduced the principle of free usage of all roads in the name of equality between citizens. However, the need to fund transport infrastructure led to a law being passed in 1955 which authorised the creation of toll motorways: the operator was allowed to collect tolls from motorway users in order to pay off capital costs and maintain, or even extend, the motorway. However, the principle of a free alternative (for example a possible route using a parallel free road) had to be observed.

On interurban tolled roads average (flat) distance-based pricing is applied with a distinction between freight and passenger vehicle classes. Tolls may vary from one motorway to another depending on the financial equilibrium of each concession. These tolls are fixed in the concession contracts. As regards revenue use, toll revenues go to the motorway concessionaire who invests, operates and maintains the infrastructure. This has made it possible for the costs at the level of the network operated by the concessionaire to be almost met, depending on the duration of the concession and on initial public subsidies in some cases.

In addition, a regional development tax ("taxe d'aménagement du territoire") is paid by toll motorway users and collected by the motorway operator (a tax of €0.007/km in 2000): the revenue from this tax is not earmarked and goes into the central government budget.

Until recently, concessions for new motorway sections were awarded to an existing motorway concessionaire in the same geographical area: the concessionaire used a kind of cross-financing from paid-off sections of its own network to new ones most of which would not be profitable on their own. As a consequence of the European Council Directive 93/37/EEC concerning the procedures for awarding public works contracts, the government is now required to advertise the contracts for motorways in order to open up these contracts to effective Community-wide competition: this implies that competitors must be treated on an equal basis and that if subsidies are needed they should be the same for each competitor.

3.1 Overview of the motorway projects

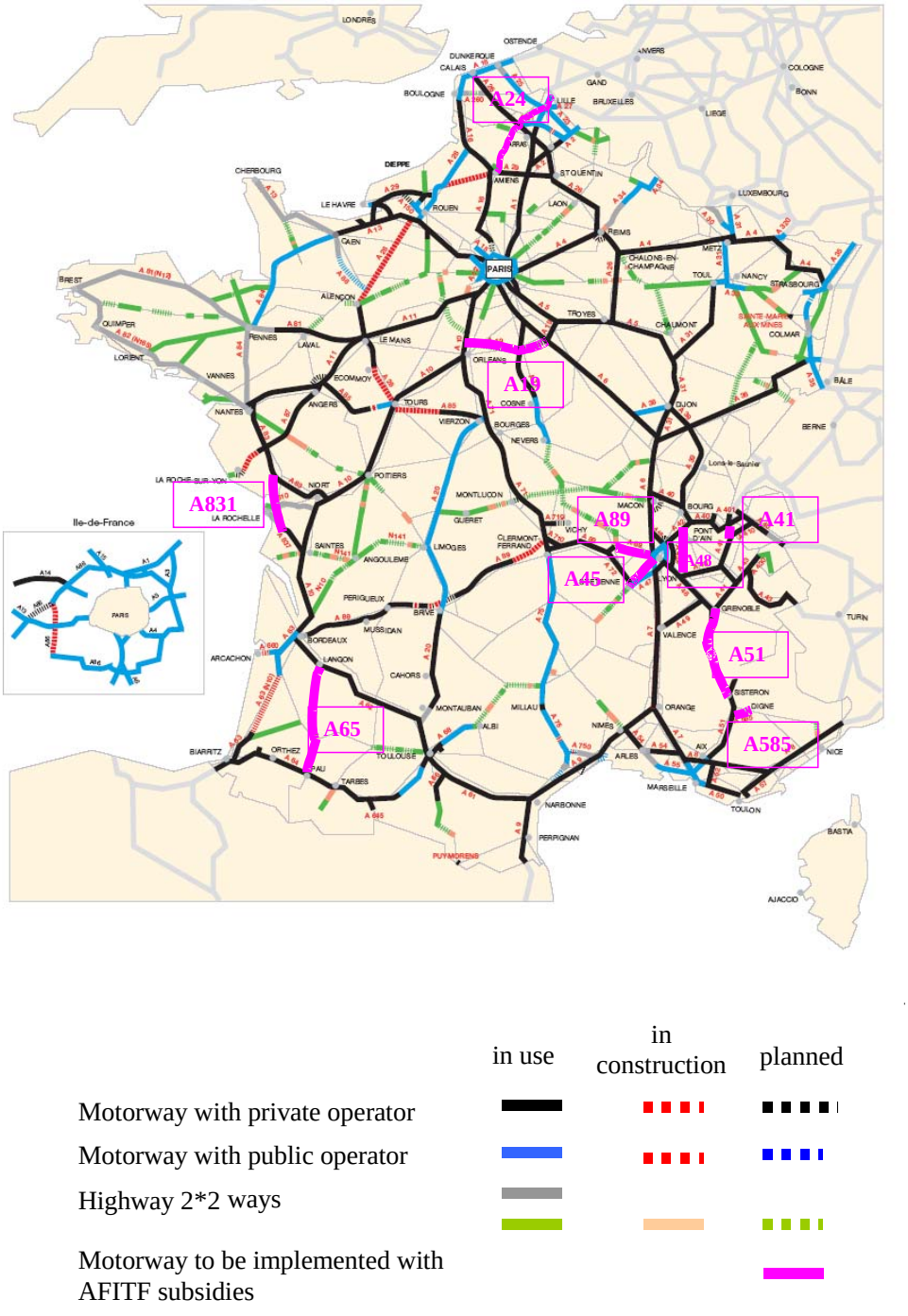
Data input used (see Table 1) mainly come from an audit realised by the Conseil Général des Ponts et Chaussées in March 2003. This audit details most of the projects which will be partly financed by the AFITF. It provides traffic forecasts, costs of projects, speed, length of projects, travel time, tolls (see map in Figure 4).

Tolled motorway project	Length	Alternative road	Construction cost*	Total public subsidies*	Public subsidies / construction cost	Construction period
A24 Motorway "Amiens-Lille-Belgium"	120 km	A1 Tolled motorway	€666 M	€375 M	56%	2009-2012
A48 Motorway "Amberieu-Bourgoin Jallieu"	55 km	N 75 Highway	€605 M	€365 M	60%	2010-2015
A51 Motorway "Grenoble-Sisteron"	80 km	N75 Highway	€1 200 M	€670 M	56%	2011-2018
A585 Motorway "Les Mees- Digne-les-Bains"	25 km	Highway 85	€209 M	€169 M	80%	2008-2010
A831 Motorway "Fontenay le Comte-Rochefort	64 km	Highways 11 and 135	€468 M	€243 M	52%	2009-2012
A89 Motorway "Lyon-Balbigny"	50 km	Highways 7, 82 and 89	€769 M	€625 M	81%	2006-2011
A19 Motorway "Artenay-Courtenay"	100 km	N60 Highway	607 M€	€165 M	27%	2006-2009
A41 Motorway "Saint-Julien -Villy"	18 km	N201 Highway	674 M€	€277 M	41%	2007-2010
A45 Motorway "Lyon – Saint-Etienne	52 km	A47 Toll-free motorway	1,300 M€	€1,118 M€	86%	2008-2011
A65 Motorway "Pau-Langon"	142 km	N10 and N134 Highways	€910 M	€142 M	15%	2008-2011

**million €, excluding VAT*

Table 3: Overview of the motorway projects

Figure 4: Map of the motorway projects



Origin :Ministère de l'Equipement, direction des Routes. RIR/MI -Cartographie

3.2 Methodology

The Molino model has been used in a "two roads, passenger/freight" configuration: the first level is the choice between transport and other consumption, the second between travelling in a peak or an off-peak period and the third between the new motorway project and an alternative highway (see Figure 5). In practice, a new project, i.e. a new tolled motorway, is compared with a locally existing competing alternative, i.e. a parallel highway: these alternative roads are not tolled (see Table 3) except for the existing tolled A1 motorway which is an alternative to the A24.

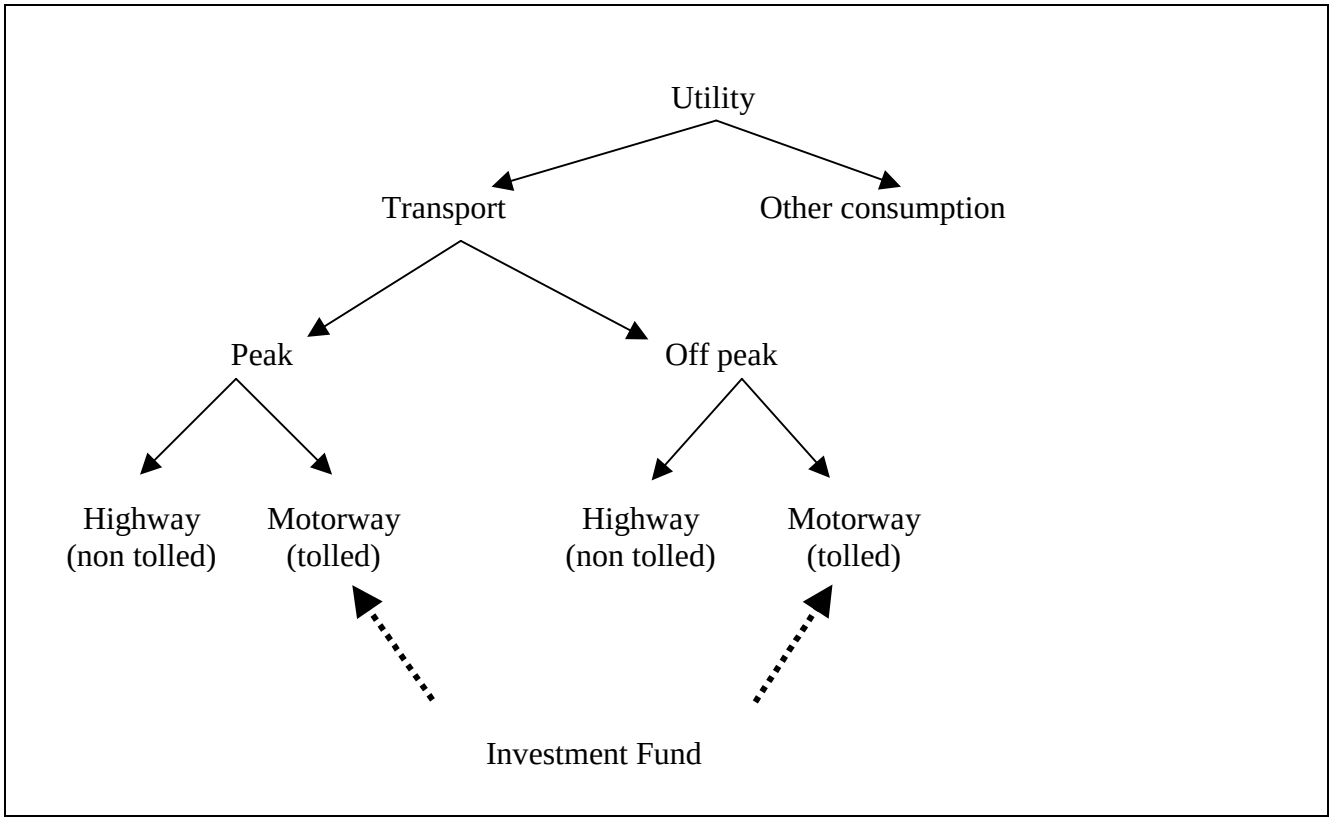
Molino is used in a *static* approach: the context is as if the new projects are implemented and in operation, and the consequences of variants of financing and pricing the use of infrastructure on welfare are assessed. This means that we take as given the level of traffic initially forecast for each project: this will be the basis upon which will be computed with Molino for instance the impact of pricing rule variants.

Given the location of these projects it is assumed that network effects are negligible i.e. the opening of any of these new motorways have no impact on demand on the other new projects. Thus each project is assessed in this Molino configuration independently of the others. Moreover, since there is no interaction between projects, the overall welfare result can be obtained by summing the individual results.

In the following assessment public subsidies and funds are exogenously allocated to each project. Transport fund allocation is based on an equal distribution of the fund's financing capacity between the projects: competition for financing between the projects consequently receives no further attention.

All the other parameters used in the modelling exercise are detailed in Appendix 1.

Figure 5: MOLINO decision tree



3.3 Results

As previously stated, the first section will compare the performance of different means of financing while the second section will test the impact of the marginal cost of public funds on the first set of results. In the third section two main pricing rules will be assessed, the planned pricing and SMCP, before an analysis of the combination of SMCP and cross-financing in the last section.

3.3.1. The financing issue

We shall now consider cross-financing performed through an investment fund that is independent from the general budget and financed by taxes on existing toll motorways. The fund partially finances each project by means of a grant. In order to determine this grant two hypotheses are made. First, it is assumed that the fund's financing capacity remains stable during the first years. Second it is considered that the fund allocation for each project is proportional to the fund's annual financing capacity. The proportion is computed on the basis of the ratio between the total subsidy needed by the project and the total expenditures of the fund during the period 2005-2012[18].

[18] Taking the AFITF's initial figures, it has been assumed that the fund's financing capacity amounted to €635M/year (in the first years) to reach a total of €11,482M in the period 2005-2012.

Alternative schemes	Pricing	Revenue use
Planned tolling scheme + public subsidies	Tolling scheme as originally planned for the new projects	Revenues from road tolls on each new motorway go to the motorway concessionaire. Additional public subsidies to cover new motorway construction costs.
Planned tolling scheme + transport fund + public subsidies	Tolling scheme as originally planned for the new projects	Revenues from road tolls on each new motorway go to the motorway concessionaire. Tax on existing toll motorways goes to the transport fund. The transport fund subsidises new motorways. Additional public subsidies when needed.
Optimised tolls + transport fund + public subsidies	Optimised tolls (only on new projects)	As above

Table 4: Overview of financing schemes

Initially, the "planned toll + public subsidies" scheme has been compared with the "planned toll + transport fund + public subsidies" scheme (see Table 4). In the first scheme, the new motorway projects are financed from the forecast toll revenues for these projects supplemented by public subsidies obtained from fiscal revenues. In the second scheme, the new motorway projects are financed from the forecast toll revenues from these projects, subsidies from a transport fund and additional public subsidies when needed: this helps to lower the level of public subsidies.

The difference between these two schemes essentially involves on the welfare cost of money: this cost is the Marginal Cost of Public Funds (MCPF) in the case of public subsidies obtained from fiscal revenues while it corresponds to the welfare loss for toll road users when part of toll revenues is used to cross-finance other infrastructures (the MCPF issue is discussed below).

The welfare loss resulting from taxation of tolls on existing motorways can be estimated on the basis of current demand on tolled motorways, the average toll and the empirical elasticity of motorway demand to tolls (approximately –0.5): this elasticity considers demand which escapes from motorway when toll increase, but this demand can take alternative free highway; so this evaluation of welfare loss is an excess estimate. The revenues from existing motorways for cross-financing new ones roughly corresponds to the current regional development tax added to tolls ("taxe d'aménagement du territoire") i.e. 0.007€/km. The impact of this tax on demand gives a welfare loss of € 0.023 per euro collected (see details in Appendix 3) .As shown below this has a marginal impact on overall welfare.

The figures in Table 5 show that the introduction of the transport fund yields a slight welfare improvement (less than 6%) but a considerable increase in central government net revenues (+ 20%), linked to the 95.5% reduction in public subsidies. The transport fund is more advantageous than a public subsidy mainly because of the lower level of money levy cost from tax on tolls when compared to the Marginal Cost of Public Funds.

	planned tolls + transport fund + public subsidies	optimised tolls + transport fund + public subsidies
Variation in overall welfare*	6.0%	5.9%
Variation in overall welfare*†	5.8%	5.7%
Variation in Central Government Net Revenue	20%	20.5%
Variation in need for public subsidies	-95.5%	-99.8%
Variation in Central tax revenues	23.4%	24.3%

** with reference to the "planned toll + public subsidies" scheme*
† *including welfare loss due to the payment of the regional development tax by toll motorway users*

Table 5: Comparison between financing schemes

After this initial phase, the tolls on new motorways have been increased in order to reduce public subsidies as much as possible. For nine of the ten projects the toll increase makes it possible to abolish public subsidies (see Table 6). The A51 project is the only project that still needs public subsidies, but the level is very low, amounting to only 2% of the initial level of public subsidies.

In spite of the reduction in public subsidies, the welfare comparison between the "planned toll + transport fund + public subsidies" scheme and the "optimised tolls + transport fund + public subsidies" scheme reveals no large differences, in fact a lower increase in global welfare (5.7% compared to 5.8%). This can be explained by the limited toll increases needed (between 3% and 17%): these have a slight negative impact on demand while allowing only a limited additional decrease in public subsidies (–99.8% compared with –95.5%).

	Planned tolls + transport fund + public subsidies			Optimised tolls + transport fund + public subsidies		
	Variation in central government net revenue*	Variation in need for public subsidies*	Variation in overall welfare*	Variation in central government net revenues *	Variation in need for public subsidies*	Variation in overall welfare*
A 24	4%	-95%	0%	4%	-100%	0%
A48	23%	-96%	4%	24%	-100%	4%
A51	24%	-96%	8%	24%	-99%	7%
A585	154%	-100%	6%	153%	-100%	6%
A831	20%	-92%	2%	21%	-100%	2%
A89	53%	-96%	na**	55%	-100%	na**
A19	17%	-93%	1%	18%	-100%	1%
A41	109%	-96%	6%	114%	-100%	6%
A45	28%	-96%	1%	30%	-100%	1%
A65	40%	-96%	3%	42%	-100%	3%
Total	20%	-92%	6%	21%	-100%	5.9%
Total†	20%	-92%	5.8%	21%	-100%	5.7%

**with reference to the "planned toll + public subsidies" scheme*
***reference welfare (in "planned toll + public subsidies" scheme) nearly zero*
† *including welfare loss due to the payment of the regional development tax by toll motorway users*

Table 6: Performance of financing schemes

3.3.2. The issue of the Marginal Cost of Public funds

Next, we shall explore the impact of the Marginal Cost of Public Funds (MCPF) on welfare results. Since some studies for France give a figure of 1.13 for this (Bernard and Vielle, 2003, quoted in Lebègue et al, 2005), a conservative value of 1.1 has been used in this study. Other studies give values of 1.5 (Laffont, 1998, quoted in Lebègue et al, 2005).

It is for this reason that the sensitivity of welfare improvement to MCPF has been tested with a value of 1.5. The "planned tolls + transport fund + public subsidies" scheme has been compared with the "planned tolls + public subsidies" scheme. An increase in welfare of 36% was observed, which corresponds exactly to the ratio between 1.5 and 1.1. The welfare result therefore depends directly on the MCPF value. This sensitivity test confirms the welfare benefit of financing these projects with a fund financed by external resources (such as contributions from motorway users which in our study yields a much lower levy cost) as compared with public subsidies from taxation. The benefits of the financing fund increase the higher the MCPF.

3.3.3. The optimal pricing issue

The next analysis varies pricing in order to study the introduction of short-run marginal cost pricing (SMCP). It is accepted that the SMCP is not optimal in the presence of financing constraints, but it nevertheless provides a useful benchmark. This pricing is applied simultaneously on (planned) new motorways and on their competing existing (currently free) highways. In this analysis, SMCP is not applied to existing tolled motorways and they keep their current tolling scheme. Furthermore, according to the pure SMCP rule fuel taxes are abolished.

Alternative schemes	Pricing	Revenue use
Planned tolling scheme	Tolling scheme as originally planned for the new projects	Revenues from road tolls on each new motorway go to the motorway concessionaire. No public subsidies
Pure SMCP	SMCP pricing on new motorway projects and their free highway alternatives	No transport fund. No public subsidies.

Table 7: Overview of pricing schemes

Two alternative pricing schemes have been tested: the "planned tolling" scheme and the "pure SMCP" scheme (see Table 7). In this section the construction costs issue has been ignored in order to focus on the pricing issue. In this hypothetical situation construction costs are deemed to have been paid from another source that is not considered in the welfare computation.

Table 8 sets out the "pure SMCP" scheme results for each of the ten planned motorway projects in comparison with the "planned tolling" scheme results.

	Planned tolling scheme			Pure SMCP scheme			
Projects	Fuel tax revenues†† (€ per day)	Toll revenues (€ per day)	Fuel taxes + toll revenues (€ per day)	SMCP revenues** (€ per day)	Variation in revenues***	Variation in Central Government net revenue*	Variation in overall welfare*
A 24	1 020 599	703 379†	1 723 978	574 946	-67%	-69%	-0.1%
A48	290 383	132 889	423 272	165 862	-61%	-66%	1.1%
A51	457 127	287 517	744 644	198 376	-73%	-74%	2.8%
A585	55 913	21 818	77 730	42 385	-45%	-65%	1.2%
A831	206 443	90 486	296 929	116 228	-61%	-64%	1.1%
A89	263 721	117 982	381 703	147 727	-61%	-68%	13.4%
A19	148 540	86 090	234 629	74 175	-68%	-53%	0.7%
A41	85 085	68 054	153 139	80 492	-47%	-67%	1.6%
A45	851 721	128 153	979 874	371 130	-62%	-74%	-0.1%
A65	276 857	96 152	373 009	125 756	-66%	-66%	0.8%
Total	3 656 389	1 732 519	5 388 908	1 897 076	-65%	-66%	3.1%

**in comparison with the "planned tolling" scheme*
*** including SMCP on new motorways and their highway alternatives*
**** SMCP revenues (in the "pure SMCP" scheme) – (Fuel taxes + toll) (in the "planned tolling" scheme)*
† *including the A1 tolled alternative*
†† *fuel taxes have been summed for new motorways and their highway alternatives*

Table 8: Performance of the pure SMCP scheme

Two main conclusions can be drawn from Table 8: first, when the projects are aggregated, the "pure SMCP" scheme results in a slightly better (+3%) overall welfare result than the "planned tolling" scheme; second, total revenues are lower in the SMCP scheme (by 65%) (when comparing SMCP revenues to tolls + fuel tax revenues). Therefore the welfare impact of replacing fuel taxes and tolls by SMCP revenues would seem to be small.

However, there are some disparities between individual projects. The welfare increase is by far the greatest (+13%) for the A89 motorway. This is a project with a low initial overall welfare (with the "planned tolling" scheme) and where the weight of fuel tax revenues in the overall welfare is far higher when compared to the other projects. This explains why once fuel taxes are removed the change in overall welfare is greater for the A89 than for other projects.

For the other projects the overall welfare variation is positive but stays below 3%, apart from for the A24 and A45 where the welfare variation is almost zero (slightly negative).

The low overall welfare increase can be explained by the initially low congestion level. Indeed, the main feature of the SMCP is that it varies according to the congestion level and some large variations in tolls occur when peak SMCP is compared to the initial flat toll (see Table 9).

Projects	Toll* on motorway						Toll* on highway**			
	Planned tolling scheme		SMCP scheme				SMCP scheme			
	Freight	Passengers	Freight		Passengers		Freight		Passengers	
			Peak	Off-peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak
A 24	1.77	4.17	7.73	1.41	15.90	1.60	4.82	1.57	9.08	1.71
A48	1.06	1.97	1.52	0.71	2.88	1.03	2.92	0.70	6.02	0.99
A51	10.95	4.04	1.33	0.99	2.03	1.27	6.48	1.59	12.72	1.65
A585	0.59	1.41	0.45	0.39	0.90	0.77	1.10	0.37	2.40	0.74
A831	1.13	2.66	1.98	0.82	3.75	1.13	3.14	0.94	6.15	1.17
A89	0.87	1.84	1.41	0.65	2.68	0.98	3.22	0.88	6.41	1.13
A19	3.10	4.39	3.29	1.20	6.16	1.44	4.29	1.32	8.18	1.46
A41	0.62	1.24	0.57	0.32	1.27	0.72	1.18	0.36	2.60	0.73
A45	0.85	1.78	0.77	0.68	1.20	1.00	2.68	0.79	5.34	1.06
A65	2.89	5.01	6.22	1.66	12.15	1.83	5.49	1.68	10.35	1.73

** per passenger or tonne per trip*
*** all highways are toll free in the "planned tolling" scheme except for the A1 alternative to the A24*

Table 9: Toll on highways and motorways in the SMCP scheme compared with the "planned tolling" scheme

However it should be remembered that with current traffic conditions on interurban roads the total duration of congestion is very short (200 hours per year on average). The decrease in peak period traffic, which represents a small proportion of total traffic, is compensated for by a considerable increase in off-peak traffic. This explains why each project experiences an overall increase in demand for both freight and passengers, which reveals a welfare gain for road users.

Projects	Demand* on highways		Demand* on motorways		Total demand*	
	Freight	Passengers	Freight	Passengers	Freight	Passengers
A 24	10%	13%	17%	27%	11%	17%
A48	-23%	-36%	36%	55%	9%	15%
A51	-75%	-36%	299%	100%	76%	36%
A585	-19%	-40%	56%	117%	5%	11%
A831	-21%	-35%	83%	31%	13%	23%
A89	-19%	-34%	31%	55%	13%	23%
A19	-34%	-38%	47%	50%	8%	7%
A41	-36%	-55%	51%	70%	17%	21%
A45	-23%	-10%	22%	99%	11%	13%
A65	-19%	-27%	48%	73%	11%	18%
Total	-10%	-22%	32%	42%	10%	18%

**variation in passengers or tonnes per day with reference to the "planned tolling" scheme*

Table 10: Variations in demand between the "planned tolling" scheme and the "pure SMCP" scheme

Highway demand decreases with SMCP pricing while demand increases on the motorway, except for the A24 motorway project (see Table 10). This overall result can be explained by the introduction of highway tolls and the reduction of motorway tolls.

Taking the example of the A41 motorway project, the decrease in alternative highway demand for freight (-36%) and passengers (-55%) can be explained by the introduction of a toll (see Table 9) of €0.358 (in off-peak periods) and €1.184 (in peak periods) per tonne for freight, and €0.73 (in off-peak periods) and €2.6 (in peak periods) for passenger vehicles. On the other hand, the considerably lower toll level for freight and passenger vehicles in off-peak periods (respectively -48% and –42%) and small changes in tolls in peak periods (respectively –8% for freight and +3% for passengers) generate an increase in motorway demand.

The A24 project is a specific case because the alternative road to the A24 motorway is also a tolled motorway (the A1) with a toll of €3.74 for passenger vehicles and €1.72 per tonne for freight. The A1 motorway already carries a high level of freight traffic. In this case, SMCP pricing increases peak tolls on both alternatives (an increase of between 140% and 180% on the A1 and of between 282% and 336% on the A24) but decreases off-peak tolls especially for passengers (-180% on the A1 and –62% on the A24). For freight, the reduction of tolls on both routes is less than 20%.

Another case the A51 project can also be highlighted. This exhibits the greatest decrease in highway freight demand and the greatest increase in motorway freight demand. The main reason is that the toll level decreases, particularly for freight (from €10.95 to €1.33 in peak periods and to €0.99 in off-peak periods). On the other hand, the toll implemented in the SMCP scheme on the alternative highway rises to €1.6 in off-peak periods and €6.5 in peak periods, which is at least twice as high as the other SMCP highway tolls. Freight road users are therefore encouraged to use the motorway.

In Table 8 we can also note the sharp decrease in central government net revenues, between 53% and 74%, when one compares the “planned tolling” scheme and the SMCP scheme. The main reason is the absence of fuel tax in the SMCP scheme: this tax revenue represents more than twice the toll revenues in the “planned tolling” scheme. The other comparison issue relates to differences in taxes on profits between the two schemes: in the SMCP scheme all highway and motorway operator profits are fed into government revenues (because they are considered as public) while in other schemes the motorway operators are private and thus yield a 35% tax on profits. In spite of the increase in peak-period tolls, the implementation of tolls on previously free highways and the increase in overall demand, the revenues from operator profits are not sufficient to compensate for the absence of fuel tax revenues.

To sum up the situation, the SMCP scheme generates an overall 65% reduction in road use pricing (toll + fuel taxes compared with SMCP) for both motorway and alternative highway users: this generates a 10% overall increase in freight traffic and an 18% overall increase in passenger traffic (see Table 10). When put in the balance against a decrease in central government net revenues due to the absence of fuel taxes, there is only a slight overall welfare improvement.

Moreover there is a problem as regards the viability of such pricing because SMCP produces insufficient revenues to finance new projects. These revenues have to be made up by public subsidies.

3.3.4. The combination of SMCP and cross-financing

The foregoing analyses of pricing and financing issues have indicated welfare improvements both when SMCP is applied and when cross-financing with a transport fund is implemented. The question then arose as to whether a combination of these pricing and financing approaches would perform better. To ascertain this we compared a “pure SMCP + transport fund + public subsidies” scheme with a “planned tolling + public subsidies” scheme (see Table 11). The main difference between the two schemes was the road pricing rule and the absence of fuel taxes in SMCP.

Alternative schemes	Pricing	Revenue use
Planned tolling scheme + public subsidies	Tolling scheme as originally planned for the new projects	Revenues from road tolls on each new motorway go to the motorway concessionaire. Public subsidies when needed.
Pure SMCP + transport fund + public subsidies	SMCP pricing on the new motorway projects and their free highway alternatives	Tax on existing toll motorways go to the transport fund. Transport fund subsidises the new motorways. Public subsidies when needed.

Table 11: Overview of pricing and cross-financing schemes

The combination of SMCP pricing and cross-financing generates a welfare increase of 9.2% when compared to the "planned tolling + public subsidies" scheme (see Table 12).

Projects	Central tax revenues*	Variation in Central Government net revenue*	Variation in overall welfare*
A 24	-66%	-45%	1%
A48	-101%	-58%	5%
A51	-138%	-99%	7%
A585	-61%	-55%	9%
A831	-99%	-55%	4%
A89	-101%	-51%	NA**
A19	-118%	-70%	1%
A41	-138%	-71%	6%
A45	-83%	-47%	1%
A65	-94%	-46%	4%
Total	-90%	-55%	9.4%
Total†	-90%	-55%	9.2%

**compared with the "planned toll + public subsidies" scheme*
***reference welfare (in "planned toll + public subsidies" scheme) nearly zero*
† *including welfare loss due to the payment of the regional development tax by toll motorway users*

Table 12: Comparison between "planned toll + public subsidies" scheme and "pure SMCP + transport fund + public subsidies" scheme

This overall result sums up the situation for most of the projects studied. Indeed, the combination of SMCP and a transport fund improves the welfare result for all the projects. However the welfare increase is generally low, in spite of a decrease in central government tax revenues (mainly the fuel taxes which are suppressed with the SMCP).

3.4 Conclusion for the road case study

By way of a preliminary conclusion, a comparison of the tested schemes shows that the combination of pure SMCP with cross-financing by a transport fund and public subsidies when needed yields the greatest overall welfare. This can be easily explained, first because the implementation of cross-financing generates an increase in overall welfare, and second because SMCP pricing and reducing road user taxes generate an overall demand increase and a welfare gain.

4. Cross-financing from road to rail: the Lyon-Turin rail link

The Lyon-Turin rail link has been used for the assessment of rail projects for many reasons. The first reason is that this rail link is part of the Trans-European Network and symbolises European transport policy which is based on intermodality and the development of alternative transport infrastructures to road. The second reason is more technical; in the case of the Lyon-Turin project a competing parallel road option can be clearly identified. This means the rail and road alternatives can be compared, making it easier to use the Molino model.

Here again the Lyon-Turin project is taken as granted. Only are assessed alternative ways of financing and pricing the use of infrastructure.

4.1 Overview of the Lyon-Turin rail project

The implementation of a new rail link between Lyon and Turin has been projected since 1990. It was confirmed as one of the main projects of the French transport policy in the Inter-ministerial Committee for Regional Development (CIADT) in December 2003. It constitutes a priority infrastructure for the European Union as a part of the TEN. Indeed the Lyon-Turin link is situated at the centre of European axes between North and South and East and West and constitutes a development axe at different levels.

First it is expected that the rail project will make easier the flow of traffic between European Union countries and improve economic trade between North and South European countries.

Secondly at a regional level the Lyon-Turin project is expected to improve transfer from road to rail and balance the traffic between these two modes. In the 25 last years in the alpine area road traffic increase was twice as high as rail one mainly owing to road transport investments. A rail link investment appears as necessary to develop rail transport. Moreover as it is underlined by the Lyon-Turin Ferroviaire (LTF) company “by the year 2015, the existing road and rail infrastructures will be saturated”. Another aspect of the implementation of the rail link is the reduction of environmental impacts. According to the LTF study “each day, more than 6000 lorries cross the valley of Maurienne in Savoy and the Valley of Suse in Piedmont (in mid-week). The transfer of goods traffic from the road to the rail (traditional trains and "railway motorway") will reduce the emissions of toxic pollution in the atmosphere by about 360 tons per day ”and respect the Kyoto protocol.

Figure 6: Map of the Lyon-Turin rail project

Origin : www.ltf-sas.com/ ita/obiettivi.htm

The new link between Lyon and Turin is divided into 8 projects. The total costs amounts 9.759 billion € (present value 2005), 8.631 billion € are expected to be publicly financed (see Table 13).

Table 13: Costs of the Lyon-Turin rail project

Lyon-Turin project	Total cost (€ million 2005)	Public Subsidies (M€ 2005)
Alpine high speed	1898	155
Access to the Chartreuse tunnel	644	579
1st line Chartreuse tunnel	1503	1353
2nde line Chartreuse tunnel	536	483
1st line Belledonne tunnel	1310	118
2nde line Belledonne tunnel	461	418
Studies and galleries reconnaissance, French part	235	235
Franco-Italian part	3172	2832
Total Lyon-Turin	9759	8631

Data input mainly come from an a synthesis made by the society “Lyon-Turin Ferroviaire” on traffic and on the profitability of the link Lyon-Turin. It provides traffic forecasts, costs of projects, speed, length of projects, travel time, tolls (see map in Figure 6). Concerning road, traffic and costs data come from motorway societies activity reports.

4.2 Methodology

The assessment focuses on the cross-financing of new rail infrastructures by road revenues with five different pricing and financing schemes summarised in Table 14 below. The transport fund considered here is slightly different from that described in the previous section. A kind of "Alpine fund" has been devised where only the two Alpine motorway crossings (Mont-Blanc and Fréjus) which compete with the Lyon-Turin rail link would be a possible source of cross-financing.

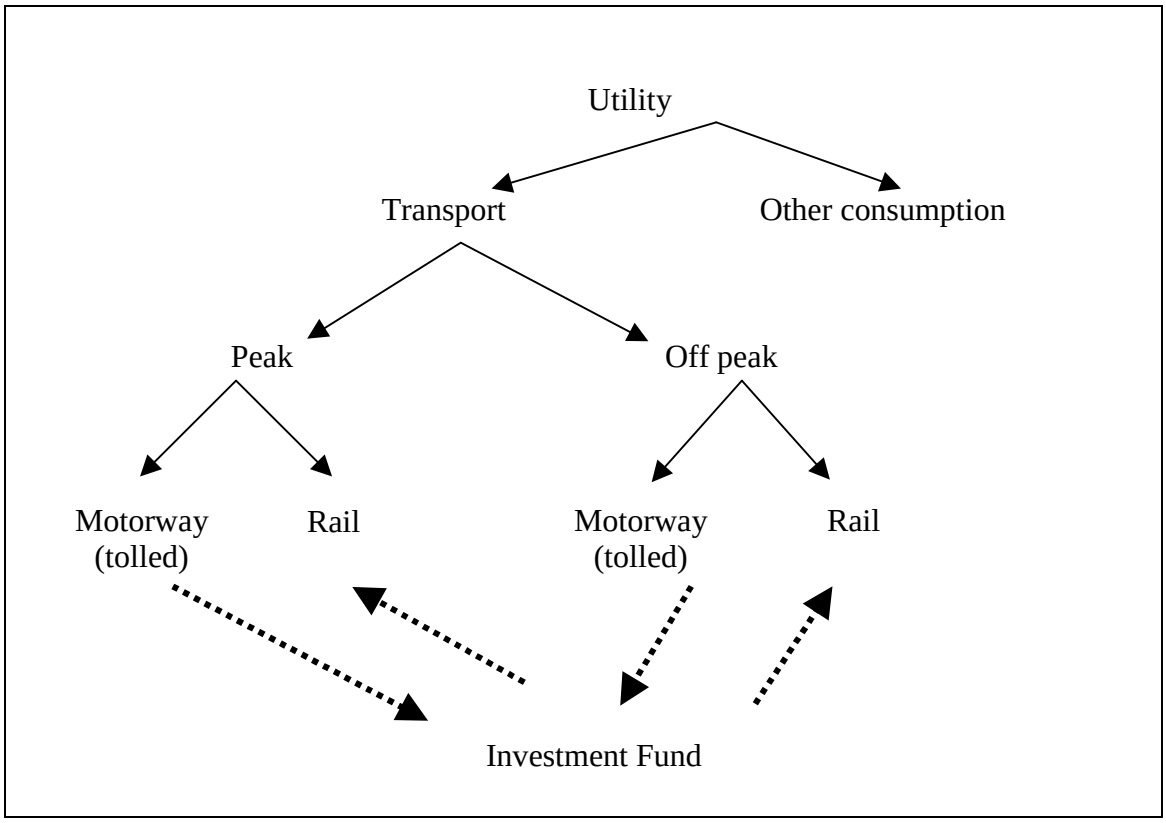
Alternative pricing and funding schemes	Pricing	Revenue use
Current motorway tolling scheme + public subsidies	Current tolling scheme on alpine motorways	Rail revenues go to rail operator or manager. Toll revenues go to motorway operator. Public subsidies for the rail link. No cross-financing.
Increase in alpine motorway tolls by 25% + transport fund + public subsidies	Mark-ups (25%) on current tolling scheme on alpine motorways	Rail revenues go to rail operator or manager. "Base" toll revenues go to motorway operator. Additional surplus of alpine motorways goes to the Alpine fund which subsidises the rail link. Public subsidies when needed.
Increase in alpine motorway tolls by 80% + transport fund + public subsidies	Mark-ups (80%) on current tolling scheme on alpine motorways	As above.
Current motorway tolling scheme + transport fund	Current tolling scheme on alpine motorways.	Tax on existing toll motorway (whole national network) goes to the transport fund. The transport fund subsidises the rail link. Rail revenues go to rail operator or manager.
Increase in alpine motorway tolls by 25% + transport fund	Mark-ups (25%) on current tolling scheme on alpine motorways	Tax on existing toll motorway (whole national network) goes to the transport fund. The transport fund subsidises the rail link. Additional surplus of alpine motorways goes to the Alpine fund which subsidises the rail link. Rail revenues go to rail operator or manager.

Table 14: Overview of alternative pricing and financing schemes for the Lyon-Turin rail link

The Molino model is used in a "road/rail, passenger/freight" configuration: the first level involves the choice between transport and other consumption, the second the choice between travelling in peak or in off-peak periods and the third the choice between existing motorways and the future rail link (see Figure 7).

Here again Molino is used in a *static* approach: we take as given the level of traffic initially forecast by the "Lyon-Turin Ferroviaire" company.

Figure 7: MOLINO decision tree



In the first scheme the "current tolling scheme" is applied (the current tolling scheme on existing Alpine motorways) while public subsidies contribute to the financing of the future Lyon-Turin rail link. The second and third schemes include an investment fund (Alpine fund) with existing Alpine motorway companies providing cross-financing to the Lyon-Turin rail project[19]. First an increase of motorway tolls of 25%[20] has been considered. It has been assumed that the motorway operator transfers the resulting increase in gross operating surplus to the fund. Next, in order to lower further the level of public subsidies needed for the financing of the rail link, an increase in tolls of 80% has been considered. This level of 80% corresponds to the toll that maximises the gross operating surplus of motorway operators, taking into account its effect of decreasing road demand. In the fourth scheme the same transport fund as in the road case study is considered instead of the Alpine fund: that is to say the regional development tax on existing toll motorway (whole national network) goes to the national transport fund which subsidises the rail link; it is assumed that the fund covers all the subsidy needs[21]. In the fifth scheme the national transport fund would be used as a remainder to the Alpine fund (with a mark-up of 25% on current tolling on alpine motorways) in order to subsidise the rail link. The purpose of these two last schemes is to assess the relative welfare performances of the financing by the national transport fund when compared with markups on tolls on Alpine motorways.

Other assumptions are detailed in Appendix 2.

[19] The timing of investment is identical in the different alternatives.

[20] This figure is based on the Directive proposal COM (2003) 448 which suggested allowing a 25% maximum mark-up on toll on motorways in environmentally sensitive areas in order to cross-finance alternative rail routes.

[21] In this case the whole financing capacity of the national fund would be allocated to the Lyon-Turin rail link during its construction period (i.e. about 10 years).

4.3 Results

Table 15 gives the variation between each the fourth schemes and the "current toll + public subsidies" scheme. The latter is taken as the reference.

	Cross-financing: road toll markups of 25%	Cross-financing: road toll markups of 80%	National Transport fund	National transport fund + road toll markups of 25%
Variation in overall welfare*	0.1%	0.2%	1%	1%
Low income passengers welfare variation*	3%	8%	14%	16%
High income passengers welfare variation*	1%	4%	4%	5%
Variation in central government net revenue*	36%	89%	137%	155%
Variation in public subsidies*	-14%	-24%	-100%	-100%
Variation in road operator profits*	0%	0%	0%	0%
Variation in rail operator profits*	18%	57%	0%	18.4%
Variation in rail infrastructure manager profits*	19%	58%	0%	18.8%

**with reference to the "current toll + public subsidies" scheme*

Table 15: Results for the Lyon-Turin rail project for the different schemes

4.3.1. Alpine fund with road toll mark-ups of 25%

This scheme has a small impact on overall welfare which remains stable. However it generates a slight increase in the welfare of high and low income passengers (respectively +1% and +3%). If the variation in low income welfare is compared with the variation in high income welfare, it is apparent that an increase in road tolls favours low income welfare more than high income welfare. Indeed, the higher central government revenues are, the greater the redistribution to low income[22]. This redistribution effect stems from the fact that low income households account for 60% of all households.

The 25% toll increase generates an increase in central government net revenue (+36%) mainly because of a reduction in public subsidies (by 14%). However this has a low impact on overall welfare.

Both rail operators and managers benefit from the road toll increase. The profits of operators and managers increase by more than 19%: this results from the modal transfer from road to rail. Road operator profits are not modified because the surplus resulting from toll mark-ups is transferred to the fund.

4.3.2. Alpine fund with road toll mark-ups of 80%

This scheme applies the same rules as above but with a toll increase of 80%.

As with the previous toll mark-up scheme, the level of welfare remains stable compared with the initial situation. However the partial welfare levels (low and high income) rise more, by 8% and 4% respectively. The public subsidies decrease by 24%. Therefore the road toll increase generates an increase in central government net revenues of nearly 90%. The considerable increase, of approximately 57%, in the profits of rail operators and infrastructure managers is noteworthy.

[22] The welfare difference between high and low income passengers has not been tested for the road case study.

As a side-effect, it is possible to analyse road/rail modal split, on which the motorway toll levels impacts clearly (see Table 16). Rail's share of passenger transport increases with motorway toll levels, but this effect is higher during off-peak than peak periods, and much higher off-peak when motorway tolls increase by 80% in this situation rail's share reaches 61%.

	current motorway tolling scheme	25% toll increase		80% toll increase	
Passenger		Peak	Off-peak	Peak	Off-peak
Rail	40%*	43%	47%	46%	61%
Road	60%	57%	53%	54%	39%
Freight		Peak	Off-peak	Peak	Off-peak
Rail	50%*	57%	42%	69%	72%
Road	50%	43%	58%	31%	28%

**according to LTF forecasts*

Table 16 : Results as regards modal shares

With regard to freight demand, starting from an initial equal split between rail and road, rail only becomes dominant in peak periods when the motorway toll increases by 25%. In off-peak periods the motorway retains a higher share (58%): this can be explained by the fact that the toll is higher on rail than on road (€40 per tonne by rail compared with €32 by road) and maximum speeds on both modes are identical. It is only when the road toll increases by 80% that rail freight becomes dominant in both peak (69%) and off peak periods (72%).

4.3.3. National transport fund alone vs. in combination with an alpine fund

The two last schemes compare the advantages of a complete coverage of the subsidies need with on the one hand the national transport fund alone and on the other hand the alpine fund completed with the national transport fund.

In spite of the complete coverage of the subsidies need the overall welfare is only slightly improved (+1% in both cases). Note that this welfare variation includes the welfare loss incurred by motorway users whether they pay the regional development tax on the existing national toll motorway network or the 25% mark-up on toll on the alpine motorways.

It follows from the absence of public subsidy need that the central government net revenues are greatly increased (+137% and +155%). Because of the redistribution by the central government the welfare of low income passengers is much more improved (+14% and +16%) when compared with the two previous schemes, and more than three times higher than the improvement of welfare of high income passengers.

The comparison of the two pricing and financing alternatives shows no difference in overall welfare. The main advantage of financing the rail link partly with the toll markup on the alpine motorway would be a policy matter: the financial balances of the rail operator and manager would be improved and the same for the rail mode share.

5. Conclusion

The first lesson from this motorway programme analysis relates to the financing issue. When compared with public subsidies from the general budget, cross-financing from existing motorways to new motorways slightly increases the level of welfare for all the projects. This overall result is a consequence of the fact that public subsidies bear a levy cost in the economy (i.e. the Marginal Cost of Public Funds) while a lower levy cost is associated with subsidies from a transport fund (when revenues come from a mark-up on tolls as in our study). Moreover the sensitivity of welfare improvement depends directly on the level of the Marginal Cost of Public Funds. Note that, because of this difference in levy cost, this only shows the advantage of direct earmarking of additional taxes on tolls, whether transiting through a transport fund or not, compared to public subsidies coming from the general levy of public money.

Secondly, with regard to optimal pricing, SMCP permits a slight increase in overall welfare when compared with the planned tolling scheme, despite the low forecast level of congestion on the studied projects. This can mainly be explained by the fact that road traffic will increase since the overall costs borne by the road users would be reduced by 65% when switching from fuel taxes plus planned tolls to SMCP. However because of the low level of congestion, pure SMCP cannot solve financing problems. It must be supplemented by subsidies from a transport fund or from central (or local) governments. This does not mean that new investments are not justified. Indeed, motorway projects are planned mainly not to reduce congestion but to improve the quality and safety of road transport. This improvement and especially the expected time savings induce a socio-economic rate of return high enough to motivate the interest of the community to achieve these projects.

Therefore, while pure SMCP is more efficient as regards pricing (without considering financing problems) and cross-financing appears to be more efficient as a means of financing new motorway projects, the combination of the two rules would increase overall welfare. Indeed for all projects the scheme that combines pure SMCP with cross-financing provides the greatest increase in overall welfare of all the alternative schemes.

Concerning the rail-road study, the assessment of the Lyon-Turin rail project shows the limited impact on welfare of cross-financing rail by road by the means of toll mark-ups on alternative Alpine motorways. However there would be a higher redistribution toward low income passengers compared with high income ones and the financial balances of the rail operator and manager would be improved while the rail mode share would increase.

It should be stressed that while public subsidies amount to 88% of the construction costs in the first scheme (no cross-financing) this level of public subsidies decreases by 14% and 24% with cross-financing by motorway toll mark-ups of respectively 25% and 80%.

The introduction of the same national transport fund as in the road case study would yield some advantage when combined with the alpine fund supplied by toll mark-ups, by achieving the complete coverage of the subsidy need while keeping the improvement of the financial balances of the rail operator and manager and of the rail mode share.

Moreover, the revenues from road toll mark-ups only consider traffic crossing the Franco-Italian border through the Mont-Blanc and Fréjus tunnels. The toll mark-up base could be widened to all traffic using the Alpine motorway network, on the premise that this traffic would benefit from lower road congestion resulting from modal transfer to rail: this would yield much higher revenues. However this option raises policy and equity issues which require more thorough analysis.

6. Appendix

Appendix 1: Assumptions and supplementary data

Traffic data
Road traffic is based on the audit data (IGF and CGPC, 2003). With regard to the distinction between local and transit traffic, local traffic is considered to be domestic while transit traffic corresponds to traffic entering and leaving the country. It is assumed that 80% of road freight traffic is local.

Occupancy rate
For roads, the hypothesised occupancy rates for the two case studies are 8.6 tonnes for freight vehicles and 1.9 passengers for passenger vehicles. For rail, the occupancy rates given in the traffic forecasts made by the "Lyon-Turin Ferroviaire" company have been used (400 passengers/train and 280 tonnes/train).

Congestion periods
Congestion on interurban roads is limited to 200 hours per year, or about 0.02 hours a day. 8% of passengers (cars and rail) and 2% of heavy goods vehicles and freight trains use infrastructures in peak periods (see EMCT case study for France, 2003).

Monetary costs
For passenger road vehicles, resource costs are made up of purchasing expenditures, financial expenditures, car insurance, fuel (without taxes), maintenance (without taxes) and parking. For freight road vehicles, they include fuel, tyres, maintenance, insurance, purchasing or hiring expenditures and staff wages.

For passenger road vehicles central taxes essentially consist of fuel taxes. For road freight vehicles only fuel tax and axle tax have been considered (because VAT is recovered by firms). Based on a paper on fuel consumption in France (Girault et al, 2000), the level of "central taxes on transit freight" has been considered to be 40% of "central taxes on local freight".

There are no resource costs for rail passengers and freight. Rail passengers pay only the VAT on the transport ticket fare. There is no central tax for rail freight transport.

Tolls
In the road case study, the level of tolls refers to the tolls estimated in the audit for each planned motorway project.

Speeds
For both road and rail modes, maximum speed is considered to be identical for passenger and freight. The same applies to peak period speed.

On road the maximum speed is higher for motorways (based on the 130 km/h speed limit on French motorways) than for "conventional" highways (between 70 km/h and 100 km/h according to local topography). The speed during congestion is 60 km/h. In some cases mountainous terrain reduces both motorway and highway speeds.

Table 17: Speed inputs for the different road projects

	Motorway		Highway	
	Max speed	Congestion	Max speed	Congestion
A 24 project	130 km/h	60 km/h	110 km/h	60 km/h
A48 project	130 km/h	60 km/h	100 km/h	60 km/h
A51 project	110 km/h	60 km/h	70 km/h	50 km/h
A585 project	110 km/h	60 km/h	70 km/h	50 km/h
A831 project	130 km/h	60 km/h	70 km/h	50 km/h
A89 project	110 km/h	60 km/h	70 km/h	50 km/h
A19 project	130 km/h	60 km/h	70 km/h	50 km/h
A41 project	120 km/h	60 km/h	70 km/h	50 km/h
A45 project	110 km/h	60 km/h	100 km/h	60 km/h
A65 project	130 km/h	60 km/h	70 km/h	50 km/h

Time costs

The official value of time is used for time costs for passengers (see CGP, 2001): this is equal to €12 /hour for distances up to 310 km. Using the same guide, operating costs are estimated at €31.4/hour for road freight vehicles. So, taking 8.6 tonnes of freight per vehicle, the VOT is estimated at €3.65/tonne/hour.

Share of household expenditure devoted to transport

The share of household expenditure devoted to transport has been taken from DAEI/SES (2003). This data make no distinction between low and high income, so a single value has been taken for both categories and 15.02% of household income is considered to be spent on transport consumption. Concerning freight transport expenditures, a single margin rate (the share of transport compared to total production and importation) of 3.4% has been applied.

Elasticities of substitution

With regard to transport/other consumption and peak/off peak elasticities the elasticities used in the TRENEN model (interregional model) and reported in (ECMT, 2003) have bee used. For peak and off-peak elasticities between motorways and highways we have sought values that give an acceptable value for the toll-elasticity of demand on toll motorways: investigation of some projects has given empirical values of between –0.4 and –0.5 on French toll motorways. The values of elasticities of substitution are shown in Table 18 below.

		transport / other	**peak/off-peak**	**peak highway / tolled motorway**	**off-peak highway / tolled motorway**
passengers	**low-income**	0.4	0.8	18	6
	high-income	0.4	0.8	18	6
freight	**local**	0.2	0.5	4	3.5
	transit	0.2	0.5	4	3.5

Table 18: Elasticities of substitution

For the rail/road case study, after verification the same values were used for all elasticities as for roads (the peak and off-peak elasticities between alternative roads become the peak and off-peak elasticities between rail and road).

Other costs

For the road case study, the motorway costs are based on data from the ASF report (2004). Operating costs include purchases and staff costs. The operating cost data is not sufficiently detailed to distinguish fixed operating costs, so these have been included in the "variable operating costs". In France, there is no distinction between the motorway manager and the motorway operator, so maintenance costs have been included with "variable operating costs". The detailed financial charges for the new road projects are not known: from this it follows that the "profit" (of road operators and infrastructure managers) used in the Molino model is actually the gross operating surplus (GOS). However since the scenarios have only been compared with each other, the variations in welfare that result from variations in the GOS are correct.

External costs

These are given in (CGP, 2001): in 2001, transport pollution was estimated at €0.009 /vehicle/km for passenger vehicles and €0.062/vehicle/km for freight.

Welfare parameters and weights

The difference between a public and a private operator is made by the input "profit tax". This tax ratio is equal to 1 when the operator is public. In this case all profits are paid to central government. When the operator is private, as is the case with road and rail operators, the profit tax ratio is equal to 0.35.

The model parameter *beta* is equal to 0.5: this means that central government revenues are equally allocated between the high and the low income users.

2005 prices have been considered with an inflation rate of 1.8% per year.

Table 19: Weights applied in Molino for the road case study

weights	**low passengers (wl)**	1
	high passengers (wh)	1
	local freight (wloc)	0.5
	transit freight (wtran)	0
	external costs (wec)	1
	Γcentral	1.1
	Γlocal	1.1
	beta central	0.5
	beta local	0.5
	profit tax	0.35
	beta operator 1	0.05
	beta operator 2	0.05
	beta infrastructure 1	0.05
	beta infrastructure 2	0.05

We did not consider difference in contract efficiency (tendering parameter set to 1)

Public subsidies vs other funding

Molino is used in a *static* approach, that is to say as if the new projects are implemented and in operation. Molino computes the traffic and financial flows on a daily basis. In order to establish a common daily basis of comparison between construction subsidies and private or transport fund financing, it is assumed for each project that public subsidies would be financed by a government loan of a 30 years duration with a 4% interest rate. By this way it is possible to compute a daily

level of public subsidy broken down for the duration of the concession. This rule is also applied in the rail-road (Lyon-Turin) study.

Appendix 2: Assumptions and additional data specific to the rail-road case study

The rail operator is private while the rail manager is public. The road operator and manager are both private.

Road traffic consists of the number of vehicles crossing the frontier between France and Italy. The traffic data given by the two motorway operators (ATMB and SFTRF) through the Mont-Blanc and Fréjus tunnels in 2003 has been aggregated. An increase of 3% per year was applied in order to obtain traffic forecasts for 2015.

Rail traffic data have been obtained from the forecasts of traffic for 2015 made by the "Lyon-Turin Ferroviaire" company (LTF, 2003a). These are daily estimated rail passenger traffic in Modane (night and day trains) according to the LTF-scenario V4[23]. Freight traffic forecasts have been considered at the border crossing.

High and low income passengers have been distinguished for both road and rail traffic. It has been assumed that 33% of passenger traffic is drawn from low income[24] households (Hivert, 2000).

Road toll levels are those applied for a trip between Lyon and Turin according to the type of vehicle. Rail tolls for passengers correspond to the ticket price paid to the railway operator SNCF by travellers. We consider that low income passengers travel second class while high income travel first class. Freight rail tolls are based on the SNCF price for freight traffic.

For the maximum rail speed, the maximum passenger speed (220 km/h) and freight speed (120 km/h) were weighted in proportion to the share of each, i.e. a maximum speed of 130 km/h. For peak period speed the assumption was that travel time for passenger and freight trains is increased by one hour. As stated above, the passenger speed (128 km/h) and the freight speed (86 km/h) were weighted in proportion to the shares of passenger and rail trains, giving 90 km/h.

Motorway costs were computed from specific operating costs for Alpine motorways, based on financial reports (see ATMB, 2004; MINEFI, 2004). Rail operating costs are taken from the SNCF report (2002). They include operating costs without infrastructure tolls and make a separation between freight trains and high speed trains.

The rail infrastructure cost corresponded to the infrastructure tolls paid by the rail operator (in our case SNCF) to the infrastructure manager (RFF). The amount of the tolls are given in the LTF study.

In the rail-road case study the model parameter *beta* is equal to 0.6: this means that 60% of the tax revenues of central government are allocated to low income users who represent 60% of households.

[23] growth rate: 1.8%, speed in tunnel: 220 km/h, €20 of additional tax on international trains and a decrease by 10% of air fares linked to the low-cost companies development.

[24] income lower or equal to €1,900 per "consumption unit" per month

Table 20: Weights applied in Molino for the Lyon-Turin rail lik case study

weights	**low passengers (wl)**	1
	high passengers (wh)	1
	local freight (wloc)	0.5
	transit freight (wtran)	0
	external costs (wec)	1
	Gcentral	1.1
	Glocal	1.1
	beta central	0.6
	beta local	0.6
	profit tax	0.35
	beta operator 1	0.05
	beta operator 2	0.05
	beta infrastructure 1	0.05
	beta infrastructure 2	0.05

Appendix 3: Welfare loss resulting from toll tax (regional development tax)

The welfare loss resulting from the payment of a land development tax by motorways users is calculated from the motorway traffic and the toll level in 2003 with a toll elasticity of demand amounting to -0.5. According to DAEI/SES and Autoroutes de France, we consider a heavy goods vehicle (HGV) yearly traffic of 12 billion vehicle-km, paying an average toll of € 0.1964 per km, and a yearly car traffic of 62.4 billion vehicle-km paying an average toll of € 0.0687 per km. The tax applied on tolls amounts to € 0.007 by vehicle-km. So we estimate a welfare loss of € 11.9 million (€ 11.1 million for cars and € 0.8 million for HGV). This gives a € 33 thousand daily loss. Since the revenue of the tax yields on a yearly basis € 520.8 million, the welfare loss is € 0.023 per euro collected.

Appendix 4: Tables of detailed results for each project

A 24 project

	Scenario : Usual tolling scheme + public subsidies	**Scenario : Tolls + transport fund (AFITF) + public subsidies**		**Scenario : SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 5 Pure SMCP + transport fund + public subsidies	
Toll on motorway				Peak	Off-peak	Peak	Off-peak
Passenger toll	4.17	4.17	4.29	15.90	1.60	15.90	1.60
Passenger toll variation*	-	0%	3%	282%	-62%	282%	-62%
Freight toll	1.77	1.77	1.83	7.73	1.41	7.73	1.41
Toll freight variation*	-	0%	3%	336%	-20%	336%	-20%
Demand on motorway							
Passengers demand variation*	28 576	0.0%	-2%	27%		27%	
Freight demand variation*	32 336	0.0%	-1%	17%		17%	
Toll on highway							
Passenger toll	3.74	3.74	3.74	9.08	1.71	9.08	1.71
Freight toll	1.72	1.72	1.72	4.822	1.566	4.822	1.566
Demand on highway							
Passengers demand variation*	74 480	0%	1%	13%		13%	
Freight demand variation*	144 480	0%	0%	10%		10%	
Global passenger demand	103 056	103 056	102 935	120 700		120 700	
Global freight demand	176 816	176 816	176 690	196 213		196 213	

	Scenario: Usual tolling scheme + public subsidies	Scenario : Tolls + transport fund (AFITF) + public subsidies		Scenario : SMCP	
Public subsidies (€/day)	60 267	2 735			-324 873
Central goverment revenues (€/day)	1 483 330	1 540 862	1 545 637	484 287	809 160
Highway operator GOS (€/day)	468 160	468 160	469 820	390 756	390 756
Variation of highway operator GOS*	N.C	0.00%	0.35%	-16.53%	-16.53%
Motorway operator GOS (€/day)	156 679	156 679	159 393	93 531	93 531
Variation of motorway operator GOS *	N.C	0.00%	1.73%	-40.30%	-40.30%
Global welfare variation*	-41 012 854	0.15%	0.16%	0.07%	0.95%
Low income welfare variation*	14 714 070	0.22%	0.22%	-0.61%	0.61%
High income welfare variation*	14 805 727	0.21%	0.23%	-1.22%	-0.02%
AFITF subsidies (€/day)	0	56 712	56 712	0	56712

**with reference to scenario 1*

***toll per passenger or ton per trip*

A 48 project

	Scenario : Usual tolling scheme + public subsidies	**Scenario : Tolls + transport fund (AFITF) + public subsidies**		**Scenario : SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 5 Pure SMCP + transport fund + public subsidies	
Toll on motorway**				Peak	Off-peak	Peak	Off-peak
Passenger toll	1.97	1.97	2.03	2.88	1.03	2.88	1.03
Passenger toll variation*	-	0%	3%	46%	-48%	46%	-48%
Freight toll	1.06	1.06	1.09	1.52	0.71	1.52	0.71
Toll freight variation*	-	0%	3%	44%	-33%	44%	-33%
Demand on motorway							
Passengers demand variation*	47 158	0.0%	-1%	55%		55%	
Freight demand variation*	37 668	0.0%	-1%	36%		36%	
Toll on highway**							
Passenger toll	-	-	-	6.02	0.99	6.02	0.99
Freight toll	-	-	-	2.924	0.700	2.924	0.700
Demand on highway							
Passengers demand variation*	37 685	0%	1%	-36%		-36%	
Freight demand variation*	30 100	0%	1%	-23%		-23%	
Global passenger demand	84 843	84 843	84 753	97 274		97 274	
Global freight demand	67 768	67 768	67 651	74 117		74 117	

	Scenario : Usual tolling scheme + public subsidies	Scenario : Tolls + transport fund (AFITF) + public subsidies		Scenario : SMCP	
Public subsidies (€/day)	33 333	2 434			1 607
Central goverment revenues (€/day)	268 329	299 228	302 060	103 056	101 449
Highway operator GOS (€/day)	-24 501	-24 501	-24 789	25 273	25 273
Variation of highway operator GOS*	N.C	0.00%	-1.18%	203.15%	203.15%
Motorway operator GOS (€/day)	102 229	102 229	105 059	77 783	77 783
Variation of motorway operator GOS *	N.C	0.00%	2.77%	-23.91%	-23.91%

Global welfare variation*	-1 623 999	2.09%	2.18%	3.30%	3.19%
Low income welfare variation*	4 653 991	0.37%	0.37%	0.80%	0.78%
High income welfare variation*	4 713 795	0.36%	0.40%	-0.48%	-0.49%
AFITF subsidies (€/day)	0	53 973	53 973	0	56973

** in reference to scenario 1*

*** toll per passenger or ton per trip*

A 51 project

	Scenario : Usual tolling scheme + public subsidies	**Scenario : Tolls + transport fund (AFITF) + public subsidies**		**Scenario : SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 5 Pure SMCP + transport fund + public subsidies	
Toll on motorway**				Peak	Off-peak	Peak	Off-peak
Passenger toll	4.04	4.04	4.73	2.03	1.27	2.03	1.27
Passenger toll variation*	-	0%	17%	-50%	-69%	-50%	-69%
Freight toll	10.95	10.95	12.81	1.33	0.99	1.33	0.99
Toll freight variation*	-	0%	17%	-88%	-91%	-88%	-91%
Demand on motorway							
Passengers demand variation*	38 988	0.0%	-10%	100%		100%	
Freight demand variation*	11 868	0.0%	-19%	299%		299%	
Toll on highway**							
Passenger toll	-	-	-	12.72	1.65	12.72	1.65
Freight toll	-	-	-	6.482	1.590	6.482	1.590
Demand on highway							
Passengers demand variation*	34 713	0%	6%	-36%		-36%	
Freight demand variation*	17 458	0%	10%	-75%		-75%	
Global passenger demand	73 701	73 701	71 621	100 182		100 182	
Global freight demand	29 326	29 326	28 764	51 713		51 713	

	Scenario : Usual tolling scheme + public subsidies	Scenario : Tolls + transport fund (AFITF) + public subsidies		Scenario : SMCP	
Public subsidies (€/day)	61 187	4 652	1 506		132 476
Central goverment revenues (€/day)	467 208	523 743	525 299	136 698	4 222
Highway operator GOS (€/day)	-21 315	-21 315	-22 629	33 943	33 943
Variation of highway operator GOS*	N.C	0.00%	-6.17%	259.25%	259.25%
Motorway operator GOS (€/day)	264 522	264 522	267 052	102 755	102 755
Variation of motorway operator GOS *	N.C	0.00%	0.96%	-61.15%	-61.15%

Global welfare variation*	4 704 015	1.32%	0.52%	4.23%	1.13%
Low income welfare variation*	8 928 650	0.35%	0.22%	0.80%	-0.02%
High income welfare variation*	9 083 395	0.34%	0.23%	-0.92%	-1.72%
AFITF subsidies (€/day)	0	101 369	101 369	0	101369

**In reference with scenario 1*

***toll per passenger or per trip*

A 585 project

	Scenario : Usual tolling scheme + public subsidies	**Scenario : Tolls + transport fund (AFITF) + public subsidies**		**Scenario : SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 5 Pure SMCP + transport fund + public subsidies	
Toll on motorway**				Peak	Off-peak	Peak	Off-peak
Passenger toll	1.41	1.41	1.48	0.90	0.77	0.90	0.77
Passenger toll variation*	-	0%	5%	-36%	-45%	-36%	-45%
Freight toll	0.59	0.59	0.62	0.45	0.39	0.45	0.39
Toll freight variation*	-	0%	5%	-24%	-34%	-24%	-34%
Demand on motorway							
Passengers demand variation*	12 825	0.0%	-4%	117%		117%	
Freight demand variation*	6 450	0.0%	-2%	56%		56%	
Toll on highway**							
Passenger toll	-	-	-	2.40	0.74	2.40	0.74
Freight toll	-	-	-	1.102	0.369	1.102	0.369
Demand on highway							
Passengers demand variation*	27 018	0%	2%	-40%		-40%	
Freight demand variation*	13 588	0%	1%	-19%		-19%	
Global passenger demand	39 843	39 843	39 812	44 049		44 049	
Global freight demand	20 038	20 038	20 004	21 089		21 089	

	Scenario : Usual tolling scheme + public subsidies	Scenario : Tolls + transport fund (AFITF) + public subsidies		Scenario : SMCP	
Public subsidies (€/day)	15 434	59			-11 465
Central goverment revenues (€/day)	28 769	44 144	44 068	15 467	26 932
Highway operator GOS (€/day)	-16 590	-16 590	-16 851	6 294	6 294
Variation of highway operator GOS*	N.C	0.00%	-1.57%	137.94%	137.94%
Motorway operator GOS (€/day)	13 943	13 943	14 520	9 173	9 173
Variation of motorway operator GOS *	N.C	0.00%	4.15%	-34.21%	-34.21%
Global welfare variation*	532 719	3.17%	3.04%	4.42%	6.79%
Low income welfare variation*	1 041 424	0.81%	0.77%	1.39%	1.99%
High income welfare variation*	1 049 581	0.81%	0.79%	0.60%	1.20%
AFITF subsidies (€/day)		26 616	26 616		26616

**in reference with scenario 1*

*** toll per passenger or ton per trip*

A 831 project

	Scenario : Usual tolling scheme + public subsidies	**Scenario : Tolls + transport fund (AFITF) + public subsidies**		**Scenario: SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 5 Pure SMCP + transport fund + public subsidies	
Toll on motorway**				Peak	Off-peak	Peak	Off-peak
Passenger toll	2.66	2.66	2.82	3.75	1.13	3.75	1.13
Passenger toll variation*	-	0%	6%	41%	-58%	41%	-58%
Freight toll	1.13	1.13	1.20	1.98	0.82	1.98	0.82
Toll freight variation*	-	0%	6%	75%	-28%	75%	-28%
Demand on motorway							
Passengers demand variation*	22 515	0.0%	-3%	83%		83%	
Freight demand variation*	27 090	0.0%	-2%	31%		31%	
Toll on highway**							
Passenger toll	-	-	-	6.15	1.17	6.15	1.17
Freight toll	-	-	-	3.136	0.935	3.136	0.935
Demand on highway							
Passengers demand variation*	23 237	0%	2%	-35%		-35%	
Freight demand variation*	14 345	0%	1%	-21%		-21%	
Global passenger demand	45 752	45 752	45 503	56 302		56 302	
Global freight demand	41 435	41 435	41 204	46 815		46 815	

	Scenario : Usual tolling scheme + public subsidies	Scenario : Tolls + transport fund (AFITF) + public subsidies		Scenario : SMCP	
Public subsidies (€/day)	22 192	3 020			-1 642
Central goverment revenues (€/day)	195 816	214 988	218 274	79 398	81 040
Highway operator GOS (€/day)	-14 593	-14 593	-14 883	20 878	20 878
Variation of highway operator GOS*	N.C	0.00%	-1.99%	243.07%	243.07%
Motorway operator GOS (€/day)	74 736	74 736	78 054	58 521	58 521
Variation of motorway operator GOS *	N.C	0.00%	4.44%	-21.70%	-21.70%
Global welfare variation*	-1 757 056	1.20%	1.26%	2.50%	2.60%
Low income welfare variation*	3 499 344	0.30%	0.31%	0.83%	0.86%
High income welfare variation*	3 543 065	0.30%	0.36%	-0.41%	-0.39%
AFITF subsidies (€/day)		35 455	35 455		35 455

** in reference with scenario 1*

** *toll per passenger or ton per trip*

A 89 project

	Scenario : Usual tolling scheme + public subsidies	**Scenarios : Tolls + transport fund (AFITF) + public subsidies**		**Scenarios : SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 5 Pure SMCP + transport fund + public subsidies	
Toll on motorway**				Peak	Off-peak	Peak	Off-peak
Passenger toll	1.84	1.84	1.95	2.68	0.98	2.68	0.98
Passenger toll variation*	-	0%	6%	46%	-47%	46%	-47%
Freight toll	0.87	0.87	0.92	1.41	0.65	1.41	0.65
Toll freight variation*	-	0%	6%	61%	-25%	61%	-25%
Demand on motorway							
Passengers demand variation*	48 515	0.0%	-2%	55%		55%	
Freight demand variation*	32 809	0.0%	-2%	31%		31%	
Toll on highway**							
Passenger toll	-	-	-	6.41	1.13	6.41	1.13
Freight toll	-	-	-	3.217	0.884	3.217	0.884
Demand on highway							
Passengers demand variation*	26 448	0%	2%	-34%		-34%	
Freight demand variation*	17 888	0%	1%	-19%		-19%	
Global passenger demand	74 963	74 963	74 444	92 417		92 417	
Global freight demand	50 697	50 697	50 391	57 511		57 511	

	Scenario : Usual tolling scheme + public subsidies	Scenarios : Tolls + transport fund (AFITF) + public subsidies		Scenarios : SMCP	
Public subsidies (€/day)	98 509	4 316			1 848
Central goverment revenues (€/day)	178 920	273 113	278 127	89 632	87 784
Highway operator GOS (€/day)	-16 800	-16 800	-17 155	23 170	23 170
Variation of highway operator GOS*	N.C	0.00%	-2.11%	237.92%	237.92%
Motorway operator GOS (€/day)	87 165	87 165	92 268	66 462	66 462
Variation of motorway operator GOS *	N.C	0.00%	5.85%	-23.75%	-23.75%

Global welfare variation*	1 604	6457.72%	6608.11%	7669.64%	7542.95%
Low income welfare variation*	4 628 532	1.12%	1.13%	1.59%	1.57%
High income welfare variation*	4 679 524	1.11%	1.18%	0.48%	0.46%
AFITF subsidies (€/day)		94 684	94 684		94 684

** in référence with scenario 1*

** toll per passenger or ton per trip*

A 19 project

	Scenario : Usual tolling scheme + public subsidies	**Scenarios : Tolls + transport fund (AFITF) + public subsidies**		**Scenarios : SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 5 Pure SMCP + transport fund + public subsidies	
Toll on motorway**				Peak	Off-peak	Peak	Off-peak
Passenger toll	4.39	4.39	4.61	5.39	1.47	5.39	1.47
Passenger toll variation*	-	0%	5%	23%	-66%	23%	-66%
Freight toll	3.10	3.10	3.26	2.95	1.22	2.95	1.22
Toll freight variation*	-	0%	5%	-5%	-61%	-5%	-61%
Demand on motorway							
Passengers demand variation*	10 300	0.0%	-3%	83%		83%	
Freight demand variation*	13 149	0.0%	-2%	66%		66%	
Toll on highway**							
Passenger toll	-	-	-	9.43	1.46	9.43	1.46
Freight toll	-	-	-	4.842	1.318	4.842	1.318
Demand on highway							
Passengers demand variation*	9 753	0%	2%	-40%		-40%	
Freight demand variation*	12 444	0%	1%	-31%		-31%	
Global passenger demand	20 053	20 053	19 969	24 696		24 696	
Global freight demand	25 594	25 594	25 465	30 356		30 356	

	Scenario : Usual tolling scheme + public subsidies	Scenarios : Tolls + transport fund (AFITF) + public subsidies		Scenarios : SMCP	
Public subsidies (€/day)	26 153	1 794			21 676
Central goverment revenues (€/day)	143 055	167 414	169 446	65 041	43 365
Highway operator GOS (€/day)	-6 909	-6 909	-7 036	17 043	17 043
Variation of highway operator GOS*	N.C	0.00%	-1.84%	346.68%	346.68%
Motorway operator GOS (€/day)	78 792	78 792	81 007	47 998	47 998
Variation of motorway operator GOS *	N.C	0.00%	2.81%	-39.08%	-39.08%
Global welfare variation*	-4 176 528	-0.64%	-0.64%	-1.16%	-0.59%
Low income welfare variation*	2 350 616	0.57%	0.57%	1.06%	0.55%
High income welfare variation*	2 396 709	0.56%	0.62%	-0.89%	-1.38%
AFITF subsidies (€/day)		24 356	24 356		24356

** in reference with scenario 1*

** toll per passenger or ton per trip*

A41 project

	Scenario : Usual tolling scheme + public subsidies	**Scenarios : Tolls + transport fund (AFITF) + public subsidies**		**Scenarios : SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 5 Pure SMCP + transport fund + public subsidies	
Toll on motorway**				Peak	Off-peak	Peak	Off-peak
Passenger toll	1.24	1.24	1.30	1.27	0.72	1.27	0.72
Passenger toll variation*	-	0%	5%	3%	-42%	3%	-42%
Freight toll	0.62	0.62	0.65	0.57	0.32	0.57	0.32
Toll freight variation*	-	0%	5%	-8%	-48%	-8%	-48%
Demand on motorway							
Passengers demand variation*	43 947	0.0%	-3%	70%		70%	
Freight demand variation*	22 102	0.0%	-2%	51%		51%	
Toll on highway**							
Passenger toll	-	-	-	2.60	0.73	2.60	0.73
Freight toll	-	-	-	1.184	0.358	1.184	0.358
Demand on highway							
Passengers demand variation*	28 215	0%	3%	-55%		-55%	
Freight demand variation*	14 104	0%	2%	-36%		-36%	
Global passenger demand	72 162	72 162	71 745	87 271		87 271	
Global freight demand	36 206	36 206	35 982	42 432		42 432	

	Scenario : Usual tolling scheme + public subsidies	Scenarios : Tolls + transport fund (AFITF) + public subsidies		Scenarios : SMCP	
Public subsidies (€/day)	43 826	1 898			15 883
Central goverment revenues (€/day)	38 319	80 247	82 111	27 083	11 200
Highway operator GOS (€/day)	-17 315	-17 315	-17 856	4 670	4 670
Variation of highway operator GOS*	N.C	0.00%	-3.13%	126.97%	126.97%
Motorway operator GOS (€/day)	41 069	41 069	43 217	22 414	22 414
Variation of motorway operator GOS *	N.C	0.00%	5.23%	-45.42%	-45.42%
Global welfare variation*	790 573	5.83%	5.87%	7.84%	5.63%
Low income welfare variation*	1 608 794	1.43%	1.42%	2.35%	1.80%
High income welfare variation*	1 632 820	1.41%	1.48%	0.84%	0.31%
AFITF subsidies (€/day)		41 972	41 972		41972

** in reference with scenario 1*

**toll per passenger or ton per trip*

A 45 project

	Scenario : Usual tolling scheme + public subsidies	**Scenarios : Tolls + transport fund (AFITF) + public subsidies**		**Scenarios : SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 4 Pure SMCP + transport fund + public subsidies	
Toll on motorway**				Peak	Off-peak	Peak	Off-peak
Passenger toll	1.78	1.78	1.97	1.20	1.00	1.20	1.00
Passenger toll variation*	-	0%	11%	-33%	-44%	-33%	-44%
Freight toll	0.85	0.85	0.95	0.77	0.68	0.77	0.68
Toll freight variation*	-	0%	11%	-10%	-21%	-10%	-21%
Demand on motorway							
Passengers demand variation*	55 594	0.0%	-6%	99%		99%	
Freight demand variation*	34 314	0.0%	-2%	22%		22%	
Toll on highway**							
Passenger toll	-	-	-	5.34	1.06	5.34	1.06
Freight toll	-	-	-	2.679	0.786	2.679	0.786
Demand on highway							
Passengers demand variation*	206 492	0%	1%	-10%		-10%	
Freight demand variation*	11 352	0%	3%	-23%		-23%	
Global passenger demand	262 086	262 086	261 322	296 622		296 622	
Global freight demand	45 666	45 666	45 272	50 520		50 520	

	Scenario : Usual tolling scheme + public subsidies	Scenarios : Tolls + transport fund (AFITF) + public subsidies		Scenarios : SMCP	
Public subsidies (€/day)	175 562	7 897			-115 694
Central goverment revenues (€/day)	593 293	760 958	769 697	201 038	316 732
Highway operator GOS (€/day)	-115 500	-115 500	-117 099	124 934	124 934
Variation of highway operator GOS*	N.C	0.00%	-1.38%	208.17%	208.17%
Motorway operator GOS (€/day)	93 241	93 241	101 651	76 104	76 104
Variation of motorway operator GOS *	N.C	0.00%	9.02%	-18.38%	-18.38%

Global welfare variation*	23 492 636	0.79%	0.79%	0.74%	1.28%
Low income welfare variation*	15 548 164	0.59%	0.59%	0.67%	1.08%
High income welfare variation*	15 602 710	0.59%	0.62%	0.32%	0.73%
AFITF subsidies (€/day)		169 260	169 260		169260

** in reference with scenario 1*

** per passenger or ton per trip*

A 65 project

	Scenario : Usual tolling scheme + public subsidies	**Scenarios : Tolls + transport fund (AFITF) + public subsidies**		**Scenarios : SMCP**			
	Scenario 1 : Usual tolling scheme + public subsidies	Scenario 2 Usual tolls + transport fund + public subsidies	Scenario 3 Increased tolls + transport fund + public subsidies	Scenario 4 "Pure" SMCP		Scenario 5 Pure SMCP + transport fund + public subsidies	
Toll on motorway**				Peak	Off-peak	Peak	Off-peak
Passenger toll	5.01	5.01	5.41	12.15	1.83	12.15	1.83
Passenger toll variation*	-	0%	8%	143%	-63%	143%	-63%
Freight toll	2.89	2.89	3.12	6.22	1.66	6.22	1.66
Toll freight variation*	-	0%	8%	115%	-42%	115%	-42%
Demand on motorway							
Passengers demand variation*	14 885	0.0%	-4%	73%		73%	
Freight demand variation*	7 482	0.0%	-3%	48%		48%	
Toll on highway**							
Passenger toll	-	-	-	10.35	1.73	10.35	1.73
Freight toll	-	-	-	5.488	1.680	5.488	1.680
Demand on highway							
Passengers demand variation*	17 780	0%	2%	-27%		-27%	
Freight demand variation*	8 944	0%	1%	-19%		-19%	
Global passenger demand	32 665	32 665	32 520	38 640		38 640	
Global freight demand	16 426	16 426	16 343	18 299		18 299	

	Scenario : Usual tolling scheme + public subsidies	Scenarios : Tolls + transport fund (AFITF) + public subsidies		Scenarios : SMCP	
Public subsidies (€/day)	87 154	3 820			-11 336
Central goverment revenues (€/day)	209 240	292 574	296 639	102 169	113 505
Highway operator GOS (€/day)	-10 918	-10 918	-11 169	35 421	35 421
Variation of highway operator GOS*	N.C	0.00%	-2.30%	424.43%	424.43%
Motorway operator GOS (€/day)	87 013	87 013	91 286	66 747	66 747
Variation of motorway operator GOS *	N.C	0.00%	4.91%	-23.29%	-23.29%
Global welfare variation*	3 075 462	2.98%	2.99%	3.97%	4.37%
Low income welfare variation*	5 283 016	0.87%	0.86%	1.43%	1.55%
High income welfare variation*	5 333 919	0.86%	0.90%	0.46%	0.58%
AFITF subsidies (€/day)		83 150	83 150		83150

**with reference to scenario 1*

*** toll per passenger or ton per trip*

Lyon-Turin rail project

	Scenario 1 : current tolling scheme + public subsidies				**Scenario 2 : Increase of toll of 25% + transport fund + public subsidies**				**Scenario 3 : Increase of toll of 80% + transport fund + public subsidies**			
Rail toll	Peak		Off-peak		Peak		Off-peak		Peak		Off-peak	
Passenger toll	77		54		77		54		77		54	
Passenger toll variation*	-		-		-		-		-		-	
Freight toll	40		40		40		40		40		40	
Toll freight variation*	-		-		-		-		-		-	
Demand on rail	Peak		Off-peak		Peak		Off-peak		Peak		Off-peak	
	Low	High	L	H	L	H	L	H	L	H	L	H
Passengers demand variation*	253	515	2 915	5 917	7.9%	10.7%	18%	16.4%	14.5%	25.3%	57.4%	51.0%
	Local	Transit	L	T	L	T	L	T	L	T	L	T
Freight demand variation*	833	208	40 809	10 202	17%	17%	20%	20%	50%	51%	61%	62%
Toll on motorway												
Passenger toll	24				30				42.63			
Freight toll	32				40				57.140			
Demand on motorway	Peak		Off-peak		Peak		Off-peak		Peak		Off-peak	
	Low	High	L	H	L	H	L	H	L	H	L	H
Passengers demand variation*	387	785	4 446	9 027	-5%	-7%	-11%	-13%	-10%	-18%	-34%	-37%
	Local	Transit	L	T	L	T	L	T	L	T	L	T
Freight demand variation*	833	208	40 809	10 202	-12%	-13%	-14%	-15%	-32%	-33%	-37%	-39%
Global passenger demand	24 245				-1%				-1%			
Global freight demand	103 158				3%				13%			

	Scenario 1 : current tolling scheme + public subsidies	Scenario 2 : Increase of toll of 25% + transport fund + public subsidies	Scenario 3 : Increase of toll of 80% + transport fund + public subsidies
Public subsidies (€/day)	1 369 296	1 180 500	1 040 040
Central goverment revenues (€/day)	999 582	1 363 725	1 886 072
Rail operator GOS (€/day)	743 757	880 270	1 166 067
Variation of rail operator GOS*	-	18%	57%
Rail infrastructure manager GOS (€/day)	939 913	1 116 392	1 486 832
Variation of rail infrastructure manager GOS*	-	19%	58%
Motorway operator GOS (€/day)	1 874 674	1 874 674	1 874 674
Variation of motorway operator GOS *	-	0.00%	0.00%
Global welfare variation according to the "initial" welfare	-140 062 608	0.10%	0.2%
Low income welfare variation*	6 316 471	3%	8%
High income welfare variation*	14 305 136	1%	4%
Funding subsidies	0	188 796	329 256

Lyon-Turin rail project

	Scenario 1 : Current tolling scheme + public subsidies				Scenario 4 : Current tolling +national transport fund				Scenario5 : Road toll markups of 25% + national transport fund			
Rail toll	Peak		Off-peak		Peak		Off-peak		Peak		Off-peak	
Passenger toll	77		54		77		54		77		54	
Passenger toll variation*	-		-		-		-		-		-	
Freight toll	40		40		40		40		40		40	
Toll freight variation*	-		-		-		-		-		-	
Demand on rail	Peak		Off-peak		Peak		Off-peak		Peak		Off-peak	
	Low	High	L	H	L	H	L	H	L	H	L	H
Passengers demand variation*	253	515	2 915	5 917	0.0%	0.0%	0%	0.0%	7.9%	10.7%	18%	16.40%
	Local	Transit	L	T	L	T	L	T	L	T	L	T
Freight demand variation*	833	208	40 809	10 202	0.0%	0.0%	0%	0.0%	17%	17%	20%	20%
Toll on motorway												
Passenger toll	24				30				30			
Freight toll	32				40				40			
Demand on motorway	Peak		Off-peak		Peak		Off-peak		Peak		Off-peak	
	Low	High	L	H	L	H	L	H	L	H	L	H
Passengers demand variation*	387	785	4 446	9 027	0%	0%	0%	0%	-5%	-7%	-11%	-13%
	Local	Transit	L	T	L	T	L	T	L	T	L	T
Freight demand variation*	833	208	40 809	10 202	0%	0%	0%	0%	-12%	-13%	-14%	-15%
Global passenger demand	24 245				0%				-1%			
Global freight demand	103 158				0%				3%			

	Scenario 1 : Current tolling scheme + public subsidies	Scenario 4 : Current tolling +national transport fund	Scenario5 : Road toll markups of 25% + national transport fund
Public subsidies (€/day)	1 369 296	0	0
Central goverment revenues (€/day)	999 582	2 368 878	2 544 225
Rail operator GOS (€/day)	743 757	743 757	880 270
Variation of rail operator GOS*	-	0.00%	18.35%
Rail infrastructure manager GOS (€/day)	939 913	939 913	1 116 392
Variation of rail infrastructure manager GOS*	-	0.00%	18.78%
Motorway operator GOS (€/day)	1 874 674	1 874 674	1 874 674
Variation of motorway operator GOS *	-	0.00%	0.00%
Global welfare variation according to the "initial" welfare	-140 062 608	1%	1%
Low income welfare variation*	6 316 471	14.3%	15.8%
High income welfare variation*	14 305 136	4.2%	5.0%
Funding subsidies	0	1 369 296	1 369 296

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