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WORKING PAPERS

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284/2006

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WIFO Working Papers, No. 284
November 2006

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2006/330/W/0

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Abstract

The transport of road goods across the Alps constitutes a problem both for European transportation and for the Alpine environment. Austria and Switzerland have made a number of attempts to decelerate the growth in lorry transit volume and shift transport onto the rail modes. After ten years, such efforts can be deemed to have failed. The envisaged new rail lines across the Alps should procure higher transport capacities and shorter transport times for the railways, but will hold their own against the road only when the transport flow is improved and prices are kept down. Accordingly, it will be virtually impossible for the railways to pay the full cost of transalpine transit links. In Switzerland, much of the financing burden of the rail infrastructure investments is shifted onto road transport. In Austria, the cross-financing permitted under the "Eurovignette" Directive will cover only a small fraction of the actual investment costs of the planned new Brenner tunnel. An ecologically sustainable and economically efficient solution proposed is to set up a quota scheme for Alps-crossing lorries in the form of emission certificates which are to be auctioned and traded.

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1. Introduction

On 12 October 2006, the transport ministers of the EU Member States signed the "Transport" protocol of the Alpine Convention, a step that allows them to take new measures designed to help solve the problems of lorry transit across the Alps.

European transport routes linking north and south are funnelled through very few roads when they cross the Alps. For residents in the valleys traversed by the traffic, the noise and exhaust fumes emitted by the lorries passing through day and night are a screaming nuisance. Road transport impairs not only their health and quality of living, but also hurts tourism, a major source of income for this originally pristine countryside. To add insult to injury, lorry exhaust fumes are considered one of the root causes for the "dying forests", a major threat in the Alpine valleys where the forest serves to protect against avalanches, mudslides and flooding. Local resistance especially to the growing transit traffic (transports loaded and unloaded abroad) took the form of organised road blocks and has forced politicians to think about solutions which, while not impeding the free movement of goods, should nevertheless reduce the environmental burden in the Alps. Switzerland and Austria each went their separate ways to solve this issue. Basically it involves a distribution problem that also occurs in other sensitive areas burdened by excessive traffic load:

The high transport quality and low costs of road haulage encourage international competition and a division of labour – two factors that underpin the material wealth of modern industrial societies. Whereas all of society profits from a high-performance road transport system, the population in the transit regions is excessively burdened by its external costs resulting from air pollution, noise, congestions, accidents, etc. This bias in the distribution of the costs and benefits of road haulage is at the core of the transit problem.

The Alpine countries each developed their own approach to the problem. France retained its liberal transport policy but its relatively high toll fees for the motorways and Alpine tunnels dampened the growth of its road transit. Switzerland switched from a weight limit on lorries to a charge on heavy-duty lorries. Austria struck out for an "ecopoints" scheme, but was in effect forced to give up this type of quotas on transit runs. By looking at the development of transit traffic over the past decades it is possible to assess the extent to which the range of measures were effective. The Alpine Convention opens up a window of opportunity for new tools to solve the transit problem. An estimate is made of the success potential for these and other tools under discussion.

2. Transit traffic – a blessing turned curse

A review of the historic development of today's transit problem will facilitate our understanding of the current situation:

In the days of carts and pack-horses carrying goods across the Alps, transit trade was a vital source of business for the valleys leading up to mountain passes which brought considerable political privileges to its inhabitants. Thus, Emperor Frederick II of the Hohenstaufen dynasty granted the valleys of Schwyz and Unterwalden the privilege of immediacy, i.e. making them immediately subordinate to the Emperor, in order to secure the road across the St. Gotthard pass into Italy which had been completed in 1231. When the Habsburgs attempted to withdraw these privileges, the people rebelled and, in 1291, assembled to swear the oath on the Rütli, thus giving birth to independence and the Swiss confederacy. Tyrolean affluence in the Middle Ages and the privileges accorded to its peasants and burghers were similarly due, at least in part, to the country's gateway function in the transit between Germany and Italy.

The transalpine railways built in the second half of the 19th century negatively affected the business of the carriers located along the transit routes and caused extensive damage to businesses associated with the haulage trade (cartwrights, blacksmiths, innkeepers, peasants). On the other hand, the railway brought tourists into the Alps and generally fostered economic development. Railway administrations

employed locals and the external costs of railways (noise, soot) did not cause any serious problems.

With the advent of motorised vehicles in the 20th century, part of the freight traffic returned to the road, offering, at least initially, new opportunities for businesses along the transit roads. Poor roads and the as yet untried technology of motor vehicles susceptible to break-downs forced drivers to stop over for repairs, filling up, meals, and accommodation. Selling strips of land to accommodate new or enlarged roads and the construction work on such projects were welcome sources of income for the locals up to the 1960s. In addition, better roads encouraged tourism and facilitated the daily drive to the workplace.

But once the transit motorways had been finished in the 1970s, the situation began to change. The employment effect of transit traffic was narrowed down to road maintenance, operating service areas, petrol stations and toll-gates and to local haulage companies to the extent they participated in international transit transports. At the same time, the traffic volume exploded, as did the associated environmental burden: the volume of freight transit on the Brenner motorway grew by 22 percent per year between 1969 and 1977, the phase of its briskest expansion, thus quintupling in just eight years. The environmental impacts, especially the roar of the traffic heard across the entire valley and the increasing symptoms of a "dying forest", caused the locals to rise in protest and was reflected in the people's voting behaviour (e.g. the result of the elections to the Tyrolean diet).

3. Measures and events that impacted on the growth of transalpine freight transit

The following deliberations concern the Alpine passes from the Brenner to Mont Cenis/Fréjus (see Table 1). The transit share of total transalpine goods transports varies considerably: from 87 percent in Austria in 2004 (only the Reschen and Brenner passes are considered, while the other motorway crossing points Tauern, Pyhrn and Semmering were not included, due to a lack of suitable data, although they show problems similar to that at the Brenner pass), to 60 percent in Switzerland (Grand St. Bernard, Simplon, St. Gotthard, San Bernardino) and just 24 percent in France

(Fréjus, Mont Blanc). The remaining traffic consists of national (Switzerland only, transports between the northern Cantons and Tessin) and international transports between neighbouring countries (between Italy and France, Switzerland or Austria). The countries have tried a number of measures to get the volume of road haulage under control. A key factor has always been the position taken by the EU Commission and Council, as the competence for the EU's transport policy rests with them. For a detailed description of the problem and the regulatory process up to 1996 see *Brandt – Schäfer* (1996).

Table 1: Goods transit across the Alps

	Austria				Switzerland				France			
	Road		Rail		Road		Rail		Road		Rail	
	Million tonnes	Share in percent	Million tonnes	Share in percent	Million tonnes	Share in percent	Million tonnes	Share in percent	Million tonnes	Share in percent	Million tonnes	Share in percent
1980	10.6	75	3.6	25	0.3	3	11.2	97	4.0	61	2.6	39
1985	14.4	80	3.7[1])	20	0.8	7	10.5	93	5.7	80	1.4	20
1990	13.8	72	5.3	28	1.7	11	14.4	89	9.7	81	2.3	19
1991	14.8[1])	70	6.3	30	2.0	12	14.4	88	10.0[1])	81	2.3	19
1992	15.7	72	6.2	28	2.2	14	13.9	86	10.3	82	2.2	18
1993	16.5	75	5.5	25	2.5	17	12.6	83	11.0	83	2.3	17
1994	16.0	68	7.7	32	2.9	17	14.1	83	11.3	80	2.9	20
1995	18.3	71	7.4	29	3.3	18	14.8	82	10.7	78	3.1	22
1996	17.7	71	7.3	29	3.5	21	12.9	79	10.3	73	3.8	27
1997	18.7	72	7.2	28	3.5	19	15.1	81	10.4	72	4.1	28
1998	21.5	73	8.0	27	4.0	20	16.2	80	10.8	76	3.4	24
1999	24.0	76	7.7	24	4.3	22	15.7	79	8.1	72	3.2	28
2000	24.1	75	7.9	25	4.7	22	17.1	78	8.2	73	3.1	27
2001	23.8	72	9.4	28	5.6	26	16.3	74	8.2	75	2.7	25
2002	24.9	74	8.6	26	6.1	28	15.8	72	8.2	75	2.7	25
2003	25.9	75	8.7	25	7.6	31	16.9	69	8.3	80	2.1	20
2004	29.2	76	9.4	24	7.5	28	19.7	72	5.8	84	1.1	16
					Average annual change in percent							
1980/2004	+ 4.3		+4.1		+ 14.4		+ 2.4		+ 1.6		– 3.5	
1992/2004	+ 5.3		+3.5		+ 10.8		+ 2.9		– 4.7		– 5.6	

Sources: Dienst für Gesamtverkehrsfragen, Berne. Alpine segment: Mt. Cenis/Fréjus to Brenner. – [1]) Estimated values.

3.1 Austria

The protest against transit traffic started out from Tyrol. Most of the transalpine road haulage in Tyrol is routed across the Brenner pass (96 percent of the transport volume in 2004), the rest across the Reschen pass. The volume across the Brenner pass began to explode in the late 1960s (see Figure 1). The Brenner motorway (Innsbruck–Brenner, a toll road since it was first inaugurated) and the Inn valley motorway (Kufstein–Innsbruck, a mileage-related toll levied from 2004) provided the required road capacities and, at the same time, improved the lorry's competitive position vis-à-vis the rail. By 1972, more freight was moved on the road across the Brenner pass than on rail. International road carriers initially dominated the game since the federal Austrian government kept adapting the quotas for cross-border transport (which at that time was generally subject to a permit) to the growing demand. It was only when the residents along the motorway, plagued by noise and exhaust fumes, began to rebel that political decision-makers started to think anew and took a number of measures:

a) The ban on night driving for noisy lorries (instituted in 1980) and a reduction of speed limits were designed to cut the noise level.

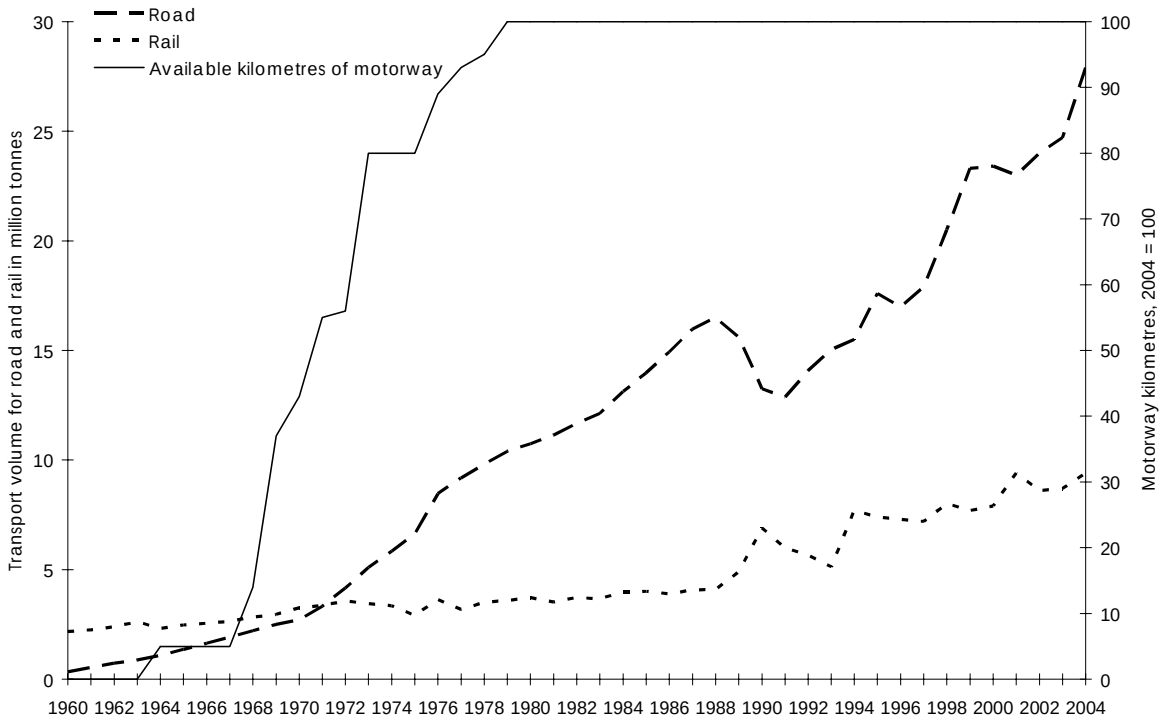
b) Restrictions in quotas granted by the federal Austrian government, together with

c) a steep rise in the toll for the Brenner motorway triggered a decline in the transport volume between 1988 and 1991.

In 1990, transit traffic was obstructed by the temporary closure of the Inn valley motorway when a bridge near Kufstein almost collapsed.

When Austria joined the European Union in 1995, it was faced with a new framework of terms in its transport policy. A salient change was the liberalisation of the cross-border road goods transport with EU member states. In its membership negotiations with the EU, Austria managed to secure a temporary exception for road transit. The "Transit Agreement" concluded in 1992 was included (with a few changes) as Protocol no. 9 in the 1994 Accession Treaty (Federal Law Gazette no. 744/1994).

Figure 1: Transport volume for Brenner transit and length of motorway



Sources: ARE – Bundesamt für Raumentwicklung, BMVIT, WIFO.

The terms of this agreement are:

a) The environmental impact (as measured by NO_X emissions) from the EU lorry fleet employed for road goods transit was to be reduced by 60 percent by 2003. The "ecopoints" system created for this purpose was based on the performance-related NO_X emission by lorries, measured by ecopoints. Under the system, a lorry consumed a number of ecopoints for each transit journey corresponding to its NO_X emissions in grammes per kWh in accordance with the "Conformity of Production" (COP) or type approval value. The ecopoints awarded by the EU Commission to its member states for its road transport operators were reduced every year.

b) Annual EU transit journeys for the entire Austrian territory (i.e. also east-west transits) and their distribution between the EU member states were, essentially,

frozen at the 1991 level up to 2003. The object of this measure was to prevent any increase in transit journeys due to a faster reduction in COP values.

c) Efforts were to be made to develop an adequate rail transit option that could compete with road transit in both qualitative and price terms. In order to encourage shifts from road to rail, the European Union and Austria undertook, in their transit agreement, to increase rail capacities on the Brenner route. National railway companies had to improve their provision of combined transport, and state subsidies for the tariffs were to make the combined transport mode more attractive.

The ecopoints system worked fairly well, although there were problems with counting the transit journeys. However, Austria and the EU Council of Ministers failed to agree on extending the scheme. By the end of 2003, the Council, with the approval of the European Parliament, adopted a transition regulation with virtually no limitations on transit journeys, to apply until the new "Eurovignette" Directive would take effect. This regulation 2327/2003 was not executed in Austria, so that the transit agreement in fact expired by the end of 2003.

Were the measures of the transit agreement successful?

a) According to statistical figures on the ecopoints system, the number of ecopoints-requiring road transit journeys from EU member states through Austrian territory as of 1999 consistently exceeded the specified upper limits. Even the allowed margin of 8 percent was exceeded. In contrast, in some countries available ecopoints themselves were never fully consumed because the lorry fleet used for transit had, on average, much lower NO_X values than the maximum provided for in the transit agreement (see Table 2). In determining the number of available ecopoints, the feasibility and opportunity for technical improvements in the stock of vehicles had thus been underestimated.

b) Technologies available to reduce emissions were not fully utilised. To give but one example: according to the ecopoints figures collected by the Federal Ministry of Transport, Innovation and Technology (BMVIT), lorries from Greece in 1996 consumed almost double the number of ecopoints per journey than did lorries

from Luxembourg. In that year, the average number of ecopoints consumed by the fleet from Luxembourg per journey already corresponded to the value required to fully exhaust the maximum number of transit journeys for 1999. Similarly, the Austrian and German fleets had achieved the averages proposed for 2003 already in 2000. The ecopoints system thus failed to achieve its desired effect of putting the most "environmentally friendly" state-of-the-technology lorries on the roads through sensitive regions. Carriers which could draw on sufficient ecopoints quotas were able to go on using obsolete high-emission lorries that put an undue burden on the environment. The (relatively) "most environmentally friendly" fleets were deployed by carriers in Austria, Denmark and Germany (see Table 3).

c) The rail service was actually improved by investments. The new Innsbruck loop line made for a significant increase in the rail capacity on the Brenner route. Generally, sufficient capacity was available for combined transport modes. The "piggy-back" transport scheme was underutilised and was temporarily discontinued on the Munich-Brenner route.

Table 2: Transit journeys through Austria and ecopoints consumption by EU countries

	Transit journeys			Ecopoints		
	Made	Upper limit (base journeys)	More (+) Less (–)	Spent	Available	Not used (–)
			In percent			In percent
1993	1,116,566	1,475,100	– 24.3	14,502,075	20,486,484	– 29.2
1994	1,244,156	1,475,100	– 15.7	14,731,275	18,528,731	– 20.5
1995	1,440,714	1,490,900	– 3.4	15,576,061	16,889,810	– 7.8
1996	1,482,495	1,490,900	– 0.6	14,036,259	15,311,543	– 8.3
1997	1,509,543	1,490,900	+ 1.3	13,114,506	13,921,726	– 5.8
1998	1,425,919	1,490,900	– 4.4	10,613,062	12,908,809	– 17.8
1999	1,707,218	1,490,900	+ 14.5	11,873,522	12,225,678	– 2.9
2000	1,696,949	1,490,900	+ 13.8	11,180,547	11,730,998	– 4.7
2001	1,640,599	1,490,900	+ 10.0	10,279,860	11,424,767	– 10.0
2002	1,723,174	1,490,900	+ 15.6	9,969,494	10,553,187	– 5.5
2003	1,648,847	1,490,900	+ 10.6	8,871,617	9,422,488	– 5.8

Sources: BMVIT.

Table 3: Transit journeys and ecopoints consumption, by countries, 1993 and 2003

	Journeys requiring ecopoints				Ecopoints		Points per journey	
	1993		2003		1993	2003	1993	2003
Lorry coming from	In 1,000	Shares in percent	In 1,000	Shares in percent	In 1,000	In 1,000		
Italy	435	39.0	586	35.5	5,776	3,161	13.3	5.4
Germany	380	34.0	564	34.2	4,822	2,918	12.7	5.2
Austria	133	11.9	224	13.6	1,634	1,150	12.3	5.1
Netherlands	63	5.7	120	7.3	821	715	13.0	5.9
Greece	17	1.5	52	3.2	266	362	15.6	6.9
Belgium	15	1.4	41	2.5	213	229	13.8	5.6
Denmark	26	2.3	38	2.3	351	195	13.4	5.1
Other EU 15	47	4.2	23	1.4	621	142	13.3	6.0
EU 15 total	1,117	100.0	1,649	100.0	14,502	8,872	13.0	5.4

Sources: BMVIT.

While the terms of the transit agreement were mostly complied with, at least in formal terms, it was less successful with regard to its underlying intentions. At the core of the transit problem was the growing environmental impacts caused by the explosive growth of heavy lorry traffic on the Brenner motorway. Although improvements in the automotive technology have reduced the noise and pollutant emission of lorries, their sheer volume has increased, in spite of a ceiling applied on the overall transit through Austria. During the decade the transit agreement was valid, the road transit volume across the Brenner pass rose by 57 percent, compared to just 32 percent in the previous decade.

Several factors caused the rise in the lorry transit volume across the Brenner route:

a) The ecopoints system was not linked to routes. As ecopoints were valid for all of Austria's territory, carriers could spend their quota on those routes that promised the greatest profits. When a haulage contract from Germany to Italy was more profitable than one for Germany to Hungary, German and Austrian operators tended to prefer the Brenner route. The system thus failed to preclude any further growth of transit traffic through sensitive Alpine valleys. Some 70 percent of the

ecopoints-consuming transport was routed across the Brenner pass, which additionally bore the brunt of the bypass traffic: according to *Köll*, 30% of the lorries in 2004 would have faced a shorter route if they had driven through Switzerland rather than across the Brenner pass (*Amt der Tiroler Landesregierung*, 2006).

b) European carriers had a large number of CEMT permits at their disposal for transit journeys through Austria. These long-term permits for cross-border road haulage, including cross-trade road transport, are issued by the European Conference of Ministers of Transport (Conférence Européenne des Ministres des Transports CEMT). Journeys under a CEMT permit were not subject to ecopoints and were used to overcome bottlenecks in transit transport.

c) Performance-specific pollutant emissions by lorries on the Brenner route declined, but total emissions did not. This was bound to have happened even without the ecopoints system, since the fleet used for long-distance haulage across mountain passes tends to be of the best performing and reliable type, i.e. the vehicles are new and thus necessarily have the lowest emission values. But total emissions remain unchanged, due to the growth of transit traffic.

d) Road fees had to be harmonised with EU requirements, which were biased in favour of lorry transit across the Brenner pass. Upon the country's accession to the EU, the road user lump sum fee, introduced by Austria for domestic and foreign lorries as early as in 1978, had to be reduced in stages from an annual lump sum of € 6,279 per 40-tonnes gross weight to € 1,214 by 1997, in order to comply with the "Eurovignette" Directive. This fee did not cover the use of transalpine motorways like the Brenner motorway. At the same time, the toll for this motorway was raised substantially. In 1988, a single lorry ticket (from a 100-tickets carnet for a low-noise four-axle lorry) cost € 30, compared to € 70 during the day and € 140 by night (10 pm to 5 am) in 1996. A non-Austrian transit carrier running 200 transits a year (half of which by night) between Kufstein and the Brenner pass thus had to pay € 12,279 in Austrian fees and tolls in 1995, an amount that rose to € 22,214 (+82 percent) in 1997. Pressured by the EU (in 1998 the Commission filed a complaint with the European Court of Justice), Austria cut its special tolls to € 49.40 by 2004 (double for a night journey). The time-based road fee for using

the Austrian network of motorways (with the exception of the transalpine motorways) was replaced by a route-based toll in 2004. In our example of 200 transit journeys for a four-axle lorry, this change reduced the costs to € 18,900 (–15 percent).

e) Ecopoints holders could as a rule enjoy quota rents. In the past few years, the maximum possible number of transit journeys allowed under the ecopoints scheme was usually exhausted (see Table 2). Road transport capacities available for transit haulage may well have run short, in which case carriers were able to raise their transport prices and thus profit from the supply shortage. From an economic point of view, it would be wise to award ecopoints by competitive criteria and thereby ensure that the scarce transport resources are efficiently used. However, ecopoints were awarded in a formalised procedure in most countries. Priority was given to carriers which had already performed regular transit haulage journeys in the past ("grandfather rights"). In this way, the market was dominated by "established" carriers, thus effectively precluding access for new operators.

3.2 Switzerland

The shortest road link between the economic centres at the Rhine and in Upper Italy is across Switzerland. Fully 83 percent of the road transit in Switzerland goes through the St. Gotthard tunnel which was completed in 1980. Switzerland did not impose any quotas on cross-border road haulage, but (up to 2000) limited the legally permissible maximum weight of lorries to 28 tonnes. For a carrier, lower load capacity translates into a productivity loss: In a lorry limited to a gross vehicle weight of 28 tonnes, 14 tonnes are taken by the vehicle, which leaves just 14 tonnes for the cargo, compared to 26 tonnes in a 40-tonne gross weight EU lorry, translating into a productivity differential of 85 percent. The costs of wages, capital and services are (mostly) independent from the weight of the cargo, and only the fuel costs will increase with the weight of the cargo. The relatively high lorry transport costs due to the low gross vehicle weight ensured that the railway enjoyed a competitive advantage in Switzerland.

Faced with this weight limit, 90 percent of the lorry transit flow bypassed Switzerland and was shunted to Austria or France, according to *Hanreich* (1990). In 1989, in terms of transport volume, only 7.1 percent of the transalpine road haulage transit passed through Switzerland. But for the crux of the transit problem, i.e. noise and pollution, it is the number of lorry journeys that is decisive: as a result of the low cargo weights and more frequent empty journeys, the Swiss share of transalpine journeys amounted to more than 18 percent in 1989. The burden suffered by the population along the Brenner route was almost six times that of Switzerland in terms of transport volume, but only double in terms of the number of lorry journeys.

Transport policy in Switzerland was aimed at shifting the growth in transalpine transport from road to rail by improving rail capacity and limiting the legally permissible maximum weight of lorries to 28 tonnes. To this end, Switzerland is building new railways across the Alps. Its 28 tonnes limit did not comply with the EU's transport policy which called for a gross vehicle weight of at least 40 tonnes in all of Europe. In 1999, the EU signed an "Agreement on the Goods and Passenger Transport on Rail and Road" with Switzerland ("Landverkehrsabkommen", SR: 0.740.72) which gives consideration to both environmental protection and an efficient transport system, especially in the Alpine region:

a) The Agreement provides for harmonising the weight limit for lorries to the level applicable in the EU. Switzerland increased the maximum weight to 34 tonnes in 2001 and to 40 tonnes in 2005. In the intervening years, the quotas for 40 tonnes lorries were constantly increased. In parallel with raising the weight limit, the country raised its "Leistungsabhängige Schwerverkehrsabgabe" (performance-dependent heavy traffic charge LSVA). Replacing the former lump-sum charge (PSVA) on 1 January 2001, the LSVA is levied on all Swiss roads from all road users, whether Swiss or foreigners. The levy is due for vehicles for passenger and goods transport with a legally permissible maximum weight in excess of 3.5 tonnes. For passenger vehicles (busses), the levy is charged as a lump-sum, whereas for freight transport vehicles it is performance-based. The LSVA is computed by the total weight of the lorry or road train as stated in the documents and the kilometres driven on Swiss territory. It comes in three categories in line with EU emission standards.

Upon introduction of the LSVA, road use by lorries has become substantially more expensive. For a transit run by a 28-tonne lorry, the PSVA amounted to € 17.50; since 1 January 2001, the same type of lorry of EURO category II has been charged € 83.50 for a journey between Basle and Chiasso. A 40-tonne lorry of EURO category II now pays € 195. By 2008, the journey will cost € 231, which comes at € 0.77 per kilometre. This corresponds to the usual freight rates in international long-distance haulage: once the LSVA is fully effective, it will thus double the cost of road haulage.

This cost increase from the new LSVA is, however, to some extent offset by productivity gains and thus cost savings achieved from the higher gross vehicle weight. When comparing a 28-tonne and a 40-tonne lorry, according to *Balmer* (2003), the additional cost of the LSVA (+19 percent) is virtually offset by the decline in fixed cost obtained from the bigger cargo (–18 percent), assuming that the shipping weight is fully utilised.

Table 4. Transalpine goods traffic in Switzerland

	Heavy goods vehicles	Goods transported	Average lorry load	Road transport as a share of overall transport
	In 1,000	Million tonnes	In tonnes	In percent
1981	312	1.6	5.1	10
1990	731	4.2	5.7	19
2000	1,404	8.9	6.3	30
2001	1,371	10.4	7.6	33
2002	1,250	10.6	8.5	35
2003	1,292	11.6	9.0	36
2004	1,255	12.5	10.0	35
2005	1,204	12.9	10.7	35

Sources: ARE – Bundesamt für Raumentwicklung.

The LSVA already impacts on traffic development. Figures on transalpine transport are provided by the Federal Office for Regional Planning for the years up to 2005: between 2000 and 2004, annual lorry traffic across the Swiss Alps (national and international transports) declined by 14 percent (a reduction by 200,000 journeys), while the freight volume transported on roads across the Swiss Alps increased by

24 percent – the result of higher average cargos (+69 percent) due to the new weight limit (see Table 4).

b) The infrastructure for rail transit is to be fundamentally improved. A key measure is the cross-financing by the road of investments in rail infrastructure. Switzerland completes the NEAT project (New Rail Alps Transit) to improve the railway infrastructure. The Lötschberg line will be ready for service in 2007, the St. Gotthard line in 2015. The new transalpine lines should help to fulfil the objective of transfer traffic from road to rail.

3.3 France

The shortest transit route between north-western Europe (UK, Belgium and the Netherlands) and Italy cuts across the French network of motorways. The two Alpine tunnels (Mont Blanc, opened in 1965, and Fréjus, opened in 1980) have shortened the distance to the industrial regions in northern Italy. Only 25 percent of the lorry traffic across the French Alps serves transit purposes; with 75 percent covering trade between France and Italy. But for the residents of the Alpine valleys crossed by the motorways the distinction between international transit and transports between France and Italy is rather irrelevant. They have risen in protest against the growth of lorry traffic and there has been the occasional road block.

France never imposed any special restrictions on transit traffic. Nevertheless, a motorway levy charged since the 1950s and the relatively high tunnel toll substantially increased total transit costs. The tunnel toll can be avoided by taking the Nice road. For as long as the German motorways could be used toll-free, there was an incentive to bypass France and take the Swiss (unloaded journeys) or Austrian passes.

The fire in the Mont Blanc Tunnel in 1999 led to major changes in the Alpine transit. The tunnel was closed for three years, and most of the traffic could be handled by the Fréjus tunnel, but the volume of transit transport across the French Alps declined by a quarter and has not yet recovered even after the tunnel was reopened.

3.4 Summary assessment of the attempts made up to now

A comparison of the effects of different transport policy regimes on the development of freight transit across the Alps gets remarkable results:

a) In spite of imposing what appeared to be the most severe restrictions, Switzerland recorded the highest growth rates in road freight transit between 1980 and 2000, with the road taking away the largest market share from the rail. This trend even accelerated once the weight limit was increased in 2001. In 2004, capacity bottlenecks on the Gotthard route made inroads on the road's share.

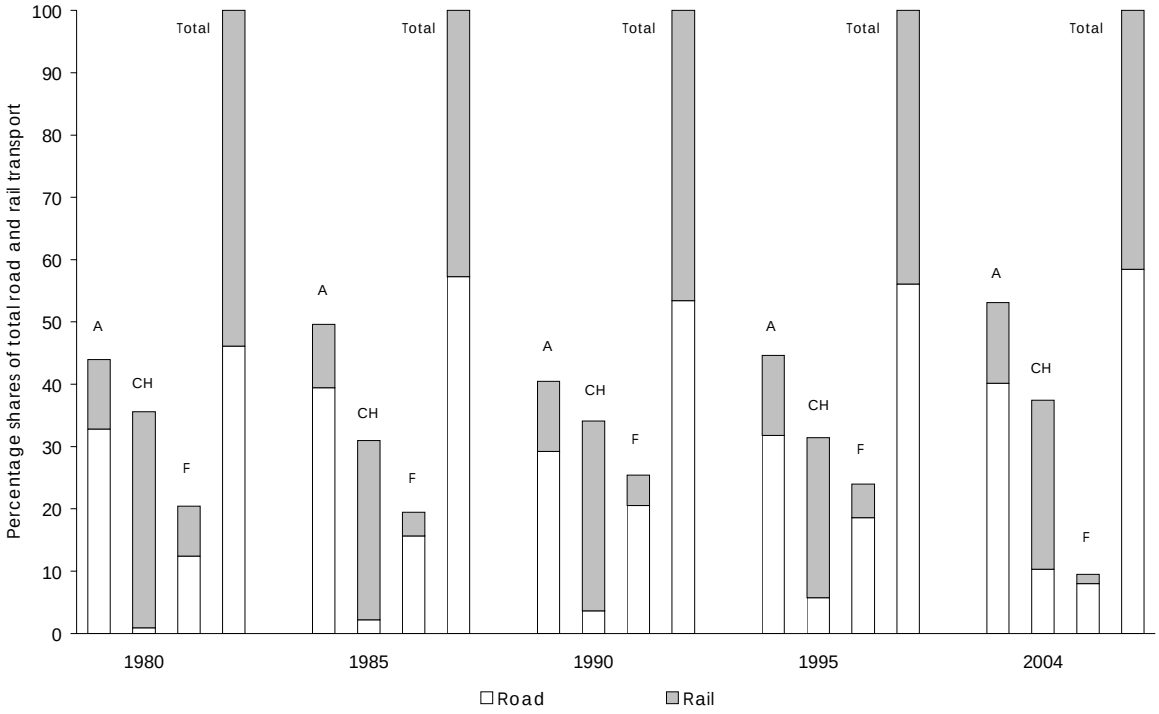
b) In Austria, road transit gained market shares due to a liberal international transport quota policy up to 1986. By reducing quotas, increasing the Brenner motorway toll charges and imposing bans on night drives, transports shifted to the rail. But from 1994 on, the rail once again lost out against the road, in spite of the ecopoints regime.

c) In France, under a liberal road transport policy regime but high tolls, transalpine rail transit declined sharply up to 1986, only to grow briskly again from the mid 1990s on, although the rail failed to profit from the closure of the Mont Blanc road tunnel (24 March 1999 to 8 March 2002). In recent years, its loss of market share has been accelerating.

d) The shifts in overall transalpine transit transports are remarkable: in 1980, 44 percent of the transit traffic went through Austria, 36 percent through Switzerland and 20 percent through France (see Figure 2). By 2004, the ratio was 53 : 37 : 10. In 1980, Austrian roads took 33 percent of the overall Alpine rail and road transit, compared to 1 percent for Swiss and 12 percent for French roads. By 2004, the share of the Austrian roads increased to 40 percent, to 10 percent of the Swiss roads and the share of French roads decreased to 8 percent. The share of road transport in overall Alpine transit increased from 46 percent in 1980 to 59 percent in 2004.

Summarising it can be said that the measures taken so far by Austria and Switzerland have had no effect in achieving the goal of shifting transit traffic from the road to the rail.

Figure 2: Shares in goods transit across the Alps



Sources: Dienst für Gesamtverkehrsfragen, Berne. Alpine segment: Mt. Cenis/Fréjus to Brenner.

4. Proposals for solving the transit problem

The approaches attempted in Austria and Switzerland have so far failed to solve the transit problem. Transport policy and citizens initiatives developed several instruments that aim to stop road transit from growing.

4.1 Sectoral transport bans

As shown by the transport statistics compiled by the *Kraftfahr-Bundesamt* (1988), much "classical" railway freight crosses the Alps by road. In transports from Germany to Italy in 1989, plastics, chemical products, scrap iron and steel, pulp, paper, paperboard, iron and steel goods and basic chemicals together made up 37 percent; in lorries running from Italy to Germany 36 percent of the load consisted of iron and steel products, mineral products, ceramics, rocks, plastics, chemical

products, pulp, paper and paperboard. Citizens initiatives in the Alpine countries call for a sectoral transport ban (e.g. the "Tyrolean transit statement") to return "rail goods" back to the rail, in this way hoping to achieve a reduction of the road transit by more than a third. Such a measure, however, eliminates the free choice of the means of transport, a key principle in the EU's transport policy. Austria wanted to employ this tool already in the summer of 1990, when the motorway bridge near Kufstein was blocked due to construction damage and caused large-scale road congestion. An ordinance was drafted by the federal ministry to ban the transport of PVC sheeting, peat, rubber, scrap steel, fertilisers, leather, timber, sawdust, etc. on the Inn valley motorway except when the railway confirmed to the shipper that it could not handle the transport. Ultimately, however, the ordinance came to nothing.

A new attempt to relieve the Brenner route was made in 2003. On 27 May, the governor of Tyrol issued an ordinance banning the transport, on a section of the Inn valley motorway, of specified goods by lorries with a gross vehicle weight in excess of 7.5 tonnes. The European Commission immediately instituted proceedings for violation of the treaty. The European Court of Justice declared the ban to be against European law and it thus had to be annulled.

What are the chances to succeed in specifying the mode of transport for specific goods by law?

With the exception of hazardous cargo, the lorry's emissions of pollutants and noise are not affected by the type of goods transported. The decisive factor is the number of journeys and the emissions released. A goods-specific transport ban will initially prevent certain journeys. Freighters will then try to fill their empty capacities with other transports. This could shift "higher-quality" goods from rail to road, so that the desired ecological effect will not come about. Efforts by the state to regulate the distribution of goods among modes of transport is also problematic from an economic point of view. Rather than any dirigistic interference, it should be competition that achieves the best possible utilisation of scarce means of transport. This, however, requires the state to restrict the number of journeys and create markets for the utilisation of scarce resources which generate the corresponding price signals.

4.2 High toll charges in sensitive zones

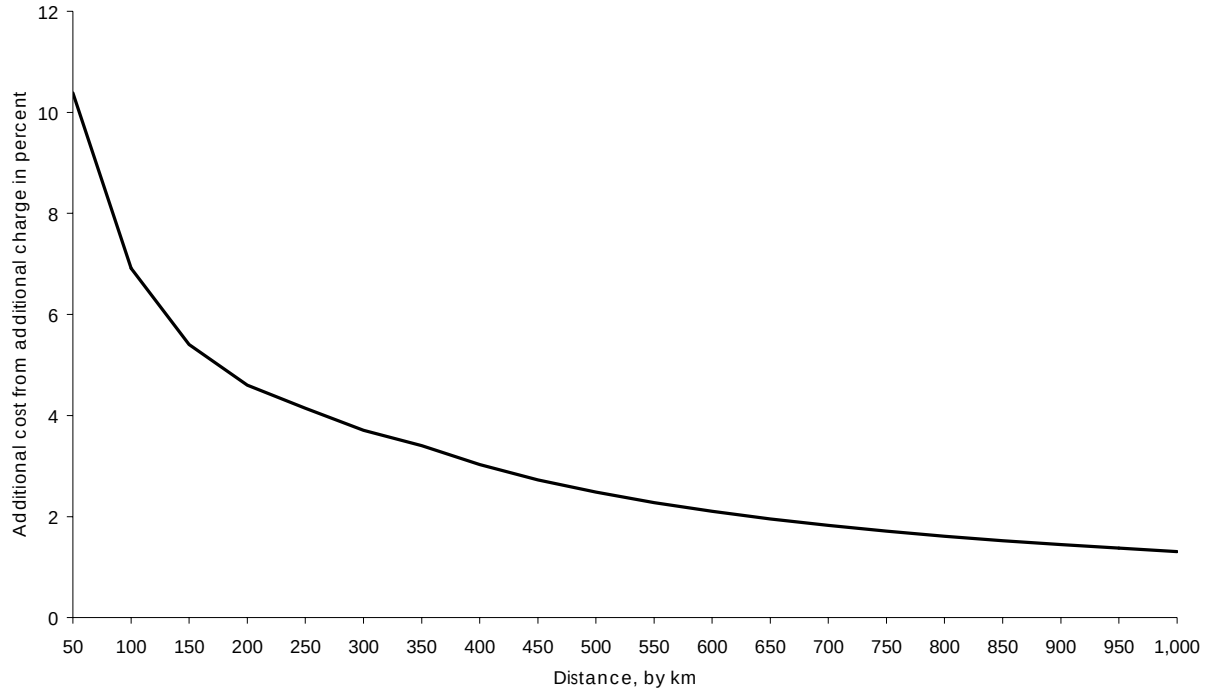
In the European Union, road charges for lorries are regulated by the "Eurovignette" Directive, which implements principles of the EU's transport policy aiming to achieve fair competition in road haulage and the smooth working of international goods transport. User charges (tolls) to pay for the infrastructure must not discriminate non-resident freighters and must reflect actual costs. By setting maximum rates for the time-dependent lump-sum charges and providing ground rules for determining mileage-dependent tolls, the Directive aims to prevent the creation of fiscal barriers to trade.

The Directive allows for differentiating toll charges by vehicle emission categories and by the time of the day, in order to counteract the transport-related emissions, nuisance noise at night and congestion during peak hours. The recommendations set out in the white paper on "Fair Payment for Infrastructure Use" (*European Commission*, 1998), which aim to internalise external costs, are not fully embodied in the Directive. Nevertheless, surcharges are permitted to road use fees in sensitive regions (generally up to 15 percent, and up to 25 percent in mountainous regions) in order to finance an infrastructure that offers a more environmentally friendly alternative. Such a financial compensation scheme between transport modes is intended to close financing gaps for railway investments in sensitive regions. The new Directive accepts the level of the existing Brenner toll, against which the Commission had filed a suit with the European Court of Justice.

The recently signed transport protocol of the Alpine Convention (*Ständiges Sekretariat*, 2002) aims to establish the "true costs" principle: by including the external cost in traffic-specific levies transport across the Alps is to be made more environmentally friendly. Yet this raises the question of how to calculate these external costs, a problem that has made for a ream of new literature (*T&E*, 1993, *Willeke*, 1996, *Wissenschaftlicher Beirat beim Bundesminister für Verkehr, Bau- und Wohnungswesen*, 1999). Particularly, the local as well as global costs of noise and pollutant emissions can be estimated only on the basis of rather arbitrary assumptions. In determining the "true costs" of transit traffic, we face a serious problem:

A premium on the toll charged in sensitive regions provides for a fixed cost element across the entire distance travelled. The relative burden it imposes on overall transport costs which are the greater the shorter the distance travelled and the lower the higher the value of the goods transported. The Brenner toll serves as an example to demonstrate the effect:

Figure 3: Additional cost for road transport across the Brenner pass from an additional charge, by staggered rates and distances, based on 2004 figures



Sources: WIFO calculations.

If we assume an additional charge of 25 percent for the Brenner toll fee, the additional costs accruing for a vehicle of four or more axles under the current toll fees is € 12.35 (€ 24.70 at night). The additional charge makes up fixed costs to transalpine journeys. The decline in the fixed costs would have to be considered: The additional charge (see Figure 3) increases the transport costs across the Brenner motorway by:

10.4 percent over a distance of 50 km (assumed shipping rate of € 1.40 per kilometre travelled);

6.9 percent over a distance of 100 km (shipping rate of € 1.30);

4.6 percent over a distance of 200 km (shipping rate of € 1.10); and

1.3 percent over a distance of 1,000 km (shipping rate of € 0.90).

The decline in fixed costs is very pronounced over the first 250 km.

The degree to which an additional charge increases international trade flows, through the cost of obtaining intermediate products and the sale of final products in adjoining regions, and thus is detrimental to a business located in such a region, depends on:

a) the length of the distance across which goods are transported;

b) the value of the goods transported; and

c) the degree to which the freighter utilises its load capacity.

Table 5 compares additional costs accruing when goods are transported across the Brenner motorway. The additional charge as a share of the cif value is just 6.2‰ across a distance of 50 km, and 5.2‰ across a distance in excess of 500 km, even for goods of a very low unit value such as tiles. For goods of a high unit value (communications equipment, apparel), the special surcharge increases the cif value by about 0.04‰.

Even though the additional charge would make road haulage more expensive (as is allowed under the new Directive), it would do very little to improve the rail's competitive position in terms of transports through sensitive regions. It should also be noted that the relative cost burden on road haulage will decrease over distance: the price increase in transit traffic, which usually involves long distances, is less steep than that on domestic, import and export traffic. According to the survey made at the Brenner toll gate in 1999 (*Kriebernegg*, 2003), the average distance for domestic transports on the Brenner motorway was 96 km, compared to almost 1,140 km for

transit traffic (see Table 6). An additional charge would increase the cost of average domestic transports across the Brenner motorway by 6.9 percent, as against 1.2 percent for transits.

Table 5: Transport costs and additional charge as a ratio of the value of the lorry load, based on 2004 figures

Transports across the Brenner motorway

	Fob value[1]) per tonnes	Load weight	Fob value per load	Cif value per load			Additional charge[2]) as a share of cif value		
				50 km[3])	200 km[4])	500 km[5])	50 km	200 km	500 km
	In €	In tonnes	In €	In €			In ‰		
Tiles	75	25	1,875	2,007	2,157	2,385	6.18	5.75	5.20
Logs	300	22	6,600	6,732	6,882	7,110	1.84	1.80	1.74
Printing paper	800	25	20,000	20,132	20,282	20,510	0.62	0.61	0.60
Non-alcoholic beverages	810	23	18,630	18,762	18,912	19,140	0.66	0.66	0.65
Beef	2,500	20	50,000	50,132	50,282	50,510	0.25	0.25	0.25
Motor vehicle parts	8,721	24	209,304	209,436	209,586	209,814	0.06	0.06	0.06
Communications equipment	36,800	8	294,400	294,532	294,682	294,910	0.04	0.04	0.04
Apparel	38,400	8	307,200	307,332	307,482	307,710	0.04	0.04	0.04

Sources: WIFO calculations. – [1]) Unit Values Export 2002 as per Statistik Austria. – [2]) € 12.4. – [3]) € 2.64 per km. – [4]) € 1.41 per km. – [5]) € 1.02 per km.

Table 6: Average travel distances and additional freight cost on the Brenner route caused by an additional charge, by type of transport, 1999

	Domestic transport		Import and export transport		Transit	
	In km	Additional cost in percent	In km	Additional cost in percent	In km	Additional cost in percent
Brenner motorway	96	+ 6.9	451	+ 2.7	1,139	+ 1.2

Sources: *Kriebernegg* (2003), WIFO calculations.

The comparison shows that the additional charge would have relatively little impact on transit traffic, whereas the average burden would more than double for imports and exports of businesses in Tyrol. The cost would increase most for goods traffic

within the "sensitive" regions. For short transport distances, rail is not much of an alternative for the road. Apart from full train load transports, the lorry is so much superior to the rail for transports over less than 300 km in terms of both costs and time input that transports generally will not be shifted to the rail regardless of how expensive the road mode may become.

4.3 No more new high-priority roads

The Transport Protocol bans the building of new motorways across the Alps. Any upgrading of existing roads will require a strict assessment of their utility, environmental compatibility and risks. It can thus be safely assumed that these strictures will make it very difficult in the future to implement road upgrading projects that aim to add new capacity. If the traffic volume continues to grow, the transit roads should thus become ever more congested for ever longer periods. However, in a mirror situation to the toll fees, it will be local, source and destination transport rather than transit transport that will be hardest hit by the congestion costs. Thus, a transit lorry on a ten-hour run getting stuck on the Inn valley motorway for one hour will have its total road time increased by just 10 percent, whereas the rise is 200 percent for a local run of half an hour. Even though such a situation will force much of the growth in the transit traffic onto the rail, the residents of the transit regions will still be left with greater congestion costs and a higher environmental burden.

4.4 Better railway infrastructure

Transit transports typically are long-distance transports, a mode that offers the best opportunity for the rail to stand up against the road. Transport policy in Austria and, especially, in Switzerland hopes to achieve a shift from road to rail transport through expanding its transalpine rail links. Certainly, the old railway lines, dating as they are from the 19th century, still offer considerable capacity. Railways have problems not so much in their infrastructure but rather in their handling of international transports. By opening the rail networks and tapping the competitive effects, and by setting European-wide rail engineering standards, the EU hopes to achieve considerable

improvements. The new rail lines and their base tunnels will provide not just a multiplication of capacity but also savings in time and lower traction costs.

In a treaty with the EC entered in 1992, Switzerland undertakes to build new transalpine links known as NEAT ("Neue Eisenbahn-Alpentransversale"). The NEAT concept foresees construction costs of € 10.3 billion (at 1998 prices) and the extension of the Gotthard link (€ 5.4 billion) and Lötschberg-Simplon link (€ 2.3 billion) as an overall system plus an improved connection between eastern Switzerland and the Gotthard link (*Testoni*, 2003). This commitment was confirmed in the Landverkehrsabkommen of 1999.

Originally, NEAT was to be financed by interest-bearing redeemable loans, but this scheme would have exceeded the financial capacity of the state and railways. In 1998, a constitutional provision was adopted by referendum according to which the projects are to be financed through a public traffic infrastructure financing fund ("FINÖV") which is fed from revenues from the heavy goods traffic charge, the surcharge for quotas, a share of the mineral oil tax and a one-thousand part of the VAT revenues (Reglement des Fonds für Eisenbahngroßprojekte 1998, SR: 742.140). During the start-up phase, shortages are covered by federal advances which will be repaid at a later date. In recent years, ongoing railway investments could be cross-financed from LSVA revenues at a rate of some 40 percent.

The fund finances not just NEAT but also general projects to rehabilitate the railway infrastructure in Switzerland ("Bahn 2000", link to the European network, noise control measures).

While Switzerland has progressed considerably in its work to set up transalpine rail links, Austria is still at the beginning. The Austrian General Transport Plan (*GVP-Ö; BMVIT*, 2002) provides for large-scale works to improve the capacity of the Brenner railway route. Under the new "Eurovignette" Directive, the Brenner toll for heavy goods vehicles could be raised to 25 percent above actual road use costs including the cost of accidents not covered by car insurance, in order to cross-finance construction of the base tunnel. Relating the financial requirements for railway construction to the annual revenues to be obtained from such a toll surcharge, we get an idea of the yield to be achieved from such cross-financing: starting out from

the toll revenues for vehicles of a maximum permissible weight in excess of 3.5 tonnes, the annual surcharge would make some € 26 million available for investment (*Puwein*, 2004). The cost of the Brenner tunnel was estimated at € 5.4 billion in 2005, to be constructed in 2007-2015 (*European Communities*, 2005). Accordingly, the toll surcharge would cover only 3.9 percent of the average annual investment cost during the construction phase. It should be noted that this static view does not account for rises in construction costs and the growth in lorry traffic volume.

The railways will contribute their share to the cost of the new infrastructure by paying for the use of the routes. But first of all, tax payers need to finance the investment costs through the public financing bodies involved. The base tunnel is a priority TEN project and is co-financed by the EU. Current plans provide for Austria and Italy to contribute 40 percent each and the EU to pay the remaining 20 percent of the construction costs. Is this distribution fair and just?

Improved traffic links promote supra-regional trade and stimulate the economic growth – reasons enough for the state to finance infrastructure investment from tax revenues. The Brenner route is used for transports between Italy and its Mediterranean ports on the one side and the rest of Europe, from Munich to Bremen in the west and from Salzburg to Gdansk in the east, including Scandinavia. Throughout this region, businesses and railways will profit from the Brenner tunnel – albeit to varying extents: the nearer to the Brenner the higher will be the profit.

How are the investment costs to be shared among the regions? We can draw upon a historic model: the railway link across the Gotthard. Next to the Swiss themselves, it was mostly regions in Germany and Italy that were eager to construct the line in the 1860s (*Kuoni*, 1995). In 1869, interested parties met for an international conference organised to solve the financing issue. Participants agreed that of the total cost of 187 million Swiss francs, 45 million was to be provided by Italy and 20 million each by Germany and Switzerland. This sum was raised by the regional administrations of the day (duchies, counties, cantons and cities) as well as private railway companies. The remaining 102 million francs were raised by shares and bonds, most of which were subsequently sold abroad and yielded dividends of, on average, more than 6 percent.

Nowadays it is unlikely that the new transalpine links will repeat the financial success of the Gotthard railway. The Brenner tunnel will need to be financed chiefly from public sources. The vented burden-sharing ratio of 40 percent each from Italy and Austria and 20 percent from the EU in no way reflects the benefit-sharing ratio. To get an idea of a "fairer" sharing of the cost among the "beneficiaries" of the tunnels (countries and railways), we might look at the regional origin of the goods currently carted across the Brenner pass by rail and road.

4.5 Environmental licences

Environmental licences are rights to emit a given quantity of pollutants. Already in the 1980s, such licences began to be issued and traded in the US. In the course of the Kyoto process, the trade in CO_2 emission rights for industries and energy production was introduced at a global scale. Traffic is excluded from quotas and trading. Nevertheless, tradable quotas could offer solutions for road traffic that reduce the environmental burden and at the same time make for more efficient use of resources. A case in point is the licences for operating passenger cars in Singapore which are auctioned off monthly (*Miyamoto*, 2004).

Already back in 1989, WIFO developed a proposal (*Puwein*, 1989) for solving the transit problem by way of environmental licences. On 14 November 2005, the selfsame system was proposed at the Conference of Transport Ministers from Alpine Countries by the Swiss transport minister Leuenberger (*NZZ Online*, 2005). WIFO had proposed as follows:

a) For certain transit routes and times, a number of lorry journeys, including empty journeys and own account transports, is determined with due regard to ecological factors, road capacity and what can be reasonably accepted to be borne by the locals. In order to determine what can be "reasonably accepted", objective criteria, i.e. measuring of the noise level and air-borne pollution, road capacity utilisation, should be used. Advances in transport and environmental technologies will increase the number of possible journeys with quantified environmental burdens remaining the same. A scheme to issue transit permits by units of pollution and noise emission (emission certificates) could accelerate the introduction of technologies that lead to more environmentally friendly vehicles.

Nevertheless, the decision-making process also needs to address subjective factors to be obtained by giving the locals a hearing. It is necessary to come to an arrangement with those affected, regardless of how difficult this may be, in order to contain the likelihood of road blockages from local protests.

b) Licences for the use of a given transit route at a given time are auctioned at a bourse. This bourse will accept domestic and foreign carriers as well as own account transport operators. Secondary trading in licences is restricted to the bourse, and provision must be made to prevent the emergence of a demand monopoly.

c) The excess revenue achieved by the bourse will be used for road maintenance and improving the quality of the environment in the transit regions concerned. Such funds must be used to finance technical measures (noise barriers and tunnels, low-noise pavements, exhaust gas scrubbing systems for tunnel ventilation, the relocation of residences and plants suffering from extreme pollution, forest rehabilitation, etc.). Some of the funds may also be used for railway construction.

This model does justice to the requirements posed by ecology, economy and distribution policy as well as to the polluters-pay principle in as much as:

a) quotas can be used to control observance of pollution limits;

b) free competition for quotas by way of auctioning sends out a price signal for the scarcity of supply and thus enables transport capacities to be used optimally (*Puwein*, 1994);

c) revenues can be used to improve the environment and quality of living in the places affected; and

d) in the end the polluters pay.

5. An attempt to rank the tools proposed to solve the transit problem

In conclusion, an attempt is made to rank the tools put forward for solving the transit problem by their key factors, i.e. the extent to which they meet the following objectives:

- reducing the environmental burden in the Alps ("ecology"), while at the same time
- keeping their impact on the free movement of traffic as low as possible ("economy"),

and the following criteria:

- administrative feasibility, and
- political feasibility.

The important point is to ensure that the economy in the Alpine transit regions will not suffer. The outcome of an effort to rank the tools is shown in Table 7. Where tools were placed at equal ranks, a mean was calculated (e.g. administration: limiting road construction and railway upgrading both rank equally behind high tolls, thus placing 2nd and 3rd, so that both tools were ranked at 2.5).

By the ecology criterion, auctioning of transit quotas ranked top: this measure limits the number of runs and produces revenues for use to finance environmental protection facilities. Limiting the construction of new roads increases the burden of congestion and negatively impacts both on European transalpine trade relations and on the economic situation of the Alpine regions. Accordingly, this tool ranks sixth (or last place) for the ecology as well as the economy criterion. When it comes to tools administration, a high toll probably is easiest to implement, whereas a sectoral transport ban should encounter the greatest problems. Same as the quota on lorry runs, such a ban does not comply with the EU transport regime and will be very difficult to put in place on a political scale. The EU has now come to accept a high toll, limited road construction and cross-financing of railway upgrading in the Alps. The latter will improve the ecology situation only when transports will be moved from

road to rail. Its economic impact will depend on how it will be financed and by whom, and on how efficient rail transport is going to be.

When totalling the ranks, we get the lowest (= best) value for a high toll and the highest (= worst) value for the sectoral transport ban, both for Europe as a whole and for its Alpine regions. If we take only the ecological and economic criteria, then the auctioning of transit quotas ranks best, and limitations on road construction ranks worst.

Table 7: Tools to solve the transit problem and their ranking by criteria

	Criteria					Ranking totals			
	Ecology	Economy		Adminis-tration	Political feasibility	Total		Only ecology and economy	
		Europe	Transit region only			Europe	Transit region only	Europe	Transit region only
Tools									
High toll	3	2	5	1	2	8	11	5	8
Limiting road construction	6	6	6	2.5	2	16.5	16.5	12	12
Rail upgrading	4	4	3	2.5	2	12.5	11.5	8	7
Sectoral transport bans	5	5	4	6	5	21	20	10	9
Quota									
Free award	2	3	2	4	5	14	13	5	4
Auctioning	1	1	1	5	5	12	12	2	2
Sum	21	21	21	21	21	84	84	42	42

Source: WIFO.

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