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UNIfication of accounts and

marginal costs for Transport Efficiency

Towards an evidence-based charging policy for transport infrastructure
17 – 18 September 2001
Venue: Ecole Nationale des Ponts et Chaussées

Can we use transport accounts for pricing policy and distributional analysis?[1]

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Abstract

This paper analyses two possible uses of transport accounts. First, business type of transport accounts can be a basis for transport policy. It is shown that balanced business accounts are in general not a good guide for pricing. Next, we examine the potential of social transport accounts and see to what extent they can be used to analyse the efficiency and equity effects of transport policy.

[1] This text is based largely on Chapters 2 and 5 of Mayeres, I., Proost, S., Quinet, E., Schwartz, D. and Sessa, C. (2001), Alternative Frameworks for the Integration of Marginal Costs and Transport Accounts. UNITE (UNIfication of accounts and marginal costs for Transport Efficiency) Deliverable 4. Funded by 5th Framework RTD Programme. ITS, University of Leeds, Leeds, May 2001.

1 Introduction

Transport accounts are used in a variety of ways to improve transport policy decision making. As a concept, transport accounts originate from business accounting. Keeping detailed financial records is necessary to monitor what is going on in a firm. It provides essential information to management and shareholders. It is less obvious how transport account information can be used in transport policy.
In this paper we examine two potential uses of transport account information. First, we examine whether balanced transport business accounts can act as a good guide for pricing policies. Secondly, business transport accounts can be augmented with external cost information to produce social transport accounts. This type of accounts is sometimes used to know whether each mode pays its fair share and whether transport policy is distributionally neutral. We examine this claim and show that social transport accounts are not sufficient for the evaluation of transport policies. This leads us to the construction of a third type of accounts, that we call "welfare accounts". Section 2 and 3 elaborate on these questions. The discussion is non-technical and accessible for non- academic economists. Section 4 concludes.

2 Are balanced business transport accounts a good basis for pricing policies?

Transport accounts and marginal cost pricing are both important tools of transport policy. In order to illustrate the different interactions we use a very simple example. Imagine a railway infrastructure company or a road authority that manages only one important link. In Table 1 we represent the annual account of costs and revenues for this company. We assume that there are no environmental or accident costs. This account gives us factual information about the different types of costs of infrastructure. On pricing it only tells us whether, this year, total costs are covered by user charges or not. Assume that important subsidies exist.

Table 1: Transport account of an infrastructure company

COSTS	REVENUES
Capital costs (depreciation and interest)	User Charges
Maintenance costs	Subsidies
Operation costs	**Net deficit (balancing item)**
TOTAL COSTS	TOTAL REVENUES

Pricing at average cost versus pricing at marginal cost

A naive use of this table is to try to achieve a break-even situation between charges and costs by charging average costs to all users of the infrastructure. To assess the effects of this pricing strategy we use Figure 1. In this figure we have plotted the demand function for the transport services as well as the marginal cost MC (taken here as a constant and consisting mainly of avoidable maintenance costs), the average cost function AC(X) and finally the current price P. The average cost is a function of the quantity produced X

because with the important fixed costs we assume here, the mark-up over variable costs that is needed to cover the fixed costs declines with output. With current charge level P, the number of (standard) vehicles or trains equals X1. The subsidy needed in Table 1 is equal to (AC(X1) – P) X1.

Charging average cost AC* results in a new level of users X2 because some users will forego the service when the price is increased. Table 1 is no longer correct now. We have less output and less avoidable maintenance costs on the cost side. On the revenue side we have higher user charges and a subsidy is no longer needed. The subsidy has disappeared but is this better in terms of economic efficiency? Probably not. To see why, let us count the economic costs and benefits for society as a whole when a switch is made from output level X1 to X2. The real costs that are saved are equal to area C, the avoided maintenance costs. The costs of moving to level X2 are the lost benefits of the disappeared trains or vehicles. These can be measured by the area under the demand function between X2 and X1. This area equals areas C+D+A. Comparing costs and benefits we see that society as a whole has lost benefits equal to D+A. This is a pure loss to society that corresponds to the difference between the willingness to pay for the service and the avoidable costs. In the absence of distortionary taxes in the rest of the economy it is the cost to society of removing the subsidy. Economic benefits are maximised when the price equals the avoidable or marginal cost of the last user. This would lead to higher output level X3. Compared to the initial price P and output level X1, there is a net gain for society equal to area B. There is a net gain because the willingness to pay (or "value") of the users is higher than the extra costs.

In this example, the maximum economic benefits can only be reached by running a deficit even larger than the one that initially existed. This raises two issues:

- The first issue is that subsidies need to be financed out of taxes and that raising tax money also creates economic losses. This point is correct and can be integrated into the analysis by adding an extra cost to public money.
- The second issue is that a firm for which deficits are automatically covered by subsidies is likely to become very sloppy in minimising costs and that we end up creating economic inefficiencies on the production side. This point is important but has more to do with the way in which subsidies are allocated. If the subsidy is allocated in the form of an amount that is fixed a priori and if the selling price is fixed too, the firm will continue to minimise costs because lower costs mean higher profits.

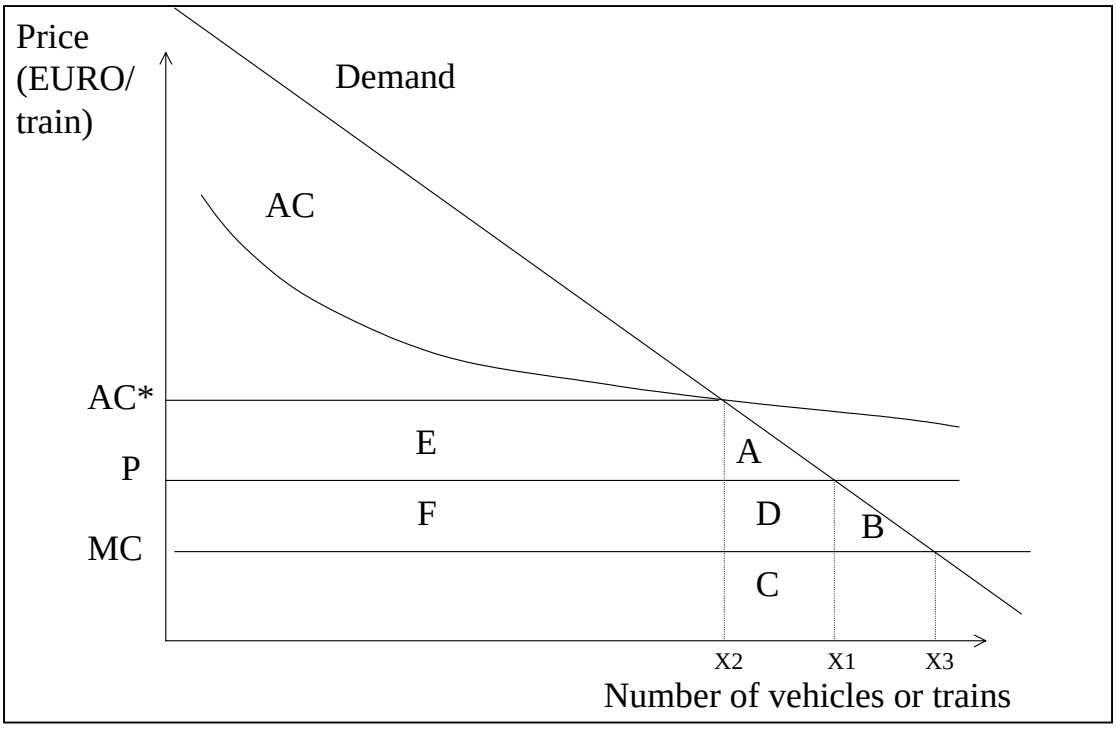

Figure 1: Average and marginal cost pricing

Pricing in a multi-product firm

The first example assumed that the infrastructure supplier produced only one type of service. All that is to be decided in terms of pricing is one price level per train or per vehicle. Most infrastructure suppliers produce many different services: passenger and freight trains, services in peak or in off-peak periods, in remote areas with low capacity utilisation and in areas where capacity is scarce. In general this does not show up in the aggregate account of the infrastructure supplier. However, it is important for pricing for two reasons.

First, different services can have different marginal costs. This is illustrated in Figure 2. Consider a heavily loaded freight train and a passenger train. To make it simple assume that the freight train causes twice as much maintenance costs as the passenger train and that the demand function for both services is identical. Assume that initially we use the same charge for both types of trains equal to the average marginal cost MC. This gives us a level of use for each type of train equal to X1. Even in this situation we can improve economic efficiency by charging freight trains their real marginal cost $MC_{Freight}$ and doing the same for passenger trains: charge them MC_{Pass}. The economic gain of doing this will consist for freight trains of the triangle A. This is the net cost saving of having fewer freight trains (saving $MC_{Freight}$ but loosing user benefits). For passenger trains, there is an expansion of output. The net benefit equals area B that corresponds to the benefit to the new users minus the marginal cost of more passenger trains.

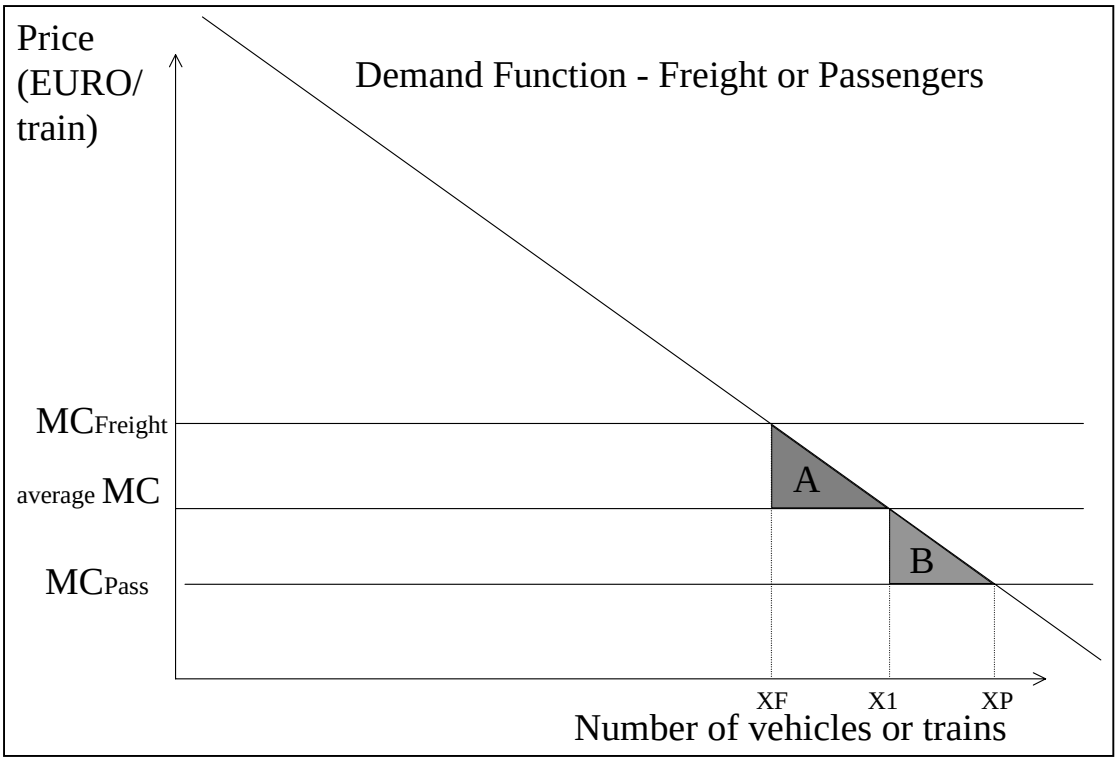

Figure 2: Losses from insufficient differentiation in pricing

The second reason is that, even if marginal costs of two types of customers are identical, pricing both groups differently can be beneficial when total subsidies are restricted. Figure 3 shows an example where infrastructure is used by freight and passenger trains but where the demand for freight trains is much more price-elastic than the demand for passenger trains. We start initially from ideal marginal cost pricing and the volume of freight and passenger trains equals X1 for both of them. Assume that fixed costs have to be covered because subsidies are restricted. One way of doing this is to charge the same price to all users that is equal to the average cost. In Figure 3 this is the price level "one price" and the quantities XF and XP. This solution generates important economic losses: the volume of freight transport diminishes sharply because they switch to other modes. A better solution exists: to charge a higher mark-up for the inelastic passenger demand. By way of illustration we show a solution where the same total net revenues are generated by charging a higher price for passenger transport only and by leaving the charge for freight trains at the MC. There will be a large benefit in efficiency for the freight transport market in comparison with average cost pricing (the large shaded area on Figure 3) and a small additional loss in efficiency for the passenger trains market (the small shaded area). Other solutions to the revenue constraint exist: one could use two-part tariffs, declining block tariffs etc.

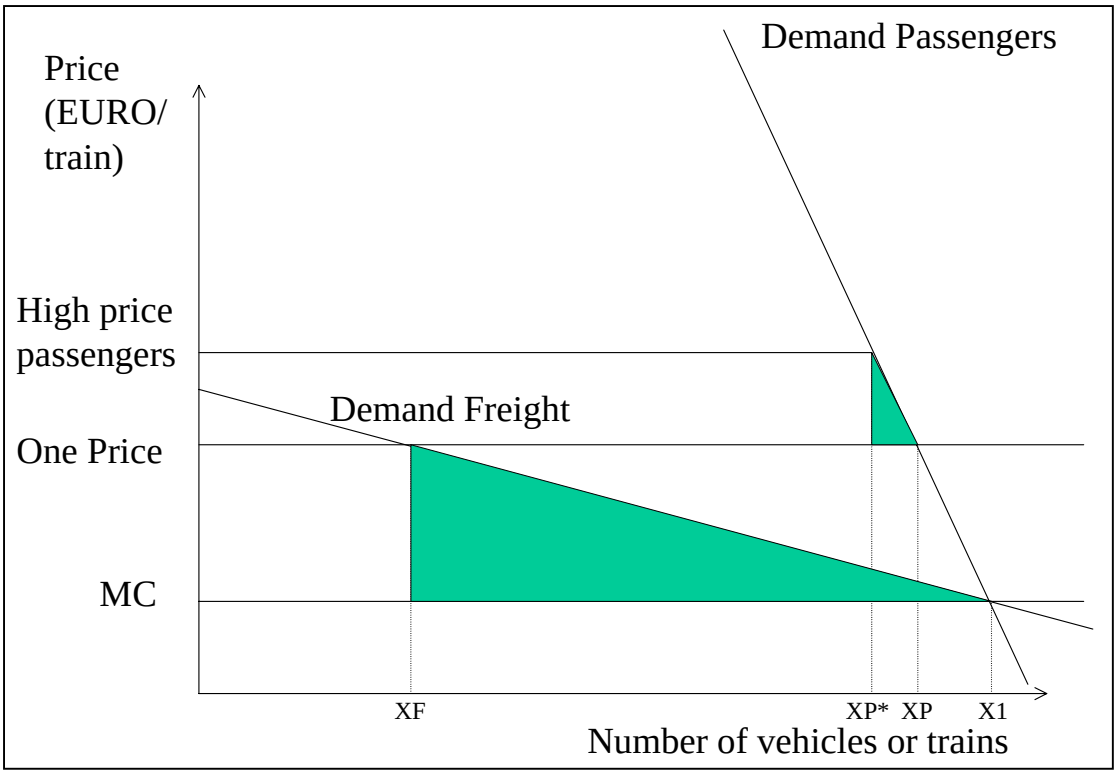

Figure 3: Efficient price discrimination in the presence of a revenue constraint

The pricing solutions discussed here may look fancy and difficult to implement. They might not be yet very common in the transport world, but they are normal business practice if one looks at examples like theatre tickets, fast-food meals or telephone charges. What is important to understand is that, although optimal prices are mostly different from the marginal costs, the marginal cost information is crucial to compute the optimal deviation from marginal cost pricing. It is interesting to know whether marginal cost pricing (or optimal deviations of marginal cost pricing) is generally accepted in the transport sector. In Mayeres et al. (2001) it is shown that in most EU countries, marginal costs are not the benchmark for transport pricing.

An important difference with the practices in non-transport sectors is that there can be important interactions with substitute transport modes. When prices on these modes cannot be set correctly there are reasons to deviate from optimal prices for each mode. We return to this issue in Section 3

Business Transport accounts as a monitoring tool for price regulators

In general, transport organisations have better information to design good pricing policies than the transport authorities themselves. The pricing behaviour of transport infrastructure providers is usually monitored by a transport authority to avoid excessive rates, to take into account cross effects on other transport markets and to meet revenue raising (or maximum subsidy) targets.

Of course the regulator will have to use a mechanism of the type price-cap or weighted price cap[2] or a cost of service system. What is the role of the business account in these cases?

Business type of accounts are needed to know the total costs that need to be covered by a subsidy. Once the price cap is in place, and the regulation system is credible for the monopolist, the change over time of total business costs can be a good indicator of changes in total resource costs. When the price cap is not considered credible, the reporting of business costs is part of the game to obtain new price caps. In that case traditional business accounts are not a reliable guide for changes in resource costs because the reported costs are manipulated.
In the case of a cost of service system, business type of accounts are needed to make the system work. Because there are poor incentives for cost minimisation, traditional accounts based on reported costs are not a good guide for an assessment of policy changes.

3 How useful are social transport accounts to assess the efficiency and distributional impacts of transport policies?

What do we mean by a social transport account?

Transport is characterised by important externalities. When environmental cost information and environmentally related charges are added to a business account one obtains a social transport account. Table 2 gives the structure of a typical social account. The net social subsidy is here the balancing item.

Table 2: A typical social account

SOCIAL COSTS	SOCIAL INCOME
+ Variable costs (maintenance,...)	+ Revenues, taxes and fees allocated to the producers and the government
+ Real depreciation of capital stock	**+ Net social subsidy***
+ Interest on capital stock	
+ Environmental damage and external accident costs	
TOTAL SOCIAL COSTS	TOTAL SOCIAL INCOME

* balancing item

Are these types of social accounts useful and sufficient for a policy maker concerned with efficiency and distribution? We address this question by looking first at only one transport market and see what is missing to make a social account useful for policy evaluation. From theory we know that we can confine a welfare analysis to the analysis of only one market if two conditions are satisfied. First, the other markets need to be undistorted. Secondly, we need not be concerned with income distribution issues. Neither of these conditions is satisfied in practice. What changes are needed in our accounting

[2] see Vogelsang and Finsinger (1979) and more generally Laffont and Tirole (1993)

framework to take that into account? We extend the framework in three steps. First, we study the case where there is a distortion on another transport market. Next, we introduce the existence of distortions on other markets, principally the labour market. Finally, we address the issue of income distribution concerns.

Transport accounts to measure the efficiency of transport policies – one transport market

For the omniscient[3] (benevolent[4]) policy maker, neither a business account, nor a social account are immediately useful for implementing optimal policies or for tracking the performance of transport policies. The reason is obvious: not all the different components of his welfare function are present. In a partial equilibrium framework the objective function of a policy maker consists of a weighted sum of:

– Consumer surplus (defined in generalised prices so as to include gains in time)
– Transport revenues and producer surplus of the operator, both weighted by the marginal cost of public funds
– External costs other than congestion (since congestion costs are included in generalised consumer surplus)

In the social accounts, although more comprehensive than business accounts, the following elements are still missing:

– the (generalised) consumer surplus of the users of the transport system
– the correction of the tax revenues or public transport deficit by the marginal cost of public funds.

In the case of one transport market the following alternative structure of accounts that we call "welfare account", could serve as a more complete welfare measure to assess transport policy on one market:

Table 3 A typical welfare account (one transport market)

WELFARE COSTS	WELFARE BENEFIT
+ variable costs (maintenance,..)[b]	+ Revenues and fees allocated to producer[b]
+ real depreciation of capital stock[b]	+ Tax revenue allocated to government[b]
+ interest on capital stock[b]	+ Gross generalised consumer surplus
+ environmental, accident damage	
+ total time and other user costs	
+ **Net welfare contribution**[a]	
TOTAL WELFARE COSTS	TOTAL WELFARE BENEFITS

[a] balancing item
[b] corrected by the marginal cost of public funds

[3] This is to be considered as a thought experiment. An omniscient policy maker does not need any accounts by definition.
[4] It may be that the transport authority has a different objective function than the government. Still another approach is a political economy framework in which the transport policy is the result of a political mechanism that weights the interests of different social groups.

The major difference with the social and business accounts is that the net benefits of the users are now taken into account. This is indeed the criterion we use in cost benefit analysis. The additional information requirements are substantial, but necessary if one wants to make a correct evaluation.

In order to implement optimal transport policies, the omniscient policy maker needs much more information than the net social subsidy in the social account or the net welfare contribution in the welfare account. What one needs are marginal costs, marginal environmental and congestion costs as well as marginal investment costs. This information cannot be derived from the welfare account as such.

The welfare account can only be used to check ex post whether welfare has improved, not to compute marginal social costs as only total costs and benefits are reported. There is also a difference in the level of aggregation used to construct welfare accounts and marginal social costs. It is very important to tailor prices to the costs of the different transport services (time and space dependency etc.). Welfare accounts can probably not be constructed with the same level of detail because many of the costs are joint costs.

Transport accounts to measure the efficiency of transport policies – two interrelated transport markets

Now we turn to the case of two interrelated transport markets. Transport markets are often distorted. A typical example is the lack of spatial and time differentiation in the pricing of road use. This leads to excessive congestion that we can try to correct using public transport subsidies.
When at least one transport market is distorted, the use of social accounts (table 2) or welfare accounts (table 3) to judge the efficiency is problematic. Two problems show up:

- The first problem is technical: a generalised consumer surplus does in general not exist. A surplus for road users can be defined only if the consumer price of the substitute mode is kept constant. We can solve this by switching to utility function type of surplus measures (equivalent variation etc.) that take into account all price changes simultaneously.
- The second problem is that most elements of the welfare account for one mode depend on policy options for the other mode. A typical example are subsidies for public transport that decrease road congestion in the peak. The public transport welfare account will deteriorate while the road welfare account will improve. So there are strong indications that a welfare assessment of transport policies needs transport account information for all modes simultaneously.

These problems require an extended partial equilibrium assessment of price changes [5].

The welfare accounts in a general equilibrium framework

Distortions are in general not confined to the transport sector. One of the most important distortions in an economy is the labour tax. This type of tax is justified principally by income distribution concerns to which we return in the next section. Here we consider the labour tax as an exogenous distortion. When we want to analyse the effects of transport

[5] De Borger and Proost (2001) use such an extended partial equilibrium framework to assess transport pricing reform in the European Union.

policies via accounting systems we need to monitor the transport markets, but also the labour market in as far as the labour market is influenced by transport policy decisions. This is almost always the case. There are two types of interrelations at work. First, there may be a direct effect in the case of commuting transport. Secondly, for non-commuting traffic there is a more subtle factor at work: making transport more expensive decreases the purchasing power of the wage and this acts as a change in the net wage and a discouragement for labour supply.

The best way not to overlook this type of effects is to examine budget neutral reforms of transport policy. This means that a change in transport tax revenue has to be balanced by a tax change on labour, by income transfer changes or by other tax changes.

Assume that we start from an arbitrary equilibrium in a simplified economy. In this economy there are only four commodities: two transport modes (for example, car and public transport), a non-taxed composite consumer good and leisure. The impact of marginal policy changes on the welfare accounts can be traced by examining the changes on all markets where there are price changes or where there are distortions. For the two transport commodities this can be represented in the following way:

Table 4: The impact of policy changes on the welfare account of the transport commodity *j* (*j*=1,2)

change in COSTS	change in BENEFITS
change in government spending on infrastructure of mode j[b]	change in tax revenue raised by the tax on commodity *j*[b]
social value of the change in the externalities (congestion, air pollution, accidents...) caused by the change in consumption of commodity *j*	direct change in consumer surplus associated with the price change of commodity *j*
Net welfare gain market *j*	

[a] balancing item
[b] NOT corrected for the marginal cost of public funds

Note that the changes in spending on infrastructure and tax revenue are not corrected by the marginal cost of public funds. The reason is that the marginal cost of public funds is no longer exogenous in this setting. The welfare effect of recycling the tax revenue/financing higher spending will be determined endogenously and will depend on the way in which revenue-neutrality is obtained.

In order to make a complete welfare assessment, one needs to take into account which non-transport instruments are used to ensure revenue-neutrality. The labour income tax or the lump sum transfer may be used for this purpose. The welfare impacts of this are not included in the welfare accounts for the two transport commodities. Even if the non-transport instruments are unchanged, and revenue neutrality is ensured by the transport instruments, one needs to take into account the effect of the transport policies on the labour income tax revenue.

Therefore, one needs supplementary information, which could be presented by means of a welfare account for the labour market.

Table 5 The welfare account for the labour market

change in COSTS	change in BENEFITS
	change in labour tax revenue
	direct change in supplier surplus associated with the change in the labour income tax
Net welfare gain labour market[a]	

[a] balancing item

For a complete welfare assessment of revenue neutral marginal policy changes, one has to include the effects on the labour market. The effects of the induced changes in that market may dominate the transport market effects.

Transport accounts to measure the distributional effect of transport policies – general equilibrium framework

Transport accounts are sometimes advocated as good monitors of income distribution effects. This may not be true because of three reasons. First, transport use may be rather heterogeneous among the population. Making sure that a social or welfare account is balanced is then insufficient as this balancing may have very different implications for each of the income groups. Secondly, some transport policies may be geared to reduce particular types of externalities (air pollution or congestion). As these externalities are valued very differently by different income groups, this distributional effect is missed too in a normal welfare account. Last but not least, the use of increased (decreased) transport revenues to reduce (increase) other taxes in the economy is an important determinant of income distribution effects that is missed by transport accounts.
In Tables 6 and 7 we show how we can adapt the welfare accounts to measure the distributional effects of a small change in transport pricing[6]. In the welfare account for the transport markets (Table 6) some terms now become weighted sums. The weights are the relative income distribution weights given to individuals having different incomes. The weights are applied to the change in consumer surplus of the income groups and their valuation of the change in the externalities. The social value of the change in the externalities now takes into account that different individuals may have a different marginal willingness-to-pay for a reduction in the externalities. In order to obtain the social willingness to pay, the individual willingness to pay has to be weighted by the social marginal utility of income.
A similar approach is taken in the welfare account for the non-transport markets (see Table 7).

[6] We follow here closely the methodology developped in Mayeres and Proost (2001)

Table 6 The impact of policy changes on the welfare account of the transport commodity *j* (*j*=1,2)

change in COSTS	change in BENEFITS
change in government spending on infrastructure[b]	change in tax revenue raised by the tax on commodity *j*[b]
Weighted sum of the individual value of the change in the externalities (congestion, air pollution, accidents...) caused by the change in consumption of commodity *j*	weighted sum of the individual direct change in consumer surplus associated with a price change of commodity *j*
net welfare gain market *j*[a]	

[a] balancing item
[b] NOT corrected for the marginal cost of public funds

Table 7 The welfare account for the labour market

change in COSTS	change in BENEFITS
	change in labour tax revenue
	weighted sum of the direct change in consumer surplus associated with a change in the labour income tax
Net welfare gain labour market[a]	

[a] balancing item

4 Conclusion

In this paper we have analysed the use of business and social accounts for transport policy. We have seen that business transport accounts as such are not a good guide for pricing policy. Smaller deficits are not the goal of transport policies. Whether a deficit or a subsidy is a more efficient result depends on many factors as there are: the difference between the average and the marginal costs, the cost of government funds, the incentives for cost minimisation and the pricing on related markets. Moreover, a given deficit can be the result of very different combinations of pricing on the different sub markets served by that mode. Some of these combinations can be very inefficient. This does not show up on the revenue side of an aggregated transport account. For this reason, an aggregate business transport account as such cannot be a basis for good transport pricing. In a private firm things are not different. An intelligent firm will base its pricing decisions on detailed cost accounting information and consult its marketing department to understand what will be the effect of changes in pricing. It will not base its policy on aggregated results at firm level. A policy maker will need the same type of details to judge the efficiency of the pricing decisions taken by a transport infrastructure provider. The aggregate transport accounts as such do not provide sufficient information to evaluate transport policies. They need to be supplemented by disaggregate information. Obviously, business type of information is needed for price regulation policies but this goes far beyond the monitoring of the financial .

When external cost information is added to obtain social accounts one may wrongly conclude that the aim is to balance the social accounts for each transport mode. Generally, this is not a relevant objective. First, what is needed for a correct welfare assessment is an account that reports all elements of a social cost-benefit analysis. We have termed this account the "welfare"account to contrast it with the social transport account that presents only a selection of the social cost-benefit components. Secondly, in the presence of distortions on other – transport and non-transport – markets a complete welfare analysis requires welfare account information for all markets simultaneously. Finally, when concerns about income distribution come into play, it becomes important to report the welfare account information by income group and to apply appropriate income distribution weights. These three points imply that one should be very careful in interpreting the social account information.

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