Challenge for the near future: Instruments for a climate friendly use of road infrastructure
Macharis, Cathy; Brusselaers, Nicolas; Mommens, Koen Maurits

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Road traffic is the lubricant of our prosperity. Without transport, everything comes to a standstill. But on the other hand, traffic causes congestion, noise pollution and the emission of harmful substances. As an important CO₂ polluter, road traffic is partly responsible for the climate problem. As traffic increases, the nuisance increases. Measures need to be taken. Road pricing is increasingly referred to as a solution. But how does road pricing actually work, what are the pros and cons. Why does it cause such a fierce social and political debate?

The Benelux Interuniversity Association of Transport Economists (BIVEC-GIBET) represents forty years of cooperation between universities and research institutes in the Benelux. This jubilee was a suitable moment to publish a book explaining the theory, practice and policy aspects of road pricing in the Benelux, and this because scientific knowledge contributes to finding the best and most widely supported solution to our daily traffic jam problem.

Editors

Leen van den Berg (1950, Zwammerdam) holds a degree in Civil Engineering from Delft University of Technology. He worked for more than 30 years as senior policy officer at the Secretariat of the Benelux Union. During this period he supported many Benelux cooperation initiatives in the field of traffic and transport, spatial planning, nature protection and cross-border cooperation. As secretary of the process consultancy group, he was closely involved in the cooperation on the deepening of the Western Scheldt and the cooperation on the construction of a new sea lock at Terneuzen.

Jacob Polak (1933, Amsterdam), studied economics at the University of Amsterdam. He first worked in the Department of General Policy of Netherlands Railways. After this, he has been a lecturer in transport economics at the University of Amsterdam and a part-time full professor of transport economics at the University of Groningen. He published in various journals and was editor and co-editor of several books. For many years, he has been Chairman of the Committee for Transport Issues, Netherlands’ Socio-Economic Council.
Road pricing in Benelux: Towards an efficient and sustainable use of road infrastructure.

Theory, application and practice
# Road pricing in Benelux: Towards an efficient and sustainable use of road infrastructure. Theory, application, and policy

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Mobility, at the right price. Mobility, at any price?

F. WITLOX (1)

BIVEC-GIBET is celebrating its 40th birthday. This Benelux cooperation of higher education institutions and research institutions, active in the broad field of the transport economics, seizes this anniversary to publish a book on the topic of road pricing in Benelux.

The key building blocks of any economic system are transport, mobility, and logistics. Therefore, they are essential for creating welfare, growth, and regional development. This is particularly true for the Benelux countries. When the neighbouring countries of Belgium, the Netherlands, and Luxembourg decided to establish the Benelux Economic Union in 1958 (entering into force in 1960), the notion of transport, mobility, and logistics was already incorporated in the promotion of free movement of workers, capital, services, and goods to increase prosperity in this area. The focus was clearly on the cooperation of economic, financial and social policies. It has brought the three nations closer together, as they stood united when common economic and transport-related interests were at stake. Even today, when important responsibilities have been transferred to the level of the European Union, cross-border cooperation between the Benelux countries remains essential to the joint application of supranational legislation, the management of ever-increasing traffic flows with their congestion problems and the development and financing of common transport policies (Witlox et al., 2007).

The Treaty between the Benelux countries was limited to a period of fifty years - ending in 2010. By end of that period, in 2008, the three countries decided to renew the agreement, which was to enter into force in 2010. The name “Benelux Economic Union” was changed to Benelux Union”, to better reflect the broader scope of the Union. At the same time, three key themes were put forward: (i) the economy and the internal market, (ii) security and society, and (iii) sustainable and digital cooperation (www.benelux.int).

Today, the Benelux functions as an open economy, heavily dependent on its quality and on the efficient use of its transport infrastructure. This quality and efficiency have huge positive impacts on the competitive position of the industrial and services sectors located in the hinterland of the Benelux gateways. This performance is also related to the strategic location of the Benelux countries at the heart of the European Union area, which also hosts the most competitive cities, the most important European production and consumption centres - in the heart of the so-called ‘Blue Banana’ of Europe. It is also combined with a very dense transport infrastructure including ports, airports, roads, railways, canals and waterways and pipelines.

(1) Senior Full Professor of Economic Geography, Ghent University (Belgium) and (i.a.) Honorary Doctor (Dr.h.c.) in Geography and Visiting Professor, Institute of Ecology and Earth Sciences, University of Tartu (Estonia), Chairman of the Benelux Interuniversity Association of Transport Researchers (BIVEC-GIBET).
In recent years, however, the mobility in Belgium, the Netherlands, and Luxembourg is increasingly at risk of coming to a complete standstill. This will worsen the area’s accessibility and degenerate the quality of the environment and everyday life. Short-term solutions cannot help to turn the tide. Instead, **structural** and **innovative** changes to the mobility system are required in order to support welfare in a sustainable manner.

Road pricing – a method for charging for road use – is one of the primary themes of transport economics. Even Adam Smith, in 1776, mentioned the principles of efficient (equity) provision of ‘public works’ (“high roads”) when he stated that “when the carriages which pass over a highway or a bridge ... pay toll in proportion to their weight ... they pay for the maintenance of those public works exactly in proportion to the wear and tear which they occasion of them. A more equitable way to maintain such works seems to be expensive”.\(^1\)

Road pricing is widely accepted as an effective tool for alleviating urban traffic congestion, reducing environmental impacts, avoiding escalating car ownership, and generating revenue to finance transport improvements, but there are also a number of barriers to implementation, particularly outside urban areas as well. Common questions are as follows: what system to install, how should it be operated, who should be the operator, what should be the amount of the charges, what should the revenue be…?

Clearly, a substantial amount of knowledge has already been built up over time to discuss this very topic. The topic, which was already a research topic when BIVEC-GIBET was founded in 1978, is still up to date. Moreover, it is put (or not put) on the political agenda as we speak… In this way, producing an anniversary book on the topic of **Road pricing in Benelux: Towards an efficient and sustainable use of road infrastructure. Theory, Application, and Policy** seems very justified.

From a political and a societal point of view, decision-making regarding road pricing seems to be very difficult, demanding, and sometimes impossible (for this, see further: Chapter 3, *The Economics of Road Pricing*).

Past experience tells us that one does not simply impose financial restrictions on someone’s use of a car without a struggle (“my car, my freedom” - remember). It is clear science and scientific research are needed in such situations to put the debate into the right, objective direction, and to look for proper solutions that are widely supported - by governments, by public and private organizations, by you-and-me.

This book provides an overview of insights developed at Benelux universities and research institutions on road pricing. As such, the book can also serve to encourage stakeholders from the transport practice to actively make use of the extensive scientific knowledge on road pricing and its effects. We are convinced that this is indeed very desirable.

The current book explains some of road pricing’s most important transport-economic and institutional aspects. It has different perspectives, and disciplines of economics, geography, engineering, spatial planning, business management, legal and technology approaches. The different contributions are based on both theory and practice, taking road pricing their scope in Benelux. There are good reasons to do so: BIVEC-GIBET has a special relationship with the Benelux. The Benelux secretariat was active in supporting the creation of BIVEC-GIBET in the late 1970s. This support has paid off as, over the past

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\(^1\) Smith, Book V, Ch. I, Part III, Article I, p. 212.
forty years, more than a hundred scientific meetings, colloquia, and seminars have been organized by the ‘oldest’ Benelux cooperation at the higher education level.

We are, therefore, very happy to be able to celebrate this 40th anniversary of BIVEC-GIBET!

Brussels, May 8, 2019
References


1 Why this book?

The 40th anniversary of the *Benelux Interuniversity Association of Transport Researchers* (with its Dutch and French acronyms: *BIVEC-GIBET*) offers the opportunity to bring to the attention of a wider public activities of this form of cooperation between higher education institutions in Benelux. In the footsteps of what was done at the occasion of a previous anniversary – the twenty-fifth, in 2003 - it was decided to publish a book with contributions from its members.

Unlike the previous time, it was now decided to devote the book to one single issue. To do so, the topic of road pricing in Benelux has been chosen. “Pricing”, here, means that road users are charged for their use of roads while, at the same time, these charges vary with distance travelled. There were two main reasons, one from economic theory and one from practice.

There were two main reasons, one from economic theory and one from practice, for deciding on road pricing as the subject of this book. The reason from economic theory is that “road pricing” touches on many issues relevant to the relative scarcity of resources, which, as is well-known, is the central theme of the economics science as a whole. “Road pricing” can therefore also serve to show what transport economics is about. Based on the secondary nature, it was also considered that the issue of road pricing has continued to have BIVEC-GIBET's interest from the very beginning of its existence.

Connected to this, and as mentioned in his Foreword to this book by the Chairman of BIVEC-GIBET, the subject of 'road pricing' has been of interest to the Association from the very beginning of its existence. The reason for practicing is that, with regards to road pricing, in decision-making as well as in the associated social debate, perception seems to regularly displace insights from theory. Against this background, BIVEC-GIBET hopes that the present book may be of use in a scientific "fact checking", for both circles from society just mentioned.

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(1) Professor Emeritus of Transport Economics, University of Groningen and former Lecturer in this field, University of Amsterdam (The Netherlands).
(2) Former Senior Policy Officer and Head of Department, General Secretariat of the Benelux, Brussels (Belgium).
2 Why “road pricing”?

"Road pricing", as the main subject of this book, is short on the question of how, according to economic theory, the optimum use of road infrastructure can be achieved. Clearly, “optimum use” is not only a problem for this type of transport infrastructure, but also for all other types of infrastructure such as ports, airports, railways and inland waterways. Needless to say, that the problem of “optimum use” occurs equally with the movement of persons and that of goods.

The main reason for only dealing with road pricing here is that the theory of pricing the use of infrastructure is the most advanced for the case of road infrastructure. This case can therefore be used as an example for the infrastructure of other branches of transport.

3 Why Benelux?

It almost goes without saying that this jubilee book also deals with the international dimension of road pricing, particularly with regard to Benelux. The Benelux countries are considered as a European transport turntable. They are heavily dependent on a well-functioning transport system, not only in the Benelux area, but also in the cross-border hinterland connections. If there is one area in Europe where road pricing deserves full attention, then that is Benelux.

There is still another reason for Benelux cooperation from the side of BIVEC-GIBET. The Group owes its existence to a large extent to the Benelux Secretariat-General, which actively supported the creation and operation of BIVEC-GIBET- currently the oldest formal Benelux collaborative project in higher education.

4 Why “efficient” and “sustainable”?

In the title of this book one will find not a single, comprehensive goal of a road pricing policy, but two of those goals are about being “efficient” and “sustainable”. This may seem strange to some readers. Why not just "efficient?" Why also "sustainable?" In fact, the answer here is relatively simple.

Just as a reminder, it may first be stated that there may be a difference between the way a term is used in daily speech and the one figuring in a theoretical framework. So, in the present case, as a technical term, “efficient” figures were meant to indicate a concept from economic theory. However, this is not yet a real answer to the questions posed above. For this, one will have to look at “welfare theory”, which is one of the branches of the economics theory.

In welfare theory, it was found for a long time that “welfare” was the same as national product, or, in money terms, national income. This view is reflected in the British economist Arthur Pigou's definition of “welfare”, which is a famous view. “Welfare”, here, as a concept in theoretical economics, is seen as “that part of social (general) welfare that can be brought directly or indirectly related to the measuring rod of money.”

In the past century, one of the most prominent Dutch economists, Pieter Hennipman, based on what is known as the Austrian School of Economists, put forward a view that differs greatly from this (see, e.g.,

According to Hennipman, the concept of welfare rests on the notion of the existence of a fundamental scarcity of resources in relation to human wants. “Fundamental”: “of all times”. In this view, maximum welfare, is obtained when there is an optimum use of scarce resources. This situation is called “efficient” in economic theory. Same as “welfare”, in the above sense, “efficient” refers to all purposes whatsoever for which scarce resources are being used, more specifically here too including: “sustainability”.

The reason why “sustainability” is mentioned separately in the title of this book as a goal for road pricing is as follows: In view of the fact that today, by many, “sustainability” is considered a major objective of economic policy; it seemed permissible here to override considerations of theoretical correctness and to reflect the above-mentioned fact in the title of the book.

5 Reading guide

The book is divided into seven parts, these with a total of twelve chapters. "Road pricing" is the theme that all chapters have in common, but this does not prevent these from being read separately.

PART I serves as an introduction to the book—opens with a Foreword by BIVEC-GIBET Chairman Frank Witlox. This is followed by a chapter, by Leen van den Berg and Jacob Polak, in which the purpose and the structure of the book are being set out.

In PART II it is explained why there are so many problems ensuring an unhindered course of road traffic? What damage does this cause to society, too? And why supplying transport facilities regularly fall short of demand? Why would "pricing" be a proper tool in this situation?

Transportation causes external effects, including substantial CO₂ emissions. Increasing attention is being paid to transport pricing to support the achievement of climate goals. This aspect and the associated pricing aspects are explained as a second contribution in this introductory part II.

Ch. 1 (Mobility: a priceless global issue to be "priced" correctly, by Willy Winkelmans) indicates that in most countries public government agencies are no longer able to taking the lead in the necessary development of transport infrastructure is a serious drawback to achieving future sustainability in this field. Although transportation remains a serious source of income for the public administration’ it seems that public funding for basic transport infrastructure is no longer part of the government's primary task! This will jeopardize the necessary future extensions of transport supply in terms of infrastructure. Therefore, Public financing of transport services therefore needs a revival both in concept and action.

Ch. 2 (Challenge for the Near Future: Instruments for a Climate Friendly Use of Road Infrastructure, by Cathy Macharis, Nicolas Brusselaers and Koen Mommens) points out that transport is inevitable in and in our daily lives, but it also has many negative effects on the economy, the society and the environment. Transportation is attributable to a large share of the external costs associated with climate change. Multiple measures will be required to meet the emission reduction targets by 2030 and 2050. Road pricing can boost the use of more environmentally friendly vehicles.

Part III (=Ch. 3, The Economics of “road pricing”, by Erik Verhoef) focuses on the question why, from the economic theory perspective, road pricing is the appropriate tool for achieving the optimum use of road infrastructure. This is first set out for an “ideal” world, i.e. a world in which all road users would agree to the introduction of this instrument. Then it is explained that it is not the case in the real world, where there is often a lot of social and political resistance to road pricing. Finally, it is shown that, under such circumstances, less strict versions of the principle of road pricing can be followed, leading to what are usually called the second best solutions to the problem of optimum use.

Part IV shows the state of affairs in the political decision-making process regarding road pricing in each of the three Benelux countries. First of all, it seems that the Benelux Member State of Luxembourg has not yet addressed the issue of road pricing at all. Looking at the other two Benelux countries, The Netherlands and Belgium, Ch. 4. (Road pricing policy in Belgium, by Thomas Vanoutrive) and Ch. 5. (Road pricing in The Netherlands, by Bert van Wee), it becomes clear that there are significant differences in approach, pace and political and social support between these two.

Part V addresses the international framework. Given the differences between the policies of the individual Benelux countries (mentioned above) it is not exactly surprising that it has been difficult to come up with a common Benelux-policy for road pricing. This state of affairs is explained in Ch. 6 (Benelux cooperation and mobility management, by Ben Hennekam and Leen van den Berg), in which aspects of Benelux cooperation around road pricing are set out.

Obviously, the Benelux Union (BU) and its member states are not operating in a vacuum. Since all three Benelux countries are members of the European Union (EU) at the same time, a possible future common BU policy will have to comply with EU rules. Ch. 7 (The approach to road pricing of the Union, by Jan Simons), describes the legal and political aspects of EU-policy on road pricing and gives an impression of what this would entail for a common BU policy on this issue.

Ch. 8 (International cooperation on freight transport pricing and investment, by Bruno De Borger and Stef Proost) focuses on the international aspects of freight transport pricing and investment policies, focusing largely on road transport. What are the effects of a shift from fuel tax to truck distance charging? And what is the role of subsidies versus pricing in financing large infrastructures?

In Part VI some practical aspects of road pricing are pointed out. This book, in principle, deals with the issue of charging for the use of roads on the basis of distance travelled. Chapter 9 (Practical applications of road pricing and associated technology, by Mario Cools) not just looks at this particular issue, but draws a wider circle for its analysis. That is, also a number of forms of charging for the use of roads other than in direct relationship with distance travelled are being considered. This wider focus reflected in the fact that, as the reader will note, in this chapter, the term "road pricing" is used in a broader sense than, for example, in the preceding chapter (Chapter 8). Finally, the author gives some reflections on the use of road pricing in Belgium.

In practice, road pricing may have specific implications for road users other than private individuals. To this end, bus and coach transportation is taken as an example. The question is being asked in Ch. 10 (Road pricing for bus and coach, Steven Lannoo and Jonas De Vos) whether road pricing is a blessing for this sector or, contrary to this, it is damaging. In order to answer this question, the effects of pricing schemes are estimated for three different scenarios.

Lastly, Ch. 11 (Review of policy instruments: beyond price instruments, by Stef Proost and Bruno De Borger) point out that the pricing of road use will not always be easy to achieve in practice. It is shown that inefficiencies can result from a conflict between central government and local governments. In Part
VII, first, some conclusions from preceding chapters are formulated (Ch. 12 *What lessons Benelux can learn from theory and practice of the managing of mobility through road pricing*, by Frank Witlox, Chairman of BIVEC-GIBET).

In dealing with sustainable mobility - in cities – David Banister, who was one of the holders of the BIVEC-GIBET Transport Chair (see further: Annex, Section 3), in Chapter 13. (*City Mobility in 2019 – Sustainable and Smart?*), helps the reader in not losing sight of the fact that “road pricing” – the central theme of this book – is part of a much wider problem. The Chapter asks the question what have been the goals of a sustainable mobility policy over the past decade and further asks what has changed, over those years. To this end, it is pointed out that two new dimensions have emerged for policy: global and local environmental pollution and inequality.

As for solutions, the Chapter's central argument is that there are a number of issues that are more fundamental than the usability of the price instrument and the use of renewable energy that need to be addressed – e.g., “what types of cities”, “availability of space in cities”.  

The Chapter’s – rather gloomy – conclusion is that new thinking on issues such as the above has been limited in recent years.

In an *Annex*, the many activities undertaken by BIVEC-GIBET in the course of its existence are shown.

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4 It is hard to escape the impression that the function attributed to road pricing in this Chapter is a more limited one than, e.g., in Chapters 2. and 3. There, at any rate, road pricing explicitly takes into account external effects such as environmental pollution.
Curricula vitae of the cooperating authors

Frank Witlox:
Senior Full Professor of Economic Geography, Ghent University (Belgium) and (i.a.) Honorary Doctor (Dr.h.c.) in Geography and Visiting Professor, Institute of Ecology and Earth Sciences, University of Tartu (Estonia), Chairman of the Benelux Interuniversity Association of Transport Researchers (BIVEC-GIBET)

Jacob Polak:
Professor Emeritus of Transport Economics, University of Groningen and former lecturer in this field, University of Amsterdam (The Netherlands)

Leen van den Berg:
Former Senior Policy Officer and Head of Department, General Secretariat of the Benelux, Brussels (Belgium)

Willy Winkelmans:
Professor Emeritus of Transport Economics, University of Antwerp (Belgium)

Cathy Macharis:
Professor of supply chain management and sustainable mobility and logistics, Vrije Universiteit Brussel, Head of Research group MOBI (Belgium)

Nicolas Brusselaers:
Ph.D. Researcher in Sustainable Logistics, MOBI Research Group, Vrije Universiteit Brussel (Belgium)

Koen Mommens:
Ph.D. Researcher in Sustainable Logistics, MOBI Research Group, Vrije Universiteit Brussel (Belgium)

Erik Verhoef:
Professor of Spatial Economics, Vrije Universiteit Amsterdam and Research Fellow at Tinbergen Institute, also Amsterdam (The Netherlands)

Thomas Vanoutrive:
Assistant professor, Research Group for Urban Development, University of Antwerp (Belgium)
Bert van Wee:
Professor of Transport Policy, Delft University of Technology (The Netherlands) and Scientific Director of TRAIL Research school (The Netherlands)

Ben Hennekam:
Former Secretary-general of Benelux, Brussels (Belgium), Former Member of Parliament in The Netherlands, former member and President of the Benelux Interparliamentary Assembly

Jan Simons:
Professor Emeritus of Transport Economics, Vrije Universiteit Amsterdam (The Netherlands), former member of Economic and Social Committee of the European Union

Bruno De Borger:
Professor of Economics, University of Antwerp (Belgium)

Stef Proost:
Professor Emeritus of Economics, KU Leuven (Belgium)

Mario Cools:
Associate Professor of Transport and Mobility, University of Liège (Belgium)

Steven Lannoo:
Economic Consultant and Team Leader, Institute for Autocar and Bus (ICB), Brussels (Belgium)

Jonas De Vos:
Post-doctoral researcher, Social and Economic Geography Research Group, Ghent University (Belgium)

David Banister:
Professor Emeritus of Transport Studies and Senior Research Fellow, St Anne's College School of Geography and the Environment, University of Oxford (Great Britain)
PART II: SETTING THE SCENE

Chapter 1. Mobility, a priceless global issue to be “priced” correctly!
W. WINKELMANS

Chapter 2. Challenge for the near future: Instruments for a climate friendly use of road infrastructure
C. MACHARIS, N. BRUSSELAERS AND K. MOMMENS
Mobility, a priceless global issue to be “priced” correctly!

W. WINKELMANS (1)

Abstract

The fact that public authorities are no longer able or able to take the lead in the necessary development of transport infrastructure in most countries is a serious drawback to achieving future sustainability in this field. Although transportation remains a serious source of income for the public administration, it seems that public funding for basic transport infrastructure is no longer part of the government’s primary task!! This will jeopardize the necessary future extensions of transport supply in terms of infrastructure. Public financing of transport services therefore needs a revival in both concept and action!

1 Introduction and theme setting (why, when, where, how, what should be done in the field of transport in order to get smart transportation?)

Generally, we assume that the economic development of a country or region as well as of cities ultimately depends on the supply and the existence of high-quality transport infrastructures. This is not an exaggerated statement: the degree and mobility of passengers, freight and data has become an increasingly important economic good worldwide.

For the sake of a wise understanding of the issue of mobility, let us agree upon following definitions:

Mobility guarantees accessibility to production and consumption, whence it is a basic human right to live freely and comfortably. Transportation concerns the traffic of goods, persons, documents and data, from which it needs rules, techniques and technologies; it also makes that it is a commercial good too.

Modal split is the result of the distribution of traffic by mode of transportation (or modes in the case of combined transport); modal shift may be a policy goal in order to increase welfare (taken here in a broad sense, i.e. everything that may be considered economically scarce). Sustainable mobility is the ultimate goal of a sound transport policy and therefore a key element in global welfare generation.

In other words, the economic development of countries, regions and cities depends on the quality of the transport infrastructure supply, which after all becomes an important enabler of economic growth. Nevertheless, infrastructure development is no longer so obvious (De Brucker et al., 1996).

(1) Professor Emeritus of Transport Economics, University of Antwerp (Belgium).
Nowadays, various stakeholders have been able to block long-term and sometimes even definitively transport projects. In developed countries, the current institutional system is apparently unable to provide a stable legal framework implementation of transport projects.

However, transport infrastructures are likely to be remaining important enablers of economic growth. Therefore, it is better to take into account not only that there is a stringent co-relation between transport and welfare, but also that “regions” basically need a sustainable smart transport system. Again, the issue of mobility is more than just a transport issue! This should be realized more than ever. Any comprehensive transport policy must therefore include coherent country and city planning measures, including the environment, safety and, last but not least, accessibility (Winkelmans, 2000).

The traditional factor economy is focused upon production, but today one should “know” that value creation is often much higher before and after the pure production or ‘make’-phase. If we look at “knowledge” in this way, i.e. essentially as a crucial raw material, one and the other implies that the process of the making is becoming more important than the production phase itself! Therefore, in order to master our mobility, it is necessary to face a whole series of old and new challenges in the development of transport infrastructure, including stakeholder management with a view to fruitful cooperation and change management. Our days we must be aware that there are numerous lawsuits by stakeholders in the industrialized economies,, by which one “hopes” to block concerned the transport projects concerned, while in the emerging economies – perhaps apart from China and some Middle East countries, at least momentarily – the infrastructural development cannot keep pace with the economic development: good examples thereof are India, Indonesia and Brazil. Ultimately, one and another appear to be difficult to understand, while political and societal doubts regarding the evaluation instruments are considered. There are often many doubts about the usefulness, necessity and the question of whether the costs are in line with the benefits.

Nevertheless, the current level of public investment in transport infrastructure has long been far too low to ensure longer-term economic growth: “Bridging the Global Infrastructure Gap” was the call by the KPMG STUDY in 2008 … unfortunately this cry is still valid!

Finally, we ought to “know” – i.e. wisely understand –:

- That the transport industry is a growing industrial activity as a function of population growth, globalization and technology.
- That free space for transportation and storage is becoming increasingly short.
- More than ever, this transport has negative external effects such as noise pollution,, air pollution and congestion, especially in and around (port) cities.
- That the worsening imbalance between the demand for mobility and the supply of transport infrastructure is not an ideal result, on the contrary!

The issue of sustainability in transport industry’s framework confronted with a global emergence of structural congestions. Although it is generally accepted, that the economic development of regions and cities depends first and foremost on the quantity and quality of their infrastructural supplies, today’s mobility is under threat for diverse reasons, including lack of sufficient infrastructural supply is one (Winkelmans, 2008).

Road congestion in particular sometimes becomes a real nightmare. It is very expensive not only in terms of waiting time and due to increased fuel costs, but also because it makes transportation
unsustainable: drivers become nervous, the number of accidents increases, citizens get a reason to think more negatively about their society and last but not least long queues harm our health and nature.

The growing emergence of structural congestion is an undeniable aspect. In the case of road transport, the increasing imbalance between demand for mobility and supply of infrastructure is one of the main causes. The interrelationship is clear: the more unit production and consumption, the more road traffic … which leads – given its limited possibilities in capacity extension - to more road congestion and accidents and negative externalities, such as noise, visual intrusions, etc. due to its limited capacity expansion possibilities. Not only is this kind of congestion cost generating it is ‘terribly’ environmentally unfriendly.

So, let us not underestimate “the more production and consumption in today’s societies, the more traffic (and accidents), the more noise, the less air, water, and space quality … and finally the less wellbeing”! Be aware that the increase in welfare (indices) is not reflected in the index of well-being (‘welvaart’ and ‘welzijn’ / ‘prospérité’ and 'bien-être'). As such, it becomes necessary to understand that the almost daily confrontation with mobility syndromes is severely contra-productive: the right of and the need for sustainable mobility therefore is too essential for a respectful “human' existence: “without transport everything will stand still”! In other words, the issues around “mobility” need a totally renewed approach. Besides, it's true that Albert Einstein's wise saying, “If you always do what you have done, you will always get what you always got. So we can't solve problems by using the same kind of thinking we used when we created them” seems perfectly applicable to this type of transport issue (Winkelmans, 2009).

A lot of solutions have already been suggested. Unfortunately, some of the instruments – think of road pricing – are regularly confronted with plenty of friends and enemies! The demand side of mobility is indeed profoundly divided: for some it is the solution, for others it is almost heretical.

Nevertheless, instruments that could influence the demand side of transport are most logical and desirable from a socio-economic point of view. In that case, of course is not just a matter of price levelling, but of restructuring the supply and demand prices; think of the fact that the environmental “costs” are largely different by mode of transportation! As such, the cost price by mode of transportation differs indeed enormously as a function differences in congestion, air pollution and noise pollution. Implementation of such external costs into final freight prices is called the “Royal Way”, given that free transfer, silence, and healthy air are scarce “goods”, which deserve to be paid for in terms of the cost price to maintain them.

Last but not least, ever-growing global demand for transport – both in terms of freight and passengers – is proceeding with a non-sustainable exponential growth of a whole series of “productions”. The fact that the worldwide transport supply and/or transport capacity often represents a much smaller expansion could be considered a benefactor, at least those who are convinced that our planet has only a limited capacity in all that.

The fact that public authorities are no longer able or able to take the lead in the necessary development of transport infrastructure in most countries is a serious drawback to achieving future sustainability in this field. Although transportation remains a serious source of income for the public administration, public financing of basic transport infrastructure is no longer part of the government’s primary task!? Although transport remains a serious source of income for the public administration, public financing of basic transport infrastructure is no longer part of the government's primary task!? This will jeopardize
the necessary future extensions of transport supply in terms of infrastructure. Public financing of transport services therefore needs a revival in both concept and action!
References


Challenge for the near future: Instruments for a climate friendly use of road infrastructure

C. MACHARIS (1), N. BRUSSELAERS (2) AND K. MOMMENS (2)

Abstract

While transport is inevitable in our economy and daily lives, it also engenders many negative effects on the economy, society, and environment. A great share of the external costs associated with climate change is attributable to transport. However, most damage costs are not entirely carried by the causer of the nuisances, hence not internalized in the pricing system. The alarming pace at which global warming and climate change are escalating cannot be denied. The transport sector still lags behind with regards to emitted greenhouse gases and faces difficulties to achieve the emission reduction goals. In order to meet the set targets by 2030 and 2050 and tackle this urgent challenge, the implementation of multiple measures will be required. In line with the ‘polluter pays’ principle, a possible instrument to reduce greenhouse gas emissions and increase the internalization rate of road freight transport is the implementation of a road pricing scheme. Not only would it stimulate the use of more environmentally friendly vehicles; this concept could also prove its use in pursuing a level playing field across different transport modes. Implementation of a pricing system should be well thought of, as perverse effects can easily arise. Road pricing will also incentivize the switch to zero-emission vehicles. A pricing scheme should be implemented coherently on a European level in order to avoid additional kilometres due to detour and related externalities.

1 Introduction

While transport is very important in our daily life and economic system, it also creates negative effects, like climate change, local emissions, congestion, and accidents. This comes with a cost for the society, economy, and environment. Climate change and its effects have recently been put high on the public and political agenda in many European countries, given the impact that greenhouse gas emissions have and will have (EEA, 2016; ECA, 2018; IPCC, 2018). In Belgium, as in several other European member states, many bottom-up actions such as Youth for Climate are organized to increase awareness on climate change and to urge governments to take adequate actions in order to limit the global warming.

(1) Professor of supply chain management and sustainable mobility and logistics, Vrije Universiteit Brussel, Head of the research group MOBI (Belgium).
(2) Ph.D. Researchers in Sustainable Logistics at the MOBI Research Group, Vrije Universiteit Brussel (Belgium).
FIGURE 1 shows the evolution of global temperature and rising CO$_2$ levels over the world between 1959 and 2016 (WEF, 2018), and highlights the clear correlation between the two. If the current rate persists, the probability for global warming to reach the 1.5°C threshold between 2030 and 2052 is very high (IPCC, 2018).

FIGURE 1  Annual global temperature and CO2 levels between 1959 and 2016 (WEF, 2018)

In order to avoid, reduce, and delay greenhouse gas emission levels, recent policies focus on mitigating actions. Indeed, the European Commission (2018) envisions net-zero greenhouse gas emissions by 2050, coherent with the global temperature objective of maximum 2°C (in comparison with preindustrial levels). Although mitigating actions are necessary to reach the targets put forward, these need to be complemented with adaptive actions to constrain the damages caused by inevitable impacts of climate change (NCC, 2016).

In this regard, the 2030 climate & energy framework (EC, 2014) targets to cut greenhouse gas emissions in the EU by a minimum of 40% by 2030 in comparison to 1990 levels, hence meeting the targets put forward in the Paris Agreement and moving towards a low-carbon economy. To achieve this cut in GHG emissions, non-ETS sectors (including transport) in Belgium will have to reduce greenhouse gas emissions by 35% by 2030 as compared to 2005 levels.

Next to the impact on climate change, the impact of the transport sector on air quality is also very worrisome. World Health Organization standards on air quality are far from being met, especially when zooming in on busy roads. Known as PM, O$_3$, and NO$_x$, the local effects of air pollution on human health are responsible for approximately 555,000 premature deaths in Europe yearly (EEA, 2016; ECA, 2018). A large share of these emissions is attributable to freight transport. While only representing 14% of total traffic in the Brussels Capital Region, freight transport is considered to be responsible for 33% of traffic related PM emissions (Lebeau and Macharis, 2014).

Next to these global and local emissions effects; accidents, congestion, and up-and downstream processes have also an important negative impact on society. These caused damages are -for the greater part- not included in the pricing system, hence not carried by the causer of the nuisances. When the associated costs of, for example, air pollution (in this case its impact on human health) are not entirely
bored by the causer (in this case the polluter), we call them external (Bickel and Friedrich, 2005). This concept is referred to as externalities, as these changes in wealth are not integrated into the price of the transport activities. In what follows, we explain (1) the challenge to reduce the greenhouse gases for the transport sector, (2) the theoretical background on how to monetarise external costs (in other words, how to assign a money value to them), and then (3) show how a policy oriented towards the internalization of external costs could look like by the means of a road pricing scheme.

2 External effects

2.1 Climate change in numbers

FIGURE 2  Distribution of total direct CO\textsubscript{2} emissions (both ETS & non-ETS sectors combined) in the EU for 2015. Source: (EEA, 2017; ICCT, 2018)

Transport accounts for 32% of total direct CO\textsubscript{2} emissions (both ETS and non-ETS sectors) in the European Union (EU-28, 2015). What is striking, however, is that the European transport sector is the only sector that did not manage to lower its CO\textsubscript{2} emissions under the level of 1990 (FIGURE 3) (EC, 2016; EEA 2016).
It is also important to stress the non-declining trend of the share of the transport sector as a whole and its associated emitted greenhouse gases in Flanders (MIRA, 2018). This is due to the increased demand for transport (both passenger and freight), influenced by trends of globalization, e-commerce, further economic and population growth, etc. The technological advances could not alter this trend. This growth in demand is expected to continue (see Figure 4).

The Federal Planning Agency of Belgium and the Federal Public Service for Mobility and Transport of Belgium prepared long-term forecasts for transport demand in Belgium. Over the period 2012-2030, the FPB estimates that the demand for the total number of passenger transport trips would increase by 10% or an average annual growth of 0.5%. The number of passenger-kilometres would increase by 11% between 2012 and 2030, or on average, a 0.6% yearly growth. For freight transport, the number of ton-kilometres for road, rail, and inland waterways would increase from 65.4 billion in 2012 to 94.5 billion in 2030. This equals an increase of 45% (an annual growth rate of 2.1%). For the modal distribution of the freight transport ton-kilometres in Belgium, road transport remains the dominant mode. By 2030
(with reference year 2012), the total number of vehicle-kilometres (both freight and passenger) on Belgian roads is expected to increase by 22%. This increase is greater for freight transport (30% for trucks and 43% for vans) compared with cars (19%) (Federaal Planbureau, 2015). In their more recent calculations, the forecast has still been adjusted to a growth of 25% between 2015 and 2040 (Federaal Planbureau, 2019).

It is clear from this overview that we are facing a huge challenge, and the implementation of multiple measures will be necessary to reach the CO₂ reduction goals. Road pricing (kilometer charging) can be one of the instruments.

### 2.2 Evolution of local emission levels (air pollution)

Reports highlight the importance of the transport sector (both passenger and freight) for a number of air pollutants in Flanders. The most striking is that 55% of all NOₓ emissions find their origin in transport (2014). The majority is attributable to road transport (both passenger and freight), and its relative share systematically stagnates (or even increases) (VMM, 2016; MIRA, 2017, Mommens, 2019).

The main causes of worsening air pollution levels are mainly the inefficient use of energy and the strong reliance on fossil fuels. The WHO attributed 3.7 million deaths to outdoor air pollution in 2012 (for people younger than 60), and states that air pollution (indoor and outdoor) is the major threat to human health globally (mainly due to high PM-concentrations) (2014).

![FIGURE 5 Spatial spread of PM$_{2.5}$ average yearly concentration at (1) Upper EU Limit Value and (2) Lower WHO Advisory Value for Flanders in 2015. Source: (IRCEL, 2017; MIRA, 2017; VMM, 2016)](image-url)

The first graph in Figure 6 has been rendered, taking into account the EU-limit for PM$_{2.5}$ and shows that this limit was not exceeded in any part of Flanders in 2015. Using the moderately stricter WHO advisory value, the second graph reveals that a large part of Flanders’ citizens is exposed to exceeding concentrations (94% population density) (MIRA, 2017). This was further confirmed by local measurements held in the CurieuzeNeuzen citizen science project, during which data from 20,000 citizens were used to build a detailed air quality map of Flanders (CurieuzeNeuzen, 2018).
3 The internalization of external costs

Externalities arise when the associated costs of nuisances are not carried by the causer, as these changes in wealth are not included in the prices of transport activities. Hence, the impact of air pollution on human health is generally not included in the price of the vehicle use (Weinreich et al., 2000). Highlighting the important concepts of external cost calculation, this part will focus specifically on climate change and air pollution for road transport (Macharis and van Lier, 2017).

Societal welfare principles aim to oversee that prices include the total cost of an activity, hence incorporating the cost of the caused nuisances. After estimating and monetizing socio-environmental damages, external costs can be internalized by implementing economic instruments such as road pricing.

3.1 External costs: a theoretical overview

An economic exchange can cause additional consequences to a third party and can either be positive (rise in housing prices due to new high-speed train stations in the city) or negative (noise nuisances caused by delivery of construction materials). This is referred to as an externality (or transaction spillover) and is defined as a cost or benefit incurred by a party who did not agree to the action causing the cost or benefit, and this cost or benefit is not reflected in the price of the good or service (Laffont, 2008, Macharis and van Lier, 2017).

As explained in more detail in Part III: Theory (Chapter 3), in classic economics, under theoretical conditions, the competitive price mechanism leads to a Pareto optimal allocation of resources. Welfare economics, however, has shown that these externalities lead to a non-optimal situation, hence causing a market failure because the market price does not equal the societal price (Schmidtchen et al., 2009). Applied on the transport industry, the many nuisances caused by transport activities (negative externalities) in the society are generally not reflected in the market price of these activities. Market driven approaches aim to recover the market/social equilibrium by internalizing external costs.

3.2 Environmental damage costs generated by road transport

When determining external costs, one needs to first measure the effects of the associated externalities, and then, correctly monetize these effects. This can be done in a straightforward way for marketed goods and services by means of willingness to pay (WTP). However, this is rarely the case for non-marketed goods and services, where some welfare components are not reflected in their market price (i.e., the impact of air pollution on human health due to freight transport activities) (Bickel and Friedrich, 2005). These welfare changes (referred to as the total economic value of the change) can be monetized by means of non-market valuation techniques.

Over the course of the past decades, extensive literature can be found on valuation techniques. Two major concepts are emphasized (Pearce and Howarth, 2000): revealed preference techniques (preferences based on actual, observed, market-based information) and stated preference techniques (a more generic term to include contingent valuation and choice experiments).

Transport activities lead to a large number of negative externalities. The most renown ones are climate change and air pollution (consequences of emissions), accidents noise, soil contamination, interference in the ecological system, damage to infrastructure, visual nuisance, and congestion (van Lier and
Macharis, 2017). The European Commission (2018) estimates the total size of external costs for transport in the EU at around 1,000 billion euro annually, or, as a size estimation, approximately 7% of the EU28 GDP (EC, 2018).

The scope of this chapter focusses on the consequences of emissions, namely climate change and air pollution. Climate change and the impact of air pollution are parts of the environmental damage costs and are highly dependent on the energy use of transport modes. Some emissions/pollutants are evaluated more expensive than others, given their different impact on human health and the environment.

3.3 Climate change (global emissions)

Nowadays, global greenhouse gas and its impacts on climate change are major topics of research output, which continuously improve economic impact assessment models. A major aspect of the calculation of the external cost of climate change is the realistic evaluation of the carbon price (Ricardo-AEA, 2014). In scientific as well as in popular literature, social costs of climate change are often associated with impacts on health, ecosystems and biodiversity, rising sea levels, energy use and demand, etc. The most important emissions generated by transport having an impact on climate change are CO2, N2O, and CH4 (van Lier et al., 2010). While being extremely complex to estimate due to their unpredictable risk patterns, long-term effects, and global geographical scale (Maibach et al., 2008), it requires an approach combining both a damage costs approach (Impact Pathway Approach) and a mitigation cost approach (reduction objectives). As for transport-generated emissions, two different types can be distinguished: direct emissions (happening while using a vehicle and consisting of both exhaust and non-exhaust emissions) and indirect emissions (related to up-and downstream processes) (Delhaye et al., 2010; van Lier and Macharis, 2009).

The transport mode and fuel types thus play a crucial role in the generated emissions. External costs output values for climate change can, for example, be retrieved in Ricardo-AEA’s Update of the Handbook on External Costs of Transport (2014). As explained in this study, the estimation of the unit cost for different transport modes envelopes different steps, combining (1) the quantification of GHG emission factors for a range of vehicle types (in tons CO2-equivalent per vkm) and (2) the valuation of climate change (per ton of CO2-equivalent) to finally calculate (3) the marginal climate change costs for a range of different types of vehicles and fuels. In this process, the cost valuation of climate change is thus important.

For this GHG emissions cost evaluation, the literature suggests two main techniques: the damage-cost approach and the abatement cost approach. The latter stresses the willingness-to-pay (WTP) for less pollution expressed in EUR values per kg of pollutant (e.g., ton CO2). The first includes all total costs assuming a business as a usual scenario in which no attempts are made to decrease the pace of global warming, which inhibits global warming effects in rising sea levels, vegetation, etc. Although this method is able to capture all external costs related to climate change, its complexity in terms of uncertainty, geographical spread, and extended time periods makes it next to impossible to measure in a simple and accurate way. Moreover, it is broadly accepted that many climate change-related threats are still unknown and thus difficult to evaluate. Therefore, the abatement cost approach, based on a set emission reduction target upon which the cost is calculated to meet the target, offers a sound alternative if these reduction targets correctly translate the societal preferences, facilitating the willingness to calculate different abatement levels (Ricardo-AEA, 2014). Furthermore, comparing the spread of results in studies using the damage costs approach or the avoidance cost approach, it is importantly lower in the latter. When reduction targets have been put forward, CO2 external costs based on
avoidance costs are thus preferred. Consequently, these costs will vary strongly based on the set target levels (Maibach et al., 2008).

Every GHG has an effect on the phenomenon of global warming. Its impact can thus be expressed in the amount it contributes to climate change. The potential impact of a greenhouse gas is used to calculate the corresponding CO2-equivalent (CO2e), a standardized unit and aggregated indicator to measure the carbon footprint (Ecolife, 2016).

The valuation of the external cost of climate change, measured as EUR/ton (against a base year), varies from study to study and evolves over time. The Handbook on Estimation of External Costs in the Transport Sector conducted by CE Delft (Maibach et al., 2008) proposed a 25EUR/ton CO2-equivalent (2005 base prices) with incremental increases over time (as shown in Figure 6).

FIGURE 6 Values for the calculation of external costs of climate change as proposed by Maibach et al. (2008)

It is worth noting that more recent studies estimate this cost to be higher than earlier ones. This is mainly attributable to an increasing knowledge on the topic and sensitivity risks, which is in its turn translated in more fine-grained modeling. However, a large spread is still noticeable in damage costs evaluations, highlighting the uncertainty associated with these approaches. A study by Kuik et al. (2009), which is strongly based on the United Nations Framework Convention on Climate Change (UNFCCC), proposes a range of 69-241EUR/ton CO2-equivalent with central value of 129EUR for the year 2025 and 128-396EUR/ton CO2-equivalent with central value of 225EUR for 2050 (base year 2005).

The Ricardo-AEA study (2014) offers an updated handbook of Maibach et al. (2008) with a central value for carbon price at 90EUR/ton CO2-equivalent (48-168EUR range, 2010 prices), which is comparable to other studies. For example, UBA (2012), for guidelines in Germany, recommends a central value of 80EUR/ton CO2-equivalent (with a range of 40-120EUR), and Watkiss and Downing (2008) recommend 80GBP/ton CO2-equivalent for the UK (for 2010). Striking is the relatively low valuation of the recent study conducted by CE Delft (de Bruyn et al., 2018), which suggests a central value of 57EUR/ton CO2-equivalent for 2015.
3.4 Carbon offsetting

Another way of evaluating the costs linked to CO$_2$ is the carbon offsetting mechanism, following the principle of CO$_2$-neutrality. Using a transparent measurement system, the latter foresees that the net calculated CO$_2$ emissions equal zero. The mechanism of carbon offsetting states that an organization indemnifies part of the GHG emissions it produces by paying for a CO$_2$ equivalent reduction in another region of the world. For example, the company indirectly invests in wind farms and hence compensates for a CO$_2$ saving equivalent to its coal-fired steel manufacturing emissions. A company’s activity is considered to be carbon neutral when all the non-avoidable emissions are offset. Carbon offsetting is different from the EU ETS scheme because the latter only allows a maximum GHG emission allowance for heavy energy-consuming activities under a ‘cap-and-trade’ scheme (ECA, 2014; CO2logic, 2014).

To enable correct measurements for additional emission reductions and avoid double counting, offsets should be validated using accepted schemes. Indeed, it is worth stressing that offsetting is not broadly used throughout the EU. One reason for this is that EU institutions have different approaches to deal with offsetting; in other words, no common carbon footprint calculation approach exists for EU institutions and bodies. Another reason is that carbon offsetting is not mandatory for EU institutions. Although some companies have been using the mechanism to a limited extent, audits reveal that companies paid, on average, between 3.45 and 24.5 EUR per ton CO$_2$-equivalent. These are lower than the maximum cost put forward by the European Parliament (40 EUR, 2007 prices) (ECA, 2014) and drastically lower when compared to the damage cost evaluation in the previous segment. We thus need to bear in mind that this discrepancy can be explained by, for example, the fluctuating market price of carbon offsetting credits and economic variables associated with the region where the compensating measures are taken.

3.5 Air pollution (local emissions)

An approved way of measuring external costs related to air pollution is the Impact Pathway Approach (IPA). This technique enables the estimation of external costs based on dose-response functions (Maibach et al., 2008), hence taking into account the number of receptors, people in the near vicinity of the emission source (generally the moving vehicle). The number of receptors is thus directly related to the magnitude of the external costs caused by air pollution.

An example of air pollution’s output values for recommended external costs, both for freight transport and passenger cars, can be retrieved in the Update of the Handbook on External Costs of Transport (Ricardo-AEA, 2014). Analogically, other transport modes are also accounted for in the same study.

Bar some exceptions, air pollution costs for heavy goods vehicles are generally higher for vehicles having a larger engine and lower EURO norm. In addition, the costs are typically higher in urban zones compared to rural ones. Key takeaways for passenger cars from this table are the lower costs of petrol cars compared to diesel ones, the impact of the EURO norm, and the considerably higher marginal costs in urban areas due to higher receptor densities compared to interurban or rural areas. In this regard, diesel passenger cars are the greatest wrongdoers when it comes to marginal environmental damage costs. The reason for this is their relatively high PM emissions, having a high impact on human health. Hybrid and electric cars, with their relatively low air pollution costs, bear the most moderate
environmental external costs. However, one needs to take into account the up-and downstream processes needed to generate electricity (well-to-tank emissions) for these activities.

3.6 Methods for internalizing external costs of transport

Vehicle purchase and ownership usually involve several taxes, such as registration (once upon registration), circulation (annually and based on for example, engine power), and value added taxes (once upon purchase). These are examples of fixed and periodical taxes or pricing measures. While potentially having an influence on the initial purchase of the vehicle, these do not take into account the use of the vehicle and its related impact on the environment or congestion and are thus not suitable to internalize external costs. A more suitable and correct way to reflect the external costs generated by transport is to implement variable taxes\(^5\), stressing car usage rather than car ownership, i.e., reducing fixed tax importance in support of variable taxes (Immers and Stada, 2004). Examples of this variabilization include congestion pricing and kilometre charging. Within the scope of this chapter, we focus on the latter.

While reducing the share of fixed taxes, the kilometre tax (or road pricing) is likely to influence traffic volume. Recording the actually driven kilometres (De Borger et al., 1997), it has the probability to differentiate fuel type, EURO norm, vehicle size, location, road type and time, and potentially also the pollution level of the concerned vehicle. Hence, it could prove to be an efficient pricing concept for the internalization of external costs\(^6\) (such as air pollution) of transport. A potential hurdle in terms of its implementation is, amongst others, the public acceptability, which is generally very low and often based on misconceptions (De Borger et al., 1997). When its implementation is being hindered, the second-best solutions can be based on factors such as parking charges or public transport subsidies.

At present, a great part of the external costs caused by the transport sector is not still being internalized, meaning the damage costs are carried by society and are not reflected in the price of the use of transport. In other words, the current taxes and charges on transport only recover the external costs partially. Within the passenger transport segment, the internalization rate is generally the highest for road transport, especially personal petrol cars (80% of its external costs) and motorcycles (more taxes than its external costs). In contrast, the external costs of diesel cars are only internalized for a share of 42%. For company cars, this figure drops to 66% for petrol and a mere 21% for diesel. The freight transport segment knows lower internalization rates. Light commercial vehicles internalize (depending on fuel type) between 27% and 50% of their external costs, while the percentage for heavy goods vehicles is 15% and 26%, respectively (Delhaye et al., 2017). For road transport, it is worth noting that time (off-peak) and place (road type) variables also render different internalization rates. Generally, heavy goods vehicles do not pay enough to compensate for their external costs, but this stressed even more during peak times and in urban environments.

In absolute figures, 75% of all transport-related external costs come from road transport. Within total external costs from transport in the EU-28 in 2016, environmental costs (air pollution and climate change) have a share of 28%. The transport sector is also responsible for other types of external costs, such as congestion and accidents costs, respectively accounting for 27% and 29% of total external costs.

\(^5\) Although variable taxes encompass excise duties, these do not fall under the road pricing scheme.

\(^6\) Fine-grained spatiotemporal observations need to be taken into account when assessing the external cost of congestion.
Figure 7 shows the external costs in EUR values generated by heavy goods vehicles per category for the EU in 2013 (T&E, 2016), and its share that is not covered by current schemes.

**FIGURE 7** Left: the external cost of heavy goods vehicles (in billion EUR). Right: share of covered external costs by trucks. Source: (Transport & Environment, 2016)

By increasing the internalization rate, users are encouraged to choose less damaging transport modes; hence, rendering the transport sector is more efficient economically, environmentally, and socially. The deadweight loss caused by external costs (not carried by the causer) should thus be minimized. The current discrepancy between the market price for the use of road transport and its external costs also engenders a ‘competitive disadvantage’ towards other transport modes, discriminating mainly rail transport. Widely accepted and currently endorsed by the European Commission, the ‘polluter pays’ principle would potentially fill this gap by means of, amongst others, road pricing or kilometer charges (TEN-T, 2019).

### 4 Road pricing measures

Road pricing schemes or kilometre charges have been extensively analysed for both passenger and freight transport during the past decades (Mommens et al., 2016). These schemes have numerous goals, such as reducing congestion levels, recouping the infrastructure or maintenance costs, or internalizing -part of- external costs of climate change or other, and involve the user of the infrastructure to pay directly for its use (Mommens et al., 2016).

**FIGURE 8** Charging of heavy goods vehicles in the EU (T&E, 2016)
Previous legislative measures from the European Commission include the ‘Eurovignette Directive’ (1999/62/EC) and set out a list of guidelines (the directive is largely opt-in based) on how member states can charge trucks for their road infrastructure use. The benefits to the member states are obvious: a reduction in external costs, public budget revenue growth, and more efficient transport. A proposal to review the Directive stresses the concepts of the ‘polluter pays’ and ‘user pays’, hence putting forward socially equitable transport (European Parliament, 2017). The goal is to extend the Directive wider than Heavy Goods Vehicles (HGV) to also cover Light Duty Vehicles (LDV) such as passenger cars, buses, and vans (especially for freight carriage).

This dynamic pricing scheme would increase the variable cost and decrease its fixed cost, thereby stimulating the ‘polluter pays’ principle. A differentiated toll scheme (by air pollutant and CO₂ emissions) and the incentivization of zero-emission vehicles are key aspects to stimulate this dynamic kilometre charge and thus reduce emissions. While road pricing on its own is not the sole element for solving climate change, air pollution concentrations, and paving the way towards decarbonisation, the concept can prove itself useful if implemented in a fashion that promotes green and sustainable transport behaviour (T&E, 2017).

4.1 Passenger transport

The Flemish government has been working towards the so-called ‘green tax shift’, following the ‘polluter pays’ principle. Current tax schemes (other than excise duties) do not take into account actual vehicle usage (the number of kilometres driven). These static tax schemes are thus bound to miss their desired effect when it comes to calculating the external cost. In other words, the conventional static vehicle tax schemes do not internalize the total external costs of vehicle usage and emitted pollutants. At the same time, implementing such a road pricing scheme might require public acceptance. That is why it also has to be studied in combination with a possible tax shift. Transport & Mobility Leuven (2019) together with KU Leuven were commissioned for this study, in order to analyse the feasibility of implementing a green tax shift based on kilometre charge (road pricing) and how the latter can stimulate the economy while keeping close attention to the environment and social aspects.

Road pricing is a concept where road users directly pay for their use, hence offering a dynamic approach to the conventional one-off tax at the time of purchase (the tax on entry into service) or a periodic tax on car ownership (annual traffic tax). This road pricing schemes thus increases the car usage’s variable cost⁷ and therefore offers a more accurate approach⁸ to internalize the external costs, such as climate change and air pollution. Therefore, we also speak about a ‘smart’ kilometre charge because it depends on where and when one drives. A dynamic road pricing scheme would encourage car users to reduce their car use, possibly to shift towards other means of transport, and discourage users from driving during peak hours (Vlaamse Overheid, 2019a).

TML (2019) differentiated multiple road pricing scenarios, taking into account the governments’ regulatory and budgetary constraints and its expected end results. Hence, these scenarios enabled the calculation of the effects on traffic volumes, congestion, and environment and were completed with a social cost-benefit analysis. The results of the study highlight the fact that the kilometre charge would enable the green tax shift from labour to road taxing. Taking into account the internalization of external

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⁷ Next to other variable cost items such as fuel costs (including excise duties and VAT), maintenance costs, and sometimes insurance costs based on kilometres.
⁸ Compared to the static tax scheme increasing the fixed costs of car usage.
costs of transport, the charge would yield 5.6 billion EUR annually with an average tax of 0.125 EUR per kilometre (with or without a higher rate during rush hour). Subtracting this figure from system costs and the current income from traffic taxes (which would be abolished), the government would still have a budgetary surplus of 3.8 billion EUR in this scenario. TML also forecasts an additional 700 million in expected payback effects, associated with the positive impact of the charge reduction on the economy and labour market, as such expecting Flanders to gain 4.5 billion EUR in this green tax shift. As a consequence, an 8% decrease in the amount of vehicle kilometre would be noticeable and would reduce the external costs of congestion, emissions, noise, and accidents by 830 million EUR per year\(^9\). The green tax shift would thus entail an increase in price for using a car but could be compensated by lowering the tax on personal income (labour). As predicted by Breemersch et al., CO\(_2\) levels could also fall by 8% and an even larger amount in terms of NO\(_2\) and PM if low-emission vehicles are favoured. When implementing the kilometre charge, a decrease in car usage (in total passenger kilometres) is also noticeable. Partially shifting to other transport modes such as train and bike would lead to relatively increase the green tax (TML, 2019).

4.2 Freight transport

In Belgium, a kilometre charge for trucks has already been introduced in April 2016 (Mommens et al., 2016; Vlaamse Overheid, 2019b). This includes a kilometre charge for the use of motorways and certain regional roads in Belgium\(^{10}\) and has to be paid by owners of freight vehicles with a gross vehicle weight of over 3.5t and for vehicles of class N1/BC\(^{11}\). A price distinction is made in terms of different roads, gross vehicle weight, and their EURO-norm and is applicable for Belgian as well as foreign vehicles. However, no time variations are taken into account. This ‘smart’ kilometre charge is calculated via an On-Board Unit (dim OBU) using GPS technology to track the number of kilometres driven. In other words, this variable kilometre charge is based on the distance covered, and how environmentally friendly the vehicle is.

Thus far, the effects of this road pricing scheme have been limited in terms of modal shift or bundling. The kilometre charge had a perverse effect mainly due to the emergence of avoidance traffic, hence partially shifting traffic from motorways to the secondary road network in order to avoid the charge. This resulted in an extension of 6 road segments in the road pricing network at the beginning of 2018, and further analyses are conducted to extend the network even further (MOW, 2018).

4.3 Road pricing for freight transport in Belgium

The common use of GPS devices and traffic monitoring techniques allow the implementation of road pricing systems which differentiate their price settings according to the vehicle, location, and time. This is illustrated by the current road pricing system in Belgium, described above. While this system has been communicated and justified as a tool to internalize transport related external costs, in reality, it is just part of the case in terms of the used prices, considered variables, and related externalities. Therefore, the question about the impact of a correct and holistic internalization of transport-related externalities remains unanswered.

\(^9\) The double dividend of environmental tax schemes implies an improvement from both an economic and environmental point of view (Gouler, 1995).

\(^{10}\) The kilometre charging includes all roads in the Brussels Metropolitan Region.

\(^{11}\) Excluded from this kilometre charge are machine-vehicles (such as cranes, bulldozers, and lifts) and other types of vehicles such as test drive license plated vehicles, old-timers, etc.
In a study for the Flemish Government (department MOW), VUB-MOBI calculated the impact of such an internalization in terms of modal split, vehicle-kilometres, and CO₂ reduction (van Lier et al., 2019). The presented research is part of a broader study, carried out by a consortium of VUB-MOBI, Sweco Belgium, and VIL, on the reduction of climate and air emissions generated by freight transport. The aim was to scientifically underpin the debate on a strategy for the reduction of greenhouse gas and air pollutant emissions from freight transport (van Lier et al., 2019). In total, nineteen different measures were identified through literature and stakeholder assessment (Macharis et al., 2019). Thereafter, all 19 measures were simulated towards horizon 2030 with two freight transport models; the Strategic Freight Model of Flanders (Borremans et al., 2015) and TRABAM (Mommens et al., 2018). The most promising ones were combined in multiple preferred scenarios.

The introduction of pricing was one of the simulated measures. It has been simulated using the Strategic Freight Model. This is a classic FOUR step model, which simulates freight transport flows between 615 zones subdividing Europe, nevertheless, with a strong focus on Flanders (518 zones). The model offers the opportunity to include passenger transport. Three types of road vehicles (vans, light duty vehicles, and heavy-duty vehicles), one type of train, and six types of barges (CETM class I to VI) are considered. Pricing has been introduced as an additional cost according to vehicle type, road type, and peak and off-hours. The external cost factors are based on the Delhaye et al. (2017) study and are presented in TABLE 1.

<table>
<thead>
<tr>
<th>Off-peak</th>
<th>Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>€/vkm</td>
<td>Highways Rural &amp; urba</td>
</tr>
<tr>
<td>Vans (1 - 3.5 tonnes)</td>
<td>0.176</td>
</tr>
<tr>
<td>LDV (3.5 - 12 tonnes)</td>
<td>0.326</td>
</tr>
<tr>
<td>HDV (12.5 - 40 tonnes)</td>
<td>0.405</td>
</tr>
<tr>
<td>IWT - small</td>
<td>2.820</td>
</tr>
<tr>
<td>IWT – medium</td>
<td>6.645</td>
</tr>
<tr>
<td>IWT – big</td>
<td>10.617</td>
</tr>
<tr>
<td>Rail</td>
<td>3.359</td>
</tr>
</tbody>
</table>

Six pricing scenarios using these costs were individually analysed, as they differentiate from geographical scope (Belgium or European Union), transport modes (road only or rail, road, and inland waterway transport), and the variable of whether road taxes and excise duties could be considered as an internalization of external costs (yes or no).

The first scenario consists of a pricing system which applies to road transport only and is performed on Belgian soil. Excise duties are not considered as internalization, and passenger road transport is confronted with flat pricing of 0.05 EUR per kilometre and a start fee of 0.25 EUR. Those passenger tariffs are used throughout all scenarios. The second scenario is equal to the first, except that it is applied
to all transport modes such as roads, rails, and barges. Both scenarios lead to relatively large reductions in CO\textsubscript{2} emitted by transport operations in Flanders. Respectively, reductions of 11.7% and 11.9% are obtained in 2030 compared to business as usual (bau) in 2030. Yet by analysing these results, they are not caused by a large modal shift or bundling strategies. Unfortunately, the reductions are explained by transport flows that avoid the additional charge by making a detour through the neighbouring countries. Therefore, the overall European CO\textsubscript{2} emissions are higher than business as usual.

This is also underpinned by the third scenario, which is on its turn equal to the first scenario, except that the pricing system applies to whole Europe. The implementation of a European road pricing system, applying the values presented in TABLE 1, results in a 0.1% reduction in CO\textsubscript{2} emissions. This limited reduction is obtained by a modal shift from the road (-1.72% of volume) to rail (+0.74%) and barge (+0.98%). However, a closer look at the results illustrated that many heavy-duty vehicles were pushed from the main roads (highways) towards local, smaller roads. The reason for this undesired effect is the relatively high congestion cost on highways with respect to the values that are applicable to congestion on local roads.

Given the negative effects of heavy-duty vehicles on local roads such as infrastructural damage, safety issues, noise nuisance, etc., two additional scenarios were constructed with adapted costs. The used costs were set on -20% on highways and +25% on local roads, as they stop the perverse effect and result in similar income of the pricing system, thus leading to a correct internalization. Additionally, both scenarios (4 and 5) consider excise duties as an internalization of external costs and exclude the external costs of CO\textsubscript{2} emissions (set on 100EUR/ton). Therefore, the following costs were applied to the pricing system in scenarios 4 and 5.

TABLE 2 External costs used in scenarios 4 and 5 (van Lier et al., 2019)

<table>
<thead>
<tr>
<th>€/vkm</th>
<th>Off-peak</th>
<th>Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Highways</td>
<td>Regional roads</td>
</tr>
<tr>
<td></td>
<td>Rural &amp; suburban</td>
<td>Rural &amp; suburban</td>
</tr>
</tbody>
</table>

| Vans (1 - 3.5 tonnes) | 0.052 | 0.085 | 0.116 | 0.136 | 0.116 | 0.136 | 0.148 | 0.182 | 0.274 | 0.291 | 0.271 | 0.291 |
| LDV (3.5 - 12 tonnes) | 0.079 | 0.136 | 0.150 | 0.217 | 0.150 | 0.217 | 0.272 | 0.329 | 0.460 | 0.527 | 0.460 | 0.527 |
| HDV (12.5 - 40 tonnes) | 0.035 | 0.095 | 0.080 | 0.152 | 0.080 | 0.152 | 0.229 | 0.289 | 0.390 | 0.462 | 0.390 | 0.462 |
| IWT – small | 2.100 |
| IWT – medium | 4.227 |
| IWT – big | 6.311 |
| Rail | 0.0 (-0.23) |

Both scenarios 4 and 5 apply on the European scale, yet in 4 all transport modes are considered, while in 5 only road transport is confronted with the pricing system. The results of both scenarios are negative, with a respective rise of 2% and 1.3% compared to business as usual in 2030. The reason for this result is twofold. First, transport flows are pushed towards the highways, resulting in higher vehicle-kilometers and related CO\textsubscript{2}. Second, transport operations are optimized to reduce air pollution and avoid
congestion, and not to consider CO₂. Although CO₂ is mostly correlated with congestion and air pollution at the first thought, it can be explained that transport flows take longer routes to avoid congestion or drive to less populated areas to avoid air pollution costs. Yet, both result in higher CO₂ emissions. This argument is underpinned with scenario six that considers an internalization of CO₂ costs only (100€/ton). This scenario results in a reduction of 3.2% compared to business as usual in 2030.

FIGURE 9 Results of pricing scheme scenarios for freight transport in Flanders compared to business as usual (bau) in 2030 (index = 1) (source: VUB MOBI)

FIGURE 9 gives an overview of the CO₂ reductions for all six scenarios compared to one another and compared to the reduction goals set by the Flemish government for 2030. The government is allowing the freight transport sector to still have rising CO₂ emissions, up to 3% compared to 2005. Therefore, it considers the expectancy of the freight sector to grow in the coming years, its related dependence on economic growth, and lastly, its challenges to become sustainable, as technologies (like electric trucks) will be commercially available in a later stage compared with passenger cars. However, this 3% goal will not be reached with solely an internalization of external costs. Therefore, a lot of other measures inducing a system change will be necessary to reach the climate goals.

5 Conclusions: possibilities and hurdles of the road pricing instrument

While transport is inevitable in our economy and daily lives, it also engenders many negative effects on the economy, society, and environment. A great share of the external costs associated with climate change is attributable to transport. In 2015, an almost 9% share of all CO₂ emissions across all sectors in the EU was particularly attributable to road freight transport (both light commercial and heavy duty). However, most damage costs are not entirely carried by the causer of the nuisances, hence not internalized in the pricing system.

The alarming pace at which global warming and climate change are escalating cannot be denied. Mitigating actions have been put forward in order to avoid, reduce, and delay greenhouse gas emissions and grow towards a low-carbon economy. However, the transport sector still lags behind with regards to emitted greenhouse gases and faces difficulties to achieve the emission reduction goals. In fact, it is the sole sector that has not been able to lower its CO₂ emissions compared to 1990 levels.
In order to meet the set targets by 2030 and 2050 and tackle this urgent challenge, the implementation of multiple measures will be required. In line with the ‘polluter pays’ principle, a possible instrument to reduce greenhouse gas emissions and increase the internalization rate of road freight transport is the implementation of a road pricing scheme. Not only would it stimulate the use of more environmentally friendly vehicles; this concept could also prove its use in pursuing a level playing field across different transport modes.

With regards to passenger road transport in Belgium, implementing a dynamic road pricing scheme could offer a more accurate approach to internalize external costs which are linked to driven vehicle kilometres, such as climate change and air pollution. Indeed, results highlight a potential CO₂ reduction of up to 8% and a double dividend (over all external costs) of up to 830 million EUR per year. While vehicle usage would then become more expensive, the additionally generated public revenue could compensate for the cost by lowering the labour tax, referred to as the green tax shift.

When it comes to road freight transport, Belgium implemented a kilometre charge in early 2016. Although the scheme has been put forward as a way to justify the internalization of external costs generated by transport activities, it is only partially the case, as can be deducted from the used prices, variables, and associated externalities. The presented study conducted by VUB-MOBI for the Flemish Government (MOW) does calculate the impact of this internalization in terms of CO₂ reduction potential, vehicle-kilometres, and modal split, based on six different scenarios. Although the largest reductions in CO₂ reach up to -11.9% in 2030 (compared to business as usual when implemented on Belgian soil only), this drop is mainly attributable to avoid traffic, shifting routes to neighbouring countries (rather than modal shift or bundling). A slight modal shift from road to rail and barge is noticeable when the kilometre charge is applied to Europe as a whole. However, a shift from motorways to the secondary road network is also noticeable because of the relatively high congestion costs on highways. A desirable internalization can be obtained when lowering the congestion cost on highways and increasing the one on local roads, hence pushing traffic volumes towards the highways.

As explained above, the implementation of a pricing system should be well thought of, as perverse effects can easily arise. Secondly, governments should go for pricing systems that internalize all transport-related externalities. The direct effect may be limited for freight transport; however, it creates an environment where more sustainable concepts, operations, and technologies can be applied more easily and with higher economic success. While an important aspect remains to properly frame and communicate the goal and impact of such a differentiated pricing system to users, a differentiated toll has the potential to generate stakeholder awareness on the external effects the transport industry is generating. It could provide insights as to how companies can enhance their logistics activities in a more sustainable way, as such lowering the external damages caused. In this way, unnecessary kilometres can be avoided, and empty journeys can be reduced by bundling trips in order to pay fewer taxes. Depending on the implementation level, pricing could also -partially- stimulate a modal shift. This modal shift will obviously be greater if a road pricing scheme is being implemented solely on road transport, as opposed to simultaneously applying a charge to rail and inland shipping. Analogically, the road pricing scheme will also incentivize the switch to zero-emission vehicles (ZEV) (more quickly), given the lower charge for more environmentally friendly vehicles. Lastly, a pricing scheme should be implemented coherently on a European level, in order to avoid additional kilometres due to detour and related externalities.
It is also worth pointing out that the instrument of road pricing is just one in many tools in meeting the long-term 2030 and 2050 decarbonisation targets, and these will also have to be implemented to reach the goals.
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PART III: THEORY

Chapter 3. The Economics of "road pricing"
E. T. VERHOEF
Abstract
This chapter focuses on the question why, from the perspective of economic theory, road pricing is the appropriate tool for achieving the optimum use of road infrastructure. This is first set out for an “ideal” world, i.e. a world in which all road users would agree to the introduction of this instrument. Then it is explained that such is not the case in the real world, where there is often number of social and political resistance to road pricing. Finally, it is shown that, under such circumstances, less strict versions of the principle of road pricing can be followed, leading to what are usually called the second best solutions to the problem of optimum use.

1 Introduction
It is a century minus one year ago since Arthur Pigou (1920) put down his theory of "road congestion pricing" and explained why, from the economics perspective, this is such a logical policy. That he was a visionary, can already be seen from the fact that at that time traffic congestion had by no means reached the scale and urgency that it has in present-day cities - worldwide. It has been reported that the biggest challenge in urban transport policy at the time was the question of what to do with the huge stocks of horse manure if mobility continued to grow as feared. In the meantime, this problem has been solved, but traffic congestion is high on the urgency list in most major cities. Pigou’s explanation is equally applicable to other “external costs” of mobility, such as emissions’ damage, risks in traffic safety as well as noise nuisance. This makes the theory all the more relevant for current traffic and transport policy.

What Pigou has shown is that where markets are missing, prices no longer provide incentives to limit consumption. Over-consumption is lurking due to unpriced scarcity. We see this reflected in excessive congestion and emissions of road traffic in and around contemporary cities. Pigou's remedy was as simple as it was ingenious: enter a price “toll” or in modern terminology and technology: a kilometre price – which after all charges the originator for the unpriced scarcity. Then, the optimum as we know it from economic textbooks is still in the picture.

Although Pigou’s analysis of the problem covered no more than one paragraph, it has had enormous follow-up literature. It is impossible to do full justice to this within the limits of an introductory chapter such as the present one.
This chapter will, therefore, be confined to a number of important insights from this literature that has two things in common: they have made an essential contribution to transport economics, and they have direct and important implications for government policy.

The structure of the current chapter is as follows: In the next section, Section 2, Pigou’s basic economic analysis of external effects in road traffic is discussed and it is explained why it is so obvious from the point of view of economics to address these externalities through regulatory levies. It will further be discussed why social acceptance of this type of policy is so low. In addition, in Section 3, it will be seen that a smart design of dynamic charges, according to principles set out by Vickrey (1969), could increase social acceptance of pricing policy. Following this, in Section 4, it will be discussed how this pricing policy contributes to a supply-oriented policy, in particular offering extra road capacity in response to increasing congestion. Central to this section is the contribution by Mohring and Harwitz (1962), who ingeniously demonstrated that the yields of optimal congestion charges under certain technical conditions are sufficient to finance the supply of optimum road capacity. Then, in Section 5, the "textbook world" is left behind and it is set out how all kinds of restrictions ensure that the "first-best“ policy discussed above is not feasible in reality, and what lessons can be learned from the now extensive literature on more realistic "second-best” policies. Finally, in Section 6, a number of possible second-best instruments are discussed from a practical point of view, focusing on instruments designed to bridge the resistance to traditional pricing policies by providing incentives as rewards (“Spitsmijden”, or: “Avoiding the peak”) or as a budget-neutral mix of rewarding and pricing (tradable mobility rights).

2 The basics – back to Pigou (1920)

Although textbooks sometimes suggest otherwise, in his 1920 book, Pigou never drew the standard graphic exhibition of road pricing. However, the standard diagram, summarizes his theory very well, and it will therefore be used for the present discussion as shown in Figure 1.

FIGURE 1 Optimal road pricing
Along the horizontal axis, the level of road use, $Q$, is displayed; the vertical axis represents costs, benefits and prices. The falling reveres demand function $D$ gives the number of road users (horizontally) for each price (vertically) and is therefore equal to the marginal benefit function $mb$: only users who attribute mobility benefits at least equal to the price will use the road. The relevant "price" also takes the value of travel time into account.

Congestion increases this price with road usage, as shown by the rising function $c$. It is found by multiplying average travel time by the time value, resulting in average costs $c$. Without further policy, equilibrium $Q_0$ comes into being, where the benefits that the last added traveller attributes to making the trip are high enough to find costs $c$ just acceptable to him.

It was Pigou's insight that the rising $c$ line indicates that marginal costs $mc$ are above average costs $c$, and that the difference between these two is due to marginal external costs: the costs that one road user causes to all other road users due to their effect on travel time.

Because of the difference between $c$ and $mc$, equilibrium $Q_0$ is not the efficient level, where social surplus - or total benefits minus total costs - is maximized. The latter requires an equality of $mb$ and $mc$ and is therefore at $Q_1$.

If road usage could be reduced from $Q_0$ to $Q_1$, costs would decrease with the area under $mc$, and benefits with the area below $mb$. The positive difference between the two is the welfare gain, expressed as an increase in the social surplus as given by the shaded triangle.

Pigou also showed how to achieve the optimum. By introducing a toll $r$ equal to marginal external costs in the optimum way, i.e. difference between $mc$ and $c$, road users between $Q_1$ and $Q_0$ will no longer want to go on the road, and the optimum is achieved. This is Pigou’s contribution in a nutshell. The theory can also be used to analyse other external costs, and is an important pillar of economics, particularly in environmental economics - where, naturally, the relevant external costs usually consist of various forms of non-priced environmental pollution.

There are at least two important reasons why economists find pricing policy such an attractive option for the reducing of external costs, in addition to what is immediately visible in Figure 1, i.e. achieving the optimum external effect volume.

The first of these is that the levy ensures that sacrificed consumption concerns those units that represent the lowest benefits. These are, in the Figure, those trips that are located between $Q_1$ and $Q_0$. This effect inherently makes the instrument more efficient than non-price solutions. An example of the latter is the number plate policy as pursued in Athens. A certain fraction of motorists are denied access to the road on certain days by rotation on the basis of the final digits of the plates. In principle, it would be possible with this policy to achieve a total use of $Q_1$ every day in the world of Figure 1. The government could then conclude that the optimum has been achieved, but that would be a serious miscalculation. It ignores that the lost benefits are higher than under pricing, because all values of $mb$, between 0 and $Q_0$, are lost on some days. In addition, lower congestion would actually attract trips with even lower benefits to the right of $Q_0$. On balance, the overall net welfare effect could even be negative, depending on how demand and cost curves run.

The second reason for finding “pricing” an attractive policy for the reduction of external costs is that, in reality, multiple behavioural margins are relevant when adjusting behaviour in order to obtain a reduction in external costs. For example, drivers could adjust their choice of travel moment, residential location, work location, mode of transport, route, type of vehicle, driving style - and there is no doubt that
more could be done. The price instrument gives the road user the incentive to choose from such a menu of options those that cause him or her least trouble. This also translates into minimal social costs to achieve a certain decrease in external costs.

Both reasons remain somewhat underexposed in policy discussions, partly because they are not visible in the frequently used network models. That, however, does not make them any less important.

With so many economic arguments in favour of using the price instrument, one would expect it to be widely used - worldwide. There is nothing less true. The actual applications of congestion charges that are in accordance with economic theory consists only a few of a very limited number of - well-known - examples. Among these, as the first large-scale application, Singapore is historically important. London and Stockholm are Europe's well-known examples. There have been many examples of implementation preparations that died prematurely. The Netherlands probably take the lead here, with a rich history of failed plans that came and went, in particular in the ‘90s and ‘00s: “Tolpleinen”, “Spitsvignetten”, “Tolpoorten”, “Mobimiles”, “Anders Betalen voor Mobiliteit”… it is a rich arsenal. Nevertheless, the Netherlands is not alone in this failure to implement: road pricing has also experienced considerable political and social resistance elsewhere. Figure 1 in fact shows why: without a return in toll revenues, the generalized price – i.e. price including both all internal and all external costs - rises: charge $r$ is higher than the decrease in costs $a$. Therefore, the net result $b$ is negative. This is independent of the exact drawing of the curves. The situation always occurs when moving along a demand line to the left. The result is that people between 0 and $Q_1$ will not easily support the proposal, because they see the price rise, while people between $Q_1$ and $Q_0$ will not be enthusiastic because they have to find an alternative to the behaviour they had before. Of course, the world is not as simple as in Figure 1: if there are differences in time valuation, for example, there may be high-value-of-time people who can benefit from road pricing even before they receive any returns (Arnott, De Palma and Lindsey, 1994). Distributional effects then come into the picture (Mayeres and Proost, 1991). The essence of the problem will remain unchanged, however, for a large proportion of road users, even if heterogeneity of travellers is allowed for.

3 Optimal dynamic tolls according to Vickrey (1969)

Interestingly enough, an important part of the price increase discussed above can be prevented if road pricing is used dynamically, at bottlenecks where otherwise traffic jams occur. Nobel Prize winner William Vickrey (1969) was the first to show this, in the now widely used “bottleneck model”, in which departure time choice has been added as an essential margin of behaviour for peak travel. Arnott, De Palma and Lindsey (1993a, b) have brought this model back to the attention of economists. Briefly, traffic jams arise in the model as an a balancing mechanism in which the sum of waiting time costs at a bottleneck the so-called schedule delay costs-the costs of not arriving at the most desired moment-remain constant over time. This creates a dynamic equilibrium: it pays for no one to change the departure time from home unilaterally. The traffic jam first grows during the rush hour, because the flow with which vehicles arrive at the tail of the traffic jam is greater than the flow out of the bottleneck, which equals its capacity. In the second part of the rush hour, the inflow at the tail of the queue drops below capacity, and the queue, therefore, becomes shorter over time, whereas as the outflow from the bottleneck remains equal to its capacity as long as there is a queue. A dynamic toll changes the dynamic departure times from home, making it constant over time and equal to capacity throughout the peak, while arrival times at work do not change as long as the bottleneck is at its maximum capacity. The optimum dynamic toll

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12 “Toll plazas”, “Peak vignettes”, “Toll gates”, “Mobimiles”, “Paying differently for Mobility”…
exactly replaces the travel time costs from the unpriced balance, and the generalized price does not increase (Arnott, De Palma and Lindsey, 1993ab). The model is applicable to traffic jams at bottlenecks and removes two common objections to congestion charges.

A first objection is that commuters are not flexible because at some point in time they simply have to be at work. However, the arrival times in the optimum of the model are the same as in the non-priced equilibrium: it is only departure times from home that change.

The second argument is that pricing policy makes no sense because alternative transport is not attractive enough for dedicated car drivers. In the model, however, traffic jams are removed by prices without changing the total road use over the entire peak. This, combined with the aforementioned characteristic that the price in the optimum does not rise relative to the unpriced equilibrium, makes it very attractive to opt for dynamic pricing at bottlenecks when introducing road pricing policies.

The particular set of ends for which revenues will be used in the same way remains an important instrument for increasing the acceptance of road pricing (Small, 1992). It goes without saying that types of usage that are closer to the interests of those who pay the levy will increase their acceptance. This was confirmed in a study of peak travellers in the Western, densely populated part of the Netherlands in 1997 (the “Randstad”; Verhoef, Nijkamp and Rietveld, 1997a).

Replacing existing fixed vehicle taxes - such as the annual motor vehicle tax or new vehicle purchase tax by variable road pricing - is a good example of this. So is the use of income to finance infrastructure.

4 Road pricing or capacity expansion?

In the social and political debate about congestion charges, it often seems as if only two tastes are conceivable: either one is in favour of road pricing and sees nothing in further construction or widening of roads, or vice versa. From an economic point of view, the contradiction suggested is rather absurd: after all, in mutual cohesion, it is wise to optimize capacity and prices. The two instruments are complementary, not replacements. That insight was formally developed by Mohring and Harwitz (1962) in the early 1960s. These authors came to a conclusion equally fascinating and important: if certain technical conditions are met, the revenues from optimal congestion charges are sufficient to cover the costs of financing the optimal supply of infrastructure. Subsequent contributions showed that the theorem remains intact when the setting is expanded (Small and Verhoef, 2007, provide an overview): for networks as well as for a single road; with dynamic instead of static congestion; for heterogeneous road users; if we take into account growing demand over the years; if we consider wear and tear; and also if not only width but also thickness (so: “wear resistance”) of the road surface can be chosen.13

The aforementioned technical conditions include, among other things, that there are neutral scale effects in road construction and congestion technology: to handle a flow of vehicles twice-as-large and driving at the same speed, road capacity is required twice as expensive. In addition, we will have to be able to treat road capacity as a continuous variable, for (mathematical) derivation. Although these assumptions will not be met literally and precisely, on average they seem to be close enough to reality over a network, to allow the theorem to be more than a theoretical curio (Krauss; 1981; Small and Verhoef, 2007). It opens the way to long-term road infrastructure self-financing. It is efficient, because the result is to optimize tolls and road capacity; transparent because it is clear what toll revenues are used for; and fair to the extent that it is considered fair that users ultimately pay for road construction costs, but also pay

no more than those costs. Certainly where acceptance of a pricing policy depends on what happens to tax revenue; all this makes the application of the theorem an attractive avenue.

The theorem is sometimes misinterpreted, and a warning seems appropriate. The fact that toll revenues cover capital costs definitely does not mean that all toll revenues should be converted into new investments. Capital costs include foregone interest, due to previous investment. The confusion referred to would lead to large-scale over-investment in road infrastructure. Secondly, where kilometre prices would also have an environmental component, income from that tax component has no relationship with the investment budgets. The theorem is purely about the congestion component of the charges.

5 Second-best tolls

What the above explanations have in common is that they are based on "first-best" analyses. That means that there are two important underlying assumptions. The first of these is, that there are no restrictions on the policy instruments. For example, in Vickrey’s analysis, the charge may vary continuously over time. Or, if this is would be necessary because different types of road users cause different marginal external costs, the charge can be perfectly differentiated between road users. Prices can also be perfectly varied for a given road user over time and place of use, and even driving style. Even if it were technically possible, it would encounter problems of ability to explain, feasibility, measurability, and privacy.

The second assumption is, if possible, even more unrealistic. Apart from the marginal external costs one wants to internalize through the levy, there is no relevant market failure in any market directly or indirectly connected to the market under consideration (for example, the market in Figure 1). That is not the case in any economy, of course. To give an example: morning and evening rush hour congestion is strongly linked to commuter traffic, while the labour markets that give rise to that traffic do not work efficiently - if only because of the income tax. The latter, for example, drives up to 52% of net and gross wages in the Netherlands. Another example is that a close substitute for road traffic is public transport, where pricing is not efficient, and rates do not generally reflect marginal costs. Also: road freight traffic often involves goods traded in inefficient markets, and for which, for example, marginal environmental costs in production are not reflected in prices.

In such cases, the most efficient choice for the charge level is no longer to equate it with marginal external costs. A classic example of this (Lévy-Lambert, 1968; Verhoef et al., 1996; Braid, 1996) concerns the pay-lane, i.e. the case of a few lanes on a highway where there is a charge, in addition to unpriced lanes. When applied, it is often motivated by considerations of acceptance: for many people, the availability of a toll-free alternative makes the introduction of a toll more acceptable. Because the charge then leads to a shift of traffic to the non-priced lanes, where congestion will increases, it is efficient to set the charge lower than the marginal external costs on the pay-lane. This partially avoids the negative side-effect on the untolled lanes.

Also, in second-best situations, the use of tax revenues becomes more than "just" a means to increasing acceptance. For example, Parry and Bento (2001) show that where a congestion charge is imposed for commuter traffic that is already economically distorted due to a labour tax, final welfare gains can be twice as high if proceeds are used to lower the labour tax. These gains may actually disappear or even become negative when using' lump-sum' revenue recycling, which discourages labour supply. These examples show that a thorough modelling work is often required for adequate policy advice on road pricing, which usually also requires looking beyond effects on transport markets.
A special form of second-best price incentives, which has already been used several times in The Netherlands, concerns rewards for avoiding the rush hour. This experience has been gained with this in various “Spitsmijden” experiments (see, for example, Knockaert et al., 2012), both in road traffic and in public transport. Although the experiments differ in their design, they have a number of common characteristics: there is automatic detection of mobility behaviour, for example through license plate recognition or via an app; participation is voluntary; and rewards are awarded to avoid the rush hour, which are usually within the range of € 2 - € 5. The behavioural effects are usually considerable and can amount to half of the number of rush-hour trips by the participants. It is important to bear in mind that there is strong self-selection due to voluntary participation: flexible travellers in particular expect to be rewarded relatively often and will therefore be more inclined to participate.

The big advantage of such reward arrangements is that acceptance among travellers often is not a problem. This, of course, is related to the fact that being rewarded is more pleasant than having to pay, and that, as already mentioned, participation is voluntary. Rewarding, however, also has its shadow sides. A practical drawback is that budgets are generally finite, so that this type of project can only be carried out temporarily and on a limited spatial scale. Roadworks are a good example.

An economic objection is that introducing a reward where there is market failure that bearing in mind Figure 1, actually requires a levy, leads to distortions. Specifically, rewarding could induce latent demand: on balance, the road system becomes cheaper rather than more expensive, and this attracts extra traffic, certainly in the longer term - just as usually seen in response to road widening.

We therefore have, on the one hand, the theoretically optimal pricing instrument which, however, has major acceptance problems, and, on the other hand, the more acceptable rewarding instrument which is, however, minimally applicable due to the finiteness of rewarding budgets. The question then arises as to whether it is not possible to envisage a budget-neutral intermediate variant that combines the best of both worlds. Such an instrument would be tradable mobility system (Verhoef et al., 1997b). This could take the form of tradable peak permits to regulate rush hour traffic. Road users are then given a limited number of peak permits that are used when driving during the rush hour. If they succeed in avoiding peak traffic more often than necessary given the number of permits they have received, they can sell permits and will thus be rewarded on balance. If it is not possible to avoid the peak, they will have to buy extra permits but pay less than with a traditional toll because they do not have to pay for the days for which they received permits. Similar systems of tradable permits can be used, for example, to allocate scarce parking space, or - via so-called “Tradable Green Days” - to encourage greener mobility behaviour within companies. A first lab experiment showed that such a system is technically implementable and is indeed understood and used by participants as intended in theory (Brands et al., 2019).

Conclusion

The economic theory behind the use of price incentives to regulate road traffic is strong and now almost a century old. The same theory can very well explain why social and political resistance to it is so strong. This can be taken advantage of in policy-making-including when designing the price incentive itself, when designing forms of tax revenue use or when designing budget-neutral price instruments. With the predicted increase in congestion in the real world, the subject remains prominently on the political agenda. The question that can only be answered with a crystal ball is whether this will in practice lead to the introduction of the principles outlined. For the time being, Belgium seems to be well on track, and
The Netherlands seems to be cautiously thinking about experiments (see further Chapters 4 and 5 in this volume, *Road Pricing in Belgium* and *idem in The Netherlands* respectively). However, all this may have changed again already in the short time between finishing this contribution, and the day this book appeared in print.
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PART IV: POLICY IN THE BENELUX COUNTRIES

Chapter 4. Road pricing policy in Belgium
TH. VANOUTRIVE

Chapter 5. Road pricing in The Netherlands
G. P. VAN WEE
Road pricing policy in Belgium

TH. VANOUTRIVE (1)

Abstract

This contribution describes how road pricing in Belgium has become a viable policy option. Since the 1990s, transport economists and other actors have been able to put a version of road pricing on the agenda that comes close to the idea of marginal social cost pricing. After some initial protest, a large group of actors seems to accept the implementation of a kilometre charge for trucks over 3.5 tons in 2016. Several Flemish politicians as well as employer organisations and environmentalist groups support the introduction of a similar road charging scheme for passenger cars and vans, but it remains unclear whether the coalition will succeed.

1 Introduction

On Thursday 31 July, 1958, the Belgian ministers of public works and transport meet a number of other prominent figures during a ceremony in the town hall of Sint-Niklaas, and then travel to Antwerp for a reception at the city hall. During these festivities, the most symbolic event took place when the minister of transport (‘Verkeerswezen’) cut the tape at the Waasland tunnel. These ceremonies were not organized to celebrate the opening of the tunnel, but to commemorate the end of ‘anachronistic’ road tolls, as the toll levied at the Waasland tunnel was the last toll present in Belgium (GvA, 1958). Tolls would only reappear in Belgium in 1991 when the Liefkenshoek tunnel between Antwerp and Beveren was opened, but this can be considered an isolated case.

Today, road tolls are back on Belgium's political agenda. However, there is a major conceptual difference between the old-style ‘funding tolls’ discussed above, and more recent calls for a ‘smart kilometre charge’. Traditionally, new infrastructure has been appointed to finance the building (and maintenance) costs. In contrast, the aim of a ‘smart kilometre charge’ is optimal use of infrastructure, irrespective of how old a particular road segment is. The latter corresponds to the idea of marginal social cost pricing for roads as was developed by transport economists in the second half of the twentieth century (Lindsey, 2006; McDonald, 2013; Vanoutrive, 2017), and which has been labelled ‘decongestion toll’ or ‘congestion pricing’ (Derycke, 1998).

(1) Assistant professor, Research Group for Urban Development, University of Antwerp (Belgium).
The growing popularity of congestion pricing among transport professionals, policy makers and some other actors in Belgium follows an international trend. Over the years, what was once a deviant idea has convinced a growing number of economists, and especially since the 1980s and 1990s—engineers, urban planners, and environmentalists (Vanoutrive and Zijlstra, 2017). International and supranational institutions such as the World Bank, OECD and the European Commission have become ardent promoters of congestion pricing, while the general public seems less enthusiastic about road pricing (Schade and Schlag, 2003; Jensen, 2013; Vanoutrive and Zijlstra, 2018). As a consequence, introducing pricing measures is a risky business for politicians. This contribution discusses road pricing policy in Belgium using academic sources as well as press articles, policy documents and election programmes. The next section describes how, in the context of changing transport policy paradigms, experts were able to introduce congestion pricing in the debate, and have, over time, awakened an interest among key policy actors. Subsequently, it is shown that the consensus on charging is not complete, and this is followed by a section on the implementation of a kilometre charge for heavy goods vehicles, which is seen by some as a first step towards road charging for cars and vans. The overview presented in this chapter indicates that the sustained efforts of transport economists to promote the idea of congestion pricing have been successful in shaping debate on the transport policy in Belgium.

1.1 Changing policy paradigms and the rise of road pricing as a policy option in Belgium

The acceptability of a measure such as congestion pricing correlates with the popularity and dominance of policy paradigms. Since the 1970s, the dominant focus on transport policy infrastructure with motorway expansion as its hallmark has been replaced by a vision that emphasises traffic and transport management. This shift from ‘predict and provide’ to ‘predict and prevent’ (Owens, 1995) or transport demand management (Meyer, 1999; Lyons and Urry, 2005) was accompanied by the sustainable mobility wave in transport research and policy (Vanoutrive, 2015). In recent years, pricing has been integrated in the smart mobility paradigm.

Congestion pricing was certainly discussed by transport experts and policy makers in Belgium, particularly in the Flanders region, from the 1990s onwards (Baeten et al., 1997). The Belgian Minister of Transport’s 1988 policy note (‘Verkeerswezen’) clearly illustrates the declining belief in infrastructure expansion and the rise of the idea that traffic must be regulated by the government to deal with congestion and related issues. Road pricing is mentioned as one of the options for influencing variable costs, but this was seen as a theoretical possibility rather than a realistic policy option (Dehaene, 1988). Following the devolution of large parts of transport policy to the regional level, we observe a similar approach in the ‘traffic and transport plan Flanders’ (Sauwens, 1991). Road pricing is mentioned as one of the options available to policy makers, but more emphasis is placed on telematics and other measures. In the mid-1990s Flemish political landscape, road pricing became a solution put forward by experts, but was not publicly supported by politicians. Academics promoted congestion pricing in numerous publications (e.g. Blauwens, 1997; De Borger and Proost, 1997), and in 1997, the Flemish secretary-general responsible for infrastructure stated that there was a consensus among experts that a system of road pricing could influence demand and he referred to the Netherlands decision to implement road pricing in the Randstad (Vlaams Parlement, 1998). At the political level, by the end of the decade, a majority of members of the Flemish Parliamentary Committee on Mobility recommended road pricing as a policy measure (Commissie Mobiliteit, 1999).
After the turn of the millennium, the draft 2001 Flanders Mobility Plan expected that road pricing would be introduced first for trucks, and in a later stage for passenger cars, but this was not expected at short notice (MOW, 2001). Overall, the 2000s witnessed a growing acceptance of road pricing among political parties, and several of them included road pricing in their programme for regional elections in 2009. Charging truck traffic was the least contested, and in 2011 the three Belgian regions reached an agreement to implement a ‘kilometre charge’ for trucks over 3.5 tons in 2016. The 2013 draft mobility plan Flanders refers to this decision and to a pilot project to be applied to passenger cars, but note that the social acceptability is rather low (MOW, 2013). During the 2014 pilot project, a research consortium installed 820 on-board units in the cars of respondents living in the commuting area around Brussels (including parts of the regions of Wallonia and Flanders) to monitor the behavioural changes caused by the charging experiment (De Vos, 2016). The mixed results were cast in the press as a failure since two thirds of the participants rejected road pricing and did not change their behaviour (VTM, 2014). Despite the negative framing in the press, the Flemish coalition agreement for the period 2014-2019 cautiously introduces road pricing as a defensible policy option (Vlaamse Regering, 2014). The Flemish mobility minister has become less cautious and has repeatedly expressed his preference for the introduction of congestion pricing for cars (HLN, 2016). To this end, a ‘social acceptability’ study was commissioned to design a plan to increase the popularity of road pricing among the public (PwC et al., 2017), and some politicians foresee that the next government will implement congestion charging (HLN, 2018a). However, establishing cooperation between the three regions comparable to the agreement on heavy goods vehicles could be challenging given the low popularity of pricing, especially in the Walloon region, and since a number of Walloon politicians seem to prefer a vignette over so-called smart technologies.

1.2 Diversity of opinions on pricing

Although a considerable number of policy-makers favour the introduction of road pricing in Belgium, a closer look at the opinions of some relevant actors reveals the variety of positions. A first group of actors are academics, and as mentioned in the introduction, the idea of decongestion tolls has its origins in academic economics. Transport economists in Belgium refer to the principle of marginal social cost pricing, and the internalisation of external costs. They consider crude, imperfect applications such as cordon charges to be lower than dynamic location-specific, network-wide pricing mechanisms. While the emphasis of transport economics at Belgian universities has been on logistics and freight, including passenger cars is promoted in pricing schemes, not least because freight and passenger traffic share roads. Applying marginal social cost pricing in another related market -public transport- has been also promoted. Over the years, researchers from related field such as transport geography, urban planning and traffic engineering have joined transport economists in their struggle to put congestion pricing on the policy agenda (see also Witlox et al., 2013). Nevertheless, some geographers and planners remained critical of congestion pricing and its potential equity impacts (Baeten et al., 1997; Vanoutrive and Zijlstra, 2018; Banister, 2018).

While theory might be the main source of inspiration for transport economists, critical accounts of the auto-mobility system are probably the main source of inspiration for environmental scholars and environmentalists when they include road pricing in their set of policy recommendations (Giuliano, 1992). The main Flemish environmental NGO, Bond Beter Leefmilieu (BBL) is clearly in favour of a ‘smart kilometre charge’ which should be based on vehicle characteristics, and the place and time of a trip (Lambregs, 2016). A similar position can be found in the mobility manifesto of the Flemish Council of Spatial Planners (VRP, 2015). Even with road pricing in place, BBL would maintain a green vehicle.
registration tax to promote the purchase of cleaner vehicles. In contrast, the Walloon counterpart of BBL, the Fédération Inter-Environnement Wallonie is more critical of congestion pricing and the conceptualisation of pollution as an external cost, and proposes, among other things, maximizing use of existing instruments such as VAT and excise duties (Courbe, 2015).

Similarly, the Flemish party openly advocates the implementation of a smart kilometre charge (Groen, 2009, 2014), while the French-speaking greens of Ecolo do not (Ecolo, 2017). The Flemish Christian Democratic party uses the conditional tense to discuss road pricing but gives the impression that is in favour of the idea (CD&V, 2009, 2014). In response to the pilot project, the French-speaking cdH rejected congestion pricing for passenger cars (Le Vif, 2014). The Flemish Nationalist N-VA is an outspoken proponent of a congestion charge (N-VA, 2009, 2014), while the Flemish liberal democrats had remained somewhat undecided (OpenVLD, 2009, 2014). But it seems to have joined the coalition that advocates replacing of the vehicle registration tax and the annual car tax with a variable smart kilometre charge (De Standaard, 2018). In general, both the French-speaking and the Flemish social democrats, respectively PS and sp.a do not promote congestion pricing for cars in their official election programmes (sp.a, 2009, 2014), although it is negotiable for the Flemish sp.a, while the French-speaking PS has proposed together with cdH the introduction of a vignette in the Walloon region (L’Echo, 2017). Members of the French-speaking political parties PS, Ecolo and FDF (now DéFI) from Brussels have indicated that it might be interesting to investigate some form of road pricing (VMX, 2013). Finally, discussions among French-speaking liberal democrats indicate that the political divide does not coincide with the language border, as the more urban section in Brussels differs in opinion from other sections (de Saint Martin, 2015). Finally, the leading employer organisations in Belgium, the Walloon UWE, The Flemish VOKA and the Belgian VBO-FEB are all in favour of the extending the kilometre charge for trucks to passenger cars and vans (UWE, 2018; VBO, 2016; VOKA, 2018).

1.3 Pricing trucks paves the way for pricing cars

While large employer organisations have become proponents of congestion pricing in general, individual companies are sometimes ardent opponents, especially in the transport sector. The start of the kilometre charge for heavy goods vehicles in April 2016 was accompanied by demonstrations and roadblocks by truck drivers and farmers. Nearly a hundred companies joined forces and went to court, but without success (Transportmedia, 2016). The main complaints were problems with the timely installation and use of On-Board Units, but also more fundamental issues related to privacy were raised (Maus, 2016). Uncertainty about the effects was a potential obstacle during the preparation phase. Port authorities, for example, were concerned about their position vis-à-vis Rotterdam and some other foreign ports, and a study seems to have helped to reduce their concern (Blauwens et al., 2011).

In addition, a few difficulties during the first phase, the implementation was considered successful (Van Apeldoorn, 2018). The tolled network has been extended to discourage rat running since the start in 2016, and its length is now 6,492 km. In 2017, 6.13 billion truck kilometres were traveled on this network, and vehicles registered outside Belgium account for 54% of this traffic, and with regions receiving € 424.4 million (Flanders), € 241.5 million (Wallonia) and € 10.1 million (Brussels Capital Region), Respectively. Viapass, the organisation set up by the three regions to manage road pricing for heavy goods vehicles, states that the Belgian approach is a leading example of the application of Global Navigation Satellite System (GNSS)-based tolling as envisaged by European policy (Viapass, 2018). However, despite the introduction of road pricing for trucks, congestion as well as the number of trucks has increased (HLN, 2018b).
Congestion is arguably the most frequently cited reason to include passenger cars and vans in the road pricing scheme. In addition, air quality is a popular topic in the media and some proponents of road pricing refer to the results of citizen science projects such as ‘curieuzeuzen’ (www.curieuzeuzen.be/) and ‘airbezen’ (www.airbezen.be/), which indicate that levels of NO₂ and particulate matter regularly exceed health standards. Representatives of the private sector in particular add that limiting tolls to trucks is not efficient and fair. The fact that a system is in place makes an extension more realistic, just like the existence of the German (and Austrian) LKW-Maut example made it easier to introduce truck tolling in Belgium. However, the feasibility of installing OBUs in all passenger cars and vans is not clear, and alternative technologies are also considered. Nevertheless, road pricing for cars is regularly framed as an extension rather than an entirely new system.

2 Conclusion

Road pricing has emerged as a policy option in Belgium since the 1990s, and the three Belgian regions introduced a ‘kilometre charge’ for trucks over 3.5 tons on major roads in 2016. Despite some difficulties and protests at the start of the project, most actors seem to accept this system as a fait accompli. Employers’ organisations, many environmentalists and several Flemish political parties are promoting the extension of this system to passenger cars and vans. The Flanders region has developed a strategy to increase the social acceptability of the measure. But road pricing remains a notoriously unpopular measure, and the example of the Netherlands illustrates the instability of pro-pricing coalitions, even after formal agreements have concluded (Smaal, 2012). It remains to be seen what will happen with the proposal to introduce a smart kilometre charge for cars in the Flanders region. The implementation of road pricing for cars is also a challenging political issue in the Brussels Capital Region and, on the basis of opinions expressed by politicians, we do not expect the introduction in the Walloon region in the short term.

With regards to the role of transport economics, the proposals in Belgium are close to the theoretical model of marginal social cost pricing. While cordon charges have been discussed, the emphasis is on place-specific and time-dependent tolls that also take into account vehicle characteristics in order to internalise most external costs. Thus, transport economists in Belgium were able to put their view of road pricing on the political agenda in tandem with international organizations. This illustrates that, apart from factors such as fuel prices and actual air quality and congestion levels, ideas and their promoters play a decisive role in the shaping of transport policy.
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5 Road pricing in The Netherlands

G. P. VAN WEE (1)

Abstract

This chapter presents an overview of policy intentions in the Netherlands related to road pricing since 1988/1990 and will discuss dominant factors for not implementing any road pricing policy so far. The contribution is limited to the payment of road use, excluding taxes on fuel and parking policies. The main conclusion is that, although the Netherlands was the first to support a national road pricing system, real world implementation failed about three decades ago, mainly due to a lack of political, social and actor support. The most important factor was that Dutch political parties were afraid to lose this vote. Uncertainty about ICT (costs, reliability) also played a role. What does this imply for the future of road pricing policies in the Netherlands? The fact that the system is going to be revolutionary change, a big bang implementation, makes implementation difficult. A more evolutionary ‘step by step’ implementation would have more chance of survival. If Germany and/or Belgium (and perhaps Luxemburg) were to impose a kilometre charge, this would increase the likeliness that the Netherlands would also do this.

1 Introduction

As Chapter 4 explains, the welfare effects of road pricing have been recognized for about a century, but real world implementation has so far been limited, such as London, Stockholm, Singapore, and Malta. Most real world implementations are at the urban scale, the German Maut system for Lorries on a selection of motorways and a comparable system later implemented in Belgium being the exceptions. To the best of my knowledge, the Netherlands has been the first country to propose a national system of road pricing for all motorized vehicles, the first proposal being launched in 1988/1990 (Second Transport Structure Plan). But the Netherlands has hardly implemented any policy on road pricing so far. This section will give an overview of policy intentions related to road pricing since 1988/1990 (for a longer term overview (see Smaal, 2012), and will discuss dominant factors for not implementing any road pricing policies in the Netherlands so far. The methodology is a hybrid one, combining reading (policy) documents, engaging in multiple discussions, conducting research and supervising PhD students doing research in this area. The section is limited to paying for the road use, excluding taxes on fuel and parking policies.

(1) Professor of Transport Policy, Delft University of Technology (The Netherlands) and Scientific Director of TRAIL Research school (The Netherlands).
An overview of policies since 1988

As explained above, the first national wide road pricing scheme was announced in the Second Transport Structure Plan (policy intentions: 1988, decision of the government: 1990), but implementation failed (see next section). In the following decade, follow-up proposals include: a toll system for major urban areas, a rush hour permit, and road pricing again but in a ‘reduced form’ compared to the proposal of 1998/1990. All proposals were initiated by policy. At the turn of the century, the debate shifted towards an ‘advanced ICT bases’ system of paying per kilometre: the Mobimiles proposal, initiated by Roel Pieper, an ICT entrepreneur, but adopted by the Minister of Transport and Public works.

Not all of these proposals have been implemented. The new Minister of Transport and Public Works in 2003, Karla Peijs, realized that she would not be able to implement any policies unless she organized support early. She asked the former director of The Royal Dutch Touring Club (ANWB), often seen as the Dutch motorist union, which in the past strongly opposed road pricing policies, to chair a committee to explore the topic of mobility payment: the so-called Platform Anders Betalen voor Mobiliteit (‘Platform Paying Differently for Mobility’). The committee included, amongst others, the dominant interest groups, such as the ANWB, Natuur en Milieu (environmental interest group), TLN (transport companies interest group), and the Ministry of Finance and the Ministry of Transport and Public Works, and a scientist. The committee recommended converting taxes on new cars and annual taxes (at least partly) into a payment system per kilometer. The proposal survived relatively long in the debates: also the next government supported the policy, and even announced the implementation of the first version in 2011 for lorries only, followed by cars in 2012. Charges for kilometres would depend on vehicles’ environmental characteristics, time of day and location. The Christian Democrats (CDA) and the Right Wing Liberals (VVD) stopped supporting the policy shortly before the upcoming elections in 2010, and the next governments did not propose a comparable policy. The only real world implementation of any form of road pricing was some local experiments of awarding people to not use their car during the rush hours. Registration bases in specific periods cars were taken place and the owners were invited to participate in experiments to not travel during the rush hours, and receive financial compensation. The first experiment started from 2008. A review of the first five experiments reveals that rush hour avoidances vary between 16-58%, time of day being the most important response (Meurs et al., 2015).

Success and failure factors

How did the Netherlands not implement any of the proposals? Without a doubt, a lack of political and (related) societal support played a major role. At least until 2003, the Ministry of Transport and Public Works’ top-down approach was not helpful for real-world implementation. Support has increased since 2004 due to the involvement of many actors. But the decision to stop supporting the policy of paying per kilometre in 2010 was partly the result of a lack of support from the actors involved, in addition to a lack of political support (Vonk Noordegraaf, 2015). This lack of support was partly fuelled by – in some cases – negative media attention (Ardic, 2015).

Besides a general lack in political support, there are also two more specific factors. First, the system costs will very likely be high (CPB and PBL, 2015) but also – to my opinion - also quite uncertain. Secondly, welfare effects could be positive if prices depend on time and places, but not in case of a flat rating replaces annual taxes, because then marginal costs of driving can easily exceed marginal benefits (CPB and PBL, 2015).
4 Conclusion

The main conclusion is that, although the Netherlands was the first to support a national road pricing system, real world implementation failed about three decades ago, mainly due to the lack of political, social and actor support.

My personal impression is that the most important factor was that CDA and VVD were afraid of losing votes if they continued to support the implementation of the kilometre charge. I also have the impression based on personal communication with policy makers, that uncertainty about ICT (costs, reliability) also played a role.

What does this imply for the future of road pricing policies in the Netherlands? I think the fact that the system would be a revolutionary change, a big bang implementation, makes implementation difficult. I think that a more evolutionary ‘step by step’ implementation would have more chance to survive. For example, convert annual taxes to a flat rate per km for the first time. This step should be motivated because many people will consider it “fair”: who drives more, pays more, and who drives less pays less. Then, as explained above, fairness comes at the welfare cost. A next step, perhaps combined with the first step, can be to differentiate by vehicle characteristics (e.g. CO₂ emission). The following step could be to convert part of the new car taxes to a kilometre charge, and the final step could be to differentiate by between place and time of day.

I also think that if Germany and/or Belgium (and perhaps Luxembourg) were to impose a kilometre charge, it would increase the likeliness of the Netherlands to do that as well.
References


PART V: INTERNATIONAL COOPERATION

Chapter 6. Benelux cooperation and mobility management
B. M. J. HENNEKAM AND L. D. VAN DEN BERG

Chapter 7. The approach to road pricing of the European Union
J. G.W. SIMONS

Chapter 8. International cooperation on freight transport pricing and investment
B. DE BORGER AND S. PROOST
Abstract

The Benelux plays an important pioneering role in the field of international cooperation. Given the important role of the Benelux as a hub for transport and trade, transport cooperation receives a lot of attention in the Benelux. Benelux was a precursor in many areas of transport. However, currently, there is no active collaboration in the field of road pricing. The cause lies in large differences of approach in the three countries. In this contribution, these differences are explained. In addition, a number of suggestions are made for cooperation which could be promising, despite the identified differences in approach.

1 Introduction: Benelux

In 1944, the Governments of Belgium, the Netherlands, and Luxemburg decided to establish the Benelux Customs Union, in order to make a joint contribution to the restoration of the countries plagued by the Second World War. In 1958, this cooperation was deepened, leading to the transformation of Customs Union into an Economic Union\(^1\).

Salient detail: The Benelux Economic Union Treaty was signed one year after the European Community Treaty of Rome. Article 233 of the latter Treaty contains the provision that, anticipating European integration, the Benelux Union can continue its activities as a European laboratory for integration\(^1\). This provision still applies today. It provides an answer to the frequently asked question, in the present time, about the usefulness and necessity of the Benelux besides the European Union. The opportunity of giving an impetus to European countries, in the EU Treaty, has always been actively used by the Benelux. Notably, Benelux, over time, has been a forerunner in traffic and transport issues, simplifying, and wherever possible, completely abolishing transport and border formalities.

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\(^{1}\) Treaty establishing the Benelux Economic Union of 3 February 1958.

\(^{15}\) Treaty establishing the European Economic Community of 25 March 1957, Article 233: "The provisions of this Treaty shall not be an obstacle to the existence or completion of regional unions between Belgium and Luxemburg and between Belgium, Luxemburg, and the Netherlands, in so far as the objectives of these regional unions are not achieved by application of this Treaty."
Common technical requirements for road vehicles were also introduced. Passenger and goods transport by road were largely liberalized. Furthermore, the Benelux Union initiated Pan-European cooperation for road transport enforcement bodies (ECR)\textsuperscript{16}. In 1985, a Benelux initiative stood at the basis of the Schengen agreements on the abolition of internal border controls for goods and passenger traffic\textsuperscript{17}.

Nowadays, Benelux transport cooperation mainly focuses on aspects related to efficient and sustainable transport such as the development of a common strategy concerning digital transport documents deepening the ECR cooperation and exchange of information concerning environmental protection measures in urbanized areas\textsuperscript{18}.

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2 \hspace{3cm} Gateway to Europe

If one looks at the role of the three countries in global and European freight transport, it is needless to say that also here Benelux fosters international cooperation. In 2016, the Benelux General Secretariat published a study in which flows of goods between the Benelux countries and between these and neighbouring countries were examined\textsuperscript{19}. The study endorses the role played by the Benelux as a hub for international freight and passenger transport within the European Union. For Benelux seaports, and for the year 2015, the study estimates the total goods transshipment of around 850 million tons. The Top 3 Benelux seaports are Rotterdam, Antwerp, and Amsterdam which are the number 1, 2, and 4 seaports of the European Union. Based on the cargo weight, these 3 ports together account for 41\% of the transshipment in all EU-28 seaports.

For Benelux airports, the total cargo transshipment was around 3.5 million tons in 2015, a substantial part of the 13.4 million EU-28 cargo transshipment. In 2015, transport in the Benelux, with an area of less than 2\% of the EU and with no more than 5\% of its inhabitants, represented 78\% of the total of tons in EU inland navigation, 24\% in EU aviation, 21\% in EU maritime navigation, 7\% in EU road, and 6\% in EU rail transport. It is hardly surprising, therefore, that the three Benelux-countries taken together are in the top ten of world logistic rankings. In this ranking, in 2014, the Netherlands took second, Belgium third, and Luxemburg eighth place.

Finally, the study quoted shows that 1 out of 11 employees in the Benelux holds a job in logistics and 1 out of 20 in the transport and storage sector. The above statistics underline the fact that, for freight transport, Benelux does not merely serve as an area of transit to and from third countries. Freight

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\textsuperscript{16} Euro Contrôle route (ECR) is the cooperation among European road transport enforcement bodies including fourteen countries and two countries as observers, working together for safe, fair, social, and sustainable road transport. ECR’s activities centre around four pillars: 1) coordinated cross border checks, 2) education and training, 3) harmonization, 4) consolidated points of view/common interest and influence decision-making process. Member states are Belgium, the Netherlands, Luxemburg, France, Germany, Ireland, the United Kingdom, Poland, Austria, Romania, Bulgaria, Hungary, Croatia, and Spain. The observer States are the Czech Republic and Slovenia.

\textsuperscript{17} On 14 June 1985, the Heads of Governments of Belgium, the Netherlands, Luxemburg, Germany, and France signed the Schengen Agreement in the Luxemburg border municipality of Schengen. The convention implementing this agreement aimed at abolishing checks on persons and goods at common, internal borders. This created the “Schengen area”, an area without internal borders. In later years, many other European countries joined this initiative.

\textsuperscript{18} Each year, the Benelux Committee of Ministers establishes the priorities of Benelux cooperation.

transport between Benelux-countries themselves has also an intensive character and direct economic importance for these countries.

There is, however, another side to the above coin. Transport-related activities put pressure on infrastructure and environmental quality. In addition, in the urbanized areas of Benelux countries, Belgium and Luxemburg especially, considerable congestion problems exist.

With the above data in mind, what follows will focus on the question of whether there are any opportunities for Benelux cooperation in the area of road pricing and, if so, what these would be. Given the position of transport within Benelux, it may seem surprising that this question still has to be asked. The introduction of road pricing, however, has proved to be a difficult subject in Benelux cooperation. This can be traced back to the circumstance that the three member-countries have diverging interests with respect to this issue, resulting in differing policies.

3 Differences in the approach of the three countries

In April 2016, Belgium introduced a form of road pricing for trucks and coaches on the main road network. Now, in 2019, it is considered an extension to secondary roads. Furthermore, initial signals have been given to apply road pricing to passenger cars in a subsequent legislature. Luxemburg presently has no plans for road pricing. In the Netherlands, road pricing has already been discussed and studied for a fairly long period (the first intention for road pricing was announced in the Second Transport Policy Plan - Tweede Structuurschema Verkeer en Vervoer - in 1990). Up till the time of writing, however, its practical application has failed to find sufficient social and political support.

In this divided landscape, it is difficult to arrive at a common Benelux approach. In this case, decisions unanimity is required for Benelux. Given these two factors, cooperation with regard to road pricing has mainly remained limited to the exchange of information on policy developments. It is useful now to take a closer look at the differences between the three Benelux-countries that, so far, have formed an obstacle to the creation of a common road pricing policy.

Luxemburg actively participates in international cooperation. That gives a lot of benefits to this relatively small country. But concerning road pricing not only matters for Luxemburg what happens within the Benelux. The Grand Duchy also borders the large countries of France and Germany, each of these has its own system of road pricing. The main road network in the Grand Duchy fulfils an important function for transit traffic. Usually, such traffic does not provide much benefit for the country concerned. In Luxemburg, however, this is different since the policy of low fuel excise duty in this country leads to great deal of transit traffic buying its fuel there. This may well explain that Luxemburg is rather reluctant to introduce road pricing as an instrument for mobility management. On the other hand and by other means Luxemburg is actively working on tackling the traffic jam problem. For example, it has recently been decided to encourage the use of public transport in Luxemburg by making it (largely) free of charge.

For Belgium, next, transit traffic formed an important argument for introducing a tax on the use of roads by HGVs. In this country, in road freight traffic, there are large transit flows, both on the east-west and the north-south axes. Unlike Luxemburg, Belgium does not have an attractive fuel excise duty that generates income from ongoing foreign traffic. With the argument that, by means of a levy, making transiting foreign HGVs pay for nuisance caused, political and social support for this measure was obtained. It was decided to introduce a levy with technical aspects similar to those in Germany. In other
words, vehicle characteristics, distance travelled, and geographical location determine the level of rates. No account is (still) taken of traffic pressure at the time of using the infrastructure. It may be noted that the choice of a system that has been set up elsewhere fits in with the Belgian certainty-oriented culture. Sophisticated systems of road pricing, such as those being considered in the Netherlands, are much less in line with this culture. Finally, for mobility policy in Belgium, a complex institutional framework exists. That is, important competences lie with the regional governments of Flanders, Brussels, and Wallonia. The levy on HGVs has the support of these partners in decision-making that not only have made investments for the present purpose but also receive a significant income from it. Both regions and the federal government will, therefore, be more inclined to build on the current system of charging for the use of roads rather than replacing another one, even one that would be more in conformity with economic theory.

The Netherlands has less transit traffic than Belgium and Luxemburg. The argument, therefore, that this traffic does not sufficiently pay for its use of roads holds far less here than in the other two Benelux-countries. Further, the degree of congestion in the Netherlands is less than the latter ones. This is due to the fact that in the Netherlands, investments in roads have been made almost continuously. This may have contributed to the situation that road pricing has not been a priority for successive governments in the Netherlands.

Furthermore, there is considerable social resistance to this measure. What fits more in Dutch culture is to set trends towards renewed mobility management. Presumably, mobility management has not been studied in any country as extensively as in the Netherlands. The goal is to remain engaged and acquire a leading position in economic and financial activities linked to mobility management.

It may be expected that the above differences between the three countries will not change in the short term. Given the formal requirement for unanimity for common Benelux activities, it will be very difficult at the present time to realize a successful common road pricing project in Benelux. With a view to a somewhat more distant future, it may be useful, all the same, at this place to make a number of suggestions for Benelux cooperation with regard to road pricing.

4 Suggestions for greater cohesion

i. Organize a Benelux assembly around the theme "level playing field for road pricing"
Similar to what was undertaken by the Benelux in the 1980s - when joint action was taken by stakeholders from the Benelux seaports against discriminatory rail tariffs in Germany - it would be desirable to bring governments, transport and port-related interest groups and researchers together, in order to find out how a European level playing could be created for road pricing.

ii. Work together to encourage the use of clean and safe road vehicles
The latest Benelux action program provides further cooperation on energy transition in road traffic. In the Benelux, ownership and use of electric vehicles are relatively high. A quarter of European hybrid road vehicles in 2017 were registered in the Benelux. Furthermore, a third of electric charging points in Europe were located within Benelux20. Benelux cooperation, in 2017, resulted in a common trans-border program for battery charging facilities. Why not deepen the Benelux cooperation on electric road

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20 Benelux Secretariat General, Political Declaration on Borderless Access to E-Mobility Services within the Benelux, Brussels, 7 July 2017 (www.benelux.int/files/8215/1274/4037/BENELUX-Political_Declaration_FINAL.pdf).
vehicles and enlarge its focus on the exchange of knowledge and coordination of policies for pricing the use of this type of vehicles? It may be added that road pricing offers opportunities for taking into account vehicle characteristics and thereby encouraging the use of clean vehicles.

iii. **Agreement on how to act with the loss of excise duty on fossil fuels in the event of a transition**

The strategy to be followed when all fuel excise duties will be disappear in the event of an energy transition has a strong political dimension. In addition, such a strategy will have direct links with the issue of road pricing. This is because the latter is an attractive instrument for differentiated taxation of road use.

As already indicated above, fuel excise is an important source of income in the three countries. Coordination of excise policy is one of the most difficult issues of international cooperation. In addition, especially in Benelux-countries, with a coordinated excise policy, much will be at stake.

Direct annual income from excise duty on fossil fuels in road traffic for the three countries together amounts to around € 13 billion. Now that the transition to non-fossil fuels has become a policy aim in these countries, the question arises how to deal with the expected drying up of this substantial source of income. A common Benelux strategy will most certainly be difficult to realize. Undoubtedly, however, it will give great benefits in return.

At the solemn celebration of the sixtieth year of Benelux establishment, in June 2018, Benelux Secretary-General Thomas Antoine pointed out that Benelux cooperation is not a static event, but constantly adapts to new developments and preconditions. In the Benelux Economic Union of 1958, the internal market and the free movement of people were the main themes of cooperation. In the new Benelux Union Treaty of 2008, less attention is focused on market aspects, and more attention is focused on social cohesion, safety, and sustainability. “Where things were central first, now people are”, Antoine said.

Benelux cooperation has an important interface with what we would call the two-sided face of mobility. On the one hand, there is mobility as an engine of prosperity, development, well-being, and culture. On the other hand, there is pollution and associated negative health and climate effects.

Mobility management in the three countries will continue to focus on traffic flows. However, limiting emissions in support of climate objectives will become an increasingly important area of attention. The use of the car (“our holy cow”) will be judged much more than now in connection with the achievement of these environmental objectives. The latter is a fascinating field of tension for the three countries that are so interwoven with transport. If one wants to achieve something substantial here, cooperation is a must. In this respect, the relationship between mobility management and climate objectives deserves a prominent place on the agenda of Benelux cooperation.

Last but not least, the fact that Benelux acts as a gateway to Europe is also reflected in higher education and in research within this community. With regard to transport and logistics, Benelux may pride itself in having within its area a number of renowned research institutes, the services of which are being provided far beyond the borders of Benelux. In addition, for the two subjects mentioned, there might not be a greater number of institutions of higher education per inhabitant as in Benelux. Therefore, it is

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21 The Treaty establishing the Benelux Economic Union of 1958 was signed for a period of fifty years. In a constantly changing international context, the focus of Benelux cooperation has shifted to the development of new policy areas. At the end of the fifty-year period, governments of the three Benelux countries decided that it was the time for renewal, taking into account the new aspects of Benelux cooperation such as safety and sustainability. The new Benelux Treaty was signed on 17 June 2008. On 1 January 2012, it entered into force.
fully understandable why Benelux Secretary-General Dick Kruytbosch provided full support for the establishment of BIVEC-GIBET in 1978.

In conclusion, one may ask oneself whether a history of forty years of BIVEC-GIBET may not serve as an inducement for further strengthening of Benelux cooperation in transport research and higher education. This cooperation include parties -national and regional- governments, institutions of higher education and for research as well as the business community.
The approach to road pricing of the European Union

J. G.W. SIMONS (1)

Abstract

This article intends to present a sketch of the European Union approach to road pricing, mainly concentrating on the transport mode road in line with the other articles in this book. First, some juridical context is given with the result that all legal acts, of course within the European Union rules, are possible when there is a political will from Commission (COM) side to make the proposals and from European Parliament and Council together to make it law. The next two sections show conception, birth, and the first steps of an EU road pricing concept. With the failure of judgment in mind, a proposal on charging different categories of infrastructure costs to heavy goods vehicles was submitted by Commission, but no legal act reaction by the Council. Commission was modified twice, in 1990 and 1992. This time, the deliberations in the Council were successful. An EU policy on road pricing is born. However, it is small and fragile. Confirmed in the White Paper on transport policy in general from the same year, the Commission added step-by-step road pricing, not excluding private cars. Moreover, it was subsequently stated in a White Paper on infrastructure charging from 1998 that it includes in principle all modes of transport; all around and in the context of competition and avoiding disturbances between modes of transport. The realization of the “Eurovignette Directive” (1999/62/EC) and the amendments of it in 2006 and 2011, caused by procedure troubles of the original Directive from 1993, will be described in more detail. An external evaluation of the Eurovignette Directive in 2014 led to the demand of Parliament for new proposals of the Commission. Section 5 “present approach” with shortcomings relating to existing provisions and problem areas that road charging could tackle, the current framework for road charging is deficient because the Eurovignette Directive disregards vehicles such as passenger cars, vans and buses and does not cover CO2 emissions. This could be discussed further to the need for simplification and clarification of the directive. In the European Commission evaluations and consultations in 2016, the Member States did not support the measures for subsidiary reasons. Nevertheless, the Commission adopted a proposal for a directive amendment of Directive 1999/62/EC in May 2017, linked to the energy union strategy and the Commission’s strategy for low-emission mobility. The proposal with amendments was voted on in the European Parliament. To continue the law making procedure, it is waiting for the position of the Council. However, it is “on hold”. Section 6 is a kind of bonus, and an item is strongly related to road pricing in the European Union legal framework. Electronic toll collection is at a glance touched on.

(1) Professor Emeritus of Transport Economics, Vrije Universiteit Amsterdam (The Netherlands), former member of Economic and Social Committee of the European Union.
The conclusion, section 7, is that European Commission and European Parliament show their political will on advancing in road pricing, but the Council has not taken a position on a basic revision of the Eurovignette Directive since 1999. It is known to be on hold. The link of the Eurovignette revision to the energy union strategy could be hopefully the catalyst to realize the Council’s position about the revision of the proposal.

1 Introduction

The European Union (EU) only became a legal entity with the Lisbon Treaty, which entered into force on 1 December 2009. Neither before nor after that date the EU has been the owner of different kinds of transport infrastructure. The question may arise, therefore, why, within the context of the EU, dwelling on the subject of the pricing of roads is necessary.

As opposed to the EU itself, nations – in the present case: Member States of the EU – are the owners of various kinds of transport infrastructure. As such, they are entitled to ask for payment for the use of it by other legal persons, including natural persons. It is common knowledge that taking action in the areas of coordination, harmonization, and the guarding of subsidiary and proportionality are tasks of the EU. It is in these areas that the EU has powers and where an approach to “road pricing” can be found. This Chapter intends to present a sketch of the European Union approach to road pricing, mainly concentrating on the transport mode—road in line with the other articles in this book.

The Chapter is structured as follows. First, in the next section, some legal context is given for a better understanding of the possibilities of the EU regarding road pricing. Sections 3 and 4 show the conception birth and first steps of an EU road pricing concept. Then, in section 5, the present EU-approach to road pricing will be described. In section 6 as a “bonus”, an item strongly related to the issue of road pricing within the EU legal framework, viz. electronic toll collection, will be briefly touched upon. Section 7 gives a conclusion. The sections 3–5 with a lot of details start with a kind of summary, named “Main line”, in italic, to permit the reader to easily follow the path in the article without all details.

2 Legal context

Formal cooperation between nations is possible in different ways. It may be bilateral or multilateral, each of which is in various forms, i.e., either with an intergovernmental or a supranational character. With the former, sovereignty transfer decisions are being taken in unanimity only. With the latter, it is possible to transfer sovereignty away from individual nations to a supranational organization, without a unanimous decision.

The cooperation between Member States of the EU is obviously of a multilateral nature, but, following the present Treaties (Lisbon, 2007), with elements of supra-nationality and inter-govern mentality. In
combination with other unique issues, such as the exclusive right of the European Commission (hereafter “Commission”) to make EU law proposals, the EU can best be described as an organization “sui generis”.  

The competence in transport issues is, as article 2 (2) in conjunction with article 4 (2) TFEU says, conferred to the Union shared with the Member States (“the Union and the Member States may legislate and adopt legally binding acts in those areas. The Member States shall exercise their competence to the extent that the Union has not exercised its competence.”)

Title VI Transport of the TFEU contains eleven articles (art 90 – 100), of which the first two are basic. According to Article 90, “The objectives of the Treaties shall, in matters governed by this Title, be pursued within the framework of a common transport policy”. According to Article 91, “For the purpose of implementing Article 90, the European Parliament and the Council shall … lay down: (d) any other appropriate provisions.” The words “Within the framework of a common transport policy”, in Article 90, merely state a condition. The substance of a common transport policy, however, has not been defined in the Treaty. This means that it will still have to be formulated. Progress in doing this was very slow until the 1980s, largely because governments were reluctant to give up control over their national transport networks and because of major differences between the regulatory and transport structures in each country. As an example, the following two extremes may be mentioned: (1) France, with its public service policy and (2) The Netherlands, with its primary market mechanism policy. Either first harmonization or liberalization, or both at the same time, that was the question.

Frustrated after at least twenty-five years of patchy legislation, the European Parliament took the unprecedented step of taking the Council to the European Court of Justice for its failure in developing a common transport policy. The Court’s judgment of May 1985 (Case 13/83, known as “failure judgment”) had the effect of injecting some political impetus and, finally, advances started to be made towards a common policy. The publication of the judgment happened to coincide with a White Paper on promoting the internal market issued by the Commission. It contained specific references to transport and certain goals to be achieved by 1/1/1993.

In addition, the Single European Act of 1986, a new treaty text which introduced qualified majority voting for sea and air transport and matters of harmonization, and the 1992 Commission Communication on the common transport policy were helpful to bring the Council, in 1993, to a legal

24 See Article 17 (2) TEU for more details.
25 The shared competences on the internal market, taxation, transport infrastructure as part of the trans-European networks and environment could also be involved with road pricing. Till now, only taxation, particularly article 113 TFEU about harmonization of national indirect taxation is used as a co-basis for legal acts about road pricing.
act, after all its resolutions and declarations about this since the Court judgment.\textsuperscript{28,29} By 1992, the foundations of a common transport policy had been laid. \textsuperscript{30,31}

3 EU road pricing concept

Main line: With the failure judgment in mind, a proposal on charging different categories of infrastructure costs to heavy goods vehicles was submitted by Commission, but no legal act reaction by the Council. Commission was modified twice, in 1990 and 1992. This time, the deliberations in the Council were successful. An EU policy on road pricing is born. However, it is small and fragile. Confirmed in the White Paper about transport policy in general, from the same year the Commission proceed in road pricing in stages, not excluding private car and stated later on in a White Paper just about infrastructure charging from1998 that in principle includes all modes of transport; all around and in a context of competition while avoiding disruption between transport modes.

In January 1988, i.e., three years after the “failure judgment”, the Commission submitted the “Proposal for a Council Directive on the charging of transport infrastructure costs to heavy goods vehicles”.\textsuperscript{32} The proposal was based on articles 75 (“no discrimination of transport contract prices”) and 99 (“harmonization of indirect taxes”) of the Treaty. The title of the Proposal already gave an indication that “road pricing” as a concept was somewhere in mind. Some elements of it are already there. The keywords below reflect the different categories of costs that would have to be taken into account in pricing the use of infrastructure:

- Traffic-related cost of using the infrastructure;
- Tolls, raised in certain Member States;
- External costs which should be considered with regard to intermodal competition.

There was no legal reaction by the Council. The Commission, therefore, in 1990, modified its proposal.\textsuperscript{33} This entails that all ‘whereas’-clauses (read: “considerations”) have been replaced. One of these clauses implicitly gives the reason why the Council did not act: figures for accurate allocation of road infrastructure costs and external costs were not generally available. In this view, a temporary system based on minimum vehicle tax rates was to be introduced. This revised proposal was again changed in November 1992.\textsuperscript{34} In the notion of “road pricing”, now, the element of the environment has been added.\textsuperscript{35} This time, the deliberations in the Council were successful. An EU policy on road pricing is born. However, it is still small and fragile.\textsuperscript{36}

\begin{thebibliography}{99}
\bibitem{28}White Paper on the future development of the common transport policy (COM(1992) 0494).
\bibitem{29}See for the few and lifeless legal acts about infrastructure costs/road pricing before 1985: Tromm (1990), paragraphs 5.6.2.4.3 and 6.2.2.1.
\bibitem{30}Of importance, here, is article 5 TEU with the principles of conferral, subsidiarity, and proportionality.
\bibitem{31}In practice, during the law-making process the Commission, pursuant to article 293 par 2 TFEU, for political reasons is adapting its original proposal to the result (motto: “some result is better than nothing”).
\bibitem{32}COM (87) 716 final (submitted by the Commission to the Council on 15 January 1988) (\textit{OJ}, 88/C 79/12).
\bibitem{34}\textit{OJ}, C 311, 27.11.1992, p. 63 ff.
\bibitem{35}“... user charges should take infrastructure and external costs, including environmental costs, into account”
\end{thebibliography}
Some keywords from the text with regard to “tolls and charges for the use of certain infrastructures” are as follows:

The Member States shall, if necessary, adjust their systems of vehicle taxes, and for tolls and user charges, in accordance with the provisions of this Directive (article 1);

- Tolls and user charges should not be discriminatory, entail excessive formalities or create obstacles at internal borders;
- The rates of user charges should be based on the duration of the use made of the infrastructure in question; (of importance for an EU road pricing concept) “…rules for determining (the) manner of application [of user charges and tolls] should be laid down, such as characteristics of infrastructure … [and] the maximum rate of user charges…”.
  (Important for Benelux) “Whereas in this context two or more Member States may cooperate for the purpose of introducing a common system of user charges, subject to compliance with some additional conditions.”37

Around the same time, December 1992, the Commission came forward with its Communication on the future development of transport policy. Knowing already what the Council would approve regarding road pricing, the Commission, of course, in its Communication, laid down what had already been reached (“As a general rule, all transport users should pay the full costs internal and external of the transport services that they consume, …. In particular, internalization of external costs should be a major element of a transport policy integrating the protection of the environment. …”).38 Later, in this document, it goes into more detail. From this, we here only underline the following:39

- The development of a Community framework in charging costs of transport can leave scope for national or local authorities to take account their particular circumstances.
- Compatible technologies are developed so that vehicles from different Member States can be processed with equal facility, and past and current (read: in 1992) Community Research & Development work is assisting the development of common specifications for a pan-European system for charging operations.
- “…road pricing is to use a market mechanism which still leaves operators with choice while ensuring a better utilization in time and space of different transport modes”.

Given the complexity of a common approach to the charging of costs, it makes sense to proceed in stages. In the short term, emphasis will be placed on the development of a framework for the imputation of infrastructure costs. Finally, notice that in this top political strategy paper, the private car is explicitly mentioned in the EU road pricing context by “…while increasing the level of charges overall, including those imposed on the use of the private car”.

All this is written around and in a context of competition and avoiding disruption between transport modes. Therefore, although not explicitly stated but confirmed later in 1998 in a White Paper, it is preserving its effects until the Council had adopted a new Directive. It is clear, however, what were the intentions of the Council.

37 In 1994, Germany (till mid-2003), Denmark, and Benelux Member States (Belgium till April 2016) and later on also Sweden in 1998 undersigned an international treaty of which originated the Eurovignette certificate, a proof to have paid vehicle taxes for a motor vehicle or articulated vehicle combination intended exclusively for the carriage of goods by road and with a maximum permissible gross laden weight of not less than 12 tons.
obvious that for the Commission ‘road pricing’ is not literally only for road transport of goods, but in principle includes all modes of transport.

In the following years, the Commission analysed national and regional differences in transport costs, charges, and pricing.

It may be noted here, which is of much more general significance, that in 1997, a new text of the “Treaty of the European Community” (TEC) was accepted. The so-called “Treaty of Amsterdam” that came into force in 1999, attributed co-decision powers to the European Parliament and the Council on nearly all aspects of transport policy. The legislative procedure thus changed, with a clearly very big influence from the parliament.

4 Towards a real policy decision


All road pricing elements described in the previous section returned in the subsequent White Paper of 22 July 1998, entitled ‘Fair payment for infrastructure use: a phased approach to a common transport infrastructure charging framework in the EU’. The Commission considers that a gradual and progressive harmonization of charging principles in all major commercial modes of transport is required across the Community. It is proposed that the charging system be based on the “user pays” principle, i.e., all users of the transport infrastructure should pay for the costs, including the environmental and other external impacts they impose at. The principles do not impose a centralized community charging scheme. Rather, they provide a framework within which the Member States would be free to set charging levels. The “marginal social cost” charging principle should enhance both the efficiency and the sustainability of the transport system.

The Commission proposes a step-by-step approach for implementation. The first phase was going to run until the end of 2000. It would contain the complementing of the existing charging system for road freight traffic and ensuring that a broadly compatible structure is in place in the main modes of transport. Charging of external costs on the basis of an agreed Community framework would be allowed, but total charging levels would be capped by average infrastructure costs. The second phase (2001–2004) would see a greater harmonization and adaptation of charging systems, especially for heavy goods vehicles (HGVs). As of this period, charges should not exceed marginal social costs (external costs). It would be important for the Member States to decide on how to use the revenues.

Phase three: beyond 2004. A further implementation of harmonized charging principles, both in terms of the marginal cost basis and the consistency of cost estimation. The level of Community-wide charges for externalities should also be reviewed. Consideration could also be given to requiring mandatory charging structures, but not levels, for local externalities.

The judgment of 5 July 1995 by the Court of Justice in the only procedure case of Parliament against Council, which nevertheless annulled Council Directive 93/89/EEC of 25 October 1993, was the reason

why, in 1999, this Directive was replaced by a new Directive. Following the text of the Treaty of Amsterdam, nowadays, both European Parliament and Council decide on the legal basis of articles 71(1) (“implementation of common transport policy”) and 93 (“harmonization of indirect taxes”) TEC. Notice that nothing more may be considered as a failure in the 1993 version of article 75 (“no discrimination of transport contract price”). In addition, notice that in the title the second part of the original title “and tolls and charges for the use of certain infrastructures” is not there anymore. This issue, however, is treated as before in article 7.

The new directive is known as the “Eurovignette Directive”. It does not oblige the Member States to introduce user charges for HGVs but allows time-based as well as distance-related charges schemes, with minimum levels of vehicle taxes for HGVs with a maximum permissible laden weight of over 12 tons. It furthermore specifies the modalities of infrastructure charging, including the variation of charges according to the environmental performance of vehicles. It notably indicates that if infrastructure charges are implemented, they should be related to the construction, operation, and infrastructure development cost. In doing so, it laid down the foundations for the internalization of the costs generated by HGVs.

An indication about the next step in Commission’s road pricing strategy may be found in the White Paper “European transport policy for 2010: time to decide”, published in 2001. This paper showed a more decisive shift towards an environmentally orientated and more efficient transport policy as a way to adapt to uneven growth in the various forms of transport, congestion on Europe’s roads and railways, and the rising impact of pollution. A mid-term progress review, that appeared in 2006, decided that more was needed to combat transport’s negative impact on energy use and environmental quality. Parliament and Council followed the progress, and the ‘Eurovignette’ Directive was amended in 2006 to include vehicles with a maximum permissible laden weight of over 3.5 tons. Nevertheless, a possibility was allowed to exempt vehicles of between 3.5 and 12 tons. In addition, greater possibilities were allowed for varying tolls according to environmental or traffic management objectives.

In 2011, White Paper “Road Map to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System” stated that “The cost of local externalities such as noise, air pollution, and congestion could be internalized through charging for the use of infrastructure”. The amending Directive of 2011 as indicated in the White Paper 2011 above gives the Member States the possibility to apply external cost charges related to traffic-based air pollution and noise. This amendment also adapted the possibility to differentiate tolls according to time, type of day, or season, with a view to mitigating congestion. Finally, for this period, an external evaluation of the Eurovignette

41 Case C 21/94; OJ, 95/C229/15, p. 8.
43 Article 7: “1. Member States may maintain or introduce tolls and/or user charges under the conditions set out in paragraphs 2 to 10”.
46 COM (2011) 144 final, Brussels, 28.3.2011, Chapter 3.3 “Modern infrastructure, smart pricing and funding”, par. 61.

Later, in March 2017, the situation was as described by Malmersjo (2017): four Eurovignette countries, including the Netherlands and Luxembourg, four vignettes (stickers on window) countries, nine network-wide electronics tolls countries, including Belgium, and six concession motorways tolls.
of 2014 concluded that “Most EU Member States have transposed the 1999 Directive and its amendment in 2006. However, only a few Member States have systematically implemented and applied all the provisions of the Directive.”

Following this, Parliament called on the Commission to submit proposals in order to provide:
- The internalization of the external costs of all modes of freight and passenger transport;
- Specific measures to ensure a wider application of the ‘user pays’ and ‘polluter pays’ principles;
- A general framework for national road charging schemes for passenger cars and light commercial vehicles prioritizing distance-based charging;
- Initiatives to ensure the interoperability of electronic road toll systems.

5 Present approach

Main line: Considering the shortcomings related to existing provisions and problem areas that road charging could tackle, as well as the need for simplification and clarification of the directive, the current framework for road charging is deficient because the Eurovignette Directive disregard vehicles such as passenger cars, vans, and buses and does not cover CO₂ emissions. In the European Commission evaluations and consultations in 2016, the Member States did not support the measures for subsidiarity reasons.

Nevertheless, the Commission adopted a proposal for a directive amendment of Directive 1999/62/EC in May 2017, which was linked to the energy union strategy and the Commission’s strategy for low-emission mobility.

The proposal with amendments was voted on in the European Parliament and now, 31 March 2019, to continue the legislative procedure, it is waiting for the Council's position, but it is ‘on hold’.

Evaluation of the current framework led to the identification of a number of shortcomings related to existing provisions and problem areas that road charging could tackle. The fact that the directive does not oblige the Member States to introduce user charges and leaves some room for interpretation on road charging methods results in a situation where there are disparities in national road charging policies and a lack of harmonization when it comes to the type of charges. Member States are free to decide if they want to implement road charges, on which part of their road network, and to what extent they want to recover the costs of infrastructure. While twenty-four Member States have implemented some sort of road charges, only fourteen Member States apply distance-based charges to HGVs and only eight to

passenger cars. The possibility of exempting vehicles between 3.5 and 12 tons leads to an uneven playing field in freight transport. For example, four Eurovignette countries (Denmark, Luxembourg, the Netherlands, and Sweden), as well as the United Kingdom, still use this possibility, while in Germany, tolls only affect vehicles over 7.5 tons. In addition, the application of charges to buses, coaches, vans, and passenger cars is outside the scope of the current legislation and is left to Members States’ discretion, which leads to a situation where road charging is primarily focused on HGVs in most Member States and does not reflect the ‘user pays’ and ‘polluter pays’ principles for all road users. Only a very limited number of Member States introduced time-varying charges to deal with congestion. Another problem related to the provisions of current legislation is that time-based charges, authorized by the directive, do not seem to be effective in covering infrastructure costs, incentivizing cleaner and more efficient operations, or reducing congestion. Moreover, application of external cost charging is too complex, and the Euro class variation is not well-defined. Finally, the variation of charges to deal with congestion is also seen as too difficult to implement and may appear as unfair if addressing HGVs alone.

In addition to the need for simplification and clarification of the directive in certain areas, the current framework for road charging is also seen as deficient in two important areas:
- The Eurovignette Directive covers HGVs only, disregarding other vehicles such as passenger cars, vans, and buses;
- The current directive does not cover CO₂ emissions, although it addresses other externalities such as air pollution and noise; over 60% of these emissions originate from passenger cars.

In order to prepare a review of the Directive, the European Commission used previous evaluations and consultations in 2016 with the general public and with specific stakeholders (among others the Member States). These made clear that, in contrast to most stakeholders, Member States did not support the measures to ensure the quality of roads infrastructures, notably for subsidiarity reasons. They considered that it is up to them to decide in what way they manage and fund their own road networks.

Nevertheless, the Commission adopted a proposal for a Directive amending (Directive 1999/62/EC) in May 2017, linked to two wider strategies, i.e., the energy union strategy which, inter alia, envisaged a road transport package, including more efficient infrastructure pricing, and the Commission’s strategy for low-emission mobility. The proposal was presented within the context of the Commission’s ‘Europe on the move’ package. The objective of the Eurovignette proposal, which substantially amends the existing legislation by extending the scope of vehicles covered, is to make progress in the application of the ‘polluter pays’

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53 Communication from the commission to the European Parliament, the council, the European economic and social committee, the committee of the regions, and the European investment bank, a framework known as a strategy for a resilient energy union with a forward-looking climate change policy, com/2015/080 final, Brussels, 25.2.2015.

European Commission, communication from the commission to the European Parliament, the council, the European economic and social committee, and the committee of the regions, a European strategy for low-emission mobility, com(2016) 501 final, Brussels, 20.7.2016.

54 Communication from the commission to the European Parliament, the council, the European economic and social committee, and the committee of the regions, Europe on the move. an agenda for a socially fair transition towards clean, competitive, and connected mobility for all, com (2017) 283 final, Brussels, 31.5.2017. Accompanied by the first series of eight legislative initiatives specifically targeting road transport.
and ‘user pays’ principles, thereby promoting financially and environmentally sustainable and socially equitable road transport.

The changes proposed are:

- Scope of application to the goods vehicles over the 3.5-tons limit, passenger cars, minibuses, vans, coaches, and buses;
- Gradually phasing out the use of time-based user charges (vignettes) for heavy goods vehicles (HGVs), buses, and coaches (until 31 December 2023) and later on for passenger cars and vans (until 31 December 2027);
- Removing the possibility to exempt HGVs below 12 tons from road charging and as of 1 January 2020, charging applies to all HDVs;
- To be proportionate to the duration of the use of the infrastructure and introduction of upper limits to user charges;
- A distinction between different types of vehicles phase out the variation of charges according to the Euro emission class of the vehicle and instead introduce a variation of charges according a heavy duty vehicles (HDV) on CO₂ emissions and to light duty vehicles on emissions of both CO₂ and air pollutants;
- Allowed will be the application of congestion charges, on top of infrastructure charges, to address the issue of interurban congestion;
- Member States levy tolls that could apply an external-cost charge from 1 January 2021 for heavy duty vehicles to at least part of the network;
- Regarding mark-up, extension of the possibility to use them beyond mountainous regions, but a mark-up would not be additionally applied to road sections where a congestion charge would be applied;
- Update provisions on reporting requirements on tolls, tolls revenues, and the use of revenues, as well as on the quality of toll roads, and simplify certain provisions such as those related to the application of external-cost charging for air pollution and noise allowing the use of reference values.

The proposal was voted on in the European Parliament Committee on Transport and Tourism (TRAN), and a mandate for negotiations in Trilogue was adopted in plenary.55

On 25.10.2018, the European Parliament adopted a legislative resolution on the proposal.56
At its first reading under the ordinary legislative procedure, Parliament amended the Commission proposal. On 25.10.2018, the European Parliament adopted a legislative resolution on the proposal as follows (summarized).57

- Tolls and user charges: Parliament considered that road charging imposed by the Member States would need to become distanced-based from 2023 for heavy duty vehicles and larger goods vans with a maximum permissible laden mass of between 2.4 and 3.5 tons and a height of more than 2 meters and from end of 2027 for light duty vehicles, meaning vans and minibuses. Notice that passenger cars were removed from the definition of light duty vehicles. As of 1 January 2020, tolls and user charges applied to heavy duty vehicles shall apply to all heavy duty vehicles and vans, rather than the carriage of goods.

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55 On 12.06.2018. For procedure see article 294 TFEU, in particular, par. 10 about the Conciliation Committee.
57 The text between brackets (“[…]”) is literal text from the amendment.
- User rights [proportionality and equal treatment]: According to the amended text, road networks covered by an infrastructure charge shall offer a high level of road safety and be equipped with all the necessary infrastructure, such as safe parking areas in all weather conditions, to comply with the obligations laid down in the Regulation on rest periods and driving times.

- External cost charging: From 1 January 2021, Member States levy tolls that shall apply an external-cost charge [for traffic-based air or noise pollution] to heavy duty vehicles and vans intended for the carriage of goods on all parts of the network referred to in the Directive that are subject to an infrastructure charge. From 1 January 2026 onwards, an external-cost charge imposed on any section of the road network shall apply in a non-discriminatory manner to all vehicle categories. Member States may apply derogations which allow external-cost charges to be adjusted for vehicles of historical interest.

- Congestion charging: Parliament proposed that congestion charges may be introduced or maintained independently from infrastructure charges. Member States may, however, decide to exempt buses and coaches for the promotion of collective transport, socio-economic development, and territorial cohesion.

- Mark-up: The mark-up does not exceed 15% of the weighted average infrastructure charge, except for mountainous areas, where infrastructure costs, as well as climate and environmental damage, are higher, and the mark-up may not exceed 50%.

- Variation in charges: Parliament proposed that, from the date of entry into force of this Directive, zero-emission vehicles will benefit from infrastructure charges reduced by 50% compared to the lowest rate. The zero-emission operation will benefit from the same reduction, provided that such operation can be proved. Member States may consider the improvement of the environmental performance of the vehicle, which is linked to that vehicle’s conversion to alternative fuels.

- Discounts: For heavy duty vehicles and vans intended for the carriage of goods, Member States may give discounts or reductions on the infrastructure charge provided that such discounts or reductions do not exceed 20% of the infrastructure charge paid by equivalent vehicles not eligible for the discount or reduction and those used for local or habitual transport, or both. Member States or competent authorities may introduce a kilometre-based flat-rate exemption on a specific road section, taking into account the mobility patterns and economic interest of peripheral regions.

In mountain areas and peripheral regions, Member States or competent authorities may vary toll rates for heavy vehicles according to distance travelled by the tolled vehicles to minimize socio-economic impacts.

- Using revenues: Revenues shall be used to (i) reduce air and noise pollution from road transport; (ii) finance collective and sustainable modes of transport; (iii) develop alternative fuel infrastructures; (iv) support the trans-European transport network and eliminating bottlenecks.

- Lastly, it is proposed to establish in each Member State an independent supervisory authority for infrastructure charging responsible for ensuring compliance with this Directive.
With the Council yet to agree on its position, there will still be a trilogue to obtain a text which can be adopted by Parliament and Council on equal footing and finally be published in the Official Journal. However, till now (i.e., 31 March 2019, date of finishing article), there is no reaction of Council. “On hold” 58 is the only indication without saying for how long. 59 Obviously, without the Council’s position, no trilogue, no formal adoption by Parliament and Council, and thus no final text of a revision of Directive 1999/62/EC exist for publication in Official Journal to become law.

6 Electronic toll collection 60

In addition to what is directly related to road pricing, a number of matters can be mentioned that are related to this issue in some other ways. That relationship may be of a more or a less strong nature (i.e., either or not based on article 91 TFEU).

An example of the latter is fuel tax, based on article 113 TFEU. Many years ago, charges on road traffic were in the form of fuel taxes. Today, the latter largely consists of excise duties. In 1992, the EU brought about a certain harmonization, just by providing a minimum rate of a tax. In practice, however, excise duties are often way above these minimum rates. 61

Strongly related to – even part of – the subject of road-pricing is the interoperability of toll systems. The Directive on the interoperability of electronic road toll systems and the Commission Decision on the definition of the European Electronic Toll Service and its technical elements are the existing legal framework focused on making all European Electronic Toll Collection schemes interoperable through a European Electronic Toll Service (EETS). 62

Directive 2004/52/EC prescribed the setting up of an EETS, enabling road users to subscribe to a single contract and use a single on-board unit (OBU) to pay electronic tolls across the EU. In particular, new electronic toll equipment, brought into service after 1 January 2007, should use one or more of the following technologies:
- Satellite positioning (GNSS – “global navigation satellite system”);
- Mobile communication (GSM – “global system mobile communication”);
- Radio service (GPRS – “general packet radio service”);
- Microwave technology (DSRC – “dedicated short range communication”).

58 The secretariat general of the Council only refers to “Europe direct of the EU Commission”. EPRS, nevertheless, was so kind to send me their “legislative train schedule - resilient energy union with a climate change policy”
59 But there was already an indication in the past. Earlier European Commission consultations show that in contrast with most stakeholders, Member States did not support the measures to ensure the quality of roads infrastructures, notably for subsidiarity reasons, considering that it is up to them to decide how they manage and fund their own road networks. Member States and stakeholders’ views also diverged regarding the possible measure to avoid discrimination and ensure a level playing field. Member States were divided according to the need for further measures to avoid discrimination, and the phasing out of vignettes attracted little support.
60 Most of the text in this Section is taken from Debyser (2019).
Decision 2009/750/EC defined the EETS and set out technical specifications and requirements as well as contractual rules relating to EETS provision. It outlined the various actors involved (Member States, toll chargers, clients, and EETS providers) and their rights and obligations. The legislation was intended to complement local electronic toll services, not to replace them. It had been stipulated that a fully interoperational EETS would be available, offering electronic toll collections services to HGV users by October 2012 and to all vehicles by 2014, but this was not achieved.

Parliament then calls for drastic action to address the lack of progress related to EETS, regrets the lack of interest among Member States in progressing with it, and calls for strong political action. It expresses concern about the regional approach suggested by the Commission to improve implementation. It calls for a continued EU-wide approach and infringement proceedings to be started against any non-compliant Member States. It asks the Commission to conduct a review of the available evidence to suggest options for an EETS based on the best practice and if necessary, requests new proposals to address any issues identified by this review. In the meantime, there is still a variety of around 140 collection systems across the EU, with DSRC as the most used technology. Interoperability between toll domains, however, is unsatisfactory.

Finally, there is now a new proposal as one of the actions of “Europe on Move”. It is presented as a recast of Directive 2004/52/EC and facilitates the wider application of the “user pays” and “polluter pays” principles by making electronic tolls easier to deploy and apply. On top of ensuring the interoperability of the electronic road toll system, it proposes to work on a legal framework for the exchange of vehicle registration data for the purpose of toll enforcement. The different categories of EETS market players, currently defined only in Decision 2009/750/EC, are more precisely defined in the Directive itself. The main changes include the deletion of a provision in Article 1 to allow the Member States to exchange information on those who fail to pay road fees where toll systems do not require the installation of on-board equipment. Regarding technological solutions (Article 3), the proposal confirms that, for the purpose of the Directive, portable devices used for electronic toll transactions are to be considered as on-board equipment. The list of technologies that can be used for electronic toll transactions is moved to Annex IV, and the Commission can amend the list by delegated act if a technology becomes obsolete or if a new technology should be added to the list. The text also mentions that EETS on-board equipment can link to other devices installed or present in the vehicle, such as satellite navigation systems or smartphones. It also specifies that communication between on-board equipment and such other devices may use technologies that are not listed in Annex IV (for example Bluetooth). Article 3 is further modified in order not to compel EETS-providers to supply EETS to all types of vehicles and to allow them to choose to provide a service for heavy or light duty vehicles only. In addition, until 31 December 2027, EETS providers serving light duty vehicles are authorized to offer their clients on-board equipment suitable for use with 5.8 GHz microwave technology only. Finally, provisions are proposed for the cross-border exchange of information on the failure to pay road fees, by adapting the provisions of Directive (EU) 2015/413 to the tolling context.

At its June 2018 plenary session, Parliament confirmed the TRAN Committee's decision to enter into inter-institutional – “Trilogue” - negotiations. The Transport, Telecommunications, and Energy Council

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63 European Parliament, resolution of 11 June on a strategy for an electronic toll service and a vignette system on light private vehicles in Europe, Strasbourg.
64 See footnote 31.
65 Technology tested in the framework of pilot tests in compliance with Article 20 of Decision 2009/750/EC.
adopted its position (general approach) on 7 June 2018. Trilogue negotiations resulted in a provisional agreement on 20 November 2018. The agreement improves information exchange on vehicle data, as national authorities will have access to other Member States’ national vehicle registration data to identify the owners of vehicles which fail to pay road fees. It will thus put all road users on an equal footing. The agreement also gives electronic tolling providers easier access to the toll collection market, by removing administrative barriers, notably local technical ones, and allows for the development of a system whereby an individual can use a single on-board toll payment device when driving across the EU. Formally adopted now by Parliament and the Council, the final text of the new approved Directive is awaiting publication in Official Journal by end March 2019.

7 Conclusion

The European Union has law making power on road pricing as far as the Treaties and derived law give competence. Coordination, harmonisation, and guarding subsidiary are general competences in the Treaties, but also in transport (title VI TFEU) where political will exists, all possibilities within a common transport policy can be used; for the European Commission to make proposals exclusively and for Parliament and the Council to make them law on an equal footing.

Unfortunately, nowadays, literally 31 March 2019, it is not the case for the Council that holds on his position on the Eurovignette Directive revision with no date limit.

For the Commission, its political will on road pricing is clear and is practiced using the newest scientific knowledge of road pricing in adapting and packeting her proposals to the highest political possibilities. So too for Parliament and even more. It summoned the Council to the Court for transport matters several times and all times with success.

The possibility exists, of course, that the Council comes to a position soon, but it is doubtful because Commission’s proposal and Parliament position in first reading under the ordinary legislative procedure contain a transfer of some sovereignty. Nevertheless, let's hope that the link of the Eurovignette revision to the energy union strategy and the Commission’s strategy for low-emission mobility will be the catalyst to convince Council that the old and only one Directive about road pricing, still based on the context of competition and disruption between transport modes, has to be adapted to the overall accepted “polluter pays” and “user pays” principles.
Abstract

In this chapter, we discuss international aspects of freight transport pricing and investment policies, largely focusing on road transport. We specifically emphasize the recent shift from fuel taxes towards distance charging for trucks, and we discuss the role of subsidies versus pricing to finance large infrastructures.

1 Introduction

The European single market has generated a strong increase in international freight traffic, mainly by road. This required not only better regulation (for example, allowing cabotage), but also a more harmonized pricing system that makes sure the different users pay for the external costs they cause when they use a country’s infrastructure. External costs include wear and tear of the road, congestion, local air pollution, accidents, and global pollution (CO₂). Although in principle these externalities can be fairly internalized, in practice political obstacles prevent many governments from doing so. This chapter focuses on two issues in the economics of international freight transport that have been heavily discussed by European policy makers over the past decades. First, accounting for external costs required a revolution in the pricing of road use by trucks, and over time diesel excises and vignettes are being replaced by distance charges. We explain why and how this evolved in Europe (Section 2). Second, the EU has been subsidizing the construction of international freight corridors. We assess the merits of this investment program, and we look for possible improvements (Section 3). Finally, Section 4 concludes the chapter.

2 Pricing of road use by trucks

Trucks and, to a lesser extent, buses cause damage to the roads. It is their axle weight to the 3rd or 4th power that creates the damage to the road surface. This is also why cars contribute little to road damage. Trucks are also to a higher degree responsible for noise, pollution, accidents, and congestion.

(1) Professor of Economics, University of Antwerp (Belgium).
(2) Professor Emeritus of Economics, KU Leuven (Belgium).
This is all well known, and governments all over the world have been trying to limit these externalities in different ways. For example, nowadays, regulations consider axle weight, and charging systems for trucks depend to some extent on the externalities caused while contributing to road maintenance. Although it is not very difficult for countries that have toll roads to implement a much better charging system, most countries have used a mixture of an annual vignette combined with diesel taxes. These second best pricing systems came under increasing pressure when international trucking did grow strongly over the last 30 years due to the integration and extension of the European economy. Neighbouring countries tried to set up a vignette system (the “Eurovignette”) that can distinguish functions of vehicle characteristics (axle weight and emission abatement equipment). The idea was that the same national vignette could be used in the neighbouring countries. Using the same vignette in all countries and hence, on all international trips, saves a lot on transaction costs. Unfortunately, when countries had to reach a consensus on the price level of this common vignette, the result was the smallest common denominator, leading to cheap vignettes. Because of this, the diesel tax became the major financing and regulating instrument for trucks.

This had important consequences because truck traffic is widely known as the international traffic. Tax competition between countries puts restrictions on the behaviour of individual countries (in a transport setting, see De Borger, Proost, and Van Dender (2005); De Borger, Dunkerley, and Proost (2007)). If the charges on truck use cannot easily be avoided (for example, in very large countries where the charges imposed by a country can only be avoided by taking another route and avoiding the country’s infrastructure), countries may impose high charges to generate large revenues. On the contrary, if the charges can easily be avoided, countries facing a lot of through traffic have incentives to set low user charges on trucks’ road use so as to attract much traffic and hence, earn high revenues.

Not surprisingly, then, as trucks pass through several countries, tax competition for diesel fuel implied that sustaining a high diesel tax was very difficult. Trucks can carry fuel in their tanks for 2000 km or more, and they simply fuel up where it is the cheapest. To see the implications, consider a large country and a small neighbouring country. The large country has no incentive to decrease its fuel tax to a level below the external cost. Doing so would mean that all traffic by domestic trucks pays less than the full social cost which is economically inefficient. The country would gain some tax revenues from the international trucks that trade goods between the two countries, but this gain will be small for two reasons: the large country does not need a lot of international trade with the small country, and the tax is small. In sum, the large country has no incentive to set low charges. Now, consider the decisions of the small country. This does have a strong incentive to decrease its diesel tax. In fact, it would gain high tax revenues since there are many trucks in the large country that will want to tank cheaply, and this will compensate for the underpricing for domestic trucks inside the own (small) country.

The fact that smaller countries may benefit from undercutting the taxes of the larger countries is one of the basic insights of the tax competition literature (Kanbur and Keen (1993)). To illustrate, in 2012, the excise on diesel was 0.47 Euro per litre in Germany and only 0.30 Euro per litre in Luxemburg. The 0.30 Euro per litre was close to the minimum fuel excise set by the EU ministers of finance. Otherwise, Luxemburg may have set an even lower excise on diesel. Tax undercutting by small countries also holds for taxes on cigarettes and alcohol and profit taxes of international companies.

As expected, all those countries that suffered from intense diesel tax competition by neighbouring countries were forced to take action. One obvious response was to shift from the fuel tax towards instruments that cannot easily be avoided. One such new instrument is a distance charge for trucks. It
is an electronic payment system that lets trucks pay per kilometre driven in a country. This cannot be avoided unless the truck totally avoids the country. To illustrate the shift, Figure 1 presents, for several countries, the total charges on road use for a 40-ton truck with a domestic haul of 400 km over the period 2000 to 2012. Several countries such as Switzerland, Germany, Austria, the Czech Republic, Slovakia, and Poland started to introduce new instruments over this period. They were later followed by Belgium (2016).

It is interesting to see the underlying economics of the shift towards distance charges. A first thing to note is that countries are more or less forced to introduce distance charging for trucks (Mandell and Proost, 2016). To see this, start with two identical countries A and B that are linked by intensive international truck traffic and use only diesel fuel taxes. The diesel taxes are initially set at the same level. Imagine now that country A lowers the fuel tax for a 100 km trip on its territory by 1 Euro, but at the same time introduces a distance charge for the equivalent of 1 euro per 100km. For the domestic trucks in country A, there will be no change, and they pay exactly the same. But all the international traffic from B will fuel up in country A; this will gain tax revenues, and country B loses revenues. The best reply of country B is to also introduce distance charges and lower its fuel tax.

But this is not the end of the story. Country A will have incentives to further reduce its fuel tax and replace it by higher distance charges in response to B’s policy, to which B will again react. Therefore, over time the fuel taxes will be driven to the bottom and progressively replaced by higher and higher distance charges. We now run the risk that truck charges become too high. Most international truck drivers can decide where to take fuel, but they have to use the roads of the countries that are part of their least cost route. Therefore, trucks have difficulties to escape the distance charges by rerouting. Small and medium sized countries with a lot of international traffic will find it beneficial to increase the distance charges and start to charge more than their external costs. The domestic trucks will also pay too much, but this may well be compensated by the extra profit that margin countries can earn from foreign trucks.

In sum, the change in charging instruments from diesel taxes to distance charges has transformed the problem of too low charging of trucks into a problem of excessive charges on trucks. Figure 1 illustrates this. The very high charge imposed on Switzerland is a clear example of overcharging compared to the social cost. It is a consequence of the fact that most trucks which go to Italy have to pass through Switzerland.
FIGURE 1 Truck charges for a standard 40-ton truck with a domestic haul of 400 km. Charging policy of 2012 Source: (Hylen, Kauppila, Chong, 2013, OECD)

What can be done to limit excessive charges on trucks? The EU can impose that charges have to be in line with the external costs. This is, however, difficult to implement since external cost estimation is complex, and it uses subjective valuations of health damage, noise nuisance, etc. Therefore, each country can claim that it has a unique ecosystem that needs to be protected at all cost. What the EU did instead is to oblige each member country to set an upper bound for the distance charge. The option that is chosen is that the distance charge cannot exceed the average infrastructure costs. This is a smart upper bound because international traffic and domestic traffic use the same road infrastructure. A member country cannot discriminate between a domestic truck and a foreign truck. The best it can do is to set a distance charge that corresponds to the investment level that is optimal for the domestic traffic (Van der Loo and Proost, 2013 and De Borger and Proost, 2016).

Over the last 20 years, we have seen a revolution in the way the use of trucks is priced, but there are some remaining problems. At the EU level, the present distance charges are not differentiated based on the level of congestion, and this will become important once road pricing is also introduced for cars. Moreover, the current EU regulation limits the distance charges for the member states, but, unfortunately, this is not binding for Switzerland (that is not an EU-member). The only option for the EU is to negotiate with Switzerland and link it to other dossiers to strike a deal.

3 Investment in international infrastructure

Competition between countries is not limited to pricing; it also has implications for countries’ investment in infrastructure. For example, countries facing much through traffic have no incentive to heavily invest in infrastructure, unless they can be charged through traffic. The benefits of their investment largely accrue to foreign users of the infrastructure so that, if they cannot charge through traffic one way or another, they will under invest. To avoid this, coordination between countries is needed.

This is certainly the case for the infrastructure that directly links two or more countries. Both the location and the timing of the investment have to be coordinated; moreover, each of the countries may think that the other one benefits more, and therefore, it should pay a larger share of the investment cost.
These potential conflicts refer to the reasons why the EU intervened and started a program to improve the international freight infrastructure, i.e., the Trans-European Networks program for transportation (TEN-T). The concept of a Trans-European transport network was formally recognized in the Maastricht Treaty (1992), and a priority list was drafted, consisting of 30 “priority” projects, to be launched before 2010. Project selection was based on a number of criteria, including the overall net socio-economic benefits and the project’s “European added value”. This concept considers the share of benefits that are truly international and the extent to which benefits target the poorer member countries. Priority projects are eligible for European subsidies.

Proost et al. (2014) tested the merits of a large number of priority projects using a combination of cost-benefit methodologies. Based on a reasonable CBA threshold, it was found that the selection of TEN-T priority projects was not efficient. Out of the 22 assessed projects, only 13 passed an elementary efficiency test; moreover, only a minority of these had any real “European added value” that may be considered a reasonable justification for EU financial aid. The “European added value” of half of the projects is below 10%, and some of the projects even have a significant negative impact on other countries.

With respect to the issue of equity, some of the 22 projects mostly benefit the richer countries, while other projects mostly benefit the poorer countries. Hence, neither do the results suggest the systematic tendency of the selected TEN-T projects to favour lagging regions, nor is the opposite true.

It is interesting to look at two projects situated in the Benelux: the Betuwe line and the canal Seine-Escaut. The Betuwe line is a railway project connecting the port of Rotterdam to the Rhein/Ruhr area. The Dutch part of the rail track was opened for transport in 2007 and cost €4.7 billion. One pricing scenario involved full marginal social cost pricing for all transport modes, which performed better than the current pricing approach, in which road use is underpriced. However, the Betuwe line gains only a small market share of the total traffic between the Hamburg-Le Havre range of ports and the German Ruhr area. The net discounted benefits are negative and in absolute value close to the investment cost. Thus, the project is not justifiable economically and can only survive financially with a subsidy that covers close to 100% of the initial investment. The main reason for the poor economic performance is the availability of substitutes for the new rail link from the port of Rotterdam, such as an existing rail link and inland waterways connections, and the availability of other ports (Antwerp, Bremen) that are connected to the Ruhr area. Unfortunately, the rail line has already been built.

The aim of the Seine–Scheldt project is to connect Belgium and the Netherlands -- in particular the ports of Rotterdam and Antwerp -- to northern France and Paris via inland waterways. The main bottleneck for inland waterway transport in this region is the Canal du Nord between Compiègne and Cambrai (in the North West of France). Navigability on this section is at the lower end of international standards, with access restricted to vessels of about 300 tons on some stretches. This canal will be replaced by a new large-gauge one, which allows barges with a loading capacity up to 4,400 tonnes to pass. Belgium has been planning for a long time (in fact, the first plan dates back to the middle of the twentieth century!) to improve navigability on the north axis of the bottleneck.

The canal between Compiègne and Cambrai will cost at least €2.3 billion and is planned to become operational between 2010 and 2020. Usually, it is argued that freight traffic on canals should cover only

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67 At this point we can mention the discussions around the Iron Rhine, connecting the port of Antwerp to the Ruhr area, a project similar in spirit to the Betuwe line. This project is pushed by the Flemish government, but according to the Dutch government, the official CBA shows a clearly negative result. ANP, 2018. Available at https://www.ed.nl/eindhoven/studie-heropen-ijzeren-rijn-via-venlo-a7a16e01/.
a fraction of the investment cost, since a canal creates additional benefits, including water management, flood protection, accessibility for recreational vessels, and recreational facilities on embankments in addition to electric power generation. Traditionally, this lowers the required threshold of net benefits to 50–70% of the investment. Unfortunately, very low economic efficiency benefits are found based on the first 9 years of operation: the net benefits are of the order of 5–10% of the total investment. There are several reasons for this. For example, the overall freight demand in this corridor is low, and there are parallel rail and road options that are not yet saturated. Clearly, the required threshold mentioned above appears unlikely to be achieved.

One other argument for subsidizing freight projects in poor regions is the contribution of these transport projects to attracting new economic projects to a region. This argument is not entirely convincing and is difficult to validate. Whether it is true is a methodologically difficult question. Regional growth theory is complex, and under some conditions, it may actually offer the opposite conclusion.

Indeed, as transport infrastructure typically runs both ways, and there are clear benefits of concentrating on economic activities, a well-intentioned transport project linking the periphery with the core regions may be counterproductive (Proost and Thisse, 2017).

One explanation for the apparent poor choice of priority projects is frequently defined as “pork-barrel” politics, which is likely to occur when transportation investments favour a particular constituency, leading to the risk of excessive supply of local projects when paid for at the federal level. This is consistent with evidence on the allocation of the federal Highway Trust Fund in the US (Knight 2004). Potential remedies include standardizing the CBA procedure under specific, pre-defined rules, and limiting European level subsidies only to projects that generate significant benefits (time savings, freight cost savings) accruing to users outside the countries investing in the infrastructure.

The discussion so far leads us to the inevitable question: what instruments can prevent this misallocation of resources? We emphasize two powerful ingredients of the mechanism design that are required to ensure optimal infrastructure planning. The first one is related to the CBA procedure itself and the second one involves the share of the projects that may be legally funded by federal public money (Proost et al., 2011).

In 2000, the Netherlands introduced a requirement that all CBA for major infrastructure projects must be carried out using published guidelines. The results are in principle available to Parliament and in practice therefore, to the general public. In addition, the Dutch government decided that a CBA is only credible if it is reviewed by peers. Consequently, the practice of a “second opinion” was instituted. Annema et al. (2007) discussed the effects of this requirement on decision making in practice. For many projects, the requirement of a standardized CBA led to a reformulation or postponement of the project. The reformulation is often a downsizing that permits the project to become economically efficient. We cannot clearly conclude from the Dutch experience that the obligation of undertaking a CBA following certain guidelines is a guarantee that an economically inefficient project is never accepted, but Annema et al. (2007) found a clear impact on public decision making.

A second solution to restricting the common pool problem present in the federal funding of infrastructure would be to intervene only if a project has important spillovers. When there are no

68 In the case of inland navigation, one should always take into consideration that both intra- and interconnection with other modes of transport are limited by the nature of their infrastructure.
important benefit spillovers into other regions, it may be strictly preferable to leave the decision process at the level of the member country; moreover, one could require private funding (without state guarantee) to finance a pre-specified minimum percentage of the project. The likely outcome would be that inefficient projects remain on paper but are not executed, as private investors are generally very careful at risking their own money.

There are two drawbacks to this procedure. Firstly, efficient projects may be selected but may not be priced correctly. Secondly, there may be socially efficient projects that will never be proposed by private operators, because the benefits of the project cannot be sufficiently ‘creamed off’ by the operator. In that case, a mismatch between private and social economic efficiency remains.

4 Conclusion

This chapter analysed the pricing of international road freight and investment in freight transport projects. For road freight, we have seen that in Europe pricing has changed drastically, as the combination of vignettes and diesel excises has been substituted by a combination of distance charging and diesel excises. This new combination dominates the former system, and this explains why the new system did not need to be imposed and evolved naturally.

The EU has a poor record in selecting the best international freight projects. This is the result of political pork barrel politics, too generous funding, and a lack of rigorous and peer reviewed implementation of Cost Benefit Analysis.
References


Hylen, B., Kauppila, J., Chong, E., 2013. Road Haulage Charges and Taxes, DP 2003-08, ITF.


PART VI: PRACTICE

Chapter 9. Practical applications of road pricing and associated technology
M. COOLS

Chapter 10. Road pricing for bus and coach
S. LANNOO AND J. DE VOS

Chapter 11. Review of policy instruments: beyond price instruments
B. DE BORGER AND S. PROOST
Practical applications of road pricing and associated technology

M. COOLS (1)

Abstract

The theoretical foundations of road pricing were discussed in chapter 3. This chapter highlights some practical aspects related to road pricing and provides an elaboration of best practice examples.

1 Road pricing objectives, types and fee collection options

When discussing road pricing, it is important to describe the different objectives, types and fee collection options in order to better understand the specific implementation of road pricing in a particular context. In terms of objectives, it is important to highlight the two commonly - and generally separately applied - goals of road pricing, i.e. (i) revenue generation, and (ii) congestion management (Rouhani, 2016). The first objective is to maximize revenue or recover specific costs-often dedicated to a particular road infrastructure project-and does not necessarily entail a desired shift to other routes and/or modes as a result of a reduced revenue generation. On the other hand, the second objective explicitly focuses on alleviating congestion, by stimulating a shift to other modes, routes and other time slots. It thus forms a travel demand management (TDM) strategy.

Road pricing can take different forms (types) and be implemented at different scales, using different technologies. The interplay of these different combinations will affect the impact of each particular road pricing solution. In terms of type of road pricing, the following main types can be distinguished (Victoria Transport Policy Institute, 2018): (i) road tolls, (ii) congestion pricing, (iii) cordon fees, and (iv) distance-based fees.

1.1 Road tolls

Road tolls, i.e. fixed driving fees on a particular road, are a commonly used method to fund road infrastructure improvements. The underlying motivation is that a fee should be levied according to the service provided, as this is considered more equitable and economically efficient than options which cause non-users to help pay for improvements. Revenue generation is the major motivation for levying tolls, especially in the case of private road operators. Road tolls are usually implemented at a point such as a bridge or a tunnel - e.g., the Liefkenshoektunnel in the city of Antwerp - or at an entire (or parts of a) facility, based on a per-kilometre basis - e.g. the “péages” on the French highway network.

(1) Associate Professor of Transport and Mobility, University of Liège (Belgium).
1.2 Congestion pricing

Congestion pricing, also referred to as “value pricing” or “smart pricing”, refers to road tolls where the fee is higher under congested conditions than under uncongested conditions. The goal here is to shift car traffic to other routes, times and modes. The tolls can vary depending on a fixed (time) schedule or can be made dynamic, so that rates depend directly on the level of congestion at a given time. Alternatively, rewards - (i.e., a form of subsidies - can be given for avoiding trip making during rush-hour, such as the “spitsmijden” (“avoiding the peak”)-trials in The Netherlands (Ben-Elia and Ettema, 2009; 2011; also see Chapter 3, Section 6 and Chapter 5, Section 5.2, in this book).

1.3 Cordon (area) fees

For driving in a particular area, typically an urban centre, cordon or area fees are tolls charged. Motorists are charged at the entrance of the toll area when they cross any of the charging points. The charges may vary depending on the type of vehicle, time of day, location and direction of the journey (Abulibdeh et al., 2018). For example, London, Stockholm and Singapore have been successful in implementing cordon pricing systems.

1.4 Distance-based fees

Tolls based on distance are tolls based on the number of kilometres driven by a vehicle. These “pay-as-you-drive” charges can be further redefined into weight-distance fees, where the kilometre-based road use charge increases with vehicle weight, representing the roadway costs imposed by individual vehicles, or into kilometre-based emission fees, where the toll reflects the emissions of each vehicle. The latter require an objective calculation of emission rates, particularly in view of test-bed manipulations such as the Dieselgate scandal (Jiménez et al., 2019).

In addition to the above four main types of road charging, other types could be distinguished, such as: (i) road space rationing, which for instance rations peak period vehicle-trips or vehicle kilometres using a tradable credit system (see, e.g., Dogterom et al., 2017), license plate rationing (see, e.g., Ramos et al., 2017; Nie, 2017) and tradable mobility permits (see, e.g., Fan and Jiang, 2013), and (ii) high occupancy toll (HOT) lanes, such as the Interstate 15 in San Diego, U.S. (Halvorson and Buckeye, 2006).

As mentioned above, charging for the use of roads can be implemented at various scales. A first one is that of a precise point or facility, where the charging is carried out on a particular roadway section or critical artwork such as bridge or tunnel. More widely, the charging can be implemented for a corridor. That is: all roads within that corridor are subjected to a charge. Further, for a particular area, charging can be related to a cordon for a particular area. In this case, the use of all roads within that predefined cordon area is being charged for. Finally, charging for road use can be applied throughout an entire region - the Austrian road tax vignette is a good example of such a way of charging.

There are a wide range of options in terms of technology, with each technology corresponding to significant differences in cost of equipment, operating costs, user inconvenience, and adjustable price. Table 1 provides an overview of different toll collection technologies, and highlights the main advantages and disadvantages of each. Note that this table does not consider the potential privacy intrusion the proposed technologies into privacy. In the light of the increased sensitivity to privacy awareness, especially the GPS based tracking method might be considered as too invasive from a privacy...
protection perspective. A more extensive discussion – *i.e.* from a technological point of view - can be found in Cottingham *et al.* (2007) and de Palma and Lindsey (2011).

**TABLE 1** Overview of road pricing technologies**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Equipment Costs</th>
<th>Operating Costs</th>
<th>User Inconvenience</th>
<th>Price Adjustability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>Drivers must purchase a pass to enter a cordoned area.</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Poor-Medium</td>
</tr>
<tr>
<td>Tool Booths</td>
<td>Drivers stop and pay at a booth.</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Medium-High</td>
</tr>
<tr>
<td>Electronic Tolling</td>
<td>An electronic system bills users as they pass a point in the road system.</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Optical Vehicle Recognition</td>
<td>An optical system bills users as they pass a point in the road system.</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>GPS</td>
<td>A GPS system is used to track the location of each vehicle. Data are automatically transmitted to a central computer that bills users.</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>On-Board Data Collection</td>
<td>An electronic system in each vehicle tracks mileage. Data are transmitted automatically to a central computer.</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>Odometer Audits</td>
<td>Odometer readings are collected by certified odometer auditors.</td>
<td>Low</td>
<td>Low</td>
<td>Low-Medium</td>
<td>Low</td>
</tr>
<tr>
<td>VUDAR</td>
<td>Vehicle operating hours are recorded by a small instrument installed in each vehicle. Data are transmitted annually at a special station.</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

** Based on Victoria Transport Policy Institute (2014; 2018)

2 Lessons learned from best practice examples

In terms of successful implementations of charging for the use of roads in Europe, in particular the stories of the cordon charges in London, Stockholm and Milan are frequently cited. Table 2 provides an overview of the main features of the charging schemes, as well as their impacts. Note that all three cities have implemented a cordon (area) fee as an instrument.
Based on a comparison of the cities of London, Singapore, Stockholm and three Norwegian cities, Albalate and Bel (2009) highlighted the main aspects that need to be taken into account when implementing road charges to alleviate urban congestion as follows: (i) the particular characteristics of the city and its traffic patterns – this, given the importance of local circumstances, (ii) allocating the use of revenues, (iii) treatment of equity concerns to reduce public rejection, (iv) make use of trials and early investments in public transport, (v) the development of local-national political interaction = to promote the road charges. This in line with the key lessons of Valletta scheme, where successful implementation revolves around three principles: (i) purpose and goals, (ii) the scheme, and (iii) the political champion (Attard and Ison, 2010). The explicit support of a person or group of people who are willing to undertake the necessary changes and face the associated problems is crucial.

3 Practical considerations for an implementation in a Belgian context

The lessons learned from abroad should be taken into account when implementing road pricing schemes in a Belgian context. The multi-layered division of authority regarding charging for the use of roads i.e. one federal, and three regional ministers of transport, does not facilitate a single common proposal. The latter is, however, a prerequisite for achieving the required public support for the policy measure. The
success stories abroad were mainly about the implementation of cordon (area) charges. The implementation of such charges in a Belgian context seems more straightforward than the introduction of distance-based fees, since low-emission zones have already been implemented (e.g. in Brussels and in Antwerp) or approved (Ghent). Moreover, the case of Milan illustrated that the conversion of a low-emission zone to a toll zone is a path in which support for road pricing can be found. In addition, the same technology can be used to identify vehicles entering / exiting the low-emission zone for cordon charges and no large additional infrastructure costs are required.

A few preconditions need to be met to ensure a successful implementation, as highlighted by Schade (2017). (2017). First, revenues should be allocated and redistributed to the broader transportation system. Personally, users should experience the advantages such as time savings while using roads, fewer parking problems, etc. The explicit use of revenue to improve public transport should therefore be envisaged.

This is particularly true given the broad consensus and approval of policy measures that improve the existing public transport offer (see, e.g., Cools et al., 2012). Secondly, the pricing structure and differentiation levels should be simple and predictable. In this regard, Schade (2017) recommends avoiding great differentiation and avoiding elements that vary non-linearly manner, vary unpredictably - e.g., charge as a function of congestion, are not clearly observable - e.g., price based on current emissions, or are based on values that are not readily known, e.g., charges expressed per km, because lack of general knowledge about travel distances.

Determining the level of charges is a crucial element in the discussion of charging for road use. Cools et al. (2011) highlighted a negative effect caused by perceived fairness on changes in activity-travel behaviour, implying that charges should exceed a minimum threshold before people will actually change their activity-travel behaviour. This is particularly true for the structural changes, such as residential relocations and changes of job location. Nevertheless, this finding does not imply that there are no limits to the congestion charges. After all, when congestion charges are too high, and there are no reasonable alternatives available, people may oppose to the congestion charges and accessibility (see e.g. Condeço-Melhorado et al., 2011) and equity problems (see e.g. Eliasson and Mattsson, 2006) can arise. Such accessibility problems are a real concern in the case of Belgium, given the continued work-job imbalance (see e.g. Saadi et al., 2016). Furthermore, the road charges need to be tailored to the activities that people perform, given that the likelihood to make behavioural changes predominantly dependent on the type of activity that people carry out (Janssens et al., 2009).

The foreign experiences mentioned above provide important lessons for Belgian policy, but at least some scrutiny is required. Vonk Noordegraaf (2014) emphasized that many case-specific factors need to be taken into account by authorities aimed at implementing road pricing. This is also highlighted by Börjesson and Kristoffersson (2015), who pointed out that, compared to Stockholm, for the city of Gothenburg a different topology and differences in the main objectives of the congestion charge had to be communicated to the public. Understanding the mechanisms determining public acceptance of road pricing is critical for its implementation (Nikitas et al., 2018). Defining appropriate support measures (e.g. discounts) for the most affected users helps in gaining public support (Beria, 2016). Finally the role of media should not be disregarded (see e.g. Arduç et al., 2015; 2018).
References


Abstract

In this chapter, the authors examine the effects of road pricing on the demand for bus and coach services in Belgium. Buses and coaches are an essential part of a sustainable transport system. Due to their collective nature and advances in zero emission technology, they have a carbon footprint that is comparable to rail transport. However, although buses and coaches are a cost-effective mode of transport, they often do not have access to the same subsidy or tax shelter arrangements as their competitors from the rail or air transport sector. In this study, the authors introduced a brief exploration of the effects of a road pricing scheme on demand for buses and coaches. They looked at the effects on monetary and time costs for bus and coach on the one hand and its main competitor (car/air) on the other. Making use of time and price elasticities deduced from the literature, they estimated the effects for three different scenarios of pricing schemes and for three typical cases of coach or bus journeys.

1 Introduction

From a theoretical-economic perspective, road pricing is an instrument to internalize the many external costs that are associated with road transportation. Such an instrument should ensure that the damage road transportation causes to the environment, our health, and the economy is reflected in its price. In theory, overconsumption of mobility will consequently be avoided, resulting in welfare gains for all of us. From this perspective, the advantages of road-pricing are so self-evident that one can only wonder why such a system has not been generally implemented in our transportation system before.

However, a few problems exist with this view, the most important one being that it is rather simplistic. As we are all aware of, in reality, the world does not function the way a classic economic model assumes. For one thing, human decision making is only partially guided by rationality. Habits, attitudes, emotions, and even fear play an important role in our decisions about where to live and work, or about how and how often we choose to travel. Moreover, next to the presence of external costs, a number of other mechanisms disturb the functioning of the transportation market. Government interventions in the industry are very common and take many forms.

(1) Economic Consultant and Team Leader, Institute for Autocar and Autobus (ICB), Brussels (Belgium).
(2) Post-doctoral Researcher, Social and Economic Geography Research Group, Ghent University (Belgium).
Market regulations, direct subsidies, fiscal benefits, and monopolies by state-controlled institutes are the rules rather than the exceptions. Whether one supports these policies or not, they do influence the way the market functions and the way the introduction of a road pricing scheme will exert an effect on human behaviour. Therefore, it is important that, prior to the introduction of such a scheme, all possible effects are carefully examined, and appropriate measures are undertaken to avoid undesirable outcomes.

In this chapter, we will examine the effects of road pricing on the demand for bus and coach services in Belgium. Buses and coaches are an essential part of a sustainable transport system. Due to their collective nature and advances in zero emission technology, they have a carbon footprint that is comparable to rail transport (Borken-Kleefeld et al., 2013). Moreover, the effectiveness of Euro VI-emission standards for heavy duty vehicles has reduced NOx and particulate matter (PM) emissions in real-world operations to an absolute minimum (Muncrief, 2016). Buses and coaches are also a very versatile mode of transport. They can move small or larger groups, and in Bus Rapid Transit-applications, they can even be deployed for transporting large groups of passengers (Cervero, 2013). Being a relatively inexpensive transport mode, they are especially interesting when metro or (light) rail applications are not economically viable.

Since they offer transport operators with a green, cheap, and flexible solution, they are deployed in many different contexts including public transport, commuting to school or work, tourism, or occasional group transfers.

Nevertheless, buses and coaches also suffer from several important drawbacks. In general, they are assumed to offer a less satisfying travel experience as compared to rail, air, or the private car (e.g., Ettema et al., 2011; Morris and Guerra, 2015). When deprived of segregated lanes, they get stuck in the same traffic jams as private cars do, which has an adverse effect on their punctuality and commercial speed. Investments in leg space and on-board facilities can improve comfort levels and attract passengers (Lannoo et al., 2019), but on the downside, they push operational costs to a higher level. In addition, although buses and coaches are a cost-effective mode of transport, they often do not have access to the same subsidy or tax shelter arrangements as their competitors from the rail or air transport sector.

Given this specific position of buses and coaches in our transport system, we believe that it is of pivotal interest to investigate the effects road pricing schemes will exert upon them. After all, undesirable outcomes are not at all unlikely, and they can have consequences for all parts of our mobility system.

2 Methodology

2.1 Journey examples and road pricing scenarios

As mentioned above, buses and coaches are deployed in many different situations and for many different purposes. Depending on issues such as journey length, time of travel, location, or travel motive, road pricing can be expected to exert a certain (positive or negative) effect on travel demand. Therefore, we calculated the effects for three specific cases of coach journeys.

In the first case, we consider a day trip from Bastogne in the Walloon region to the Belgian coast (De Panne). We will calculate effects on demand for the coach and for the car, the latter being considered the main competitor in this kind of excursions. The second case is an international four days trip from Lommel in Flanders to London. For the second example, the plane is considered the main competitor.
(connection from the airport of Eindhoven in neighbouring Holland, located approximately 40km from Lommel). The third and final case is a so-called Office Bus-line, a new concept that has been introduced by private bus companies. An office bus is a coach equipped with facilities allowing passengers to work while traveling: a fast and reliable Wi-Fi connection, a desk, ample space, and a coffee machine. The lines make a connection between office areas tormented by heavy congestion problems and the lack of well-served public transport connections on the one hand and several cities accommodating large numbers of commuters on the other. In this specific case, the line makes a connection between the periphery of Ghent and Brussels. Currently, it is a non-subsidized service to companies seeking to shift their employees from passenger car use to collective transport.

We opted not to include any cases from a public transport context because it is unlikely that a public company would include a tax increase in the ticket price, and therefore, the example would be of no interest for our research questions. The specific journeys that were studied are described in Table 1.

Not only are there very different kinds of bus and coach journeys, but also road pricing schemes can take many different forms. For an overview of these different forms, we refer to other contributions in this volume. In our contribution, we took a closer look at three different scenarios, the tariffs of which are shown in Table 1.

The three scenarios are, quite evidently, not chosen at random. The first scenario is based on the texts of the revision of the Eurovignette Directive that is currently on the table of European Union legislators. The text proposes to make the application of distance-based charges that are currently applicable for heavy duty goods vehicles mandatory for all heavy duty vehicles (Debyser, 2018). This means that the new legislation would introduce a kilometre based charge for buses and coaches, but not for private cars. The current scheme for heavy duty goods vehicles is a distance-based charge with different tariffs dependent on the maximum permissible mass of the vehicle and the euro norm of its engine, but not dependent on the time of day or the specific road junction used. In our calculations, we use the tariff applied to euro norm 5 and 6 and to weight class 12-32 tons, which is the weight class most buses and coaches would fall into. For the specific journeys studied in this example, the use of recent vehicles is very likely.

**TABLE 1**  
Tariff overview for three scenarios of road pricing

<table>
<thead>
<tr>
<th></th>
<th>Bus/coach Peak</th>
<th>Off-peak</th>
<th>Car Peak</th>
<th>Off-peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>12.4</td>
<td>26.3</td>
<td>12.4</td>
<td>0.0</td>
</tr>
<tr>
<td>S2</td>
<td>12.4</td>
<td>17.3</td>
<td>0.0</td>
<td>15.0</td>
</tr>
<tr>
<td>S3</td>
<td>0.0</td>
<td>15.0</td>
<td>0.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Highway</td>
<td>12.4</td>
<td>24.9</td>
<td>12.4</td>
<td>14.8</td>
</tr>
<tr>
<td>Other roads</td>
<td>12.4</td>
<td>18.9</td>
<td>0.0</td>
<td>14.8</td>
</tr>
<tr>
<td>City</td>
<td>0.0</td>
<td>10.8</td>
<td>0.0</td>
<td>10.8</td>
</tr>
</tbody>
</table>

S= Scenario

The second scenario is based upon the decision of the Flemish Government to order a study on the application of a distance-based charge for all vehicle categories. The tariffs of this scheme are dependent on the time of travel (peak versus off-peak hours) and the kind of road that is used (highway, urban roads, or other roads). The aim of the scheme is threefold: to reduce congestion, to internalize external costs, and to make users pay for infrastructure costs. In order to reduce congestion, we apply a congestion charge of 4 eurocents per kilometre on urban roads and 6 eurocents per kilometre on
highways and other roads. Buses pay 1.5 times more than cars, a proportion that is currently proposed in the texts of the revision of the Eurovignette Directive (cf. infra). The charge is only introduced on peak hours and road junctions that are actually congested. We choose to apply a higher rate on non-urban roads because it is believed that, in the long run, this stimulates moving to city-centres, which will also help reduce congestion problems (De Vos, 2016). The external costs taken into account are based on external costs estimated for road transport in a recent study carried out on behalf of the Environmental Council of Flanders (Delhaye et al., 2017). Costs related to noise, direct emissions, and accidents are all taken into account. Finally, infrastructure costs for the entire road network are based on proper calculations. A rate of 3.9 eurocents per kilometre is applied. For buses, this rate is increased by 2.87 eurocents, which is estimated to be the marginal infrastructure costs of buses in Belgium (Delhaye et al., 2017).

The third and final scenario is a copy of the second one but introduces zero rates for bus and coach. This scenario should allow us to test the effects of a possible exemption applied to this mode.

2.2 Calculating effects on demand

Combining three journey examples with three road pricing scenarios results in nine situations for which the effect of road pricing can be examined. For every situation, a calculation is made based on the effects on the demand for coach/bus on the one hand and demands for its main competitor on the other.

Calculations are based on a simple model that takes four elements into account including (1) changes in monetary costs for the mode under consideration, (2) changes in time costs for the mode under consideration, (3) changes in monetary costs for the competing mode, and (4) changes in time costs for the competing mode.

TABLE 2 Elasticities used in the calculations

<table>
<thead>
<tr>
<th>Elasticity</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price Elasticity Bus Commute</td>
<td>-0.85 Dunkerley et al., 2018 (table A3)</td>
</tr>
<tr>
<td>Price Elasticity Bus Leisure</td>
<td>-1.1 Dunkerley et al., 2018 (table A3)</td>
</tr>
<tr>
<td>Time Elasticity Bus Commute</td>
<td>-1.15 Dunkerley et al., 2018 (table A4)</td>
</tr>
<tr>
<td>Time Elasticity Bus Leisure</td>
<td>-1.05 Dunkerley et al., 2018 (table A4)</td>
</tr>
<tr>
<td>Price Elasticity Auto Commute</td>
<td>-0.24 Bogaert et al., 2006 (table 10)</td>
</tr>
<tr>
<td>Price Elasticity Auto Leisure</td>
<td>-0.38 Bogaert et al., 2006 (table 10)</td>
</tr>
<tr>
<td>Time Elasticity Auto Commute</td>
<td>-0.36 de Jong and Gunn, 2001 (table 3)</td>
</tr>
<tr>
<td>Time Elasticity Auto Leisure</td>
<td>-0.21 de Jong and Gunn, 2001 (table 3)</td>
</tr>
<tr>
<td>Demand bus after change in price of car (commute)</td>
<td>0.18 Bogaert et al., 2006 (table 10)</td>
</tr>
<tr>
<td>Demand bus after change in price of car (leisure)</td>
<td>0.12 Bogaert et al., 2006 (table 10)</td>
</tr>
<tr>
<td>Demand bus after change time cost of car (leisure)</td>
<td>0.46 de Jong and Gunn, 2001 (table 7)</td>
</tr>
<tr>
<td>Demand bus after change time cost of car (commute)</td>
<td>0.23 de Jong and Gunn, 2001 (table 7)</td>
</tr>
<tr>
<td>Demand car after change prince bus (leisure + commute)</td>
<td>0.116 Litman, 2010, (table 40)</td>
</tr>
<tr>
<td>Demand car after change time cost bus (leisure + commute)</td>
<td>0.09 Litman, 2010 (table7)</td>
</tr>
<tr>
<td>Demand air travel after change in prince bus</td>
<td>0.01 Dargay, 2010 (table 27)</td>
</tr>
<tr>
<td>Demand air travel after change in time cost bus</td>
<td>0.01 Dargay, 2010 (table 27)</td>
</tr>
</tbody>
</table>
Algebraically, the model can be represented by the following two equations:

\[
\Delta Q_{\text{bus}} = E_{P_{\text{bus}}} \cdot \Delta P_{\text{bus}} + E_{T_{\text{bus}}} \cdot \Delta T_{\text{bus}} + CE_{P_{\text{comp}}} \cdot \Delta P_{\text{comp}} + CE_{T_{\text{comp}}} \cdot \Delta T_{\text{comp}}.
\]

\[
\Delta Q_{\text{comp.}} = E_{P_{\text{comp.}}} \cdot \Delta P_{\text{comp.}} + E_{T_{\text{comp.}}} \cdot \Delta T_{\text{comp.}} + CE_{P_{\text{bus}}} \cdot \Delta P_{\text{bus}} + CE_{T_{\text{bus}}} \cdot \Delta T_{\text{bus}}
\]

in which \( \Delta Q_{\text{bus}} \) represents changes in demand for the bus and \( \Delta Q_{\text{comp.}} \) changes in demand for the main competitor. Changes in monetary and time costs that are a consequence of the road pricing scheme are represented by \( \Delta P \) and \( \Delta T \), respectively. In order to determine \( \Delta P \), we assumed that bus companies recharged the cost increase caused by the road pricing scheme entirely to their customers. Changes in \( \Delta T \) are not based on calculations, but on estimations made by the authors.

\( E_{P_{\text{bus}}} \) represents a price elasticity for the bus and \( CE_{P_{\text{comp.}}} \) a cross price elasticity for the main competitor. Price elasticities are deduced from the literature. The values used and the sources from which they were collected are mentioned in Table 3.

### 3 Results

Table 3 shows the results of the calculations. For the first case (daytrip Bastogne-De Panne), we had a marginal cost of € 15.25 for the coach and € 56.64 for the car. The marginal cost for the coach ticket is equal to the cost of renting the bus divided by the number of passengers (cf. Table 1). For private cars, only fuel costs are included in the marginal cost. Cost of purchase, insurance, etc. are fixed costs and should therefore not be included. Although maintenance costs are in fact variable costs, we believe that the cost structure is too obscure for travellers to take them into account when deciding whether or not to take the car. Therefore, they are excluded from external costs. Time costs for the journey were estimated at nine hours and five minutes for the coach and 7 hours and 52 minutes for cars.

In the first scenario, the current heavy duty goods charge is applied to bus and coach. As can be read from Table 1, this means a constant charge of 12.4 eurocents per kilometre. To calculate the increase in marginal cost for the passengers of the coach, we first divided the tax for the journey by the number of passengers on-board and subtracted the cost of the current tax for coaches. The cost of the tax is estimated at 1.44 eurocents per kilometre\(^{69} \). As an example of the daytrip, the first scenario leads to a marginal cost increase of 10% for the coach. Since there is no change in the marginal price of the car, there is no effect on congestion. Therefore, the time cost for both car and coach remains unchanged. As a result, the introduction of this road pricing scheme leads, in the case of the daytrip to the coast, to a decrease of 10.94% in demand for the coach and an increase of 1.15% for the car.

In the second case, we start from a marginal cost of € 75 for the coach and € 85 for the plane. The increase in marginal cost is lower as compared to the first example because a large part of the mileage of the journey is covered abroad. Under the first scenario, this leads to an increase of 1% in marginal cost and a decrease of 1.52% in demand for the coach. Since there is no change in monetary cost for air travel and in time costs for both modes, and since the cross elasticity of air travel for changes in monetary

\(^{69} \) Although this is a fixed tax for the bus company, it is a variable cost for the traveller since the bus company includes the tax cost in the ticket price. We assume that the introduction of the road pricing scheme will replace the existing fixed road tax. This means that for the marginal cost increase, the cost of the old tax scheme should be deducted. For cars, this is different since the existing tax is not a marginal cost for the car user.
costs for coach is very low (see Table 3), the effect on demand for the plane is limited to an increase of 0.01%.

In the third example, the Office Bus-line, marginal costs were € 19.90 for the bus and € 12.29 for the car. Important to note here is that such special regular services are not submitted to the current tax scheme. Consequently, the increase in marginal cost caused by the road pricing scheme of the first scenario makes marginal costs increase by € 0.64 per passenger or by 3% of the ticket price. The result is that the demand for the office bus decreases by 2.71%, and the demand for the car increases by 0.37%.

The second scenario introduces a smart distance-based charge with time and place-dependent tariffs for bus and coach as well as for cars. Since the tariffs per kilometre are higher as compared to the first scenario, the increase in marginal costs is also higher. For the first example (daytrip to the coast), marginal costs increase for the coach is € 2.49 or 15% of the ticket price. For cars, the increase is as high as € 57.39 or 101% of the marginal cost before the tax. Both for cars and buses the scheme allows for a reduction of 10 minutes in travel time or about 2% of total time costs. This combination of factors drives demand for cars down by more than 36%. Demand for the coach, however, goes down by 3.27%. This negative evolution means that the improvement in the relative price competitiveness of the coach and the reduction in time costs are not sufficient to offset the increase in monetary cost.

In the example of the London trip, the effects are different. The increase in marginal costs is limited to € 1.85 per passenger for the coach, and there is a gain of ten minutes in travel time. There are no changes in monetary and time costs for air travel since this mode is not impacted by the road pricing scheme. The coach suffers a decrease of 1.55% in demand, and the demand for air travel goes up by 0.01%.

In the example of the Office Bus, the ticket price goes up by 6% or € 1.22 Marginal costs for car commuters go up by € 17.19 or 140%. Both bus and car reduce travel times by 15 minutes or 7% and 15%, respectively. This leads to an improvement in the relative competitiveness of the bus both in monetary and time cost terms. As a result, demand for the bus goes up by 21.75%, and demand for the car goes down by 28.25%.

In the third scenario, the same smart distance-based charge as in the second scenario is introduced, but with 0-tariffs for bus and coach. Since the introduction of the distance-based charge implies the disappearance of the fixed charge, this leads to a reduction in marginal travel costs for the coach both in the coast trip and the London trip examples. For the office bus example, there is no reduction since for this kind of transport no charge was in place. Monetary cost evolutions for the car remain the same as in the second scenario. In addition, the time costs for both coach and car remain the same.
TABLE 3  Results

<table>
<thead>
<tr>
<th>Scenario 1: applying current heavy duty goods charge to bus &amp; coach</th>
<th>Scenario 2: smart distance-based charge, no exception for bus &amp; coach</th>
<th>Scenario 3: smart distance-based charge, 0-tariffs for bus &amp; coach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilometres (return)</td>
<td>Kilometres (return)</td>
<td>Kilometres (return)</td>
</tr>
<tr>
<td>Bus/Coach 590</td>
<td>Bus/Coach 590</td>
<td>Bus/Coach 590</td>
</tr>
<tr>
<td>Car/Air 56.64 €</td>
<td>Car/Air 56.64 €</td>
<td>Car/Air 56.64 €</td>
</tr>
<tr>
<td>Marginal cost before road pricing 16.25 €</td>
<td>Marginal cost before road pricing 2.4928 €</td>
<td>Marginal cost before road pricing -0.2127 €</td>
</tr>
<tr>
<td>Δ Marginal cost (€) 1.6163 €</td>
<td>Δ Marginal cost (€) 2.4928 €</td>
<td>Δ Marginal cost (€) -0.2127 €</td>
</tr>
<tr>
<td>Δ Marginal cost (%) 10%</td>
<td>Δ Marginal cost (%) 101%</td>
<td>Δ Marginal cost (%) 101%</td>
</tr>
<tr>
<td>Time cost before road pricing (min) 545</td>
<td>Time cost before road pricing (min) 545</td>
<td>Time cost before road pricing (min) 545</td>
</tr>
<tr>
<td>Δ Time cost (min) 0</td>
<td>Δ Time cost (min) 0</td>
<td>Δ Time cost (min) 0</td>
</tr>
<tr>
<td>Δ Time cost (%) 0%</td>
<td>Δ Time cost (%) 0%</td>
<td>Δ Time cost (%) 0%</td>
</tr>
<tr>
<td>Δ Demand (%) -10.94%</td>
<td>Δ Demand (%) -10.94%</td>
<td>Δ Demand (%) -10.94%</td>
</tr>
</tbody>
</table>

**Case 1: Daytrip Bastogne-De Panne**

<table>
<thead>
<tr>
<th>Kilometres (return)</th>
<th>Kilometres (return)</th>
<th>Kilometres (return)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus/Coach 900</td>
<td>Bus/Coach 900</td>
<td>Bus/Coach 900</td>
</tr>
<tr>
<td>Car/Air 85.00 €</td>
<td>Car/Air 85.00 €</td>
<td>Car/Air 85.00 €</td>
</tr>
<tr>
<td>Marginal cost before road pricing 75.00 €</td>
<td>Marginal cost before road pricing 1.8541 €</td>
<td>Marginal cost before road pricing -0.3245 €</td>
</tr>
<tr>
<td>Δ Marginal cost (€) 1.0333 €</td>
<td>Δ Marginal cost (€) 1.8541 €</td>
<td>Δ Marginal cost (€) -0.3245 €</td>
</tr>
<tr>
<td>Δ Marginal cost (%) 1%</td>
<td>Δ Marginal cost (%) 2%</td>
<td>Δ Marginal cost (%) 0%</td>
</tr>
<tr>
<td>Time cost before road pricing (min) 901</td>
<td>Time cost before road pricing (min) 901</td>
<td>Time cost before road pricing (min) 901</td>
</tr>
<tr>
<td>Δ Time cost (min) 0</td>
<td>Δ Time cost (min) 0</td>
<td>Δ Time cost (min) 0</td>
</tr>
<tr>
<td>Δ Time cost (%) 0%</td>
<td>Δ Time cost (%) 0%</td>
<td>Δ Time cost (%) 0%</td>
</tr>
<tr>
<td>Δ Demand (%) -1.52%</td>
<td>Δ Demand (%) 0.01%</td>
<td>Δ Demand (%) 0.01%</td>
</tr>
</tbody>
</table>

**Case 2: International trip Lommel - Londen**

<table>
<thead>
<tr>
<th>Kilometres (return)</th>
<th>Kilometres (return)</th>
<th>Kilometres (return)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus/Coach 128</td>
<td>Bus/Coach 128</td>
<td>Bus/Coach 128</td>
</tr>
<tr>
<td>Car/Air 12.29 €</td>
<td>Car/Air 12.29 €</td>
<td>Car/Air 12.29 €</td>
</tr>
<tr>
<td>Marginal cost before road pricing 19.90 €</td>
<td>Marginal cost before road pricing 1.2233 €</td>
<td>Marginal cost before road pricing 0.0000 €</td>
</tr>
<tr>
<td>Δ Marginal cost (€) 0.6349 €</td>
<td>Δ Marginal cost (€) 1.2233 €</td>
<td>Δ Marginal cost (€) 17.1867 €</td>
</tr>
<tr>
<td>Δ Marginal cost (%) 3%</td>
<td>Δ Marginal cost (%) 6%</td>
<td>Δ Marginal cost (%) 140%</td>
</tr>
<tr>
<td>Time cost before road pricing (min) 202</td>
<td>Time cost before road pricing (min) 202</td>
<td>Time cost before road pricing (min) 202</td>
</tr>
<tr>
<td>Δ Time cost (min) 0</td>
<td>Δ Time cost (min) 0</td>
<td>Δ Time cost (min) 0</td>
</tr>
<tr>
<td>Δ Time cost (%) 0%</td>
<td>Δ Time cost (%) 0%</td>
<td>Δ Time cost (%) 0%</td>
</tr>
<tr>
<td>Δ Demand (%) -2.71%</td>
<td>Δ Demand (%) 0.37%</td>
<td>Δ Demand (%) 0.37%</td>
</tr>
</tbody>
</table>

**Case 3: Office Bus line Gentbrugge - Zaventem**

<table>
<thead>
<tr>
<th>Kilometres (return)</th>
<th>Kilometres (return)</th>
<th>Kilometres (return)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus/Coach 128</td>
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</tr>
<tr>
<td>Δ Marginal cost (€) 0.6349 €</td>
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</tr>
<tr>
<td>Δ Marginal cost (%) 3%</td>
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<td>Time cost before road pricing (min) 202</td>
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<td>Time cost before road pricing (min) 202</td>
</tr>
<tr>
<td>Δ Time cost (min) 0</td>
<td>Δ Time cost (min) 0</td>
<td>Δ Time cost (min) 0</td>
</tr>
<tr>
<td>Δ Time cost (%) 0%</td>
<td>Δ Time cost (%) 0%</td>
<td>Δ Time cost (%) 0%</td>
</tr>
<tr>
<td>Δ Demand (%) -2.71%</td>
<td>Δ Demand (%) 0.37%</td>
<td>Δ Demand (%) 0.37%</td>
</tr>
</tbody>
</table>
In the case of the coast trip, this results in an increase of over 15% in demand for coach travel. Demand for cars decreases by 38.37%, almost one percentage point more than the second scenario. For the London trip example, we have an increase of 1.64% in demand for the coach. This small change is still better than the decrease we noticed in the second scenario. This time there is also a marginal decrease of 0.02% in demand for air travel. Finally, for the office bus example, we notice a small reinforcement of the effects noticed in the second scenario, i.e., an increase of almost 27% in demand for the coach and a decrease of 29% in demand for the car.

4 Conclusion

In this study, we introduced a brief exploration of the effects of a road pricing scheme on demand for buses and coaches. We looked at the effects on monetary and time costs for bus and coach on the one hand and its main competitor (car/air) on the other. Making use of time and price elasticities deduced from the literature; we estimated the effects for three different scenarios of pricing schemes and three typical cases of coach or bus journeys.

The results show that the introduction of a pricing scheme pricing bus use but exempting car use has a strong negative effect on demand for the first, even when the current fixed tax scheme would disappear. This is especially the case for domestic occasional services. When the cost of the scheme is completely integrated into the ticket price, a strong reduction in demand can be expected. Since this would in turn negatively affect load factors and/or utilization days of the vehicle, such an evolution would put many companies under severe financial pressure. However, not integrating the cost into the ticket price would lead to strong cost increases and would have the same financial consequences. Moreover, since the price scheme improves the relative competitiveness of the car, small but relevant increases in demand for car trips are to be expected. It is clear that this scenario should be avoided, both from an economic and a sustainable transport perspective.

The effects of a general smart distance-based charge for all road transport modes are very different, at least for those journeys where the coach competes mostly with the car. This is due to the fact that the negative effects of a monetary cost increase are (partly) offset by the positive effects of the decrease in time costs and the increase in monetary costs for the car. In the case of the Office Bus, this even leads to an increase in demand. However, when interpreting the results, one should take into account that the model used for the estimation is a simplification of reality. For one thing, it does not take into account that coaches also compete with the train. Since the introduction of the pricing scheme deteriorates the competitive position of the coach compared to the train, it can be expected that the positive effects reported here will be somewhat weaker in reality. Moreover, it does not take into account that abolishing the fixed annual road tax for cars might lead to an increase in car ownership, which in turn stimulates car use.

For journeys where the coach competes with the plane, the introduction of the smart pricing scheme has a negative impact on demand for the coach and a positive one on demand for air transport. This is a clear example of an undesired effect of road pricing. Although the effects reported are small, they are not negligible. First of all, the negative effects of the charge would be larger when it would simultaneously be introduced to other European countries. Given the texts for the revision of the Eurovignette directive that are currently on the table, this is not at all unlikely. Second, one should take into account that, unlike coach travel, air travel momentarily benefits from VAT and excise duty exemptions and other forms of positive discrimination (Piket, 2009). For the coach, the introduction of a road pricing scheme would, therefore, mean adding a competitive disadvantage on top of many other competitive disadvantages that
already exist. In an ideal world, the introduction of a pricing scheme should be accompanied by measures abolishing these positive discriminations of air travel and the introduction of an equivalent system for the internalization of external costs. When these measures are politically impossible, other accompanying measures should be considered.

One possible measure would be the introduction of zero tariffs for bus and coach. Our analysis shows that in the case of competition with air, zero tariffs can turn the negative effects around. In the case of competition with the car, the positive effects are reinforced. Of course, zero tariffs are at odds with the goal of road pricing, i.e., to put the right price on road transportation. From an economic perspective, equal fiscal treatment of all modes and subsidies in line with the social added value of a mobility service are the optimal choices. However, given the existing political constraints, zero tariffs can constitute a good second best.
References


Abstract

Road traffic creates different types of externalities including congestion, noise, local air pollution, accidents, and climate change. To control externalities, economists have mainly been focusing on the use of pricing instruments. In practice, however, pricing has not often been used. Instead, very different types of policy instruments have been implemented including Low Emission Zones, speed bumps, traffic lights, pedestrian bridges, and restricted access for through traffic and trucks. In this chapter, we explain why local governments using non-price measures will often make decisions that are inefficient. We further explain the inefficiencies arising from the conflict between central and local governments when local governments use non-price measures and the central government introduces road pricing on main roads. This is not implausible in the future that the development of cheap ANPR cameras could both lead to road pricing developments and generalized implementation of restricted access zones. We review the problems that follow from the use of both pricing and non-pricing instruments. The use of non-price instruments to regulate traffic has received relatively less attention from economists, although instruments like road bumps, traffic lights, pedestrian overpasses, and access restrictions for non-locals are heavily used as a policy instrument. These instruments may become even more important when road pricing is introduced on the main roads.

1 Introduction

Economists love pricing solutions to address the external costs of road transport (congestion, air pollution, accidents, and noise). Pricing is efficient when prices are well-targeted to external costs and handled with care. Of course, we have pricing instruments in place including high fuel excises, purchase and ownership taxes differentiated by the level of emission and fuel type, parking levies, and experience-rated insurance charges. However, these instruments are not what economists dream about because they are not well targeted to the level of the external cost they try to deal with.

This raises the question why we do not have better price instruments. First, it is difficult to design pricing instruments closely reflecting marginal external costs when these are time-and-place-specific. A tailored approach is needed, but this requires detailed information on external cost variability, and it requires new pricing instruments that can capture this variation in time and space.
The appropriate instruments (electronic road pricing) exist, but it is well known that they have high implementation costs. Second, the implementation of road pricing proves to be politically difficult. For example, it has been argued that several types of uncertainty (on the effects of road pricing, on the use of the revenues) cause major obstacles to the introduction of road pricing (De Borger and Proost, 2012). Another handicap of sophisticated pricing solutions is that conflicts between central and local governments may arise (De Borger and Proost, 2016).

On the one hand, it is difficult for a central government to impose locally differentiated fares and prices because this may easily lead to spatial favouritism. On the other hand, leaving pricing solutions to the local government level may give rise to exploitation of non-locals. It is possible to decentralize pricing decisions, but this requires complicated safeguards against the issues just mentioned.

The two implementation problems raised above made governments look for non-price instruments that can easily be locally differentiated according to local conditions. These include speed bumps, low emission zones, pedestrian overpasses, traffic lights, bypass roads, etc. This is the main topic of this chapter. In Section 2, we develop a taxonomy of such measures. We then argue that the use of these measures may lead to conflicts between different governments. In Section 3, we emphasize that central and local governments will make very different decisions on the use of non-pricing measures; in most cases, local government decisions will be inefficient. Section 4 looks at possible conflicts between local governments. In Section 5, we focus on the implications of the competition between the central and the local governments when local governments use non-price measures, and the central government introduces road pricing on main roads. A final section concludes.

1.1 A taxonomy of measures

To analyse the wide variety of measures, we need to classify their impacts, costs, and benefits. This is done in Table 1. In addition, refer to a study by De Borger and Proost (2013, 2018). The table starts with the traditional economists’ solution to impose “tolls”; however, they are virtually non-existent in the Benelux. The other measures commonly used are non-price measures addressing a variety of external costs, ranging from noise (noise walls) to congestion (restricted entry and bypass capacity). Reducing external costs may involve a combination of a volume reduction, a change in vehicle use, and the use of restrictive or protective measures. To evaluate the efficiency of various measures, we need to know how they affect the overall volume of traffic by not allowing certain traffic (low emission zones, restricted entry), sending traffic along another route (bypass capacity), or increasing the generalized costs (speed restrictions, road bumps). Moreover, we need to have information on how much they reduce the external cost per kilometre and on the implementation cost. Some measures are very costly to implement but are very effective (pedestrian overpass), while other measures are less costly but still can have some desirable effects (changes in the control of traffic lights). All these characteristics are needed to make a formal cost-benefit analysis.

70 The information needed to make cost-benefit evaluations of the use of different instruments which can also help in monitoring the conflicts between governments are studied further in this chapter.
Table 1: Taxonomy of policy measures that address external costs and benefits of traffic (Legend: 0 = no (or negative) effect; +: positive effect)

<table>
<thead>
<tr>
<th>Benefits of different measures</th>
<th>Reduces traffic volume in city</th>
<th>Speed reducing effect</th>
<th>Requires large public investment</th>
<th>Reduction of external cost per car kilometre</th>
<th>Impact on urban traffic by the local population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolls</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Noise walls, investment in quiet asphalt</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>Speed restriction, increasing the red phase of traffic lights</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>New traffic lights, road bumps, etc.</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td>Restricted entry</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Emission standards for cars</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Low emission zones</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Bypass capacity</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>+</td>
</tr>
</tbody>
</table>

1.2 Conflicts between government levels

Consider a policy measure (placing speed bumps, traffic lights, etc.) implemented at the local level. The local level can be a large city, but it can also be a small municipality. To evaluate the effects of this policy, the local governments will take into account the benefits for local traffic (more precisely, the benefits of the improvement in traffic conditions for the local population), and it also considers the costs for the local taxpayers. The central government should care about the costs and benefits of the policy measure for all traffic conditions, local and non-local (through traffic from other communities). De Borger and Proost (2013, 2018) use this framework to show the origin of various conflicts between local and central governments. They offer a number of results that we briefly discuss.

Result 1. Compared to the federal social optimum, the local government over-invests in externality-reducing infrastructure whenever this infrastructure increases the generalized cost of through traffic. The local government invests optimally when policies do not affect generalized costs.

To illustrate what this result means, we focus on road traffic and consider a local road that is also intensively used by through traffic. Then, we compare the welfare implications of speed bumps and pedestrian overpasses, two types of measures that can be used to reduce transport externalities.
Pedestrian overpasses will not affect the traffic volume of cars. To evaluate this policy measure, the local government will compare the traffic safety benefits with construction costs. As all the safety benefits accrue to the local population, and the construction costs are captured by the local community, there is no systematic bias in the level of investment, and the central government would make exactly the same comparison when evaluating the policy (there are neither benefits nor costs outside the local community).

It is also important to consider speed bumps. They will obstruct both local and through traffic, raising their generalized costs of using the road. As before, there are traffic safety benefits in the form of lower accident risks for pedestrians from the local community. The main difference with pedestrian bridges is that the local government will not care (or care less) about the increase in generalized costs for through traffic, and will, therefore, underestimate the full cost of the measure implemented. As a consequence, it will over-invest in speed bumps compared with what would be the best solution for the country as a whole (of course, the central government does take into account the effect on through traffic).

*Result 2. Local governments will favour restricted access to local communities, even when this is socially undesirable.*

The availability of cheap ANPR cameras allows restricting the use of a local road to the inhabitants or visitors of the local community and keep through traffic out. This offers advantages for the local community. For example, on the local road, there will be less congestion, less noise, less pollution, and there may be fewer traffic accidents. Note that restricted access can also be specific for trucks only; this is already a widespread technique adopted to shield local communities from noise, vibrations, and congestion.

However, especially when it applies to cars and trucks, restricted access for through traffic transport is not necessarily beneficial for the country as a whole. Through traffic that can no longer use the local road has to make a detour. If this traffic is diverted towards a heavily congested main road, the increase in generalized costs may be so large that, from a social perspective, the benefits do not compensate for these high costs. In that case, it would be better not to restrict access.

Given the advantages for local communities, restricted access techniques could become very common throughout Flanders. Although in many cases this can be justified, our point is that not all such restrictions will be beneficial for the country as a whole.

*Result 3. In a low emission zone, the urban government has incentives to impose too stringent standards and too high fees on non-compliance compared to the federal optimum.*

Low emission zones (LEZ’s) exist in several EU countries, including Belgium (Antwerp Brussels, Mechelen, Ghent, etc.). In addition, they have been studied for several Dutch cities.

As always, we need to compare the benefits and costs of the policy. The benefits of the LEZ are mainly local. It puts a restriction on the type of car that can be used, leading to higher costs for both inhabitants and outsiders. However, the extra costs for non-inhabitants are not taken into account by the urban government. This results in too severe standards and too high fees for non-compliance compared to what a central government would impose. The reason is again that the central level would take into account the implications for non-inhabitants in their decisions.

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71 A second reason for the local government’s tendency towards high fees is that they serve as a transfer of income from non-inhabitants to inhabitants.
Result 4. The city government will underinvest in bypass capacity.

A bypass around the city keeps through traffic away from the most vulnerable roads in the city centre, where the external costs are the highest. A bypass allows faster traffic for both the inhabitants using the local road and for through traffic using the bypass. The local government will take into account the traffic benefits and external cost reductions for local users in its investment decision, but will not consider the benefits for traffic. The central government would do so when considering welfare for all users. As a result, local governments will underinvest in bypass capacity.

1.3 Conflicts between local governments: the race to the top

The use of non-price traffic calming instruments by municipalities can also lead to conflicts between the different local governments. Consider two municipalities A and B that are located on a route between two important cities. The two cities generate a lot of bilateral traffic. This traffic can opt to take the route via A or B. It generates a lot of externalities in both the communities A and B.

Result 5. The non-cooperative game between two parallel communities leads to excessive use of instruments that increase the generalized costs for through traffic.

Municipality A would prefer that through traffic chooses the route via B, and it has instruments to achieve this. The obvious way is to install non-price measures (traffic lights, speed bumps, etc.) that increase the generalized cost of passing through A. This shifts through traffic to some extent to B. But, of course, B itself prefers that through traffic passes via A. It will act the same as A and start to use non-price measures to stimulate through traffic to go via A. This is a non-cooperative game between the communities; it leads to excessive use of the non-price measures to keep through traffic out of the own community (Proost and Westin (2017)).

Result 6. It is optimal to concentrate through traffic on only one of the two parallel roads.

As there are economies of scale in investing in non-price measures, the best solution is to equip only one of the two roads for through traffic and direct all through traffic to pass via one of the two communities. For this solution to be acceptable for the community that receives all the through traffic, it needs to be compensated by the central government.

1.4 Road pricing on the main roads and local non-price measures

In this section, we discuss some results that arise when the central and the local governments both use different instruments on different parts of the network. This will become more relevant in the future when a move towards road pricing can be expected. However, it is unlikely that road pricing will immediately apply to the whole network. More plausibly, the central government may introduce tolls on the main roads, whereas local governments will implement traffic calming measures (speed bumps, etc.) on the local roads through their local communities.

More specifically, we consider the traffic problems of a small local town or community that is located parallel to a heavily congested main road, such as a motorway. A common problem in such situations is that traffic uses a local road through the community as an alternative for the congested motorway. Of course, this generates accident risks and other inconveniences for the local population. Now suppose

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72 This is a well-studied second best problem in the economics of transportation. See Small and Verhoef (2007, ch 4.2)
that the federal government can impose tolls on the main road\textsuperscript{73}; the local government controls local accident risks and local congestion using non-price measures such as speed bumps, traffic lights, and formal access restrictions (i.e., restrictions on who is allowed to use the local road).

\textit{Result 7}. \textit{For any given toll on the main road, the use of non-price measures by the local governments will be excessive.}

This is easy to explain. The users of the main road are tempted to divert towards the local road so as to avoid the congestion tolls\textsuperscript{74}. However, this raises congestion on the local road and leads to higher accident risks for the local population. Therefore, local authorities will react and make the use of the local roads more difficult. This can be done by speed bumps, introducing traffic lights, etc. This, in fact, raises generalized costs for all traffic through the local community, both local traffic and through traffic. More drastically, they can use number plate detection technologies to restrict access to local traffic and keep through traffic out. The higher the charges on the main road, the more traffic will divert to the local road, and the more stringent will be the local response. Importantly, however, the local government’s use of non-price measures will be excessive (too many speed bumps, too many traffic lights, etc.) because it does not care for the implications of its policies on through traffic that no longer can pass through the local community.

\textit{Result 8}. \textit{Competition between central and local governments will lead to tolls that are too high and too much traffic calming.}

This result follows by extending the previous discussion. The use of tolls on the main road and traffic calming by the local government on the local road give rise to a rat race. The toll leads to more speed bumps, but this obviously raises the generalized costs for through traffic. By strongly restricting through traffic from using the local road, traffic and therefore congestion on the main road increases, and this induces the central government to set higher tolls on the main road to reduce external congestion costs. The result of this competition is that we end up with tolls that exceed the social optimum and too excessive use of traffic calming measures by the local authorities.

\textit{Result 9}. \textit{Given the use of traffic calming measures by local governments, it may be better not to impose tolls on the main road at all.}

The rat race described above may lead to a very inefficient outcome with very high tolls on the main road and many obstacles of using the local road through the small town. In those cases, welfare may actually be higher if one only uses traffic calming on the local road and no tolls on the main road.

2 Conclusion

This chapter has summarized the use of non-price instruments to regulate traffic. This has received relatively less attention from economists, although instruments like road bumps, traffic lights,

\textsuperscript{73} This is not unrealistic in the future. The technology to introduce road pricing is available. However, implementation is costly. Therefore, it is probably worthwhile to introduce it just on the main corridors or around the main agglomerations.

\textsuperscript{74} This was already a problem when distance charging for trucks was introduced in Belgium. Distance charges were only to be paid on the main roads to limit the monitoring and collection costs. The idea was that traffic conditions on the main roads were so much better than the local roads that trucks would only use the local roads when they had to be there. This proved not to be correct as truck traffic was massively diverted towards using local roads to avoid the charges.
pedestrian overpasses, and access restrictions for non-locals are heavily used as policy instruments. These instruments may become even more important when road pricing is introduced on the main roads.

All non-price instruments that also affect non-local traffic users will tend to be used too intensively by local authorities. This is one of the main economic reasons why many countries have a hierarchy of roads. Local governments cannot take policy measures on roads of national importance as these policy measures may be suboptimal. On the other hand, national policy makers may be poorly informed about local traffic problems created by national roads. Finding the right division of power between local and national levels of policy making remains a difficult question.
References


Chapter 12. What lessons Benelux can learn from theory and practice of the managing of mobility through road pricing?
F. WITLOX

Chapter 13. City mobility in 2019 – sustainable and smart?
D. BANISTER
What lessons Benelux can learn from theory and practice of the managing of mobility through road pricing?

F. WITLOX (1)

“In theory, there is no difference between theory and practice. But, in practice, there is.”

- Jan L. A. van de Snepscheut

Developments like globalization and internationalization, combined with a growth in population and in income, have undeniably led to a spectacular increase in the movement of people and of goods. Unique longitudinal research by Grübler (2004), analysing average daily travelling distances in France (excluding walking), revealed this overall growth pattern (see Figure 1. below).

FIGURE 1 Average daily travelling distances in France, 1800-2000, by mode of transport.

With the exception of the periods of the two World Wars, the growth of transport (quasi-)continuously increasing. Especially the growth in the use of car and bus - and aviation - transport is stunning.

Given the positive relationship between travel growth and prosperity, the increase in traveling distances can be considered as a virtuous development. However, this relationship questionable if transport systems become over-saturated and malfunction, leading to loss in efficiency and quality. The resulting societal costs – such as climate effects, environmental damage, road safety, loss of time and productivity – are most likely very high.

(1) Senior Full Professor of Economic Geography, Ghent University (Belgium) and (i.a.) Honorary Doctor (Dr.h.c.) in Geography and Visiting Professor, Institute of Ecology and Earth Sciences, University of Tartu (Estonia), Chairman of the Benelux Interuniversit University Association of Transport Researchers (BIVEC-GIBET).
Being mobile and having access to mobility is nowadays considered a basic right. The right to mobility/transport stands at equal level with the right to education, housing, freedom of speech, or medical treatment. When confronted with a temporary or permanent loss of mobility, our daily lives are immediately affected (remember: “without transport everything stands still”).

So transport and mobility are as essential for human development as food and clothing. Yet – at least at the Benelux level – remarkably little real innovation can be noted in tackling the mobility problem. Not that we have not yet tried everything; ranging from spatial planning, price measures, modal shifts, employer-based measures, information campaigns, developing new technologies and innovations, in more detail:

a) Built environment, spatial planning
   • Constructing new infrastructure (missing links)
   • Increasing capacity of existing infrastructure (peak hour lanes, HOV lanes, block driving, vehicle/truck platooning, eco-combi, autonomous driving)
   • Adapting infrastructure (road signs)
   • Transport-oriented-development (TOD)

b) Pricing mechanism
   • Road user charge, tolls, road/cordon pricing
   • Traffic/travel mitigation fees (‘spitsmijden’)
   • Travel trading schemes (tradeable permits)
   • Fuel charge
   • Parking charge

c) Modal shift
   • Active travel: walking, bicycling
   • Public transport renaissance
   • New forms of individualized transport (MaaS, Uber)

d) Employer-based measures (carpooling, flexible/compressed work hours, teleworking)

e) Information (public awareness) // Lifestyle

f) Technology (cleaner, smarter, more sustainable, leaner, faster technologies; catapult transport, tubes, container zeppelins, drones, foldable cars, hyper-loop)

In unravelling the mobility/transport problem, one issue is agreed upon by all: ‘the’ solution does not exist. So we need to combine measures, mitigate negative externalities, and search for the most effective/efficient measures. From the above, it will become clear that different perspectives exist and that, consequently, different measures can be taken, these ranging from:

• Supply- vs. demand-oriented measures
• Push vs. pull measures
• Top down vs. bottom up measures
• Private vs. public participation (PPP) measures
• Price instruments (market-based) vs. regulatory (command and control) measures
• Short vs. long-term measures
• Passenger- vs. freight transport-related measures
• Employee (commuter)- vs. employer-based measures (this, in respect to home-to-work travel)

When it comes to the point of confronting the user of mobility -the car user- with the costs he/she causes, i.e. by means of a road pricing mechanism, this approach seems to be off-limits. This is odd, as there are strong reasons for adopting a ‘polluter pays principle’. This is because marginal external costs associated with a transport activity, viewed from a life cycle assessment (LCA) approach, are
The principle relates to: (i) vehicle operation: accidents, noise, air pollution, climate change, upstream and downstream processes, congestion, (ii) vehicle fleet: use of public space, and (iii) transport infrastructure: damage to nature and biodiversity, visual intrusion, barrier formation.

The growing awareness - with climate marches, citizen science projects relevant to clean air, etc. - pushes politicians to take action. But, apparently, no sense of urgency has emerged in Benelux. In quite some other countries around the world, some form of market-based mobility management system is operational. Within Benelux, only in Belgium a Kilometre Charge for heavy goods vehicles (HGV’s) of over 3.5 tons entered into force April 1, 2016 (see also Chapter 5.). All Belgian and foreign lorries that operating in Belgium must be equipped with a switched-on On-Board Unit (OBU). The charge ranges from €0.074 to €0.292 per kilometre driven and depends on the weight of the lorry, its emission class, and type of road (www.viapass.be). This type of charge is, however, not designed to allocate road space or to optimize congestion over time. In fact, we are dealing, here, with a taxation system that has little to do with making good use of the road assets (Button, 2010). A much better – smarter - system would vary the charge in space and time.

In theory, the most appropriate way forward seems to be to influence travel demand by charging the costs caused by road users. To this end, a whole range of road charging measures-which have proven to be efficient and effective in practice-are available. So, from the economic theory point of view, this should be the ‘easy road’, after all, the free flow of people and goods, clean air, quietness and safety are scarce/economic goods. Anyone who uses these scarce goods and “consumes” them will have to pay for them – as is the case with all economic goods.

Opposite to trying to influence demand for transport is the idea of expanding infrastructure capacity. That is, instead of focusing on decreasing/managing transport demand, in principle a supply side approach could be followed. Building more infrastructure is however always controversial. It may temporarily, see Anthony Downs’ 1962 law of peak-hour expressway congestion, and Duranton and Turner’s fundamental law of highway congestion - alleviate the capacity issue, and governments presently are less inclined to play their traditional role as a major investor in (road) infrastructure. As a consequence, investment budgets lose priority over maintenance costs. Note that increased transport capacity also quickly clashes with public support (NIMBY at its best). Therefore, a more expanded investment policy for road infrastructure seems to have less popular today as a solution to the current mobility problem.

History has shown us various tipping points that gave direction to how the mobility issue would evolve. The use of the steam engine resulted in the development of the railways and (sea) shipping. The use of fossil has boosted road and air transport. The Internet and the digital revolution contributed to virtual mobility (when it comes to personal communication), but also gave rise to e-commerce and the subsequent ‘vanisation’ of the economy (meaning: the use of small vans to distribute goods). The burning question is: what is to follow? Will the next tipping point be stagnation, decline or, as some call it, degrowth, referring to a “voluntary transition towards a just, participatory, and ecologically sustainable society” (Mastini, 2017) as a result of growing congestion, climate and clear air awareness? If so, then fundamental policy changes are needed.

As stated at the beginning of this book, the latter deals with problems concerning the use of the infrastructure for road transport only. Other modes of transport, however, face similar problems: e.g., how to allocate space on busy parts of rail networks, slot allocation at airports. This means, that the above conclusions for roads are also valid for a broader transport debate: the optimum use of infrastructure does not, as pointed out in chapter, present itself as a problem just for road infrastructure, but for all other kinds of transport infrastructure as well.
Finally, when matters are complicated - as they are - it seems wise to seek help, and not trying to solve the conundrum on one’s own. This also holds true for Benelux. It would be intelligent to start a joint future-oriented discussion on this issue in Benelux - after all, one of the most important transport regions in Europe. The Benelux Union is supported by the three countries’ advanced scientific research, in transport economics as well as in other, related, fields. Also, the Benelux is supported with an active input from both public and private stakeholders. In turn, the problems that arise from the practice of transport can provide an incentive for further scientific research. This joint discussion should lead to a clear and, above all, cross-border, coherent Benelux vision on mobility, transport, and logistics.
References


Transport is a key and central element in maintaining and enhancing global and local connectivity, and its importance has been augmented by the ubiquitous availability of the internet and social media. Contacting people around the world and even visiting them is relatively easy—we live in a networked society. Such ready connectivity is reflected in the number of motorised vehicles that now (2017) exceed 1.2 billion, with 3.5 billion Internet users, and about 3.2 billion social media users with 7.68 billion mobile phone subscribers, all for a global population of 7.6 billion. Physical connectivity will increase with an expected doubling of travel by 2050, with an even greater growth in electronic connectivity (Schäffer et al., 2009).

This growth is driven primarily by global population increases, the continued growth in the global economy, ever expanding social networks, and the desire to travel. But it is also well known that such an attractive future comes at a cost, principally adding to global warming, road crashes, local pollution, health, neighbourhood severance, noise and other externalities. Such a future is compounded in urban areas where more than half of the world’s population lives, as the impact of traffic congestion and other externalities is detrimental to the quality of life. The fundamental question here is whether all society can capture the huge benefits of greater mobility without incurring the damaging costs that currently accompany those same high levels of mobility.

The sustainability mobility paradigm was published in 2008, and this questioned conventional transport planning thinking along with the strong assumptions embedded in it (Banister, 2008a). The conclusions reached were that there were good opportunities to address the problems created by motorised transport in cities. Essentially, the focus of transport planning on time minimisation should be reframed as planning for reasonable travel times and improved travel time reliability. Travel should be seen as a valued activity in itself, as not all travel time is wasted. The importance of the links between transport and land use planning was recognised as one means of reducing travel distances, as was the potential for the substituting physical movement through the increased use of the internet. It was also suggested that all big cities are dependent on high quality public transport, supplemented by priority for walking and cycling. New thinking would embrace more imaginative use of the available infrastructure and capacity through efficient management that increased occupancy levels and load factors through demand management (e.g. pricing and regulation).

(1) Professor Emeritus of Transport Studies and Senior Research Fellow, St Anne's College School of Geography and the Environment, University of Oxford (Great Britain).

75 https://data.worldbank.org/indicator/it.cel.sets.p2
The overall goal; would be to significantly improve the quality of places and spaces in cities, as all citizens have a right to a safe and secure environment. Such thinking is based on the acceptance that cities are for people and for social interaction. This is the rationale for cities, and the old (transport) and new (internet and social media) technologies should support this primary goal rather than making it much harder to achieve.

What has changed over the last ten years? The same issues are still central as are the priorities, but two new dimensions have emerged. Discussions on quality of life were framed in global climate change issues (mainly CO$_2$ in the case of transport), but this has been added to by impacts of local pollution on air quality and people's health (mainly CO, NO$_x$, and PM$_{2.5}$). It is much easier to engage with the people in a local debate rather than the global issues, as it has a much more direct and short term immediacy. In both the global and local pollution debates, transport contributes about a quarter of all emissions (Brand and Hunt, 2018).

The second change has been the concerns over inequality, and whether large scale public investments in transport together with the many forms of transport subsidy benefit all travellers. The evidence seems to suggest that many decisions benefit the rich more than the poor, both directly as it allows the rich to travel further, faster and more often, and indirectly as the poor travel less far and to local destinations, but they are more likely to be affected by the other people’s activities (Banister, 2018). This is known as the double injustice, which means you contribute less to the problem, but you are impacted more by those who contribute more to the same problem (Gough, 2017).

In the past, as illustrated by the contributions to this volume, economists have long argued for the allocation of road space by price and the individual’s willingness to pay. But almost universally, road pricing has proved difficult to implement in cities, and positive outcomes have only been possible with high quality public transport, where there is effective land use planning, and where there is strong governance (e.g. London, Stockholm and Singapore). More recently, the debate over congestion and sustainable mobility in cities has been hijacked by the technologists promising a highly mobile future using only renewable energy. This possibility is seen as being sustainable and smart, but the reality is more complex as the impacts on congestion, inequality, pollution and city living conditions are all unclear. For example, new technology (e.g. autonomous vehicles and electric vehicles) tend to work alongside existing technologies and do not necessarily replace them, and the transition problems from one regime to another are difficult. The energy mix in many cities is not carbon neutral, and there are substantial amounts of carbon embedded in the vehicles themselves, in the infrastructure and system management, and there is also pollution from vehicles, brakes and other vehicle components. The complexity of the city, its transportation and road network, and the diversity of demand make such solutions seem rather utopian (Batty, 2018). How then might ‘sustainable and smart’ mobility evolve in cities?

Underlying the attractions of simple solutions (e.g. road pricing) and technologies (e.g. electric vehicles and autonomous vehicles) are a series of more fundamental issues that need to be addressed to improve the living conditions in cities for all. One relates to the types of cities that we wish to live in and the role of the car in that vision. A second issue concerns the availability of space in cities and how this space should be used. These two issues are interrelated. About 20-25 per cent of street space is allocated for roads, and excluding parks, open spaces and parking (UN-Habitat, 2013). This street network also provides the connectivity necessary for urban productivity and for necessary services (e.g. water, energy and drainage), as well as for movement. In terms of transport, this space is used for traffic, including cars, freight distribution, public transport, cycling and pavements for walking. It is also a space for markets and other types of street trading, a space for social activities, and a space for leisure.

The key issue here is over the ownership of that space and who has priority access to it. Pricing is one mechanism that can be used to allocate this space, but this does not consider people’s rights to that same
space, the quality of that space, and its importance to all people. The amount of space available is a given and it will not increase, but the uses made of it may well change over time and by time of day. Underlying such thinking is the availability and affordability of street space to as many people and different activities as possible – it must be seen as a public asset and not as private space. This means that creative thinking is needed to address the means to make the best use of that space for all people so that the quality of city life can be enhanced. For example, being able to walk in cities could be given priority, as this concept addresses health, safety, and experiential aspects of wellbeing, as well as raising the potential for street-based activities.

The car’s role is an essential part of the debate. At present, the technologists are encouraging the use of electric vehicles and autonomous vehicles in cities, supported by politicians and city administrations. The vehicles being developed take up far too much space and they are too heavy. Designing a new electric car that weighs over 2 tonnes and is 5 metres in length to carry one person (80 kg) will always be inefficient in both resource costs and its space requirements. There is a huge opportunity to design a small, slow, shared and lightweight vehicle to be used in cities.

Reflecting on the six years since I was the 1st BIVEC-GIBET Chair (2012-2013) and on the four lectures I gave in the Benelux countries, my conclusion would be that there has only been limited new thinking on sustainable mobility has been limited and, as noted here, the technologists have taken over the sustainable and smart transport agenda. In my opinion, what is being proposed now is neither sustainable nor intelligent, and this comment is even more apparent in cities. The debate on sustainable and smart mobility needs to build upon the sustainable mobility paradigm (Banister, 2008b) together with the new dimensions of health and inequality. Most trips in cities are short and this means that motorised trips can be undertaken primarily on public transport, supplemented by some demand responsive shared services directed at those with mobility difficulties or for particular groups late at night or for those in more suburban areas. The Mobility as a Service (MaaS) concept has potential but should be seen as an integral part of the overall supply of transport. Most efforts should be directed towards promoting micro mobility that encourages active, healthy and fair movement. This would include networks and priorities for walking, cycling, bike sharing (and dockless bikes), scooters and other devices. Perhaps some of these would be e-bikes or e-scooters; with the new mobility hubs for recharging becoming the new ‘hots spots’ for social and leisure activities in cities. Such a new set of priorities would address the space constraints in cities and stabilise transportation efficiency as the mode of travel would weigh less than the person being transported. To me this is both sustainable and smart!
References


ANNEX

40 years of BIVEC-GIBET activities
L. D. VAN DEN BERG AND J. B. POLAK
The Articles of the Benelux Interuniversity Association of Transport Researchers (BIVEC-GIBET) were approved at a solemn academic session in Rotterdam on 21 June 1978. In the 1960s, on the initiative of a number of Belgian and Dutch university professors, informal cross-border cooperation in the field of transport economics has now finally been formalized. What follows, here, is a review of BIVEC-GIBET activities over the period of its existence.

1. The start: cooperation in the field of teaching in port- and transport economics

BIVEC-GIBET pioneer and first Chairman, Prof. H.C. Kuiler, looked back at the first period of cooperation during the aforementioned session (see photo below; standing Professor Kuiler).

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(1) Former Senior Policy Officer and Head of Department, General Secretariat of the Benelux, Brussels (Belgium).
(2) Professor Emeritus of Transport Economics, University of Groningen and former lecturer in this field, University of Amsterdam (The Netherlands).

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1 The official founding of BIVEC-GIBET took place in the presence of the then Dutch Secretary of State for Transport, Public Works and Water Management, Mrs. N. Kroes and the then Secretary General of the Benelux Economic Union, Mr. E.D.J. Kruytbosch.
Kuiler outlined the usefulness and necessity of this Benelux interuniversity cooperation. His former analysis provides an insight into the start-up of BIVEC-GIBET and therefore deserves a full place in this jubilee book.

The Benelux Port Study Days were born out of student excursions at the beginning of the 1960s. These excursions have become a recurring event that could no longer be ignored in our Benelux university world. Their aim was to convince the young generation of transport economics students of the superfluity of the struggle between the major Delta ports by acquainting them with people working in ports, their problems and their solutions in practice. Also, to indicate the importance of these port activities for the transport of essential goods to and from the European hinterland. Transport activities that are at the basis of the Benelux countries’ prosperity and well-being.

The idea was successful. Many students from that time are now in leading positions in the Delta ports. The competition has not disappeared - and that is healthy - but the old contradictions no longer appear as bright as before. When this was achieved, the idea of going one-step further matured in the Benelux Port Study Days organizers inner circle. The Benelux countries have a common European function in transport and ports are of such great importance for their respective economies. Then, it must also be possible to integrate transport economics teaching on both sites of the border in such a way that the young generation of students becomes better prepared for their future professional tasks in the field of transport and port. The BIVEC-GIBET was initiated in 1977.

The goal was clearly formulated; the design and elaboration initially remained vague. They had to get their exact content in the mutual contact. It is this process that has taken place in the past two years in the most friendly way and without any distinction of nationality, especially in the bosom of the Executive Board.

It became clear that three related main lines could be distinguished. In the first place there was teaching itself, the transfer of knowledge. However, teaching assumes the regular provision of knowledge obtained from research, particularly in the case of transport and ports, which exceeds the possibilities of individual scientists. The results of Benelux transport research institutes should be used for this purpose. Thirdly, teaching in transport and in port economics also concerns the institutional provisions of the Benelux governments, which are partly based on the results of science in their assessment.

We, as teaching representatives, succeeded in establishing both forms of scientific contact. The research concerns the (at that time) non-commercial transport institutes of Belgium and of The Netherlands. It
concerns the Benelux Economic Union's “Commissie Verkeer/Commission des Communications” (High Level Communications Group).5

In this context, the elaboration of possible theses into documents that can be of value to the governments is a still open line. We will have to consider this in the near future.

As far as teaching itself is concerned, a first integration step is almost complete, i.e. the classification of the thesis in transport and port economics. This will increase the accessibility of theses in the Benelux, especially for students working on similar or related subjects. They can then build on already achieved results and thereby gain a deeper insight.

A next step will be the inventory of the content of teaching at the various universities and colleges of higher education. In the coming months, the Executive Board will take the necessary steps. Such an inventory can be the basis for the exchange of lectures, common courses, post-academic teaching etc. Of course, there could not be a lack of a legal framework for cooperation. Its development took a long time-too much time for scientists. In this context, I would like to expressly mention that we have received an invaluable secretarial assistance from the General Secretariat of the Benelux Economic Union. Without this help, we would certainly not be ready in just two years, as is currently the case.

I hope that our universities will also find reasons to support the BIVEC-GIBET along roads that are open to them for this purpose.6

2. Design: structure, management, decision-making and financing of BIVEC-GIBET

a. Legal anchoring
BIVEC-GIBET's founders opted for an association with legal personality. For practical reasons, an "International Association without a profit objective" ("I.V.Z.W.") was chosen according to Belgian law.7

b. Member structure
The Association has four categories of members:
- Active members, persons working in the field of transport economics at a university or college within the Benelux; Associated members, people from outside the educational field with an affinity with transport economics and working within the Benelux; Collective members, research institutes within Benelux working in the field of non-profit transport economics; Corresponding members, persons outside the Benelux countries with affinity with the field of transport economics.

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5 Chapter 4, Article 28, of the Treaty establishing the Benelux Economic Union of 1958 provides a High-Level Committee for Traffic. This Committee supported the initiative to establish BIVEC-GIBET. Members of this Committee regularly cooperated with BIVEC-GIBET representatives in order to be able to link BIVEC-GIBET activities to current policy questions. A new Benelux Treaty was signed on 17 June 2008, introducing “Benelux Union” – no longer merely “Economic” - as the new name of the Union. The new Treaty no longer provides for permanent consultative committees, but an annually adaptable project orientated structure in which consultations on subjects related to traffic and transport have a prominent place.

6 Above text is the integral text pronounced by Kuiler.

7 Its Articles of Association state that the seat of BIVEC-GIBET is at the address of the General Secretariat of the Benelux (Economic) Union in Brussels, Belgium.
c. Decision-making and Management
The General Assembly is the highest decision-making level. The active, associated and collective members are entitled to participate in that Assembly, which must be held at least once a year.
The Association has a Board of Directors chosen from the active members. It has been attempted from the beginning for all universities and high schools in the Benelux with transport-related courses to be represented in this Board. Representatives of the collective members have an advisory vote in the Board. The Board of Directors elects from among its members a Chairman, a secretary and a treasurer from among its members. Together they form the Daily Management Board of the Association.

d. Financing
BIVEC-GIBET funding takes place through a member-contribution. The collective members' contribution is an important source of income. The starting point is that the activities of BIVEC-GIBET will take place completely independently and in full academic freedom. Therefore, external sponsorship as a structural source of income was deliberately omitted. However, targeted facilities and substantial support by companies and governments have been used gratefully in the organization of study days, seminars and colloquia. Here as well, care has been taken to ensure that this does not detract from the scientific quality and independence of the work. The aforementioned support is solely aimed at increasing the quality of the activities of BIVEC-GIBET.

e. Benelux
The then Secretary General of the Benelux Economic Union, E.D.J. Kruytbosch, was a warm advocate of closer Benelux cooperation in the field of transport economics and related science areas. He saw the importance of actively using science as a basis for policymaking and strengthening international cooperation. In addition, he believed that BIVEC-GIBET could play a useful role in bringing about greater coherence between the three countries through its scientific activities. He not only ensured that BIVEC-GIBET was supported through a deputy secretary (J. Rousseau, L.D. van den Berg, Mrs. S. Stevens, Mrs. S. van Rossem and P. Janssen), but also made useful contacts between the BIVEC-GIBET board and representatives of governments, research institutes and the business community. The General Secretariat also provided the group with active administrative, organizational, translation and secretarial support until 2003. BIVEC-GIBET subsequently took these supporting tasks on its own. In addition, the good contacts with the Benelux secretariat continued to exist.

3. Getting started
1. Overview
BIVEC-GIBET, thanks to the enthusiastic efforts of its members, knew a good take-off. At the beginning, the Association already had thirty active members. In the first year, four transport institutes joined as a collective member. Over the years, the number of active members has grown and is now stabilizing around a hundred. There are currently three collective members.

From the beginning, activities have been focused on three target groups: students and lecturers at universities and high schools and those interested in the results of scientific research not connected to an educational institution. Initially the emphasis of the activities in education, gradually and in connection with a - Europe-wide - changed study design at the educational institutions, shifted this emphasis to research. In what follows, the activities of BIVEC-GIBET will be reviewed in more detail.

2. Teaching
BIVEC-GIBET supported the organization of the Benelux Ports- and Transport Study Days (for details, see 144 below). These Study Days were usually very well attended and always highly appreciated by
participants. A special focus has always been on a low-threshold access for students to events such as study days and working visits.

Until the 1990s, work was carried out on a database of scientific transport economics publications in the Benelux, the BIVEC-GIBET script. This turned out to be a stubborn project that never really got off the ground. The work on this project was discontinued after the internet gradually began to offer much more extensive information possibilities.

In the early 1980s, work was done on an inventory of study programs for educational institutions relevant to transport in the Benelux. This inventory provided useful insights for teachers and stimulated the exchange of knowledge and people. This activity came to an end when such an inventory was set up in a broader European framework and also linked to the exchange of projects for students.

After the death - in 1979 - of Prof. Raoul Jacobs, co-founder of the Association, a prize named after him was set for the best graduation work of transport economics students. Over the years many papers by were judged by a jury formed by members of the organization, which resulted in many laureates. It should be noted that the jury has always set the scientific bar high and did not hesitate to award the prize for a year if the quality of the submissions remained below the expectations stated. The participation in this competition and certainly the winning of the prize was a nice reference for the participants in their later career. The prize went down to its success. The assessment of the sometimes dozens of submissions turned out to be too great a burden for the judges, which led to ending this activity of BIVEC-GIBET in 2005.

On September 1, 1998, BIVEC-GIBET pioneer and Honorary Chairman Prof. H.C. Kuiler died. His special merits for the group in view of the BIVEC-GIBET reason for organizing three forums around a current theme.8

In 2012, the BIVEC-GIBET Transport Chair was set. This Chair awards an individual who has made an important scientific contribution and/or significant social merits related to transport and mobility within Europe. The recipient of the award provides several guest lectures, each at various Benelux universities.9

Because, as mentioned above, the effectiveness of BIVEC-GIBET gradually shifted from the field of education to that of the research, a new competition was introduced in 2009. This “Piet Rietveld” Prize named after one the foremost Dutch transport economists, who died at a relatively early age was an award for the best (broadly defined) doctoral thesis within B in the field of transport research. The evaluation of theses submitted each time is in the hands of a jury of experts.

8 Forums "Prof. H.C. Kuiler":
1998, University of Antwerp, Economic Principles in Transport Policy, Emeritus Prof. Trevor D. Heaver (UBC Sauder School of Business, Vancouver);
2000, Free University Brussels, Transport deregulation and privatization - should Europe follow Britain?, Prof. John Preston (University of Southampton);
2001, University of Antwerp, Airline Restructuring and Privatization, Prof. Rigas Doganis (Visiting Professor at Cranfield University).

3. Research
From the start, BIVEC-GIBET organized two different kinds of meetings that dealt with research. These are seminars and colloquia respectively. The former are aimed only at the Association’s own members, the second category is intended for a wider audience.

In later years, two other forms of study meetings have been added: Workshops and the Transport Research Days. The latter took place for the first time in 2005 and have taken place bi-annually since then. Two awards for the best paper presented were created with the aim of stimulating academic research in transport and logistics as follows:
- Papers by authors in the context of the Best Junior Paper;
- All papers submitted can compete for the Best Paper Award.

4. Comments
With the above overview of 40 years BIVEC-GIBET a few comments. An important motive for the start of the Benelux Port Study Days and subsequently the establishment of BIVEC-GIBET was to stimulate cross-border contacts between (future) colleagues and thus stimulate the exchange of knowledge. These initiatives must also be seen in the light of the then important developments in European and Benelux integration. In the 1960s and 1970s, people who cherished this integration founded various associations in different fields. Given the important role of the Benelux countries in European transport, it was obvious that this should also be done in the area of transport and ports.

In the early days, the internal and external contacts of BIVEC-GIBET were of the kind that is currently called "cross-border networks" - a term that was not yet in use at that time. Forty years later, part of this networking was replaced by the internet. But despite instruments as teleconferencing, Skype, WhatsApp or Facebook, it is good and therefore also occasionally useful to see each other "in reality" and to "taste" the practice of a port or a terminal on the spot. Due to tight curriculum programming and the study and workload, the possibilities for this kind of "classic" networking activities are much more limited than they were forty years ago. BIVEC-GIBET's original objective, namely to promote cross-border joint actions for students, both among themselves and with practice, nowadays is given less priority. The fact that the contacts between this breeding ground of transport economies and their future work environment have been reduced is also probably an important reason why it appears to be increasingly difficult for stakeholders - both in the research field and in the business community and government - to be structurally involved with BIVEC-GIBET. Interest is there, but then on an ad hoc basis. The challenge for BIVEC-GIBET to respond to this.

Communication is an important point of attention for an association such as BIVEC-GIBET. At the beginning of the 1990s, thanks to the efforts of several enthusiastic young members, a website was developed with information about the Association. Incidentally, "paper" publications have also appeared about many activities.10

Given that it is not easy for a large audience to be interested in BIVEC-GIBET, we have chosen an approach in which researchers and teachers and representatives of transport-related institutes in particular are included and, if possible, actively involved in their work-oriented activities. For example, the Transport Research Days also have the function of finding new interested parties in BIVEC-GIBET.

Looking at the list of approximately 100 organized activities (see i, iii and iv), it is striking that many subjects are in line with the current political and social relevance. That is certainly not a coincidence. Certain topics are still very current today. The starting point has always been to approach the chosen subjects from a scientific point of view. This does not in any way alter the fact that the treatment of these topics can also great value to policymakers, civil society organizations, the media and politics. Because of the scientific approach, complex and socially sensitive traffic and transport problems are often stripped of emotions and prejudices, and knowledge is paramount instead of perception. Now that not only traffic but also decision-making about traffic problems seems to become a problem, the question arises whether BIVEC-GIBET would do well to bring more publicity to what the Association can offer to governments and businesses.

This jubilee book is an example of how scientific knowledge can be important in solving practical transport issues.
i. Benelux Port- and Transport Study Days

1964, Rotterdam: Hinterland connections

1965, Antwerp: Port of Antwerp

1966 Amsterdam: Management and operation of the port (see picture)

1967, Rotterdam: Various themes around ports

1968, Antwerp: Work in the port

1969, Amsterdam: The changing function of seaports

1971, Rotterdam: European function of the Delta seaports

1972, Antwerp: Benelux seaports and UK accession to the Common Market

1974, Amsterdam: Economic activities bound to the port

1975, Rotterdam: European seaport policy

1976, Antwerp: Scheldt-Rhine connection

1977, Groningen/Delfzijl: Problems of smaller seaports in Benelux

1979, The Hague/Rotterdam: Problems around an industrial complex in the North Sea

1980, Ghent: Reconstruction of old ports

1981, Amsterdam: Changes in the Western European economy and position of the Benelux seaports

1983, Rotterdam: Trade and transport function of seaports
1984, Antwerp: *Future of European seaports*

1985, Bruges: *Main ports in Benelux*

1986, Brussels: *Netherlands Railways freight transport* (Transport Study Day)

1987, Liège: *Container transport by barge*

1998, Schiphol Airport: *Excursion*

1989, Amsterdam: *Perspectives of the Rhine-Main-Danube Canal in relation to Benelux ports*

1990, Amsterdam: *Cooperation in aviation - Growth and limitations in Benelux* (Transport Study Day)


1992, Breda: *Cross-border deployment of Western Brabant in view of the presence of Benelux seaports* (Transport Study Day)

1992, Ostend-Ramsgate-Calais: *Study trip "Transmanche"*

1993, Rotterdam: *Strategic challenges for Benelux seaports in the twenty-first century*

1994, Liège: *Inland shipping* (Transport Study Day)

1995, Ostend-Ramsgate-Ostend: *Short sea shipping*

1996, Rotterdam: *Combined transport* (Transport Study Day)

1997, Antwerp: *Hinterland connections: a future for the railways - Case study for the port of Antwerp*

1999, Ghent/Terneuzen: *Cooperation between ports: Gent-Terneuzen*

2000, Antwerp: The high-speed train (Transport Study Day)

2003, Flushing: *Spatial and economic developments in the ports of Terneuzen and of Flushing*

2005, Hasselt, *Transport Study Day*

### ii. Founding Fathers

Cooperation is people’s work. Realizing that it is risky to mention specific people, where countless others contributed to the start-up of the Benelux Port Study Days and the resulting BIVEC-GIBET cooperation, here, the authors still would like to mention a number of persons who may be seen as "founding fathers" of the Association.

At the start of the Benelux port study days, professors H.C. Kuiler (*Erasmus University Rotterdam*), L. Baudez (*University Faculties Saint-Ignatius Antwerp*), R. Jacobs (*idem*) and J. Vandenbergh (*State University Centre Antwerp*) acted as quartermasters.\(^1\)

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\(^2\) N.B.: all affiliations are only listed once, i.e. where a certain name appears for the first time in the text.
In preparation for the founding of BIVEC-GiBET, an initiative group met for the first time, on 4 October 1977, in Rotterdam. On that occasion, the draft statutes of Association were discussed and a (Daily) Board was appointed. H.C. Kuiler acted as chairman, G. Blauwens (University Faculties Saint-Ignatius Antwerp) as vice-chairman and W. Winkelmans (State University Centre Antwerp) as treasurer. Further members of the initiative group were: H.A. van Gent (Free University Amsterdam), J. Lheureux (State University in Mons), J.B. Polak (University of Groningen), E.H. van de Poll (Delft University of Technology) and Ph. Wilmès (.) Representatives of the associated transport institutes also participated in the initiative group: E.J. Visser (Netherlands Transport Institute), G. Gort (Economic Bureau for Road and Water Transport, The Hague), H.J. Noortman (Netherlands Transport Institute), J.M. Van Stappen, Y. De Bouwer, F. Jennes (the latter three: [Belgian] Institute for Road Transport), D. Van Den Noortgate and V. Boogaerts ([Belgian] Institute for Transport along the Inland Waterways).

The approval of the statutes of BIVEC-GiBET took place during an academic session at the Chamber of Commerce in Rotterdam, on June 21, 1978. The following signatories are listed in the Articles of Association:


After publication of the statutes in the Belgian Official Gazette, the "Benelux Interuniversity Association of Transport Researchers" (IVZW BIVEC-GiBET) formally entered into force. In addition to the above persons, a number of "co-initiators" of BIVEC-GiBET here deserve special mention: Prof. R. Jacobs (UFSIA, Antwerp) as well as the then Secretary General of the Benelux Economic Union, E.D.J. Kruytbosch. And last but not least Benelux employee J. Rousseau. As deputy secretary he supported the initiative group, and after that also BIVEC-GiBET - the latter for considerable time.

The Association appointed founder H.C. Kuiler as honorary chairman. Because of special and long-term merits for the Association, in later years, Messrs Kruytbosch (1984), Beuthe, Polak (the latter two in 2003), Blauwens, Winkelmans (the latter two in 2005) and Hennekam, former Secretary General of the Benelux Economic Union (2007), were appointed honorary members.

iii. BIVEC-GiBET PhD Awards/after 2017: "Piet Rietveld Prize"

2009
Winner: Dr. Pieter Vansteenwegen (Catholic University of Louvain): "Planning in tourism and public transportation. Attraction selection by means of personalized tourist information and train transfer scheduling”. Supervisors: Prof. D. Van Oudheusden (idem) and Prof. W. Herroelen (idem)

2012
Winner: Dr. Tijs Neutens (University of Ghent): "Space, time and accessibility: analysis of human activities and travel opportunities from a time-geographic perspective". Supervisor: Prof. Philippe De Maeyer (idem), Prof. Frank Witlox (idem) and Dr. Tim Schwanen (University of Oxford)
Winner: Dr. Veronique Van Acker (*University of Ghent*): "Spatial and social variations in travel behaviour. Incorporating lifestyles and attitudes into travel behaviour-country use interaction research". Supervisor: Prof. Frank Witlox (*idem*), Prof. Bert van Wee (*Delft University of Technology*)

Honourable mention: Dr. Vincent van den Berg (*Free University Amsterdam*): "Congestion pricing with heterogeneous travellers". Supervisors: Prof. Erik Verhoef (*idem*), Prof. Piet Rietveld (*idem*)

2014

Winner: Menno Huijs (*Delft University of Technology*): "Building castles in (Dutch) air: Understanding the policy deadlock of Amsterdam Airport Schiphol 1989-2009". Supervisor: Prof. Bert van Wee (*idem*)

2017

Winner: Dr. Fariya Sharmeen (*Technical University Eindhoven*). “Dynamics of social networks and activity travel behaviour”. Supervisor: Prof. Harry Timmermans (*idem*)

Winner: Dr. Hugo Silva (*Free University Amsterdam*): "Airport pricing policies: Airline product, price discrimination, dynamic congestion and network effects". Supervisor: Prof. Erik Verhoef (*idem*)

iv. Study days, colloquia, seminars and symposia

*Legend*

**C** = Colloquium

**S** = Seminar

**SD** = Study Day

**TD** = Theme Day

1979, Brussels, *Modal split* (S)

Id., Rijswijk, *Simulation models for Management in Public Transport* (S)

1980, Antwerp, *Transport Policy in Crisis Time* (C)

Id., Brussels, *Tariffs in road goods transport in Benelux* (S)

1981, Rijswijk, *Evaluation of investment projects in transport infrastructure* (C)

Id., Rotterdam, *Freight pricing in transport by barge in Benelux* (S)

1982, Brussels, *Market observation of freight transport* (C)

Id., Antwerp, *Border obstacles in international freight transport*

Id., Utrecht, *Cost allocation and coverage in passenger and freight transport by rail* (S)

1983, Groningen/Delfzijl, *The role of the small seaports* (C)
1984, Ghent, *The interaction between spatial planning and passenger transport* (S)

1985, Antwerp, *Cost/benefit analysis with regard to the expansion of the Belgian waterway network* (S)

1986, Amsterdam, *Benelux ports in a world perspective* (S)

Id., Louvain, *High speed rail links* (C)


1987, Antwerp, *The future of land transport in Europe* (SD)

Id., Brussels, *The European transport market after 1992* (C)

1988, Rotterdam, *The elderly and public transport* (S)

Id., Brussels, *Traffic congestion: an (un)soluble problem?*

1989, Antwerp, *Where with trade and transport documents?* (S)

Id., Antwerp, *Transport and port policy* (C)

1990, Antwerp, *The Economic Impact Study (E.I.S.) as a policy instrument for the government - an application in the maritime sector* (S)

Id., Brussels, *Mobility, Traffic and Environment* (C)

1991, Amstelveen, *Telematics in the Transport Market* (C)


1994, Brussels, *The road facing its growth* (C)

Id., Corsendonk, *Transport economics of the year 2000* (at the occasion of the third lustrum of BIVEC-GIBET) (S)

1995, Eindhoven, *The regional airports in Benelux*

1996, Namur, *Transport economics of the year 2000: external costs of transport and mobility*

1997, Brussels, *The liberalization of European inland navigation in the year 2000* (C)


1999, Antwerp, *Iron Rhine and Betuweroute. The debate on the right tracks?* (C)

2000, Mons / Strépy- Thieu, *Transport Science in 2000 as seen from an economic point of view* (S)
2002, Lille, *Liberalization of inland navigation - experiences and perspectives*

2003, Antwerp, *Staying accessible 'on land, at sea and in the air' (C)*


2004, Antwerp, *Security in freight transport Myth, Might or Necessity? (C)*

(Book: Frank Witlox, ed., title as colloquium, Antwerp/Apeldoorn, Garant, 2005, ISBN 90 441 1775 0, 978 90 4411 775 2)

2006, Breda, *Military and civil logistics - what can the two learn from each other?* (together with Netherlands Defence Academy) (S)


Id., Brussels, *Transport and Energy (TD)*

2007, Rotterdam, Transport Research Day

(Book: Cathy Macharis and Laurence Turcksin, eds, *Proceedings of the BIVEC-GIBET TRANSPORT Research Day*


2008, *Road safety in Benelux (C)*

2009, Brussels, Transport Research Day

Id., Brussels, *Cross-border mobility (C)*

2011, Rotterdam, *Chinese Logistics in Europe (S)*
Id., Namur, Transport Research Day

2012, Louvain, *Eco zones* (S)

2013, Luxemburg, Transport Research Days


2015, Antwerp, *Infrastructure and mobility* (sponsored by Regional Science Association Netherlands, RSAN)

Id., Eindhoven, Transport Research Days

2016, Brussels, *Is Belgium a logistic top location?* (together with Belgian Institute for Transport Organizers - BITO-IBOT) (S)

Id., Brussels, *The future of collective transport by road* (Conference together with Belgian Institute for Car & Bus, ICB)

2017, Liège, Transport Research Day (S)

2019, Brussels, Road pricing in Benelux, Study Meeting at occasion of the fortieth anniversary of BIVEC-GIBET (TD)