OPTION Conference

Tinbergen Institute, Amsterdam, 9 and 10 April, 2015

Optimizing Policies for Transport: accounting for Industrial Organization in Network markets

ERC Advanced Grant – Prof. dr. Erik Verhoef
(VU University Amsterdam)

Book of Abstracts

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Th. 09:00 – 09:25

Erik Verhoef - Introduction

ERC Advanced Grant – OPTION – Optimizing Policies for Transport: accounting for Industrial Organization in Network markets

by

Erik Verhoef

Background

In 2010, the European Research Council of the European Commission decided to fund the research proposal with the acronym OPTION - Optimizing Policies for Transport: accounting for Industrial Organization in Network markets - with an ERC Advanced Grant. This research project started in May 2010 and is now reaching its final stages.

This 2-day conference in Amsterdam marks the end of the project, with some 36 presentations from OPTION researchers presenting their work as well as from invited foreign experts. All presentations are related to the theme of the OPTION project, Industrial Organization in Transport Network Markets. This set up has led to a full and intensive but – I believe – very promising program.

The Theme

The motivation for the OPTION project stems from the observation that transport policy analyses have traditionally often ignored the strategic behaviour of 'large actors'; and still do so. One could characterize such approaches as bi-layered, where the transportation system is implicitly assumed to consist of a lower layer of atomistic individuals, above which there is a second layer with a single operator or government, usually optimizing some aggregate objective such as system-wide social surplus or profits. To an increasing extent, however, it is realized that transport systems and markets are often more complex than this relatively simple structure, due to multiple private and (semi-)public stakeholders with a more-than-marginal impact on the functioning of these transport markets. Such 'large actors' typically pursue objectives that do not (fully) run parallel to the overall public interest. In such instances, central transport policies will not have the impact that is anticipated, because these large actors change their behaviour in response to central policies, thus affecting the market outcomes. This can dramatically affect the optimal design and impacts of central policies. The project has developed models incorporating large actors for a number of specific cases, e.g. integrated airport-airline networks, rail-road competition, private road supply, insurance companies and traffic accidents, automated highways and electric vehicles, and taxi markets. These transport policy problems are not only of great academic interest, but also present some of the greatest challenges faced by transport policy makers in their daily operations.

Airport Pricing and Capacity in a Hub-Spoke Network
by
Ming Hsin Lin and Anming Zhang

Presenter: *Anming Zhang*

Abstract:
This paper investigates airport congestion pricing in a hub-spoke network, which is in contrast to the existing literature that has focused on a single airport. The hub airport is congested and it levies a per-flight charge on its carriers and discriminatory per-passenger charges on the local and connecting passengers. We characterize the socially optimal airport charges, and provide explanations for why hub airports may charge a connecting passenger lower than a local passenger, even though the connecting passenger contributes a relatively higher runway congestion at the hub than a local passenger. Our main results are: 1) the socially optimal per-passenger charges should take the higher congestion contribution by the connecting passengers into account, which may lead to a higher charge on a connecting passenger than on a local passenger; 2) generally, the optimal outcome cannot be achieved when the hub airport only levies aircraft-based, per-flight charges on carriers; 3) the optimal per-connecting passenger charge should be lower (higher, respectively) than the per-local passenger charge when the per-flight charge is large (small, respectively); and 4) the profit-maximizing hub airport can charge a connecting passenger lower than a local passenger, owing to the exercise of its market power.

Social cost minimizing network lines structures for Public Transport on a Parametrically Representative Urban Setting
by
Sergio Jara-Diaz, Andrés Fielbaum and Antonio Gschwender

Presenter: *Sergio Jara-Diaz*

Abstract:
The spatial arrangement of transport services is part of a decision process where cost functions and demand play a key role. This has been studied in different transport industries with different emphasis. However, there is no systematic way to address the problem of finding the optimal lines structure for a public transport system. The literature shows advances in two directions: heuristics on large, real scale networks, and analytical models developed and solved for small networks. Unfortunately these different efforts have very little relation between them.
We start by searching for an appropriate description of an urban structure using a number of measures that represent different spatial and connectivity properties plus some economic analysis on the role of centers and sub-centers in real cities. After realizing that a grid is a very bad urban representation, we

decided to work with a radial city that includes a CBD, sub-centers and peripheral nodes (zones). A series of parameters permits a flexible definition of the network and the O-D matrix, such that a mono-centric city, a polycentric city or a disperse city can be represented as particular cases.Four different transit structures are defined on the parametric city: direct lines, exclusive lines, feeder-trunk and hub & spoke. For each line structure, we find the minimum social cost (operators plus users) solutions for all combinations of parameters in terms of lines structure, fleet sizes, frequencies and bus sizes. In this way we obtain conclusions about which kind of structure responds in a better way to different urban phenomena, such as having a very important CBD or a more important role of the sub-centers. The role of transfer penalties is particularly analyzed. If transfer penalties are disregarded, a Hub & Spoke system would be the best way to serve mono-centric cities, and a Feeder-Trunk system would dominate if the city was more disperse. The main conclusion is that under the realistic consideration of transfer penalties, total patronage is as important as the dispersion of the trips. In this case, the Direct lines structure is the best one, unless patronage is too large, making the Exclusive lines structure to be the optimal.

Finally, we compare the exact solutions with that obtained using two classic heuristic algorithms, finding that they tend to generate Direct lines systems with only some small variations, irrespective of the value of the parameters that represent the different urban forms. These lines systems are always worse than the optimal structures obtained rigorously, suggesting that it is better to start finding a global structure based on the main features of the city and only then apply heuristics to refine the solution.

Th. 10:15 – 10:40

Airport Prices in a Two-Sided Market Setting: Major US Airports
by
Marc Ivaldi, Senay Sokullu and Tuba Toru

Presenter: *Marc Ivaldi*

Abstract:
In this paper, we study on airport business model under a two-sided market setting in which airports are two-sided platforms where airlines and passengers are the two end-users. Our first result is on the existence of two-sided network externalities between the passengers and airlines. Thus, we conclude that the airports indeed should be considered as two sided markets.

Furthermore, as a result of empirical exercises on the business models of airports, we found two main facts. First, airports in our data set do not consider the two-sided structure of the industry while deciding on the prices for passengers and airlines. In other words, they do not internalize the externalities exist between two sides. Secondly, they use different pricing schemes for each side. We find empirical evidence of profit maximizing prices for passengers and Ramsey prices for airlines.

Miles, speed and technology: traffic safety under oligopolistic insurance
by
Maria Dementyeva and Erik Verhoef

Presenter: *Maria Dementyeva*

Abstract:
We study road safety when insurance companies have market power, and can influence drivers' behavior via insurance premiums. We obtain first- and second-best premiums for different market structures in insurance. The insurance program consists of an insurance premium, and marginal dependencies of that premium on speed and own safety technology choice. A private monopolist internalizes accident externalities up to the point where compensations to users' benefit matches the full (immaterial) costs; in oligopolistic markets, insurers do not fully internalize accident externalities. Analytical results demonstrate how insurance firms' incentives to influence traffic safety coincide with or deviate from socially optimal incentives.

Follow or Join the Leader?
by
Paul Koster, Christiaan Behrens and Erik Verhoef

Presenter: *Paul Koster*

Abstract:
Consider a market that is characterized by one large player ('the leader') which is a merger of *K* separable individual firms, and a continuum of *J* follower firms. A transport application we have in mind is the taxi market, with one big leader firm and many follower firms. This paper analyses the case where the size of the leader firm is endogenously determined taking into account the behavior of a competitive fringe. We analyze two cases: first we assume that entry in the follower market is free and therefore the size of the fringe is endogenously governed by the zero profit condition. This corresponds to a long run situation where firms will enter the market as long as there are profits to gain. Second, we analyze the case where the number of followers is exogenous which is more in line with the short run, or with a situation where market entry is regulated by for example a license fee. Customers in our model respond to firms prices, but also face search costs, which are decreasing in the number of firms operating at the market, meaning that the probability to find a firm belonging to the leader (follower), increases in *K* (*J*).
An essential ingredient of our model is that we consider a situation of *profit-sharing* at the leader firm: each individual firm belonging to the leader firm receives the same share of the total profit pie. The leader firm therefore optimizes average profits taking into account the price and entry behavior of the fringe. We derive (implicit) solutions for follower and leader prices in an unregulated Cournot

equilibrium using Lagrangean techniques, where we show how prices of followers and the leader relate to demand related parameters, search costs and the size of the leader firm.

Because there are search costs externalities involved, the unregulated equilibrium is sub-optimal in welfare terms and there is scope for welfare improvements using taxes or entry fee regulation. We first investigate welfare optimizing first-best policies as a natural benchmark and then proceed with the analytical analysis of second-best policies where the government can only control the size of the fringe and the prices, or where only entry regulation in the follower market is possible.

Th. 11:45 – 12:10

On timetable assumptions in railway investment appraisal
by
Jonas Eliasson and Maria Börjesson

Presenter: *Jonas Eliasson*

Abstract:
The benefits captured in an appraisal of a railway investment are determined by what timetables the analyst assumes in the scenarios with and without the investment. Without an explicit, objective and verifiable principle for which timetables to assume, the appraisal outcome is virtually arbitrary. This means that appraisals of railway investments cannot be compared to each other, and opens the door for strategic behaviour by stakeholders conducting seemingly objective cost-benefit analysis. We explain and illustrate the nature and extent of the problem, discuss possible timetable construction principles, and show that current practice is likely to exaggerate appraisal benefits.

Th. 12:10 – 12:35

Optimal policy for a multimodal road:
Congestion pricing, bus waiting times, crowding-in-the-bus and capacity allocation
by
Alex Anas

Presenter*: Alex Anas*

Abstract:
We combine the flow model of congestion with the trinomial logit model of modal choice among driving, riding the bus and walking. We show an unnoticed property, that reducing bus waiting times can increase road congestion on the road when pedestrian market share is large as it is in the megacities of many developing nations. We then use the model to examine simultaneously the first-best optimal public policy. How should car congestion tolls and bus fares be set? How bus waiting times and crowding-in-the-bus are determined optimally? How should road capacity be allocated? Under what

conditions should road capacity be shared by cars and buses, and when should it be segregated into portions dedicated to each mode?

Causes and Effects of Air Traffic Delays: Evidence from Aggregated Data
by
Volodymyr Bilotkach and Paulos Ashebir Lakew

Presenter: *Volodymyr Bilotkach*

Abstract:
This study uses aggregated data on concentration, delays, and airfares from the US airports to shed light on two issues. First, we examine the concentration-delays relationship to contribute to the airport-congestion self-internalization debate. Our study is the first investigation of this issue that uses data on sources of delays. Second, we evaluate whether increases in flight delays result in lower airfares when traveling from an airport. Our empirical results demonstrate patchy support for the self-internalization hypothesis: while total delays are positively correlated with airport-level concentration, the variance of delays at larger airports does fall as concentration increases. We also find that an increase in airport concentration consistently decreases the share of delays that can be deemed endogenous to the airline. The negative relationship between delays and prices is confirmed, and estimates of this effect are similar to those found in the relevant literature. Of the various sources of delay, weather and late-aircraft delays have the strongest negative impact on prices.

Air traffic control regulation in a union bargaining model setting
by
Thomas Blondiau, Amihai Glazer and Stef Proost

Presenter: *Stef Proost*

Abstract:
This paper studies the behavior of the air traffic control (ATC) centers in the EU. We assume that the decisions of an air traffic control center are the outcome of a bargaining game between the public air traffic agency and the unions of air traffic controllers. This framework is used to understand the behavior of the ATC center for wage formation, their reactions to a price-cap, adoption of new technologies, peak load pricing, effect of vertical disintegration, competition and the possible success of mergers between different national ATC centers.

Tacit collusion in price and frequency in the airline industry
by
Leo Basso

Presenter: *Leo Basso*

Abstract:
Empirical analyses of airline mergers have consistently found that prices increased while frequencies decreased. Therefore, if airlines were able to compete less aggressively, they would do so by affecting both prices and frequencies. Moreover, this implies that, if firms were to attempt to reach collusive agreements, they would try to agree on both prices and frequencies. Surprisingly though, the literature on collusion in airline markets has not directly looked at the possibility of collusion emerging on both variables. In this paper we characterize the sustainability and profitability of tacit collusive schemes when firms have the option to choose strategically price and quality (frequency); the degree of horizontal differentiation is exogenous. The addition of this second variable induces the existence of two types of cartels: full and partial. Importantly, the order in terms of profitability of the different collusive schemes might not coincide with that of their sustainability. We develop two super-games, one where firms simultaneously choose price and quality in the stage game, and one sequential where qualities are chosen before prices. For the functional forms we use, we find that in the simultaneous game a partial price cartel will never emerge, because while being more profitable than a quality cartel, it is not as sustainable; and when discount factors are large enough to sustain the price cartel, a (more profitable) full cartel on price and quality is also sustainable. A sequential stage game brings back the possibility of finding partial price cartels, depending on parameter values. We also provide an ordering of all values of quality and price for all of cartels, deviations and competition.

Congestion in the bathtub
by
Mogens Fosgerau

Presenter: *Mogens Fosgerau*

Abstract:
This paper presents a model of urban traffic congestion. It is similar to the seminal Vickrey bottleneck model, but allows for hypercongestion. Hypercongestion has fundamental importance for the costs of congestion and the effect of policies such as road pricing, transit provision and traffic management, treated in the paper. Following recent empirical evidence, speed varies over time according to the instantaneous density of cars in motion but is constant across space: congestion equalizes over space like water in a bathtub.
In the simplest version of the model, the unregulated Nash equilibrium is also the social optimum among a wide range of potential outcomes and any reasonable road pricing scheme will be welfare

decreasing. Large welfare gains can be achieved through road pricing when there is hypercongestion and travelers are heterogeneous.

Th. 15:15 – 15:40

Robot cars in the bottleneck model: the effects on capacity, value of time and preference heterogeneity
by
Vincent A.C. van den Berg, Erik T. Verhoef and Sylvia Bleker

Presenter: *Vincent van den Berg*

Abstract
'Robot cars'—also referred to as self-driving or autonomous cars—are cars that drive themselves. They can drive closer together than human driver 'normal cars' and thereby raise road capacity. But besides this capacity effect, people who use a robot car instead of a normal car also gain a decrease in their value of time (VOT) because travel time can now be spent on other activities besides driving. This also means that the VOT becomes (more) heterogeneous (unless all drivers use a normal or robot car).

In the base model, there is one VOT for normal cars and another lower VOT for robot cars. Increasing the share of users with a robot car raises capacity and lowers VOTs (of those users who switch car type), but it also hurts users who already had a robot car as the switching users now have a lower VOT and this increases their bottleneck congestion externalities (Lindsey, 2004; Van den Berg and Verhoef, 2011a). Increasing the share with a robot car not only lowers travel cost by increasing capacity and lowering the VOT of switching users, but also raises total bottleneck congestion cost.

When the capacity effect dominates, buying a robot imposes a positive externality, in that it lowers the cost for other users; when the heterogeneity effect dominates, it imposes a negative externality. The numerical analyses show that the former positive externality case is most likely, but that a negative externality may occur if the effect on capacity is small (e.g. a 25% increase, where the literature review suggests that such a small effect may occur).

Besides socially-optimal provision of robot cars, we also study provision at marginal production cost and monopolistic provision. Due to the externality it is not (second-best) socially optimal to provide robot cars at marginal production cost and typically a subsidy is needed. The monopolistic car supplier adds a mark-up to its purchase price and tends to leads to an even larger undersupply than marginal cost provision.

Th. 15:40 – 16:05

Does public transit reduce car travel externalities?
Quasi-natural experiments' evidence from transit strikes
by
Martin W. Adler and Jos N. van Ommeren

Presenter: *Martin Adler*

Abstract:
One of the main unanswered questions in the field of urban economics is to which extent subsidies to public transit are justified. We examine one of the main benefits of public transit, a reduction in car congestion externalities, the so-called congestion relief benefit, using quasi-natural experimental data on citywide public transit strikes for Rotterdam. On weekdays, a strike induces car speed to decrease only marginally on the highway ring road (by 3 percent) but substantially on inner city roads (by 10 percent). During rush hour, the strike effect is much more pronounced. The congestion relief benefit is substantial, equivalent to about half of the public transit subsidy. We demonstrate that during weekends, car speed does not change noticeable due to strikes. Further, we show that public transit strikes induce similar increases in number of cyclists as number of car travelers suggesting that bicycling-promoting policies to reduce car congestion externalities might be attractive.

Th. 16:20 – 16:45

Equilibrium in the Bottleneck Model with Atomic and
Non-atomic Users
by
Hugo Silva, Robin Lindsey, André de Palma and Vincent van den Berg

Presenter: *Robin Lindsey*

Abstract:
Individual users of transportation facilities can control an appreciable fraction of total traffic. Examples include: commercial airlines at airports, major freight shippers, taxicab fleets, and large government departments. Large users have an incentive to "self-internalize" the congestion delays their vehicles or employees impose on each other. Large users therefore tend to make different travel decisions than small users. Routing decisions by large users have been studied in the literature, but departure-time decisions have been virtually ignored. One exception is Silva et al. (2014) who use the Vickrey bottleneck queuing model to address the existence and uniqueness of a deterministic user equilibrium (DUE) in departure times with large users. They show that DUE may not exist, and may not be unique. They assume that all users are large. The goal of this paper is to analyze mixtures of large and small users.

The first section of the paper uses optimal control theory to derive general necessary conditions for a DUE to exist. The second, longer, section considers a set of examples to address some questions: Under what parametric conditions does a DUE exist? If a DUE does exist, when do large users schedule their traffic relative to other users? Do they favour peak (i.e., congested) or off-peak periods? Does self-internalization of congestion by large users necessarily result in a reduction of their equilibrium costs? How does it affect other users' costs?

A wide range of outcomes turn out to be possible. Equilibria can exist in which large users avoid queuing altogether. Equilibria can also exist in which large users schedule part, or all, of their vehicle fleets during queuing periods. Self-internalization can also affect costs in diverse ways. Small users can end up either better or worse off — both as discrete user groups and in aggregate. Paradoxically, a large user can end up worse off itself because self-internalization induces other users to change their trip-scheduling decisions in a detrimental way.

Th. 16:45 – 17:10

Network market conduct with atomic and non-atomic players
by
André de Palma and Leonid Engelson

Presenter: *Andre de Palma*

Abstract:
We consider a Stackelberg game in a static network with two routes in parallel and two user groups: a continuum of cars and a fleet of trucks, coordinated by a single operator. The congestion functions are affine and group specific. Each car is non-atomic and ignores the impact of his route choice on congestion. On the contrary, the coordinator of the trucks internalize their own congestion and can predict the response of cars to her routing strategies. We consider several regimes: the coordinator reducing the total travel cost of the trucks, the system optimum, the second-best optimum with coordinator minimizing the total system cost, as well as the benchmark, with no coordination at all. We show that solution to the first regime coincides with user equilibrium for small number of trucks and may improve or worsen it for large number of trucks. The set of interior solutions for the first regime is not less than in the user equilibrium and not larger than in the second best. Finally, the route usage by trucks can be non-monotonic and perform multiple jumps when the size of the fleet gets larger.

Th. 17:10 – 17:35

The Deterministic Bottleneck Model with Non-Atomistic Traffic
by
Joseph I Daniel

Presenter: *Joseph I Daniel*

Abstract:
This paper investigates the conditions under which dominant airlines internalize self-imposed delays in a deterministic bottleneck model of airport pricing, complementing the similar analysis of Brueckner and Van Dender (BVD, 2008) for the standard congestion-pricing model. A unified model of bottleneck tolling includes untolled, uniform-, coarse-, multi-step-, and continuous-toll equilibria as special cases. Explicit closed-form solutions for aircraft scheduling and tolling provide a theoretical foundation for Daniel's (1995, 2008) empirical findings that dominant airlines often ignore self-imposed delays to preempt additional entry by fringe aircraft. Optimal tolls for dominant and fringe airlines have identical step increments but they may differ by a uniform amount, rather than varying in inverse proportion to market share as in BVD. The model is the price-setting dual of Daniel's (2014) quantity-setting slot constraint model, and achieves identical social costs. Optimal tolling pays for optimal airport capacity, under constant returns for building airport capacity.

Th. 17:35 – 18:00

Dynamic Equilibrium At A Congestible Facility Under Market Power
by
Erik Verhoef and HugoSilva

Presenter: *Erik Verhoef*

Abstract:
Various contributions to the recent literature on congestion pricing have demonstrated that when services at a congestible facility are provided by operators with market power, the case in point often being a few airlines jointly using a congested airport, optimal congestion pricing rules deviate from the familiar Pigouvian rule that tolls be equal to the marginal external costs. The reason is that an operator with market power has an incentive to internalize the congestion effects that its customers and vehicles impose upon one-another, so that Pigouvian tolling would lead to overpricing of congestion. More recent contributions to this literature, however, have brought to the fore that when congestion at the facility takes on the form of dynamic bottleneck congestion à la Vickrey (1969), where trip scheduling is the key behavioural margin, there may exist no Nash equilibrium in arrival schedules for oligopolistic operators also under rather plausible assumptions on parameters. This paper investigates whether in such cases, an equilibrium does exist for another congestion technology, namely the Henderson-Chu dynamic model of flow congestion. We find that a stable and unique equilibrium exists also in cases

where it fails to exist under bottleneck congestion (notably when the value of schedule late exceeds the value of travel delays). Our results suggest that self-internalization with only two firms leads to a considerable efficiency gain compared to the atomistic equilibrium (83% or more of the gain from first-best pricing in our numerical exercises).

Fr. 09:00 – 09:25

A Game of two cities:
A Toll Setting Game With Experimental Results
by
Simon Shepherd and Chandra Balijepalli

Presenter: *Simon Shepherd*

Abstract:
In this paper we model the competition between two cities as a game to maximise the welfare considering the impact of demand management strategies in the form of cordon tolls. This research builds on earlier work which studied the competition in a small tolled network meant for private modes of transport which have a choice of route. The earlier work showed that while both cities have an incentive to charge alone, once they begin, they are likely to fall into the 'Nash Trap' of a prisoner's dilemma where the incentive to defect is higher than that to cooperate thus eventually leading to a 'lose-lose' situation. The current paper extends the idea of competition between cities by setting up a system dynamic model of two cities which includes modes such as car, bus, train and walking and cycling. This paper innovates by integrating the simulation of land use transport interactions with a class room style experimental game and analyses the gaming strategies from a continuous repeated prisoner's dilemma involving setting of tolls to maximise the welfare of residents. The aim is to test (a) whether the strategies adopted are as theory predicts and (b) whether the players recognise the benefits of lower tolls when given information about the regulated solution and collaborate or continue to play to win. The results show that players respond to the information and maintain a collaborative solution which may have significant implications for regulation and the development of cities within regional partnerships.

Fr. 09:25 – 09:50

Joint Provision of International Transport Infrastructure
by
Se-il Mun, Yoshida Hon-machi and Sakyo-ku

Presenter: *Se-il Mun*

Abstract
We consider the following scheme for the development of cross-border transport infrastructure: two countries jointly establish an operator of the infrastructure that are responsible of collecting the user charge, maintenance, etc.; the costs for infrastructure investment are covered by .nancial contributions from two countries; and the revenue from infrastructure charge is distributed according to the share of contributions. The governments of two countries choose the amount of contribution so as to maximize

the national welfare. Assuming that the infrastructure use is non-rival, we show that .nancing infrastructure by the revenue from user charges is better than .nancing by tax revenue. We extend the analysis by incorporating congestion in infrastructure use. It is shown that independent decisions on contributions by two governments attains the first-best optimum when the operator sets the user charge so that the toll revenue just covers the cost for the investment. We further examine the condition that joint provision is realized in Nash equilibrium.

Fr.09:50 – 10:15

Lobbying and the political economy of pricing access to commercial districts

by
Bruno de Borger and Antonio Russo

Presenter*: Bruno de Borger*

Abstract:
We develop a positive theory of parking fees or cordon tolls in downtown commercial districts of cities. The model accounts for the special interests of both downtown traditional retailers and superstores at the edge of the city, and it studies how lobbying activities by such groups shapes the government's policy. Our baseline model shows that central city retailers typically have steeper lobbying contribution schedules than superstores, so that lobbying by both groups leads the government to underprice transport in the city's commercial district. Introducing the possibility of "multiple-stop shopping" further weakens the incentives of suburban large stores to lobby for tighter traffic measures in the central shopping street, resulting in even lower parking charges. Introducing an alternative travel mode (e.g. public transport) to the central shopping area weakens the link between profits of traditional retailers and the cost of reaching their premises by car. However, we find that, unless all consumers who shop in the traditional retail district go by public transport, our baseline results do not fundamentally change. Finally, extending the model to allow for lobbying by residents within the traditional retail district we find that residents may lobby for higher or lower parking fees, depending on the their relative concern for the vitality of the central district. As a consequence, depending on parameter values, the outcome of lobbying may produce parking fees below or above first-best levels. These results are in line with empirical observations.

Fr. 10:15 – 10:40

Cabotage: The Effects Of Foreign Airline Competition
On Fares In U.S. Domestic Markets
by
Clifford Winston, Jia Yan and Quentin Karpilow

Presenter: *Clifford Winston*

Abstract:
Travelers on U.S. domestic and international airline routes have enjoyed the benefits of unregulated airline competition in fits and starts. The 1978 Airline Deregulation Act removed government controls on U.S. carriers' fares, entry, and exit behavior in U.S. markets and beginning in the early 1990s open

skies agreements removed those government controls on U.S. and foreign carriers in certain international markets. However, foreign airlines are still prevented from providing service between American cities, which denies travelers the full benefits of open skies and deregulated airline markets. Consolidations between the major U.S. carriers during the past decade have led to growing concerns that the U.S. airline industry is becoming less competitive, enabling carriers to keep tighter control over their capacity, which leads to higher fares. Thus new entry, which would occur if foreign airlines were granted cabotage rights to serve U.S. markets, would be welcome to stimulate competition.
This paper presents, to the best of our knowledge, the first empirical analysis of the effects of granting cabotage rights on U.S. travelers' fares. Although no foreign airlines serve U.S. routes, it is possible to obtain a plausible estimate of the effects of entry by low-cost foreign carriers on those routes' fares by using a difference-in-difference (DID) matching estimator, which determines the effect of entry by low-cost carriers (LCCs) on fares in European markets and then translates the effect on fares in European markets into U.S. markets. We find that entry by European LCCs in U.S. markets could supply effective competition that reduces fares.

Fr.10:55 – 11:20

Modelling Changes in European Air Traffic Control Provision:
a Network Congestion Game
by
Nicole Adler, Eran Hanany and Stef Proost

Presenter: *Nicole Adler*

Abstract:
In order to analyse potential paths for change in air traffic management in Europe, we develop a network congestion game to test a series of scenarios. The two stage game models air traffic control (ATC) providers that set peak/off-peak charges and in the second stage airlines that choose flight paths

given an airline schedule and the charges from the first stage. The scenarios analysed in the model include (i) the impact of privatization and deregulation; (ii) defragmentation of the set of current providers; (iii) introduction of technology via the pilot common projects and SESAR step 1; and (iv) the regional forerunner approach in which ATC providers and a specific airline co-operate. The results show that horizontal integration across ATC providers, known as functional airspace blocks, would appear to be problematic with respect to incentives hence regional forerunners in a bottom-up institutional process would appear to be a preferable approach. Vertical integration between companies may succeed in accelerating change as long as the ATC companies are permitted to charge for improved quality, such as reduced congestion, via higher peak charges as a function of standardized equipment purchases. Institutionally, a clear separation of the ATC providers from the Member States and subsequent franchising of the support and ATC services could further encourage efficiency, consolidation and technology adoption.

Fr. 11:20 – 11:45

Platform pricing and consumer foresight: the case of airports
by
Ricardo Flores-Fillol, Alberto Iozzi and Tommaso Valletti

Presenter: *Ricardo Flores-Fillol*

Abstract:
Airports have become platforms that derive revenues from both aeronautical and, increasingly, commercial activities. The demand for these services is characterized by a one-way complementarity in that only air travelers can purchase retail goods at the airport terminals. We analyze a model of optimal airport behavior in which this one-way complementarity is subject to consumer foresight, i.e., consumers may not anticipate in full the ex post retail surplus when purchasing a flight ticket. An airport sets landing fees, and, in addition, also chooses the retail market structure by selecting the number of retail concessions to be awarded. We find that, with perfectly myopic consumers, the airport chooses to attract more passengers via low landing fees, and also sets the minimum possible number of retailers in order to increase the concessions' revenues, from which it obtains the largest share of profits. However, even a very small amount of anticipation of the consumer surplus from retail activities changes significantly the airport's choices: the optimal airport policy is dependent on the degree of differentiation in the retail market. When consumers instead have perfect foresight, the airport establishes a very competitive retail market, where consumers enjoy a large surplus. This attracts passengers and it is exploited by the airport by charging higher landing fees, which then constitute the largest share of its profits. Overall, the airport's profits are maximal when consumers have perfect foresight.

The Effect of Government Corruption on the Efficiency of U.S. Commercial Airports

by
Jia Yan and Tae Hoon Oum

Presenter: *Tae Oum*

Abstract:
In this paper, we argue that the cost of providing public goods is affected by local government corruption because bureaucrats have no strong incentives to pursue mandated tasks under a corrupt environment. Commercial airports in the United States are chosen to demonstrate such impacts of corruption. We first develop a theory which predicts the impacts of corruption on productivity and variable input allocation of airports. We then test the predictions by estimating a stochastic variable cost frontier model which incorporates both technical and allocative efficiency of airports. The empirical evidence confirms the theoretical predictions by revealing the following: 1) airports are less productive in more corrupt environments; and 2) airports tend to use more contracting-out to replace in-house labor in more corrupt environments. The findings can be applied to the context of other public goods and have important policy implications for reforming governance structure of public good provision.

Alternative regimes of airport privatization

by
Ó. Álvarez-San Jaime, P. Cantos-Sánchez,
R. Moner-Colonques and J. J. Sempere-Monerris

Presenter: *Pedro Cantos*

Abstract:
There is an extensive literature devoted to the economic analysis of airports and airline markets. The review by Zhang and Czerny (2012) offers a wide and updated description of the most relevant research on this issue. Recently, the Spanish government has announced the privatization of AENA, the entity that groups and owns the whole system of public airports in Spain. Many questions have sprung related with the implications of this process. Should this process be undertaken for the whole airport network, or should it be undertaken only for a group of airports? If only for a group, which one? What will be the implications of this process in terms of prices, frequencies and surplus for the passengers and the industry?
Our objective is to move forward the literature on airport pricing and privatization. The model is based on a hub-spoke structure. There are three airports, two of them are public and located in a given country, A and H, and the third, B, is located elsewhere. Thus, there are two types of routes, a domestic

one that connects A and H plus an international route connecting H and B. In this network we assume that the structure of the airline market in the domestic route is a monopoly whereas that in the international route is a duopoly. We shall characterize the equilibrium outcome of several three stage games where airports choose landing/take off fees, and airlines choose the number of flights and finally prices. This framework allows us to analyze various privatization regimes. In particular, either A and H are privatized, or just one of them is. The reallocation of traffic induced by a particular ownership, due to changes in the landing/take off fees, will finally determine which privatization regime is socially desirable from a domestic viewpoint and delivers higher government revenues.

Fr. 13:20 – 13:45

Price differentiation and discrimination in transport networks
by
Harry van der Weijde

Presenter: *Harry van der Weijde*

Abstract
This paper analyzes the effects of price differentiation and discrimination by a monopolistic transport operator, which sets fares in a congestible network. Using three models, with different spatial structures, we describe the operator's optimal strategies in an unregulated market, a market where price differentiation is not allowed (i.e., ticket prices must be uniform across users), and a market where price discrimination is illegal (i.e., ticket prices must only differ with users' marginal costs), and analyze the welfare effects of uniform and non-discriminatory pricing policies. The three models allow us to consider three different forms of price differentiation and discrimination in networks: by user class, by origin-destination pair, and by route.
We generalize the existing literature, in which groups usually only differ in their value of time, and hence, there is no distinction between differentiation and discrimination. In our models, users may also have different marginal external costs; we show how these two differences interact. We also show how uniform and non-discriminatory policies can increase or decrease welfare, and that uniform pricing can be better than non-discriminatory pricing, despite the latter being the 'fairest' pricing structure. The network models show that results obtained for a single-link network can be generalized to a situation where operators price-discriminate or differentiate based on users' origins and destinations, but not directly to a situation in which differentiation is based on route choices.

Fr. 13:45 – 14:10

Input Third-Degree price discrimination by congestible facilities
by
Hugo Silva Montalva

Presenter: *Hugo Silva Montalva*

Abstract:
This paper studies third-degree price discrimination by transport facilities, such as airports and seaports, which sell access to the infrastructure as a necessary input for downstream production. These facilities are prone to congestion --which makes downstream markets interrelated-- and their ownership structure is diverse, varying from public (domestic welfare maximizing) to private (profit maximizing). We show that input price discrimination by a private supplier can increase aggregate output and increase welfare in a setting where, in absence of congestion, output does not change and welfare is reduced when price discrimination is allowed. Therefore, the presence of negative consumption externalities enlarges the extent to which input price discrimination is desirable. We also analyze the effects of price discrimination by a public facility and describe the conditions under which banning input price discrimination is efficient for both types of ownership forms. We argue that there is a limited scope for this to occur, which suggests that the current practice of enforcing a broad ban on input price discrimination that covers congestible facilities with different ownership forms may have to be revised.

Fr. 14:10 – 14:35

Markups and Scale Elasticities for Differentiated Railroad Networks

by
Taylor K. McKenzie and Wesley W. Wilson

Presenter: *Wesley Wilson*

Abstract:
Railroads operate over expansive and differentiated networks and provide a multitude of different services. Each of the services differs in terms of demand and cost characteristics, and each location and shipment may face different sources and levels of competition.   In this paper, we develop and estimate a model that provides both markups and scale elasticities that vary across railroads and through time for the traffic on their networks.   Our model is based on a framework provided by Hall (1986) and Klette (1998) wherein markups and scale elasticities are estimated from production relations. In our model, we aggregate the shipments over each firm's network, which provides a mapping from inputs and network and shipment characteristics to aggregate outputs over the network.   Markups and scale elasticities are taken to follow a multivariate distribution. This allows for differences in markups and scale across firms and through time, but also for covariances across firms in markups and scale.   We

estimate the model with Bayesian methods to find markups that are generally well in excess of marginal costs and scale elasticities that generally point to increasing or constant returns in the industry.

Fr. 14:35 – 15:00

Uncertainty Types and Identification
by
Achim Czerny, Erik Verhoef and Anming Zhang

Presenter: *Achim Czerny*

Abstract:
This paper distinguishes uncertainty types that differ with respect to the degree to which uncertainty affects the optimal price or quantity. Monopoly and welfare examples are used to show that seemingly strong assumptions on functional forms can represent a wide variety of different scenarios, while seemingly innocent (implicit) assumptions on uncertainty types can lead to quite special results. The monopoly example is further used to show that a firm can benefit from uncertainty only if a high price is associated with high quantity (and vice-versa) and that, in transport, uncertainty increases optimal frequency only if prices are more uncertain relative to quantities. The welfare example is further used to analyze the optimality of prices versus quota to control for congestion externalities. Here, we derive the practical and intuitive policy recommendation that prices should be preferred from the social viewpoint if welfare-optimal prices are less uncertain relative to welfare-optimal quotas.

Fr. 15:15 – 15:40

Endogenous preferences and network effects in the demand for electric vehicles
by
Sylvia Bleker, Christiaan Behrens, Paul Koster and Erik Verhoef

Presenter: *Sylvia Bleker*

Abstract:
The market for personal vehicles exhibits network effects, thus it is difficult for new, environmentally friendly, technologies to gain significant market share. This is often the reasoning behind government subsidies on electric vehicles (EV's). Temporary subsidies lower the price enough to entice sufficient consumers to buy and thereby create a customer base, after which the subsidies are no longer necessary. Governments are interested in building a customer base, since EV's create less pollution and thereby increase societal welfare relative to standard vehicles with internal combustion engines (ICV's). In this paper we investigate optimal subsidy policies of governments when they can subsidize EV's in multiple ways. We assume there are two products in the market, an ICV and an EV, each produced by a different firm. A consumer in this market decides whether to buy the ICV or the EV based on which option gives the higher utility. For a specific consumer, utility of a vehicle depends on the preference for

environmentally friendly technologies of the consumer, on the purchase price of the vehicle, and on expected search costs associated with that type of vehicle. Search costs stem from the fact that a consumer needs to refuel frequently. When there are more refueling stations available, search costs decrease. We assume that the number of refueling stations of a technology increase with the number of consumers buying that technology, thereby introducing network effects into the model. Thus, utility of a technology depends on the expected number of consumers buying a car of that same technology, through expected search costs. We assume that the environmental preference parameter is distributed among the population according to the type 1 extreme value distribution. Thus, consumers make decisions on which car to buy as in a multinomial logit model, where deterministic utility of each option is determined by purchase price and expected search costs (which is determined by expected demand). We then solve the model using the rational expectations equilibrium, where expectations on demand are correct and equal actual demand. Additionally, we assume that the government can subsidize EV's in two different ways. The government can set a direct subsidy for consumers on the purchase price of the EV. Additionally, the government can build refueling stations, in addition to the ones created through demand, thereby lowering expected search costs. We are interested in how the government will trade or between the cost of subsidies and the societal cost of pollution. Additionally, we investigate how the government combines both instruments for EV subsidization. We compare welfare in the cases of no subsidies, only one instrument, or both. Even though the model used is a simplification of actual markets, the results will be able to shed light on the effectiveness of several policy instruments available to governments

Fr. 15:40 – 16:05

Consumer surplus: does it need an apology?
by
Christiaan Behrens and Erik Verhoef

Presenter: *Christiaan Behrens*

Abstract:
In this article we address the simple question whether we should apologize when using the practical Marshallian measure of consumer surplus in determining the social optimal level of continuous policy instruments, such as pricing tools. Although it is well-known that measures based on uncompensated demand functions generally do not yield exact changes in consumer well-being, we show that the choice of benefit measure, e.g. compensating (equivalent) variation or consumer surplus, does not lead to other policy recommendations for a large set of first- and second-best public policy questions. In a simple model set-up looking at a congestible good, we show that whether the regulator's objective function includes the integral under the compensated or uncompensated demand function, the resulting equilibrium is socially optimal, i.e. marginal benefits equal marginal costs, with and without rebating tax revenues. Particularly, only if the reference price used for the Hicksian measure is equal to the optimal price, both measures yield the same equilibrium, otherwise using Hicksian measures yields biased predictions of the equilibrium and multiple iterations are needed to arrive at the social optimum.

Fr. 16:05 – 16:30

Cost-Efficiency Benchmarking Of Eueopean Air Navigation Service Providers

by

Volodymyr Bilotkach, Simone Gitto, Radosav Jovanović, Juergen Mueller and Eric Pels

Presenter: *Eric Pels*

Abstract:
This study uses EUROCONTROL data on operating performance of the national air navigation service providers over the 2002-2011 time period to document in detail the efficiency changes across providers and time using data envelopment analysis. Our results suggest that overall providers' productivity improved over the time period covered by the data, driven by improvements in technical rather than allocative efficiency. However, some trend reversals in the post-2008 crisis period are also observed.

Fr. 16:45 – 17:10

Parking and Urban Form

by

Jan K. Brueckner and Sofia F. Franco

Presenter: *Jan Brueckner*

Abstract:
This paper analyzes the provision of residential parking in a monocentric city, with the ultimate goal of appraising the desirability and effects of regulations such as a minimum-parking requirement (MPR) per dwelling. The analysis considers three different regimes for provision of parking space: surface parking, underground parking, and structural parking, with the latter two regimes involving capital investment either in the form of an underground parking garage or an above-ground parking structure. Parking area is viewed as a dwelling attribute that, along with floor space, provides utility. In addition, road congestion in the neighborhood (which affects the commuting costs of local residents) depends on the average amount of off-street parking per dwelling, an externality that is ignored by profit-maximizing developers, making the equilibrium inefficient. The analysis explores the equilibrium spatial behavior of the two dwelling attributes as well as residential and parking structural density, and analysis of land rent shows which parking regimes are present in different parts of the city. Efficiency requires an increase in parking area per dwelling at each location, which can be achieved in a crude fashion by an MPR, whose effects are analyzed.

Fr. 17:10 – 17:35

Congestion pricing in urban polycentric networks with distortions outside the transport system: a model tailored for the area of Randstad.
by
Ioannis Tikoudis

Presenter: *Ioannis Tikoudis*

Abstract
The paper presents a polycentric general equilibrium model with congestion externalities, distortionary taxation and suboptimal provision of public transport, calibrated to fit the key empirical regularities of the regional economy and transport system of Randstad conglomeration. In line with earlier research on congestion pricing in the presence of distortions outside the transport system, the model predicts that a Pigouvian road tax with revenue returned lump-sum could be pretty harmful for the average household of the region. Using plausible labor and property tax rates, the annual welfare losses are shown to exceed € 1000. Furthermore, the paper investigates the impact of other proposed pricing schemes (e.g. a system of cordon tolls around the largest cities) and the conditions under which a pricing scheme without any sophisticated revenue recycling program could provide substantial welfare gains.

Fr. 17:35 – 18.00

The impact of land use policies and highway connections on urban development
by
Or Levkovich and Jan Rouwendal

Presenter: *Or Levkovich*

Abstract:
In this paper we investigate land use policy in the Netherlands by analyzing transactions of ready-to-be developed land provided by the Dutch Land Register (Kadaster). The Netherlands is a densely populated country where land use restrictions are abundant. The factual tightness of these restrictions and their impact on urban development is not clear. Previous literature has mainly concentrated on residential land prices, but we also observe transactions for industrial land. The distinction is important because zoning has the potential of segmenting the market for land by spatially separating the various uses by zoning.
After reviewing the relevant literature we develop a model of an urbanized area with dispersed employment and housing. We use this model to derive equations for the prices of residential and industrial land in the various locations of this urbanized area. In a competitive land market, arbitrage ensures that land prices for all uses present in a zone are equalized. This provides a clear benchmark

case. Preliminary results confirm the segmentation of the land market and substantial differences in the prices of industrial and residential land that is ready to be developed. Our findings suggest that land regulations and "active" land use policy implemented by municipalities have a significant effect on the differences between the value of newly developed land for residential and industrial use. Areas which have stricter land use restrictions generally present higher land values, and residential values are more strongly affected by land regulation compared with industrial land values. The results also confirm that higher provision of urban amenities results in higher residential land values, and better accessible areas are valued more by residents and firms alike.