The role of intention as mediator between latent effects and behavior: application of a hybrid choice model to study departure time choices

An increasing number of papers are focusing on integrating psychological aspects into the typical discrete choice models. The majority of these studies account for several latent effects, but they mainly focused on the direct effect of attitudes, perception, and norms in the discrete choice. None of them consider the effect of intention and its role as mediator between those psychological effects and the choice, as implied in the Theory of Planned Behavior. In this paper we contribute to the literature in this field by specifically studying the direct effect of the intention on the actual behavior, while attitude, social norms, and perceived behavioral control affect the intention to behave in a given way. We apply a hybrid choice model to study the departure time choice. For this, we use data from Danish commuters in the morning rush hours in the Greater Copenhagen area. We find a significant effect of the intention to arrive at work on time on the departing time choice, and also a significant effect of the lower level mediators on intention. Furthermore, the attitude toward short travel time is also significant in explaining the departure time choice. Finally, in terms of forecasting, we find that individuals who have a strong intention to be at work on time will be less likely to reschedule their departure time. This suggests that campaigns targeting the working culture could affect the subject norms among colleagues, which in turn influence individuals' intention to be on time or to reschedule to a less congested time slot.
A disaggregate freight transport chain choice model for Europe
This paper presents the estimation of a discrete freight transport chain choice model for Europe, which was developed for the European Union as part of the Transtools 3 project. The model describes nine different multi- and single mode chain alternatives of which three can be either container or non-containerised, and it segments freight into dry bulk, liquid bulk, containers and general cargo. The model was estimated on the basis of disaggregate data at the shipment level (Swedish CFS and French ECHO data). Several transport costs specifications and nesting structures were tested and elasticities compared with reference literature. It was found that freight models are characterised by heterogeneity, non-linearity in transport costs and hence Value of Times and non-constant rates of substitution. Not taking these elements into account will have consequences for the evaluation of transport policies using the freight transport model.
A spline function class suitable for demand models

A function class suitable for estimating cost preferences in demand models is presented. The function class is applicable to any positive cost variable and is designed to be: (i) monotonically decreasing, (ii) to have decreasing marginal sensitivity with respect to cost, and (iii) to be differentiable at every point. It is shown how suitable functions can be formed from sequences of tailored functions in a manner that ensures their continuity and differentiability at the knot points. The proposed functions are well suited for demand models where price elasticities exhibit a damped pattern as the values of their argument increase. The usual linear-in-parameter functions or non-linear functions, such as the Box-Cox function, do not have an equally flexible way of accounting for such a pattern. This can be relevant when estimating transport demand models where the sensitivity of demand with respect to transport costs is known to decline as the cost increases, i.e. the phenomenon of “cost-damping”. However, it may also be relevant as a means to capture the marginal return of investments or declining marginal utility of income. To provide an illustration, the functions are incorporated in a multinomial logit model that is estimated from synthetically generated data by maximum likelihood. A Monte Carlo simulation study shows that the estimator is able to recover the true parameters.1 The practical application of the function class is also considered within the new large-scale Danish National Transport Model.

Population synthesis is concerned with the generation of synthetic yet realistic representations of populations. It is a fundamental problem in the modeling of transport where the synthetic populations of micro agents represent a key input to most agent-based models. In this paper, a new methodological framework for how to grow pools of micro agents is presented. This is accomplished by adopting a deep generative modeling approach from machine learning based on a Variational Autoencoder (VAE) framework. Compared to the previous population synthesis approaches based on Iterative Proportional Fitting (IPF), Markov Chain Monte Carlo (MCMC) sampling or traditional generative models, the proposed method allows unparalleled scalability with respect to the number and types of attributes. In contrast to the approaches that rely on approximating the joint distribution in the observed data space, VAE learns its compressed latent representation. The advantage of the compressed representation is that it avoids the problem of the generated samples being trapped in local minima when the number of attributes becomes large. The problem is illustrated using the Danish National Travel Survey data, where the Gibbs sampler fails to generate a population with 21 attributes (corresponding to the 121-dimensional joint distribution). At the same time, VAE shows acceptable performance when 47 attributes (corresponding to the 357-dimensional joint distribution) are used. Moreover, VAE allows for growing agents that are virtually different from those in the original data but have similar statistical properties and correlation structure. The presented approach will help modelers to generate better and richer populations with a high level of detail, including smaller zones, personal details and travel preferences.

Den danske landstrafikmodel Version 2.0


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Fremskrivningstendenser for persontrafikken til 2030

Intelligent truck platooning: how to make it work

Platooning of trucks is a means to improve efficiency in the road transportation of goods. Truck platooning can lead to fuel savings in the order of 5-10%, but may also yield substantially larger benefits by, fully or partially, obviating drivers. This may be possible in situations where drivers, who engage in platooning activities, can rest while they are not the leading truck. In this paper we argue that forming truck platoons is unlikely to be successful if based on an ‘on-the-fly’ principle. Rather, a system of "platooning-stations" is required for forming platoons off the road. In the paper we propose a simple greedy-algorithm and subsequent local search for achieving locally optimal platoons at such stations. The solution reflects an optimisation of shared mileage among members of each platoon and is solved in discrete time-steps at each
station. As a final contribution, we investigate the potential of the proposed algorithm in a real-world case by investigating platoon formation under a variety of circumstances for an artificial platooning station located close the Elb-tunnel. More specifically, we consider the generated route-path of 1500 trucks crossing this location and calculate optimal solutions for a variety of different design criteria's.

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**Large-scale spatial population synthesis for Denmark**

The recent development in micro-based transport models is a major step towards an improved understanding of transport demand and its underlying drivers. By adapting a detailed geographical resolution level and a fine-grained social description of individuals it becomes possible to investigate distribution effects across social classes and geographical spaces, elements which were not possible to take into account until recently. However, the increasing amount of details comes at a cost. As the prediction-space is enlarged, models become increasingly dependent on the quality of inputs and exogenous model assumptions of which the formation of synthetic population forecasts is by far the most important one. The paper presents a coherent description of a large-scale population synthesis framework involving all relevant steps in the synthesis stages from target harmonisation, matrix fitting, post simulation of households and agents and reweighting of the final population. The model is implemented in the Danish National Transport Model and is aimed at predicting the entire Danish population at a very detailed spatial and social level. In the paper we offer some insight with respect to the propagation of sampling noise caused by the household simulation stage and a brief validation of the model when comparing a modelled 2015 population with observed data.

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Population Synthesis Meets Deep Generative Modelling
Agent-based transport models depend to a high degree on the formation of the underlying population. Models and methods for generating such populations, possibly under constraints to reflect future margins, are commonly referred to as “population synthesis” models. Historically, different approaches have been proposed, ranging from deterministic
approaches, such as the Iterative Proportional Fitting (IPF) algorithm (Deming and Stephan, 1940; Rich and Mulalic, 2012), to simulation based approaches of the Markov Chain Monte Carlo (MCMC) type (Farooq et al., 2013). Often, matrix fitting methods such as the IPF has been used in combination with postsimulation based methods in order to translate prototypical individuals into true micro agents. While the existing models are capable of producing acceptable results for agents with relative few socioeconomic and spatial characteristics, these methods do not scale well when the dimensionality of the underlying distribution becomes large. As a result, in many cases, these methods are not able to accommodate the increasing need for more dimensions that result from, e.g. smaller zones, the combination of household-based and individual-based synthesis and more detailed variables in general. In this paper, we propose a different approach to population synthesis based on generative models from the deep learning framework. Contrarily to existing methods, these new methods are scalable and can handle a very large number of both numerical and categorical attributes at the same time.

Modelling production-consumption flows of goods in Europe: the trade model within Transtools3
The paper presents a new model for trade flows in Europe that is integrated with a logistics model for transport chain choice through Logsum variables. Logsums measures accessibility across an entire multi-modal logistical chain, and are calculated from a logistics model that has been estimated on disaggregated micro data and then used as an input variable in the trade model. Using Logsums in a trade model is new in applied large-scale freight models, where previous models have simply relied on the distance (e.g. crow-fly) between zones. This linkage of accessibility to the trade model makes it possible to evaluate how changes in policies on transport costs and changes in multi-modal networks will influence trade patterns. As an example the paper presents outcomes for a European-wide truck tolling scenario, which showcases to which extent trade is influenced by such a policy. The paper discusses how such a complex model can be estimated and considers the choice of mathematical formulation and the link between the trade model and logistics model. In the outcomes for the tolling scenario we decompose the total effects into effects from the trade model and effects from the logistics model.

Testing the slope model of scheduling preferences on stated preference data
The valuation of travel time variability is derived either from a structural model, given information on departure time, or directly from a reduced-form model where departure time is assumed to be optimally chosen. The two models are theoretically equivalent under certain assumptions, hence are expected to yield similar results. We use stated preference data to compare the valuation of travel time variability under a structural model where trip-timing preferences are defined in terms of time-dependent utility rates, the “slope model”, against its reduced-form model. Two choice experiments are
used that are identical except one has a fixed departure time while the other allows respondents to choose departure time freely. The empirical results in this paper do not support the theoretical equivalence of the two models as the implied value of travel time variability under the reduced-form model is an order of magnitude larger. This finding, which is robust to various specification tests, is in line with a recent Swedish study by Börjesson, Eliasson and Franklin [Transportation Research Part B: Methodological, 46(7), 855–873 (2012)]. Since our data allows a direct comparison of the two approaches, we are able to rule out some potential explanations lined up by past research for the observed discrepancy between the two models.
Cost damping and functional form in transport models

Transport models allowing for cost damping are characterised by marginally decreasing cost sensitivities in demand. As a result, cost damping is a model extension of the simple linear-in-cost model requiring an appropriate non-linear link function between utility and cost. The link function may take different forms and be represented as a non-linear-in-parameter form such as the well-known Box–Cox function. However, it could also be specified as non-linear-in-cost but linear-in-parameter forms, which are easier to estimate and improve model fit without increasing the number of parameters. The specific contributions of the paper are as follows. Firstly, we discuss the phenomenon of cost damping in details and specifically why it occurs. Secondly, we provide a test of damping and an easy assessment of the (linear) damping rate for any variable by estimating two auxiliary linear models. This turns out to be an important guidance as the damping rate largely dictates which link functions are appropriate for the data. Thirdly, inspired by the Box–Cox function, we propose alternative linear-in-parameter link functions, some of which are based on interpolation of approximate Box–Cox end points, and others which are inspired by Taylor Expansions. The different functions are tested in simulation experiments and subsequently in a large-scale demand model based on more than 22,000 revealed preference observations. It is concluded that the use of properly specified linear-in-parameter functions gives good data fit and sometimes even outperforms the Box–Cox functions without increasing the number of parameters.

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How flexible is flexible? Accounting for the effect of rescheduling possibilities in choice of departure time for work trips

In departure time studies it is crucial to ascertain whether or not individuals are flexible in their choices. Previous studies have found that individuals with flexible work times have a lower value of time for late arrivals. Flexibility is usually measured in terms of flexible work start time or in terms of constraints in arrival time at work. Although used for the same purpose, these two questions can convey different types of information. Moreover, constraints in departure time are often related not only to the main work activity, but to all daily activities. The objective of this paper is to investigate the effect of constraints in work and in other daily trips/activities on the willingness to shift departure time and the willingness to pay for reducing travel time and travel delay. We set up a survey to collect detailed data on the full 24-hour out-of-home activities and on the constraints for each of these activities. We then built a stated preference experiment to infer preferences on departure time choice, and estimated a mixed logit model, based on the scheduling model, to account for the effects of daily activity schedules and their constraints. Our results show that measuring flexibility in terms of work start time or constraints at work does not provide exactly the same information. Since one-third of the workers with flexible working hours in the survey indicated that they have restrictions on late work-arrival times, their willingness to pay will be overestimated (almost doubled) if flexibility information is asked only in terms of fixed/flexible working hours. This clearly leads to different conclusion in terms of demand sensitivity to reschedule to a later departure time. We also found that having other activities and constraints during the day increases the individuals' willingness to pay to avoid being late at work, where the presence of constraints on daily activities other than work is particularly relevant for individuals with no constraints at work. The important impact of these findings is that if we neglect the presence of constraints, as is common practise in transport models, it will generally lead to biased value-of-time estimates. Results clearly show that the shift in the departure time, especially towards a late departure time, is strongly overestimated (the predicted shift is more than double) when the effect of non-work activities and their constraints is not accounted for.

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The Danish national passenger model – Model specification and results

The paper describes the structure of the new Danish National Passenger model and provides on this basis a general discussion of large-scale model design, cost-damping and model validation. The paper aims at providing three main contributions to the existing literature. Firstly, at the general level, the paper provides a description of a large-scale forecast model with a discussion of the linkage between population synthesis, demand and assignment. Secondly, the paper gives specific attention to model specification and in particular choice of functional form and cost-damping. Specifically we suggest a family of logarithmic spline functions and illustrate how it is applied in the model. Thirdly and finally, we evaluate model sensitivity and performance by evaluating the distance distribution and elasticities. In the paper we present results where the spline-function is compared with more traditional function types and it is indicated that the spline-function provides a better description of the data. Results are also provided in the form of a back-casting exercise where the model is tested in a back-casting scenario to 2002.
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Departure time choice: Modelling individual preferences, intention and constraints.

Copenhagen – like most other major cities – is facing problems with congestion, (especially) related to commuting in dense urban areas, in which the demand is condensed in peak-hours (Mahmassani, 2000; The Forum of Municipalities, 2008). A number of studies have shown that people are more likely to change their departure time rather than changing their transport mode to avoid congestion (Hendrickson and Planke, 1984; SACTRA, 1994; Kroes et al., 1996; Hess et al., 2007a). Hence, understanding the departure time choice from an individual perspective is important to develop policies aimed to address growing congestion issues. A common approach to study departure time choices is the Scheduling Model originally formulated by Small (1982). Assuming that people have a specific preferred arrival time, the basic concept of the scheduling model is that individuals choose their departure time as a trade-off between travel time and a delay “penalty” resulting from being late or early. However, studying departure time choice is complicated as it is affected by additional factors. Firstly, it is related to a range of other trip-related decisions such as choice of mode, destination and trip purpose. Secondly, it is more generally related to the overall activity schedule of activities. Such an activity schedule is planned in coordination with household members as well as other social interactions, e.g. friends, colleagues, clients, etc. When considering activities within the activity schedule it is important to consider the level of flexibility (or lack of the same) as well. Flexibility is a complex issue affecting departure time in multiple dimensions. The most straightforward constraint when studying commuter trips is on the arrival time at the work place (e.g. due to individuals having fixed or flexible working hours) as the penalty of late arrival is very likely to be higher for individuals with constraints on arrival time. However, flexibility is not only a matter of fixed arrival time. Activities can be mandatory or discretionary (Yamamoto and Kitamura, 1999), performed alone or jointly with family and/or friends (Thorhauge et al., 2012), and restricted or non-restricted in terms of time and space (Bowman and Ben-Akiva, 2000). Depending on the type of activity, temporal, spatial and/or social constraints might play an important role in scheduling the activities and in choosing a specific departure time. Parallel with the micro-economic theory, the psychology literature has evidenced that individuals’ behaviours are driven by underlying latent constructs, such as attitude, norms and perceptions. In the past decades, more attention has been given to incorporate and understand underlying psychological effects (such as attitude, norms, etc.) into discrete choice models (Koppelman and Lyon, 1981; Ortúzar and Huett, 1984; McFadden, 1986). However, most studies usually focus only on a few latent constructs, often considering only attitudes (see e.g. Daly et al., 2012; Jensen et al., 2013; Paulissen et al., 2013; Kamargianni and Polydoropoulou, 2013; Kamargianni et al., 2014). None of these studies, nor any studies in the psychology literature, deal with the departure time problem. It is reasonable to believe that the departure time choice can also be substantially affected by individuals’ attitudes, norms and perception towards being on time (or towards reducing travel and cost) other than by objective measure of times and costs. Arellana et al. (2012) are the only ones who consider these effects in the context of departure time, though they focus only on attitudes. This thesis approaches the problem of the departure time choices for car commuters in the greater Copenhagen area under a more general framework that recognises that the choice of when to depart is affected by both micro-economic and psychological factors. Moreover, it is not an isolated decision, but rather a decision within a complex activity decision chain, where constraints imposed by one activity can V affect all other activities in the chain and in particular the preference for the departure time to work. Constraints can be objective (temporal, spatial and social) and directly affect individual departure time choice, but can also be perceived by the individuals as barriers towards participating in activities. Perceived constraints affect the departure time choice through the individual intention of being on time. This PhD thesis also contributes to the departure time literature by discussing the problem of collecting appropriate data to analyse departure time choices. The travel time variation observed in repeated preference data is usually not large enough to be able to identify departure time preferences. For this reason, much recent research has used stated preferences data. Building stated preference designs is especially challenging for departure time studies because of the interdependence among attributes and the challenge of ensuring realism in the stated questions. Orthogonal designs were the predominant way of building stated experimental designs, while nearly none of the departure time studies have relied on efficient experimental designs. Koster and Tseng (2009) presented the first efficient design for departure time studies. Later, Arellana et al. (2012b) developed a pivoted efficient design including activity participation time (i.e. duration) at work. In order to create the design they had to sacrifice the traditional one-step process of creating efficient designs, thus relying on a two-step efficient design which reduces the efficiency. To the best of my knowledge, no researchers have used a fully efficient stated preference experimental design for the scheduling model. Summarising, the contribution of this PhD thesis is as follows. Firstly, it provides evidence of a fully efficient stated choice design for a departure time context. Using a pivot design (Rose et al., 2008) built around a reference trip (usually from the day before), the thesis shows that the efficient design performs well in cases where good prior knowledge about the parameters is available. Secondly, it investigates the impact of accounting for a daily activity schedule and the corresponding constraints. It shows the importance of taking the daily activity schedule and their constraints into consideration. In particular, the thesis explores whether and to which extent the willingness to shift departure time to avoid congestion and willingness to pay for reducing travel time and travel delay to work is affected by the way information on flexibility at work is collected and by other trips/activities realised during the day and also whether they are constrained. The thesis also provides empirical evidences of the policy implication of not accounting for other activities and their constraints. Thirdly, the thesis shows that the departure time choice can be partly explained by psychological factors, which have previously been neglected by nearly all studies within departure time. More importantly it shows that the underlying psychological processes are more complex than simply accounting for attitudes and perceptions which are typically used in other areas. The work in this PhD thesis accounts for the full Theory
of Planned Behaviour (Ajzen, 1991), in which Intention act as a mediator between the underlying latent factors (attitude, norms, and perception). It was found that the psychological factors not only influenced the choice but also individual preferences.

System convergence in transport models: algorithms efficiency and output uncertainty
Transport models most often involve separate models for traffic assignment and demand. As a result, two different equilibrium mechanisms are involved, (i) the internal traffic assignment equilibrium, and (ii) the external equilibrium between the assignment model and the demand model. The objective of this paper is to analyse convergence performance for the external loop and to illustrate how an improper linkage between the converging parts can lead to substantial uncertainty in the final output. Although this loop is crucial for the performance of large-scale transport models it has not been analysed much in the literature. The paper first investigates several variants of the Method of Successive Averages (MSA) by simulation experiments on a toy-network. It is found that the simulation experiments produce support for a weighted MSA approach. The weighted MSA approach is then analysed on large-scale in the Danish National Transport Model (DNTM). It is revealed that system convergence requires that either demand or supply is without random noise but not both. In that case, if MSA is applied to the model output with random noise, it will converge effectively as the random effects are gradually dampened in the MSA process. In connection to DNTM it is shown that MSA works well when applied to travel-time averaging, whereas trip averaging is generally infected by random noise resulting from the assignment model. The latter implies that the minimum uncertainty in the final model output is dictated by the random noise in the assignment model.
Historically there has been a lack of knowledge with respect to long distance travel. Due to the considerable contribution of long distance travel to total travelled kilometres and the related energy consumption from the transport sector and derived impacts on greenhouse emissions, this is problematic. The average travel distance has steadily increased during the latest decades together with the increasing motorisation of daily travel and international aviation. Previously most focus has been on domestic daily travel activities, but globalisation has, together with changes in price structures and increasing income, emphasised a travel type segment with significant impact on the total level of travelling. International travel has increased its market shares considerably, and the strong relation with income changes suggests a travel type segment of significant importance regarding future travel behaviour and emissions from transportation in particular. ii The work of this thesis is not limited to a distinct definition of long distance travel, but explores long distance travel in a broader context. The analysis applies data from three different travel surveys: The Danish National Travel Survey (TU), the TU overnight survey, and the Danish Tourism Statistics from the Business and Holiday Survey (HBS). This has enabled focus on infrequent travel activities segmented relative to travel purpose, distance threshold, or travelling with overnight stays. At an overall level the thesis has three main objectives: i) to describe and combine empirical knowledge on Danish travel behaviour in relation to long distance travel, ii) to provide information on the troubles and uncertainties related to different travel survey methodologies, and iii) to reveal some of the drivers of long distance travel related to e.g. socio-economic variables. The analysis of Danish travel activities described in the three different travel surveys has outlined detailed information on Danish travel behaviour at an aggregated level during the past two decades. It has above all revealed the significant role of leisure travel. Private travel represents more than 60% of all travelled kilometres by individuals, and almost 25% alone stem from international holiday tourism even though international holiday travels represent only 0.1% of all travel activities. The study of holiday tourism has outlined some apparent trends that are of high relevance when considering future emissions from transportation. Besides the fact that the share of Danish holiday travellers has increased, the characteristics of the holiday activities have changed as well. The number of domestic holiday activities has stayed more or less constant and the growth is mainly observed in international travel and travel by plane in particular. The development in destinations is two-fold, with a substantial growth in destinations outside Europe as well as a significant growth in European weekend holiday activities. These travel activities are furthermore found to be more sensitive to income changes. The analyses of the three travel surveys also contribute to a validation of different survey methodologies and their ability to describe travels, with overnight stays, in a comprehensive way. The comparison of the travel surveys outlines the classical trade-off between sample sizes and survey uncertainties related to tailored retrospective travel surveys. From a three month retrospective survey it is found that travels with overnight stays are
underestimated by 11%, but also that a retrospective survey period is necessary to achieve representative samples. The memory loss of respondents is certainly present in a retrospective survey focusing on multiday travel even though travel activities with overnight stays, intuitively should be easier to recall than e.g. travelling above a specific distance threshold. The analysis stresses the importance of further targeting the travel activities of interest to reduce the impacts of memory loss or on the contrary to reduce the survey period. In addition to the descriptive statistics and the comparison of different travel surveys presented in part I of this thesis, the thesis includes four studies of travel behaviour presented in paper form in part II. The first paper outlines and exemplifies the presence and magnitude of different survey biases in the Danish National Travel Survey (TU). The study finds that response biases are heterogeneously distributed across the population and that the bias leads to significant overestimation of car ownership and a consequently underestimation of the respective income elasticity. The study evaluates the impact of measurement error and reveals considerable problems in the data collection of income which in this case reduces the income elasticity. The second paper includes all three Danish travel surveys in a study of leisure travel, with an analysis of the income elasticity of this travel segment. Due to the different survey methodologies, the samples of leisure activities describe the whole span from daily leisure travel activities embedded into people’s daily routines to the infrequent holiday activities. The applied model describes the travel distance of leisure travel including the probability of having leisure activities or not. The study finds increasing income elasticities of travelling or not and increasing income elasticities of travel distances as the leisure purposes become less frequently completed activities. This includes larger elasticities for long distance journeys and journeys with an overnight stay. The paper furthermore reveals and analyses differences in travel patterns for different regions in Denmark, and contribute hereby to an understanding of how future changes in location of the population will influence leisure travelling and the length of long distance travel behaviour. The income elasticity of long distance travel is also examined in the third paper. This study is based on the Danish expenditure survey and analyses consumption of plane tickets and travel packages in relation to the consumption on other non-durable goods. This study finds these infrequent travel activities to be somewhat more sensitive to income changes than found from the three travel surveys. The two different studies of income elasticities outline a wide span of income elasticities for leisure travel that varies between 0.1-1.4 when iv measured in terms of travel demand and from 0.2-0.6 when measured in terms of travel distances. The final paper differs from the others as it explores and evaluates the impacts of the Oresund Bridge ten years after its opening. The new bridge resulted in significant changes in travel behaviour that was not as dominated by long distance leisure travel activities as expected, but rather resulted in a considerable integration of daily travel behaviour between the two countries. The financial benefits were compared with the construction and maintenance costs of the bridge in an ex-post cost benefit assessment which suggests that the bridge is a sound socio-economic investment.

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**Preferences for travel time variability – A study of Danish car drivers**

Travel time variability (TTV) is a measure of the extent of unpredictability in travel times. It is generally accepted that TTV has a negative effect on travellers’ wellbeing and overall utility of travelling, and valuation of variability is an important issue in transport demand modelling and in appraisal of transport and infrastructure projects. The effect of TTV has been analysed in several methodological papers and empirical studies (see, e.g., the review in Carrion and Levinson, 2012). Most methodological research is based on the premise that the value of TTV is closely linked to travellers’ trip scheduling preferences – their preferences for departing and arriving at given times of day.

In this paper, we present the design of a new Danish stated preference (SP) survey regarding TTV and the choice of departure time. We analyse data from a pilot survey using a scheduling model proposed by Engelson and Fosgerau (2011). Our objective is to check if travellers’ preferences are consistent with the theoretical model and to estimate a monetary value of TTV.

The survey is part of the development of a new national Danish traffic model, and the main part of the data collection is to take place in the spring 2014. The results presented here stem from a pilot study from December 2013, yielding 111 interviews for analysis. Overall the results are encouraging and the survey will be launched with only minor changes. Rather than being representative of the population, the aim of the survey is to aid the development of an appropriate scheduling model to use in the valuation of TTV. We therefore focus solely on morning commute trips for car drivers who are used to commuting to work in congested conditions. This is to achieve a relatively homogenous sample of travellers and trips in terms of scheduling preferences, to exclude non-traders, and to avoid complicated issues related to scheduled public transport services.

The survey uses customised Internet questionnaires, containing a series of questions related to the traveller’s most recent morning trip to work, e.g.:

- Travel time experienced on this day,
The effect of perceived mobility necessity in the choice of departure time

Departure time choice plays a crucial role in addressing the problem of urban congestion. Since the work of Small (1982), many studies have shown that travelers trade-off between travel time and scheduling delay and that travel time variability also plays an important role because uncertainty is likely to affect the choice of departure time. However departure time choice is also related to the full daily activity pattern, such as a restriction or a preference in one activity may form restrictions in the flexibility of other activities and thereby affect the preference for the related departure time. In this paper we investigate how the latent effect of the perceived mobility necessities affects the choice of departure time. A stated choice experiment collected among workers who commute to Copenhagen center is used to estimate 9 hybrid choice attributes.

• Number of stops along the way, their duration, and whether these stops involved restrictions on time of day,
• Restrictions regarding departure time from home or arrival time at work,
• How often such a trip was made within the last month and the range of experienced travel times,
• What the traveller considers to be his “normal” travel time and departure time,
• What the traveller considers to be his free flow travel time (without queues or congestion), and his preferred departure time in the hypothetical situation where there were never queues or congestion.

The survey contains two SP games, each consisting of 6 binary choices. The first game involves trade-offs between travel time, TTV and monetary travel cost, while the second also includes departure time. An overall aim in the survey is to keep the SP trade-offs as simple as possible, and hence TTV is described using travel time distributions that can attain only two values, a low value with probability (1-p) and a high value with probability p. We deliberately avoid the phrasing of travel times as “normal travel time” and “delay”, to minimize effects of potential reference-dependence and loss aversion (Kahneman and Tversky, 1979). Attribute levels are determined using an orthogonal and partly randomised design rather than an “optimised design”. This is due to robustness considerations since the optimised design requires the true scheduling model to be known in advance. The effects of assuming a wrong “true” model are not sufficiently clear.

As a first step in our analysis, we use the information about “normal” departure time (NDT) and preferred free flow departure time (FFDT) to check whether the basic premises of the theoretical models hold. These premises predict that travellers react to TTV by moving their departure time away from the peak hours. As a result we expect that a large share of the respondents travelling outside the peak would actually prefer to travel during the peak, if there were no TTV. Hence FFDT should be later than NDT for trips before the peak and earlier than NDT for trips after the peak. This pattern is confirmed by our data, and is particularly clear for respondents who are used to travel time varying by more than 15 minutes (see Figure 1). The majority of the respondents (70%) depart between 7AM and 8AM, and the general tendency is that people who travel early (depart before 7AM) would prefer to travel later if there were no congestion, while people who travel late (depart after 8AM) would prefer to travel earlier if there were no congestion.

The relation between FFDT and NDT does not seem to differ between respondents with fixed work start time and respondents without. Neither do we see an effect of having restrictions on arrival time (how late one can arrive) or restrictions on departure time (how early one can depart) – however, the evidence regarding the latter is sparse.

Figure 1: FFDT and NDT (unit: minutes past midnight). RTS is the experienced travel time variation (diff. between max and min).

The next step in our analysis is to estimate a value of TTV (VTTV) using the data from the SP games. In line with Börjesson et al (2012), we estimate two models: One assumes that departure time is not optimally chosen (the model with scheduling preferences), and so the traveller’s utility is a function of both the travel time distribution and the departure time. This model is estimated using a discrete choice model with the SP data with a departure time attribute. The other model assumes departure times are optimally chosen (reduced form), so that the traveller’s utility is solely a function of the travel time distribution. This model is estimated using a discrete choice model with the SP data without a departure time attribute. In both models TTV is measured by the travel time variance.

The results based on the pilot data for the model with scheduling preferences yields a high value of travel time (VTT) of 0.34 Euro/minute (approx. 20 Euro/h) which is to be expected given our high-income sample. The VTTV is extremely low, however, at 0.0002 Euro/minute2. The reduced form model yields a similar VTT of 0.32 Euro/minute. The VTTV is very low: 0.006 Euro per minute2, but nonetheless more than 30 times higher than in the model with scheduling preferences. This inconsistency between the two models is similar to the one reported by Börjesson et al. (2012). When examining the VTTV further, we find that travel time variances below a certain size (approx 100 minute2) are valued at very low rates, however at 0.0002 Euro/minute2. The reduced form model yields a similar VTT of 0.32 Euro/minute. The VTTV is very low: 0.006 Euro per minute2, but nonetheless more than 30 times higher than in the model with scheduling preferences. This inconsistency between the two models is similar to the one reported by Börjesson et al. (2012). When examining the VTTV further, we find that travel time variances below a certain size (approx 100 minute2) are valued at very low rates, while larger values are valued at higher rates. These findings will be elaborated on the basis of the full-scale survey.

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models where the discrete choice of departing before or later than the current trip depends on the latent construct of the perceived mobility necessities. Results show that individuals who perceive they have high mobility necessity tend to prefer the current departure time, and in particular dislike departing later. However, the latent variables account also partially for panel effect across choice tasks.

**Analyzing the Relationship Between Car Generation and Severity of Motor-Vehicle Crashes in Denmark**

While the number of fatalities on Danish roads has decreased in the last 40 years, research has not investigated the contribution of legislative changes, enforcement measures, technological enhancements, infrastructural improvements and human factors to this reduction. In the context of a Danish car market with remarkably high registration tax that causes potential buyers to hold longer onto old cars, the relationship between technological enhancements of vehicles and severity of crashes requires particular attention.

The current study investigated the relationship between car generation (i.e., car's first registration year) and injury severity sustained by car drivers involved in accidents in Denmark between 2004 and 2010. A generalized ordered logit model was estimated while controlling for several characteristics of the crash, the vehicle and the persons involved, and a sensitivity analysis was performed to assess the effect of car generation on drivers’ injury severity. Results illustrate that newer car generations are associated to significantly lower probability of injury and fatality, and that replacing older cars with newer ones introduces significant and not to be overlooked benefits for both population and society.
The paper presents an ex post socio-economic assessment of the Oresund Bridge conducted ten years after the opening in July 2000. The study applies historical micro data to re construct the travel pattern with no bridge in place and compare this to the current situation. To complete the socio-economic assessment, the consumer benefits including all freight and passenger modes, are compared with the cost profile of the bridge. The monetary contributions are extrapolated to a complete 50 year period. It is revealed that the bridge from 2000–2010 generated a consumer surplus of €2 billion in 2000 prices discounted at 3.5% p.a., which should be compared with a total construction cost of approximately €4 billion. Seen over the 50 year period and by assuming a medium growth scenario the bridge is expected to generate an internal rate of return in the magnitude of 9% corresponding to a benefit-cost rate of 2.2. A main advantage of analysing infrastructure ex post is the ability to learn and understand behavioural and methodological elements not foreseen at the ex ante stages. Following this we offer an extended discussion including two parts. Firstly we compare the ex ante predictions for the bridge to the current transport flows. The importance of having the right assumptions and the ability to model the phasing-in process are underlined. Secondly, we offer a wider discussion on why some projects are more beneficial than others. This is done by comparing the Oresund Bridge, the Channel Tunnel, and the Great Belt Link.

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Valuation of travel time for international long-distance travel - results from the Fehmarn Belt stated choice experiment
The geographical scope of travel varies from short distances in urban areas to long distances across cities and countries. While urban travel has been widely analysed in the literature, travel over longer distances and particularly across countries, has received much less attention. While this may be justified due to the number of travellers it cannot be justified when looking at the mileage consumption and its resulting environmental impacts. In this paper, we investigate international long-distance travel preferences related to travel between Scandinavia and Central Europe with particular focus on the Fehmarn Belt fixed link between Germany and Denmark to be opened in 2021. To facilitate long-term demand forecasts for the future fixed link, stated preference data were collected in 2011. Based on these data a discrete choice model for long-distance travellers was developed in order to estimate the value of travel time savings (VTTS). The final model, which was formulated as a nested logit model and included Box-Cox transformed travel time and cost attributes, revealed several interesting findings. Firstly, we found damping effects in both cost and time – most strongly in cost. Secondly, we found significant interactions among travel cost and time, and journey characteristics, such as distance
and duration. This had direct impact on the VTTS, which was shown to decrease with distance and duration. Thirdly, we found that air travel implies a higher average VTTS, which is to be expected but rarely supported by empirical evidence.

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BFI (2009): BFI-level 1
A long-distance travel demand model for Europe

In Europe, approximately 50% of all passenger kilometres come from trips beyond 100 km according to matrices developed in the TRANSTOOLS project. This accounts for an even larger share of CO2 emissions due to a higher modal share of air transport. Therefore long-distance trips are increasingly relevant from a political and environmental point of view. The paper presents the first tour-based long-distance travel demand model for passenger trips in and between 42 European countries. The model is part of a new European transport model developed for the European Commission, the TRANSTOOLS II model, and will serve as an important tool for transport policy analysis at a European level. The model is formulated as a nested logit model and estimated based on travel diary data with segmentation into business, private, and holiday trips. We analyse the estimation results and present elasticities for a number of different level-of-service variables. The results suggest that the perception of both travel time and cost varies with journey length in a non-linear way. For car drivers and car passengers, elasticities increase with the length of the journey, whereas the opposite is true for rail, bus, and air passengers - a fact that reflects a change in substitutability. Moreover, elasticities differ significantly by trip purpose with private trips having the highest and holiday trips the lowest elasticities.
Generating synthetic baseline populations from register data

The paper presents a population synthesiser based on the method of Iterative Proportional Fitting (IPF) algorithm developed for the new Danish national transport model system. The synthesiser is designed for large population matrices and allows target variables to be represented in several target constraints. As a result, constraints for the IPF are cross-linked, which makes it difficult to ensure consistency of targets in a forecast perspective. The paper proposes a new solution strategy to ensure internal consistency of the population targets in order to guarantee proper convergence of the IPF algorithm. The solution strategy consists in establishing a harmonisation process for the population targets, which combined with a linear programming approach, is applied to generate a consistent target representation. The model approach is implemented and tested on Danish administrative register data. A test on historical census data shows that a 2006 population could be predicted by a 1994 population with an overall percentage deviation of 5–6% given that targets were known. It is also indicated that the deviation is approximately a linear function of the length of the forecast period.

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On structural inelasticity of modal substitution in freight transport

At the European level there is an increasing focus on how freight transport can be moved from trucks on roads to more environmentally friendly modes such as rail and ship. A large proportion of the transport services between OD pairs, however, cannot be substituted since there is only one alternative available. The paper investigates the magnitude of this "structural inelasticity" of modal substitution in freight transport due to a sparser layout of rail and ship-based freight networks compared to road. In the analysis we use a recent Scandinavian freight demand model covering more than 800 zones. We find that the structural inelasticity is very significant – in particular for transportation over less than 500 km. Moreover, the inelasticity varies greatly with commodity groups and between OD pairs, and it depends strongly on the port and rail infrastructure. The results suggest that pure charging instruments (road pricing for trucks) in many regions will have limited mode substitution impacts. However, if combined with structural changes in terms of improved infrastructure for rail and ship, impacts may be greater.
System Convergence in Transport Modelling

A fundamental premise of most applied transport models is the existence and uniqueness of an equilibrium solution that balances demand $x(t)$ and supply $t(x)$. The demand consists of the people that travel in the transport system and on the defined network, whereas the supply consists of the resulting level-of-service attributes (e.g., travel time and cost) offered to travellers. An important source of complexity is the congestion, which causes increasing demand to affect travel time in a non-linear way.

Transport models most often involve separate models for traffic assignment and demand modelling. As a result, two different equilibrium mechanisms are involved, (i) the internal traffic assignment equilibrium, and (ii) the external equilibrium loop between the assignment model and the demand model.

Traditionally, there has been much research focus on the internal assignment equilibrium, which involves iterating between a route-choice (demand) model and a time-flow (supply) model. It is generally recognised that a simple iteration scheme where the level-of-service level is fed directly to the route-choice and vice versa may exhibit an unstable pattern and lead to cyclic unstable solutions. It can be shown that the contractor region, e.g. the region for which $(x,t)$ is stable, depends on the demand and the supply curve. Generally, as the slope (i.e., $dx(t)/dt$ and $dt(x)/dx$) between the curves increases, the contractor region shrinks. To obtain stable convergence various techniques including the method-of-successive-averages (MSA) have been proposed. Convergence of the MSA under fairly weak regularity conditions was shown in Robbins and Monro (1951).

The iteration between demand and assignment—the external equilibrium—are in many models either decoupled or follow a very simple iteration pattern. However, as demand models are often based on logit or probit models, and thus conform to the way demand is represented in stochastic assignment models, there is reason to believe that convergence problems should also be expected in the external equilibrium loop. The intuitive explanation is that, if an iterative solution algorithm may not converge in traffic assignment with fixed demand (base OD-matrix), adding the complexity of variable demand makes the problem even more difficult to solve. At a more practical level there is also the issue of computation time needed to obtain a certain level of precision. As the external equilibrium loop involves running a complete assignment model combined with a complete demand model (which may involve simulation of taste heterogeneity), iterations are much more costly than for the inner loop. This does not justify a simple iteration scheme for the sake of simplicity. As only 3 to 8 iterations may be possible in practice, it is important that these are spent wisely.

In the paper, we first investigate in details the convergence of the inner assignment loop and demonstrate the conditions for stability. On a synthetic network we explore convergence performance of various techniques including MSA, weighted MSA and adaptive averaging. Hereafter, we focus on the convergence of the external loop. To facilitate the analysis, the synthetic model framework is extended to include a demand model for the choice of mode, which is iterated with a stochastic assignment algorithm. A detailed stability analysis based on simulation experiments is presented and conditions for stability are explored. Finally, we investigate techniques for improved speed of convergence. In addition to the techniques tested for the inner-loop, which were all based on the MSA averaging principle, we explore the possibility of using gradient-based algorithms. This includes a simple linear curve fit approach, a spline approximation, and a Newton-based algorithm. In each of these cases, the idea is to utilise knowledge of the curvature of the demand curve to obtain faster convergence. Problems and limitations are discussed.
A weighted Logit Freight Mode Choice Model

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Peer-reviewed: Yes

Publication information
Journal: Transportation Research. Part E: Logistics and Transportation Review
Volume: 45
Issue number: 6
ISSN (Print): 1366-5545
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.03
Web of Science (2017): Impact factor 3.289
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.68
Web of Science (2016): Impact factor 2.974
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.51
Web of Science (2015): Impact factor 2.279
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.59
Web of Science (2014): Impact factor 2.676
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.64
Web of Science (2013): Impact factor 2.193
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.91
Web of Science (2012): Impact factor 2.272
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.77
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<th>Title</th>
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<tr>
<td>Introduction to Transport Models: Application with SAS Software</td>
<td>State: Published</td>
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<td></td>
<td>Organisations: Traffic Modelling, Department of Transport</td>
</tr>
<tr>
<td></td>
<td>Contributors: Rich, J.</td>
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<tr>
<td></td>
<td>Number of pages: 331</td>
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<tr>
<td></td>
<td>Publication date: 2009</td>
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<td></td>
<td>Publisher: Lulu Press</td>
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<td></td>
<td>Original language: English</td>
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<td>Source: orbit</td>
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<td>Research output: Education › Book – Annual report year: 2009</td>
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<td>Report on Scenario, Traffic Forecast and Analysis of Traffic on the TEN-T, taking into Consideration the External Dimension of the Union: trans-Tools Version 2; Model and Data Improvements</td>
<td>State: Published</td>
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<tr>
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<td>Organisations: Traffic Modelling, Department of Transport, Kiel University</td>
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<td>Publication date: 2009</td>
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<td>Original language: English</td>
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<td>Research output: Research › Report – Annual report year: 2009</td>
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<tr>
<td>Report on Scenario, Traffic Forecast and Analysis of Traffic on the TEN-T, taking into Consideration the External Dimension of the Union: assessment of Infrastructure packages</td>
<td>State: Published</td>
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<tr>
<td></td>
<td>Organisations: Traffic Modelling, Department of Transport, Decision Modelling</td>
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<td></td>
<td>Publication date: 2009</td>
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<td>Original language: English</td>
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<td>Research output: Research › Report – Annual report year: 2009</td>
</tr>
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A choice model for mode and crossing for freight: Evidence from the Oresund region

General information
State: Published
Organisations: Traffic Modelling, Department of Transport, Modelling Centre
Contributors: Rich, J., Holmblad, P. M., Overgård, C. H.
Publication date: 2008

Host publication information
Title of host publication: Freight transport policy and practice
Volume: ETC proceedings
Source: orbit
Source-ID: 229029
Research output: Research › peer-review › Article in proceedings – Annual report year: 2008

External Effects of Road-pricing

General information
State: Published
Organisations: Department of Transport
Contributors: Rich, J., Nielsen, O. A.
Publication date: 2008

Host publication information
Title of host publication: Road-pricing, the economy and the Environment
Publisher: Springer
(Advance in Spatial Science).
Source: orbit
Source-ID: 229028
Research output: Research › peer-review › Book chapter – Annual report year: 2008

Long-Distance passenger demand model

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J., Mabit, S. L.
Number of pages: 52
Publication date: 2008

Publication information
Publisher: Technical University of Denmark, Transport
Edition: 402-002
Original language: English
Source: orbit
Source-ID: 229031
Research output: Research › Report – Annual report year: 2008

Mode and crossing model – Øresund Freight, The Øresund Gods project

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J.
Number of pages: 46
Publication date: 2008

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English
Source: orbit
Source-ID: 229030
Public-Acceptability Change of Urban Road Pricing

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Gehlert, T., Nielsen, O. A., Rich, J., Schlag, B.
Pages: 111-122
Publication date: 2008
Peer-reviewed: Yes

Publication information
Journal: Proceedings of the Institution of Civil Engineers - Transport
Volume: 161
Issue number: 3
ISSN (Print): 0965-092X
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.33 SJR 0.17 SNIP 0.272
Web of Science (2017): Impact factor 0.239
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.42 SJR 0.246 SNIP 0.442
Web of Science (2016): Impact factor 0.402
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 0.39 SJR 0.221 SNIP 0.488
Web of Science (2015): Impact factor 0.314
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.43 SJR 0.313 SNIP 1.164
Web of Science (2014): Impact factor 0.262
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.29 SJR 0.256 SNIP 0.359
Web of Science (2013): Impact factor 0.321
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.37 SJR 0.258 SNIP 0.661
Web of Science (2012): Impact factor 0.295
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.3 SJR 0.225 SNIP 0.553
Web of Science (2011): Impact factor 0.326
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.213 SNIP 0.318
Web of Science (2010): Impact factor 0.191
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.134 SNIP 0.122
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.202 SNIP 0.294
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.235 SNIP 0.644
A socio-economic assessment of proposed road user charging schemes in Copenhagen

Road pricing, congestion charging, toll-systems and other road charging instruments are intensively discussed in many countries. Although many partial analyses of the consequences have been published, few overall socio-economic analyses have been carried out. The article presents such a socio-economic analysis of four different proposed road pricing schemes for the Copenhagen area. The purpose was to assess all benefits and costs involved, including impacts on traffic and environment, maintenance and financing costs as well as tax distortion effects. It was concluded that the socio-economic surplus of the projects depends crucially on the congestion level. With the Current traffic level, road pricing will not yet be socially expedient in Copenhagen. However, if the opening year is postponed to 2015, the two most favourable schemes will turn positive. The analyses also showed that the magnitude of demand response by introducing road pricing is likely to have significant impact on the project surplus. This is an important observation because most shore term driven traffic models will then underestimate the projected surplus. Finally, it was found that the degree to which benefits outweigh costs depends considerably on the use of revenue. Although it may contribute to decreasing road congestion, recycling all of the revenue back to the transport sector turned out to be inefficient and costly.
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.93 SJR 1.51 SNIP 1.675
Web of Science (2017): Impact factor 2.512
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.65 SJR 1.348 SNIP 1.715
Web of Science (2016): Impact factor 2.269
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.36 SJR 1.403 SNIP 1.479
Web of Science (2015): Impact factor 1.522
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.44 SJR 1.458 SNIP 1.835
Web of Science (2014): Impact factor 1.492
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.25 SJR 1.579 SNIP 1.925
Web of Science (2013): Impact factor 1.718
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.01 SJR 1.247 SNIP 1.64
Web of Science (2012): Impact factor 1.541
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.22 SJR 1.2 SNIP 2.159
Web of Science (2011): Impact factor 1.719
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.135 SNIP 2.184
Web of Science (2010): Impact factor 1.171
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.451 SNIP 1.684
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.227 SNIP 1.404
Scopus rating (2007): SJR 1.094 SNIP 1.476
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.923 SNIP 1.356
Scopus rating (2005): SJR 1.088 SNIP 1.517
Scopus rating (2004): SJR 1.034 SNIP 1.365
Scopus rating (2003): SJR 1.341 SNIP 1.336
Scopus rating (2002): SJR 0.456 SNIP 0.86
Scopus rating (2001): SJR 0.436 SNIP 0.676
Scopus rating (2000): SJR 0.319 SNIP 1.621
Scopus rating (1999): SJR 0.303 SNIP 0.777

Original language: English
Keywords: cost-benefit analysis, congestion, transport externalities, road pricing
DOIs: 10.1016/j.tranpol.2007.03.003
Research output: Research - peer-review › Journal article – Annual report year: 2007

Estimation of a route choice model with congestion and congestion charging explicitly described

General information
State: Published
Organisations: Department of Transport, Traffic modelling and planning
Contributors: Rich, J., Mabit, S. L., Nielsen, O. A.
Publication date: 2007
Peer-reviewed: Yes
Research output: Research - peer-review › Paper – Annual report year: 2007

Greenland air transport model system – A joint transport modelling and optimisation problem

General information
State: Published
Organisations: Department of Transport, Traffic modelling and planning
Publication date: 2007
Peer-reviewed: Yes
Research output: Research - peer-review › Paper – Annual report year: 2007

MOTOS Best practice examples

General information
State: Published
Organisations: Transport Economics, Department of Transport, Modelling Centre, Traffic Modelling
Number of pages: 123
Publication date: 2007

Publication information
Publisher: MOTOS project
Original language: English
(MOTOS Deliverable; No. Deliverable 2.2).
Source: orbit
Source-ID: 235091
Research output: Research › Report – Annual report year: 2007

MOTOS State-of-the-art report

General information
State: Published
Organisations: Transport Economics, Department of Transport, Modelling Centre, Traffic Modelling
Number of pages: 306
Publication date: 2007

Publication information
Publisher: MOTOS project
Original language: English
(MOTOS Deliverable; No. Deliverable 2.1).
Source: orbit
Source-ID: 235090
Research output: Research › Report – Annual report year: 2007

Road pricing and its consequences for individual travel patterns
While mobility pricing is discussed as a suitable tool for tackling urban traffic problems, its impact on the travel pattern of individuals is largely unexplored. Individual responses to pricing emerge as a number of different changes. As an example,
it involves the reduction in actual trip-making, more efficient route-choice decisions, trip chaining, and change of
destination choice. The analysis of reliable data seems necessary to gain a deeper insight into the personal motivations of
behavioural adjustments to the new monetary constraints. The AKTA Copenhagen study - which was part of the European
Union-funded project Pricing Road Use for Greater Responsibility, Efficiency and Sustainability in Cities (PROGRESS) -
was a real-life experiment of road pricing in the greater Copenhagen region, which allows one to trace these changes
under realistic conditions. During 2001 and 2002, 400 cars were equipped with GPS data-loggers over a period of up to 26
weeks, of which 352 cars had enough observations for further information. In 2003 a third round was carried out with 100
cars, resulting in 91 valid observations. The on-board systems monitored vehicle movement data for each second and
were used to simulate road pricing by displaying cost information for every trip driven. The experiment showed significant
demand effects with a decrease in daily kilometres travelled between 0 and 40 per cent depending on the location and the
pricing scheme; however, the deeper impacts on personal mobility have so far been largely unexplored. One of the
appealing features of AKTA is the possibility of examining the different pricing systems applied in their impact on personal
mobility. This article explores the question of how road pricing impacts destination choice by a detailed analysis of the rich
GPS trip dataset. The panel structure with multiple observations for single cars/drivers allows us to investigate the
diversity of individual activity repertoires and related travel patterns in both the control and the pricing periods. In
particular, the analysis aims at describing how road pricing affects the choice of destinations and the size and structure of
activity spaces (employing measures developed for longitudinal travel data by Schönfelder and Axhausen).
Who are the winners and losers of heavy vehicle fees?: An SCGE analysis of the regional economic impacts of heavy vehicle fees

General information
State: Published
Organisations: Transport Economics, Department of Transport, Traffic Modelling
Contributors: Kveiborg, O., Rich, J., Larsen, M. M.
Publication date: 2007

Host publication information
Title of host publication: World Conference on Transport Research 2007
Volume: CD-Rom
Publisher: World Conference on Transport Research Society
Editor: Meersman et al., H.
Source: orbit
Source-ID: 235078
Research output: Research - peer-review \ Article in proceedings – Annual report year: 2007

It is a bad idea to use all the revenue from roadpricing to the public transport

General information
State: Published
Organisations: Department of Transport
Publication date: 2006
Peer-reviewed: No

Publication information
Journal: The Engineer
ISSN (Print): 0013-7758
Ratings:
Scopus rating (2017): CiteScore 0.01 SJR 0.1 SNIP 0
Scopus rating (2016): CiteScore 0 SJR 0.1 SNIP 0
Scopus rating (2015): CiteScore 0 SJR 0.1 SNIP 0
Scopus rating (2014): CiteScore 0 SJR 0.1
Scopus rating (2013): CiteScore 0 SJR 0.1 SNIP 0
ISI indexed (2013): ISI indexed no
Scopus rating (2012): CiteScore 0 SJR 0.1 SNIP 0
ISI indexed (2012): ISI indexed no
Scopus rating (2011): CiteScore 0 SJR 0.1 SNIP 0
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.1
Road Charging in Copenhagen: Traffic effects

**General information**
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J., Nielsen, O. A.
Publication date: 2006

**Publication information**
Publisher: Institut for Miljøvurdering
ISBN (Print): 87-7992-043-8
Original language: Danish
Source: orbit
Source-ID: 195042
Research output: Research - peer-review › Report – Annual report year: 2006

Roadpricing in Copenhagen

**General information**
State: Published
Organisations: Traffic Modelling, Department of Transport
Publication date: 2006

**Host publication information**
Title of host publication: System design, use of revenue and the future of roadpricing
Source: orbit
Source-ID: 194826
Research output: Research › Article in proceedings – Annual report year: 2006

Socio-economic assessment of road pricing systems – results from two projects in Copenhagen.

**General information**
State: Published
Organisations: Department of Transport, Traffic modelling and planning
Contributors: Rich, J., Nielsen, O. A., Wrang, K.
Publication date: 2006
Peer-reviewed: Yes
Research output: Research › Paper – Annual report year: 2006

The Travellers in Copenhagen do know that it is healthy to use bicycles

**General information**
State: Published
We base the models on the road users' actual behaviour
Interurban road pricing for heavy vehicles - what are the impacts for the regional economy?

General information
State: Published
Organisations: Department of Transport, Danish Institute for Local and Regional Government Research, Danish Transport Research Institute
Contributors: Kveiborg, O., Larsen, M. M., Rich, J.
Publication date: 2005

Host publication information
Title of host publication: European Transport Conference
Volume: CD-ROM
Publisher: Association for European Transport/PTRC
Source: orbit
Source-ID: 235057
Research output: Research › Article in proceedings – Annual report year: 2005

Road pricing and individuals responses within travel patterns behaviour change - lessons from the Copenhagen AKTA study

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Publication date: 2005
Peer-reviewed: No
Source: orbit
Source-ID: 188490
A New Generation of Passenger Transport Models

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J.
Publication date: 2004

Host publication information
Title of host publication: Trafikdage
Source: orbit
Source-ID: 183600
Research output: Research › Article in proceedings – Annual report year: 2004

A passenger transport SCGE model

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J. H., Nielsen, O. A.
Publication date: 2004

Host publication information
Title of host publication: Proceedings of World Conference on Transport Research Society (WCTRS)
Volume: D03 paper 1225
Source: orbit
Source-ID: 178138
Research output: Research › peer-review › Article in proceedings – Annual report year: 2004

Assessment of Traffic Noise Impacts
A steady growth in traffic intensities in most urban areas throughout the world has forced planners and politicians to seriously consider the resulting environmental impact, such as traffic noise, accidents and air pollution. The assessment of such negative factors is needed in order to reveal the true social benefit of infrastructure plans. The paper presents a noise assessment model for the Copenhagen region, which brings together GIS technology and non-linear hedonic regression models to reveal the implicit costs of traffic noise measured as the marginal percentage loss in property values with respect to the decibel traffic noise. The model distinguishes between houses and apartments and shows that the ability to include refined accessibility variables have significant impact on estimated prices.

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J. H., Nielsen, O. A.
Pages: 19-30
Publication date: 2004
Peer-reviewed: Yes

Publication information
Volume: 61
Issue number: 1
ISSN (Print): 0020-7233
Ratings:
BFI (2019): BFI-level 1
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.58 SJR 0.239 SNIP 0.436
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Traffic Models

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Nielsen, O. A., Rich, J. H., Sørensen, M. V.
Pages: 29-33
Publication date: 2004

Host publication information
Title of host publication: Trip Final Conference
Volume: Proceedings
Source: orbit
Source-ID: 178152
Research output: Research - peer-review › Article in proceedings – Annual report year: 2004

Use of GPS- and SP-data to estimate changes of driver behaviour due to road pricing

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
A national freight transport model - Methodological study

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Publication date: 2003

Publication Information
Place of publication: The Danish Transport Research Institute
Original language: Danish
Source: orbit
Source-ID: 183436
Research output: Research – Report – Annual report year: 2003

A national freight transport model - recommendations

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Publication date: 2003

Publication Information
Place of publication: The Danish Transport Research Institute
Original language: Danish
Source: orbit
Source-ID: 183435
Research output: Research – Report – Annual report year: 2003

Freight Transport in a Spatial Economic Model

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J. H., Kveiborg, O., Larsen, M. M.
Publication date: 2003
Peer-reviewed: No
Source: orbit
Source-ID: 39091
Research output: Research – Paper – Annual report year: 2003

Hedonic Evaluation of Traffic Noise - an empirical study

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J. H., Nielsen, O. A.
Publication date: 2003

Host publication information
Title of host publication: Trip research conference: The Economics and Environmental Consequences of Regulating Traffic
Source: orbit
National freight model: pre-study

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Fosgerau, M., Nielsen, O. A., Overgaard, C., Rich, J. H.
Publication date: 2003

Publication information
Original language: Danish
(CTT/DTF report; No. 57632).
Source: orbit
Source-ID: 39097
Research output: Research - peer-review › Report – Annual report year: 2003

National value-of-timestudy: pre-study

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Publication date: 2003

Publication information
Original language: Danish
(COWI report; No. 57632).
Source: orbit
Source-ID: 39096
Research output: Research - peer-review › Report – Annual report year: 2003

Prestudy for socio-economic value of times

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Number of pages: 130
Publication date: 2003

Publication information
Publisher: Danish Ministry of Transport
Original language: English
Source: orbit
Source-ID: 39098
Research output: Research - peer-review › Report – Annual report year: 2003

The Helsingør-Helsingborg Tunnel Project: Atkins Report

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J. H., Holm, J., Nielsen, O. A.
Publication date: 2003

Publication information
Original language: Danish
Source: orbit
Source-ID: 39095
Research output: Research - peer-review › Report – Annual report year: 2003
TRIP and the price of silence

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Bjørner, T. B., Rich, J. H., Nielsen, O. A.
Publication date: 2003

Host publication information
Title of host publication: Environmental Research : The Strategic Research Programme
Volume: No. 57
Source: orbit
Source-ID: 178172
Research output: Research › Book chapter – Annual report year: 2003

Cost-Benefit Evaluation of Infrastructure: Doing it the hedonic way

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J. H., Nielsen, O. A.
Publication date: 2002

Host publication information
Title of host publication: European Transport Conference (PTRC) : Seminar on Methodological Innovations
Volume: CDROM with proceedings, PTRC.
Source: orbit
Source-ID: 39090
Research output: Research › peer-review › Article in proceedings – Annual report year: 2002

Cost-Benefit Evaluation of Infrastructure: Doing it the hedonic way

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J. H., Nielsen, O. A.
Publication date: 2002

Host publication information
Title of host publication: Nordic Research Network on Modelling Transport, Land-Use and the Environment : Sixth Workshop
Source: orbit
Source-ID: 178157
Research output: Research › peer-review › Article in proceedings – Annual report year: 2002

Long-term Travel Demand Modelling

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J. H.
Publication date: 2002

Publication information
Original language: English
Source: orbit
Source-ID: 39093
Research output: Research › Ph.D. thesis – Annual report year: 2002

Portzone model for the Øresund Region: forecasting the traffic potential for a new train tunnel between Elingsore and Helsingborg
Two aspects of location modeling: Short-term versus long-term demand and the case of two-worker households

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J. H.
Pages: 397-409
Publication date: 2001

Host publication information
Title of host publication: Travel Research Behaviour : The leading Edge
Volume: Chapter 24
Publisher: Pergamo
Editor: Hensher, D.
Source: orbit
Source-ID: 39059
Research output: Research - peer-review › Book chapter – Annual report year: 2001

A micro-based spatial equilibrium framework for households

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J.
Publication date: 1999

Host publication information
Title of host publication: Presented at 46th RSAI Conference Montreal, Canada
Source: orbit
Source-ID: 183597
Research output: Research - peer-review › Article in proceedings – Annual report year: 1999

Choice of Residential Location and Workplaces for Two-Worker Households

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J.
Number of pages: 26
Publication date: 1999

Host publication information
Title of host publication: Land-Use and the Environment
URLs:
Source: orbit
Source-ID: 183631
Research output: Research › Article in proceedings – Annual report year: 1999

Integreeret Miljøinformationssystem (IMIS) indenfor bymiljø og trafik

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Jensen, S., Kousgaard, U., Christensen, L., Rich, J.
Number of pages: 1,999
Pages: 3-11
Publication date: 1999

Host publication information
Title of host publication: ISP's skriftserie 238
Source: orbit
Behavioural Statistical Analysis of Transport Surveys.: Using Marketing Research

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J.
Number of pages: 17
Publication date: 1998

Host publication information
Title of host publication: Land-Use and the Environment
URLs:
http://www.infra.kth.se/tlenet/meet2/marketin.doc
Source: orbit
Source-ID: 183806
Research output: Research › Article in proceedings – Annual report year: 1998

Prototypical Sample Enumeration using Log-Transformed QUAD Optimisation: Simulation Experiments and Evidence from a Danish National Transport Survey

General information
State: Published
Organisations: Traffic Modelling, Department of Transport
Contributors: Rich, J., Kveiborg, O.
Number of pages: 18
Publication date: 1998

Host publication information
Title of host publication: Land-Use and Environment
URLs:
http://www.infra.kth.se/tlenet/meet2/parmu981.html
Source: orbit
Source-ID: 183807
Research output: Research › Article in proceedings – Annual report year: 1998

Projects:

Modelling of shared and autonomous mobility
Papu Carrone, A. V., PhD Student, Department of Management Engineering
Jensen, A. F., Supervisor, Department of Management Engineering
Rich, J., Main Supervisor, Department of Management Engineering
Samfinansieret - Andet
01/12/2017 → 30/11/2020
Award relations: Modelling of shared and autonomous mobility
Project: PhD

Adfærdsmodeller for passagerers rutevalg
Anderson, M. K., PhD Student, Department of Management Engineering
Nielsen, O. A., Main Supervisor, Department of Transport
Prato, C. G., Supervisor, Department of Transport
Rich, J., Examiner, Department of Transport
Bekhar, S., Examiner
Börjesson, M., Examiner
DTU-lønnet stipendie
01/05/2007 → 25/08/2014
Award relations: Adfærdsmodeller for passagerers rutevalg
Project: PhD
**Modeller for trafik- og lokaliseringsadfærd**
Rich, J., PhD Student, Department of Management Engineering
Nielsen, O. A., Main Supervisor, Department of Management Engineering
Algers, S., Examiner
Brundell-Freij, K., Examiner
Madsen, B., Examiner
Algers, S., Examiner
Madsen, B., Examiner
Forskerakademiets Samfinansier
01/10/1998 → 12/12/2001
Award relations: Modeller for trafik- og lokaliseringsadfærd
Project: PhD

**Attractiveness of Public Transport Systems in a Metropolitan Setting**
Ingvardson, J. B., PhD Student, Department of Management Engineering
Nielsen, O. A., Main Supervisor, Department of Management Engineering
Kaplan, S., Supervisor, Department of Management Engineering
Rich, J., Examiner, Department of Management Engineering
W. Axhausen, K., Examiner
Wilson, N. H. M., Examiner
Samfinansierede - Virksomhed
01/10/2014 → 16/04/2018
Award relations: Attractiveness of Public Transport Systems in a Metropolitan Setting
Project: PhD

**Green corridors in freight logistics**
Panagakos, G., PhD Student, Department of Management Engineering
Psaraftis, H. N., Main Supervisor, Department of Management Engineering
Larsen, A., Supervisor, Department of Management Engineering
Rich, J., Examiner, Department of Management Engineering
Cullinane, K., Examiner
Ojala, L., Examiner
Ojala, L., Examiner
Samfinansieret - Andet
15/08/2014 → 25/11/2016
Award relations: Green corridors in freight logistics
Project: PhD

**Trafikmodellering af lange rejser**
Knudsen, M. A., PhD Student, Department of Transport
Nielsen, O. A., Main Supervisor, Department of Transport
Rich, J., Supervisor, Department of Transport
Prato, C. G., Examiner, Department of Transport
W. Axhausen, K., Examiner
Börjesson, M., Examiner
Börjesson, M., Examiner
DTU-lønnet stipendie
01/02/2007 → 19/12/2014
Award relations: Trafikmodellering af lange rejser
Project: PhD

**Aktivitetsbaseret trafikmodellering af roadpricing**
Mabit, S. E., PhD Student, Department of Management Engineering
Nielsen, O. A., Main Supervisor, Department of Transport
Fosgerau, M., Supervisor, Department of Management Engineering
Rich, J., Examiner, Department of Planning
Bierlaire, M., Examiner
Daly, A., Examiner
DTU-lønnet stipendie
01/09/2003 → 07/03/2008
Activity-based modeling of transport demand

Thorhauge, M., PhD Student, Department of Transport
Rich, J., Main Supervisor, Department of Transport
Cherchi, E., Supervisor, Department of Transport
Møller, M., Examiner, Department of Transport
Børjesson, M., Examiner
Ortúzar, J. D. D., Examiner

Institut stipendie (DTU) Samf.
01/04/2011 → 24/09/2015

Justering af bilmatricer til Ørestadens Trafikmodel (OTM)

Nielsen, O. A., Project Manager, Department of Transport
Rich, J., Project Participant, Department of Transport
Landex, A., Project Participant, Department of Transport
Zabic, M., Project Participant, Department of Transport
Hansen, S., Project Participant, Department of Transport
Andersen, J. L. E., Project Participant, Department of Transport

Project ID: 35111
Sam.arb.aftaler, Private danske - Andre virksomheder: DKK130,000.00
04/11/2005 → 31/03/2006

TGB: Traffic Plan for Greenland: Decision Support Tool TGB


Jensen, A. V., Project Participant, Department of Transport
Salling, K. B., Project Participant, Department of Transport
Nielsen, O. A., Project Participant, Department of Transport
Hansen, S., Project Participant, Department of Transport
Larsen, A., Project Participant, Department of Transport
Knudsen, M. A., Project Participant, Department of Transport
Indtægtsdækket virksomhed UK 90: DKK1,500,000.00
06/06/2005 → 31/12/2005
Award relations: Traffic Plan for Greenland: Decision Support Tool TGB
Project: Research

SCGE for freight
Project for the ministry of transport concerned with the development of a SCGE freight model to evaluate roadpricing for trucks
Rich, J., Project Manager, Department of Transport, Administration
Project ID: 35123
Sam.arb.aftaler - Statslige danske: DKK146,140.00
18/10/2006 → 01/12/2007
Award relations: SCGE for freight
Project: Research

Opdatering af turmatricer og Ørestadens Trafik Model (OTM)
Nielsen, O. A., Project Manager, Department of Transport
Rich, J., Project Participant, Department of Transport
Landex, A., Project Participant, Department of Transport
Zabic, M., Project Participant, Department of Transport
Hansen, S., Project Participant, Department of Transport
Andersen, J. L. E., Project Participant, Department of Transport
Sam.arb.aftaler, Private danske - Andre virksomheder: DKK630,000.00
16/03/2005 → 31/10/2005
Award relations: Opdatering af turmatricer og Ørestadens Trafik Model (OTM)
Project: Research

IMPROSA: Improving Road Safety : Developing a Basis for Socio-economic Prioritising of Road Safety Measures
The aim of this project is to develop an improved basis for efficient socio-economic prioritising of road safety measures. Road fatalities and injuries are together with congestion the largest externalities connected to transport. The traditional way of predicting road accidents – and thus assessing road safety measures – has been to model accidents as a function of road type and traffic volume only. However, these variables cannot alone explain the trend in accidents over time and moreover, in traditional models the severity and accidents are completely decoupled. This project will overcome these shortcomings and combine the modelling approach with in-depth insight into road user behaviour. This project will use the aggregate and disaggregate parts of the so-called DRAG modelling approach to establish quantitative relations between accidents of various degrees of severity and road user (risk) behaviour, vehicle ownership, infrastructure and economic activity. Moreover, the project will estimate preference-based economic values of road safety measures. As a novelty, accident modelling will include both police recorded accidents and emergency room recorded accidents. In addition, modelling will include individual socio-economic and demographic data from the entire Danish population. Finally, a more qualified inclusion of human behaviour factors, i.e. road user sub group behaviour, in the models will be possible. Methods range from in-depth interviews to statistical modelling. The project is organised in five work packages (WPs), each with defined tasks and scope. Thus, data for WP3 will be documented and provided by WP1 and 2; modelling will take place in WP3, qualification of the models in WP2, development of a scientifically founded valuation method of accidents in WP4, and eventually transforming results into recommendations in WP5.
Hakamies-Blomqvist, L., Project Manager, Department of Transport, Traffic Safety
Hels, T., Project Manager, Department of Transport, Traffic Safety
Møller, M., Project Manager, Department of Transport, Traffic Safety
Rich, J., Project Manager, Department of Transport, Traffic Safety
Kveiborg, O., Project Manager, Department of Transport, Traffic Safety
Bernhoff, I. M., Project Participant, Department of Transport, Traffic Safety
Martinussen, L. M., Project Participant, Department of Transport, Traffic Safety
Janzstrup, K. H., Project Participant, Department of Transport, Traffic Safety
Lyckegaard, A., Project Participant, Department of Transport, Traffic Safety
Abele, L., Project Participant, Department of Transport, Traffic Safety
Østergaard, M. H., Contact Person, Department of Transport, Traffic Safety
Project ID: 35254
A microeconomic model for car ownership, resident and work location
The research project - following the Ph.D.-study by Jeppe Rich - develops a 3-component model for car ownership, resident and work location. 1: A strategic microeconomic model based on a refined random utility framework, in which residential location, work location for up to two workers in the household and car ownership is considered. 2: An equilibrium framework for the housing market, leading to endogenous bid-rents, and 3: A short-term tactic micro model for mode and route choice. Funding: The Transport Council combined with the TRIPS Centre.

Rich, J., Project Participant, Department of Planning
Nielsen, O. A., Project Manager, Department of Planning
01/01/2000 → …
Project: Research

Marie Currie Joint European transport Research network (JET)
The proposed network will arrange a series of seminars and Ph.D.-schools within transport modelling and optimisation. Members are – among others – TØI, SINTEF, MOLDE, Linköping, KTH, LTH, ITS Leeds, Imperial College London, ETH Zurich, IDSIA Lugano, Univ. of Rome, Reggio Calabria, Brescia, TU Delft, Eindhoven Tech. Univ., TRAIL, National Tech. Univ. of Athens, Univ. of Hamburg, RWTH Aachen. These are among the leading universities in transport within Europe. CTT is leading partner. The network is planned to be jointly chaired by Oli B.G. Madsen and Otto Anker Nielsen. Jeppe Husted Rich is project leader. Funds for application (JET) have been obtained from the national research foundation (STVF).

Rich, J., Project Manager, Department of Transport
Nielsen, O. A., Project Participant, Department of Transport
Madsen, O. B., Project Participant, Department of Transport
Sam.arb.aftaler - Statslige danske: DKK150,000.00
22/09/2004 → 30/04/2006
Award relations: Marie Currie Joint European transport Research network (JET)
Project: Research

CLG: Centre for Logistics and Freight Transport
The Centre for Logistics and Freight Transport (CLG) is a multi-disciplinary research centre on logistics and freight transport. The Centre is headed by CTT. CLG is a cooperation between a number of Danish and international universities and companies. CLG is funded by The Danish Technical Research Council (STVF). The objective of the Centre is to strengthen the Danish research on logistics and transport. This is achieved through specific research projects and through networking activities within the center. A number of the research projects are multi-disciplinary. The scope of the Centre is to obtain an increased knowledge about the various stakeholders within the logistics and transport sector and to develop new methods and concepts which are applicable to the stakeholders. This includes organisatorial and management concepts as well as methods based on mathematical models in order to support the various stakeholders which briefly can be characterized as follows: Manufacturers and consumers of goods (transport users). Transporters (operators, forwarders, etc.). Transport infrastructure owner (public authorities, ports, airports, etc.). Public authorities (political means and control). National economics (derivated effects of the transport system and the external influences).

Nielsen, O. A., Project Manager, Department of Transport
Madsen, O. B., Project Participant, Department of Transport
Leleur, S., Project Participant, Department of Transport
Overgård, C. H., Project Participant, Department of Transport
Rich, J., Project Participant, Department of Transport
Jørgensen, R. M., Project Participant, Department of Transport
Larsen, A., Project Participant, Department of Transport
Pedersen, M. B., Project Participant, Department of Transport
Sølling, K. B., Project Participant, Department of Transport
Jensen, A. V., Project Participant, Department of Transport
Sørensen, M. V., Project Participant, Department of Transport
Landex, A., Project Participant, Department of Transport
Holvad, T., Project Participant, Department of Transport

Project ID: 421-35044
Forskningsrådene - STVF: DKK15,723,006.00
25/06/2001 → 31/12/2006
Award relations: Centre for Logistics and Freight Transport
Project: Research

Activities:

**Intelligent truck platooning: how to make it work**
Period: 17 Sep 2018 → 21 Sep 2018
Jeppe Rich (Speaker)
Rune Larsen (Other)
Thomas Kjær Rasmussen (Other)
Transport DTU
Transport Modelling
Department of Management Engineering

**Description**
Platooning of trucks is a means to improve efficiency in the road transportation of goods. Truck platooning can lead to fuel savings in the order of 5-10%, but may also yield substantially larger benefits by, fully or partially, obviating drivers. This may be possible in situations where drivers, who engage in platooning activities, can rest while they are not the leading truck. In this paper we argue that forming truck platoons is unlikely to be successful if based on an 'on-the-fly' principle. Rather, a system of “platooning-stations” is required for forming platoons off the road. In the paper we propose a simple greedy-algorithm and subsequent local search for achieving locally optimal platoons at such stations. The solution reflects an optimisation of shared mileage among members of each platoon and is solved in discrete time-steps at each station. As a final contribution, we investigate the potential of the proposed algorithm in a real-world case by investigating platoon formation under a variety of circumstances for an artificial platooning station located close the Elb-tunnel. More specifically, we consider the generated route-path of 1500 trucks crossing this location and calculate optimal solutions for a variety of different design criteria’s.

Degree of recognition: International
Documents:
Platooning ITSW

**Related event**
25th ITS World Congress
17/09/2018 → 21/09/2018
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

**Value-of-time through a financial crisis: temporal and inter-temporal variation**
Period: 5 Sep 2018
Jeppe Rich (Speaker)
Christian Anker Vandet (Other)
Transport DTU
Transport Modelling
Department of Management Engineering

**Description**
In this paper we ask the question if the value of travel time savings (VTTS) is increasing and continue to investigate this based on a pooled cross-section model. The analysis is based on data originating from a large-scale Danish national continuously ongoing travel survey from 2006 to 2016 consisting of more than 400,000 trips. The period is interesting from a research perspective as it offers substantial variation in income, is characterised by structural changes due to increased
urbanisation and congestion and at the same time represents a phasing-in period for mobile broadband solutions from almost no coverage to full national coverage. Several things are revealed from the analysis. It is shown that the financial crisis impacts VTTS and that the impact differs across income groups. It is also found that, over the period, VTTS increases by approximately 10%. Although this largely correspond to the growth in the disposable income, it is not possible to point to precise confounders and their relative importance. Rather the paper suggest that the increase in VTTS is caused by a mix of different cofounders, which include (but is not limited to) increasing travel distances, increasing congestion and increasing income.

Degree of recognition: International
Documents:
Value-of-time through a financial crisis

Related organisation

Value-of-time through a financial crisis: temporal and inter-temporal variation
Rich, J. (Speaker), Vandet, C. A. (Other)
5 Sep 2018
Activity: Talks and presentations › Conference presentations

Landstrafikmodellen version 2.0
Period: 26 Aug 2018
Jeppe Rich (Speaker)
Transport DTU
Transport Modelling
Department of Management Engineering

Description
Gennemgang af modelstrukturen for den nye landstrafikmodel.
Degree of recognition: National
Documents:
Trafikdage 2018

Related organisation

Landstrafikmodellen version 2.0
Rich, J. (Speaker)
26 Aug 2018
Activity: Talks and presentations › Conference presentations

Dansk Industri - Transportudvalget
Period: 6 Jun 2018
Jeppe Rich (Participant)
Transport DTU
Transport Modelling
Department of Management Engineering

Description
Invited speaker.
Documents:
DI seminar June 2018

Related event

Dansk Industri - Transportudvalget
06/06/2018 → …
København, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Is the Value-of-time increasing
Period: 31 May 2018
Related event

Transport Summit DTU 2018: Rethinking Transportation
31/05/2018 → 31/08/2018
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

LTM 2.0 project overview
Period: 31 May 2018
Jeppe Rich (Invited speaker)
Transport DTU
Transport Modelling
Department of Management Engineering
Documents:
Summit 2018 LTM Pitch

Related event

Transport Summit DTU 2018: Rethinking Transportation
31/05/2018 → 31/08/2018
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

The transport future - Possible impacts of autonomous and shared vehicles UNF
Period: 15 Mar 2018
Jeppe Rich (Invited speaker)
Transport DTU
Transport Modelling
Department of Management Engineering
Documents:
The transport future - Possible impacts of autonomous and shared vehicles UNF

Related event

Ungdommens Naturvidenskabelige Forening, UNF
01/01/1994 → …
København (DK), 1 Sep
Activity: Talks and presentations › Conference presentations

Folketingets transportudvalg (netværksmøde): Præsentation af Landstrafikmodellen
Period: 19 Feb 2018
Jeppe Rich (Participant)
Otto Anker Nielsen (Participant)
Transport DTU
Transport Modelling
Department of Management Engineering
Network performance of autonomous cars at low market shares
Period: 14 Sep 2017
Andrea Vanesa Papu Carrone (Speaker)
Jeppe Rich (Other)
Department of Management Engineering
Transport DTU
Transport Modelling

Description
In this paper we consider how network performance is affected by a mixture of two heterogeneous car classes, a class which is designed to mimic the behaviour of autonomous vehicles (AVs) and a class which is designed to mimic normal driver behaviour. This makes it possible to investigate network effects as a function of the market shares of AVs.
Degree of recognition: International

Related event
hEART 2017: 6th Symposium of the European Association for Research in Transportation
12/09/2017 → 14/09/2017
Haifa, Israel
Activity: Talks and presentations › Conference presentations

Modelling production-consumption flows of goods in Europe: the trade model within Transtools 3
Period: 5 Oct 2016
Gerard de Jong (Speaker)
Reto Tanner (Other)
Jeppe Rich (Other)
Mikkel Thorhauge (Other)
Otto Anker Nielsen (Other)
John Bates (Other)
Department of Management Engineering
Transport DTU
Transport Modelling

Description
Estimation results and elasticities are presented for the trade model within the European transport model Transtools3. We also explain how the outcomes of this model are used in the overall freight model.
Degree of recognition: International
Documents:
Trademodel TT3 ETC_2016_v1

Related event
European Transport Conference 2016
05/10/2016 → 05/10/2016
Barcelona, Spain
Activity: Talks and presentations › Conference presentations
A model for freight transport chain choice in Europe
Period: 14 Sep 2016 → 16 Sep 2016
Anders Fjendbo Jensen (Speaker)
Mikkel Thorhauge (Other)
Gerard de Jong (Speaker)
Jeppe Rich (Other)
Thijs Dekker (Other)
Daniel Johnson (Other)
Manuel Ojeda Cabral (Other)
John Bates (Other)
Otto Anker Nielsen (Other)
Department of Management Engineering
Transport DTU
Transport Modelling

Description
This paper describes the structure of the Transtools3 freight transport chain choice model for Europe and the data at the shipment level that were used in estimation, and presents the estimation results and resulting elasticities. It also discusses the structure of the overall freight model and how production-consumption matrices from a trade model are combined with the transport chain choice model in model application. In the estimation of the transport chain choice model on the available disaggregate data sources (the Swedish Commodity Flow Survey 2009 and the French ECHO survey) we tested several options for the specification of transport costs in the model and various nesting structures.

Degree of recognition: International

Documents:
TT3 transport chain choice hEART 2016 v5

Related event

heart 2016
14/09/2016 → 16/09/2016
Delft, Netherlands
Activity: Talks and presentations › Conference presentations

Synthesis of household based trip diaries
Period: 14 Sep 2016
Mikkel Thorhauge (Speaker)
Jeppe Rich (Other)
Department of Management Engineering
Transport DTU
Transport Modelling

Documents:
Thorhauge - Trafikdage 2016 - Synthetic HH

Related event

heart 2016
14/09/2016 → 16/09/2016
Delft, Netherlands
Activity: Talks and presentations › Conference presentations

Udvikling af transportvætedata for husholdninger
Period: 23 Aug 2016
Mikkel Thorhauge (Speaker)
Jeppe Rich (Other)
Department of Management Engineering
The Role of Intention as Mediator Between Latent Effects and Current Behaviour: Application of a Hybrid Choice Model to Study Departure Time Choices
Period: 2016
Mikkel Thorhauge (Speaker)
Elisabetta Cherchi (Other)
Joan Walker (Other)
Jeppe Rich (Other)

Transport DTU
Transport Modelling
Department of Management Engineering
Traffic modelling and planning

Building Efficient Stated Choice Design for Departure Time Choices using the Scheduling Model: Theoretical Considerations and Practical Implementations
Period: 2014
Mikkel Thorhauge (Speaker)
Elisabetta Cherchi (Other)
Jeppe Rich (Other)

Transport DTU
Transport Modelling
Department of Management Engineering
Traffic modelling and planning

The Effect Of Perceived Mobility Necessity in the Choice of Departure Time
Period: 2014
Mikkel Thorhauge (Speaker)
Elisabetta Cherchi (Other)
Jeppe Rich (Other)
Transport DTU
Transport Modelling
Department of Management Engineering
Traffic modelling and planning
Degree of recognition: International

Related event
Transportation Research Board 93rd Annual Meeting
12/01/2014 → 16/01/2014
Washington DC, United States
Activity: Talks and presentations › Conference presentations

Accounting for the Effect of Rescheduling Possibilities in the Departure Time Choice using an Efficient Stated Preference Design
Period: 2013
Mikkel Thorhauge (Speaker)
Elisabetta Cherchi (Other)
Jeppe Rich (Other)
Transport DTU
Transport Modelling
Department of Management Engineering
Traffic modelling and planning
Degree of recognition: International

Related event
hEART 2013: 2nd Symposium of the European Association for Research in Transportation
04/09/2013 → 06/09/2013
Stockholm, Sweden
Activity: Talks and presentations › Conference presentations