

## Summary

# Explaining low economic return on Norwegian road projects

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*Road projects in areas that have large differences in altitude or are far from central areas have lower estimated net economic return. This implies that there might be a trade-off between economic efficiency and other criteria like regional policy and redistribution, which should be reflected in project assessment. Differences in geographic characteristics also imply lower economic return on road projects in Norway than in Sweden and Denmark. In addition, differences in policy and in the design and implementation of each project could further result in lower economic return in Norway.*

## Introduction

Earlier studies show that many planned road projects in Norway have negative economic return in terms of estimated net present value. We have explored what can explain this finding and whether these explanations imply lower economic return on projects in Norway than in Sweden and Denmark. We have investigated four possible explanations:

1. Large public wealth results in less strict priorities and efficient use of public resources.
2. Overall policies and priorities tend towards planning and implementing many projects with low or negative economic return.
3. The design and implementation of each project results in lower economic return.
4. Economic return is lower in Norway due to geographic characteristics like steep topography and low population density.

We have used the following methods to investigate these explanations:

- A. A review of literature, particularly related to explanations (1) and (2).
- B. A comparison between standards and requirements for road construction in Norway, Sweden and Denmark and a review of issues related to the implementation of road projects that could affect economic return (explanation 3).
- C. An econometric analysis of the effect of local geographic characteristics on the economic return of Norwegian road projects.
- D. A comparison of the geographic characteristics of Norway, Sweden and Denmark and a discussion of the implications for differences in the economic return on road construction (explanation 4), based on (C).

Based on our findings, we provide recommendations regarding how to select road projects when many projects have negative net present value.

## **Review of literature**

We have conducted a brief review of existing literature using the recent studies by Welde et al. (2013), Eliasson et al. (2015), Strand et al. (2015) and Sager (2016) as the point of departure, and including other relevant studies. Our findings are:

- The same factors that cause decision-makers to put little weight on economic return in the final selection of projects could also result in many projects with low or negative economic return being considered at an earlier stage.
- We cannot reject the hypothesis that large public wealth results in less strict priorities and efficient use of public resources
- Differences between Norway and Sweden in the administrative culture could imply that Swedish planners and decision-makers put more weight on measurable effects of policies, including economic efficiency.
- Decision-making in Norwegian transport planning is to a large extent bottom-up. However, this is also the case in other countries.
- Decision-makers in Norway seem to be aiming for a certain distribution of investments between geographic areas, which might conflict with economic efficiency and other professional criteria.
- Tactical political considerations could also come at the expense of economic efficiency. However, the implications of the geographic allocation of seats in the Norwegian parliament has been misrepresented in the literature. Although some districts have more seats per capita, their impact on the overall election result is proportional to their vote shares, due to adjustment seats. If winning the election is the objective, parties therefore have no incentive to allocate more investments to the over-represented districts.

## **Road design and project implementation**

We have conducted a brief review of standards and requirements for road design in Norway, Sweden and Denmark, as well as an informal interview with the state-owned infrastructure company Nye Veier AS. We find that

- Several elements of the Norwegian practice and tradition pull in the direction of a rather piecemeal approach to road construction. Since the traffic flow and user benefit reaped on any one road link is affected by the level-of-service offered, not only on that particular leg, but on the entire adjacent network, such a piecemeal approach risks ignoring the fairly important synergies arising in a well connected corridor of high, even quality. Chances are that the overall benefit-cost ratio of Norwegian road construction could be improved through a more holistic approach to infrastructure development.
- Experience suggests that four-lane motorways have a much longer service life in Norway than do ordinary two- or three-lane highways. If this difference in service life is not taken into account, the cost-benefit analysis risks underestimating the value of building high quality trunk roads.
- The added benefit of adapting the motorway design to a 110 km/h speed limit, rather than to 90 or 100, may often outweigh the extra cost. Travel time savings increase, and so do any wider economic benefits in the form, e.g., of an expanded labour market for commuters.
- Construction cost savings could be achievable through the application of more rigorous cost-benefit criteria for road investments. If, e.g., the government made

clear that the realisation of a given project was contingent upon its positive net economic return, construction firms would be challenged to find cost saving ways to design and carry out the project. Today, the decision to go forward with a particular road investment is generally made prior to the tendering process, something which reduces the government’s bargaining power.

## Analysis of Norwegian road projects

We have estimated econometric models on two data sets consisting of road projects that have been candidates for the Norwegian national transport plans for 2010-2019 and 2014-2023, respectively. Our dependent variable is the benefit-cost ratio (BCR). Our independent variables are characteristics of the municipality in which the project is located. Our analysis shows that such characteristics explain a substantial share of the variation in BCR:

- Projects in centrally located municipalities (as defined by Statistics Norway) have higher BCRs.
- Projects in municipalities with high population density have lower BCRs, which partly nets out the effect of centrality. However, this effect mainly explains differences in BCR among the most central municipalities, for instance between an urban road project and a highway project close to a major city.
- Projects in municipalities with large differences in altitude, low temperatures and/or a coastline have lower BCRs. Precipitation and the share of the municipality that is located on islands have no apparent effects.
- The BCR is lower in municipalities with low median income. However, there is no effect of the income level on the BCR when controlling for other municipality characteristics. This suggests that income does not have a direct effect on the BCR within Norway, but that municipalities with low income levels have a high score on other characteristics that imply low BCRs.

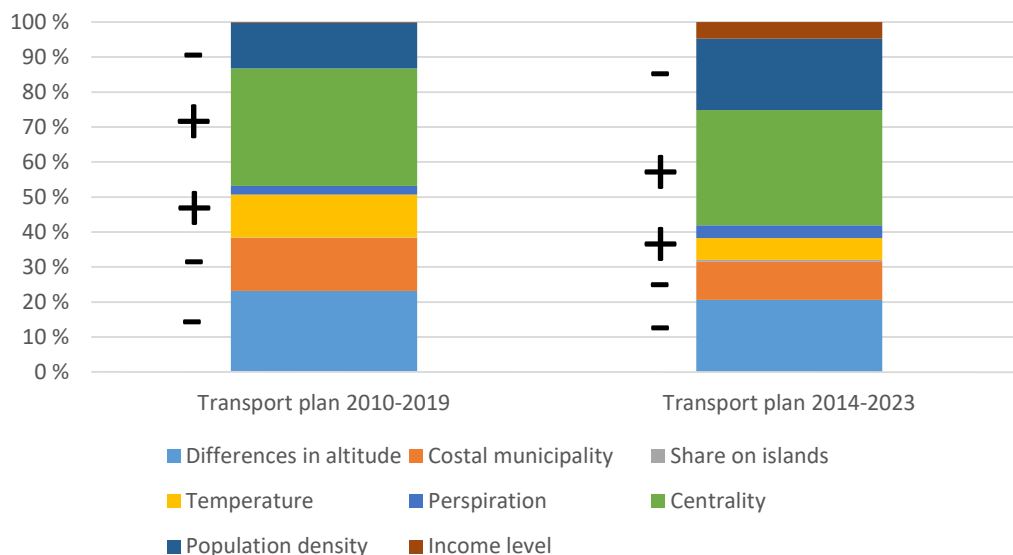


Figure 1. The explanatory power (squared partial correlations) of local geographic characteristics on the benefit-cost ratio of Norwegian road projects. The direction of the effect of each characteristic is indicated by a plus or minus sign.

Our results imply that there might be a trade-off between building new roads in certain types of areas and selecting projects based on economic efficiency. However, one should be aware that the relationships between the BCR and geographic characteristics depend on current practice with respect to the design of roads. For instance, more moderate requirements for roads with low traffic volumes could result in a less steep relationship between the BCR and centrality.

## **«External factors»: Differences between Norway, Sweden and Denmark**

We have compared Norway, Sweden and Denmark with respect to various characteristics that could affect the economic return on road projects. We have assessed the importance of these characteristics based on the results of the econometric analysis and other considerations. Our conclusions are the following:

- Norway has larger differences in altitude, a longer coastline relative to the area and lower temperatures. This implies lower economic return on Norwegian road projects.
- Norway has a lower population density for the country as a whole, which also implies lower economic return on roads. Differences in the settlement pattern could also play a role.
- Kilometres travelled are somewhat higher in Norway relative to population, which implies higher economic return on roads. However, this does not outweigh the effect of lower population density.
- The income level is higher in Norway. This implies higher economic return on roads, but this is likely to be outweighed by higher construction costs. The growth in road construction costs over time roughly follows the growth in GDP per capita.

Based on this, we can safely conclude that differences in geographic characteristics result in lower economic return on road projects in Norway compared to the two other Scandinavian countries.

## **Conclusion and recommendations**

Our analyses show that geographic characteristics both explain differences in economic return among road projects within Norway and between Norway and the neighbouring countries. Differences in policy and the design and implantation of individual projects could also affect the economic return on road investments.

The fact that many projects have negative estimated economic return does not imply that one should not take economic return into account when selecting projects. If the total budget is taken as given, total net benefits are maximized if one ranks projects based on the BCR. This also applies to projects with negative net benefits ( $BCR < 1$ ) if the total budget is larger than the total cost of all projects with a  $BCR > 1$ . However, any project with  $BCR < 1$  involves an economic loss. A high level of investment therefore implies that one should try to achieve positive net benefits.

There could, however, be a trade-off between economic efficiency and investing in new roads in certain types of areas. This suggests that one should not only evaluate projects based on the BCR, but also other criteria like:

- Regional policy: This could be captured by an indicator that depends (1) on the total benefits of the project and (2) on the extent to which these are reaped by areas with a population growth lower than the national average.
- Redistribution: This could be captured by an indicator that depends (1) on the total benefits of the project and (2) on the extent to which these are reaped by areas with an income level lower than the national average.

A challenge in applying these criteria is that different political parties will put different weight on them. It could therefore be problematic for planners to apply them in their recommendations. This can be solved either by letting the incumbent government instruct the planners on how to use these criteria, or by only showing these indicators as part of the documentation of each project and leaving it to the politicians how they should be valued in the final selection of projects. In any case, we recommend that one aims for a more standardized and transparent assessment of each project, including the arguments made for selecting it.

Another potential criterion for project selection is positive synergies between projects and achieving a uniform road standard along the same highway corridor. In our opinion, this should not be a criterion in itself. The benefits, if any, should be captured if one merges the projects that are adjacent to each other and conduct a cost-benefit analysis for this joint project.

Furthermore, we recommend a critical review of the standards and requirements that apply to Norwegian road projects. One should also abandon the practice of selecting which type of road to build based on annual average daily traffic. The allocation of funds between areas and types of projects should be flexible and not necessarily stable over time. We also recommend to explore the potential for cutting cost and improving net benefits through new forms of contracts and models for co-operation between the Public Roads Administration, the contractor and the local government.