Local labour market effects of transport investments: The case of two Norwegian regions

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Abstract: Improvements in infrastructure may facilitate commuting between neighbouring regions, which in turn may stimulate the regional integration of local labour markets. In Norway, the average travel distance to work has increased by more than 20 percent since the mid-1980s, while the average travel time has remained constant. The increase in commuting may be interpreted as a regional integration of labour markets, in response to improved accessibility and increased range. The increase in travel distances has been largest in the peripheral municipalities.

Studies of two Norwegian infrastructure projects demonstrate that these investments have led to reduced travel time and increased commuting. This in turn results in a more varied and effective labour market, providing greater opportunities for employment and economic growth, and a better matching of skills in the labour market. In both cases there has been an increase in commuting flows, although to varying degrees. The variation may be explained by the composition of the industry structure and employment opportunities within the two regions. Increased spatial competition may result in redistributive rather than generative growth, especially with regards to the location of service activities.

The paper draws on a statistical analysis of commuting flows, settlement and employment patterns at a low level of aggregation. A detailed analysis of commuting between basic statistical units for the years 2001 and 2007 reveals a commuting pattern that is not discernible when using data at the municipality level. The statistical analyses are complemented by interviews with firms and local authorities in selected case study areas. Together, the two data sources provide insights into the local consequences of specific infrastructural investments.

Keywords: commuting, infrastructure investments, labour markets, regional development

Introduction

The idea that investments in transport infrastructure stimulate regional development and economic growth is central in transport policies. Several analyses demonstrate a relationship between transport infrastructure and economic growth, but the direction of causality is unclear, and the mechanisms on which this relationship is founded are not well understood. One effect of infrastructure investments is the enlargement of labour regions. Improvements in infrastructure may facilitate commuting between neighbouring regions, which in turn may lead to the regional integration of local labour markets. The integration of labour markets is also considered a means to secure settlement in peripheral regions (Amcoff 2007). The idea is that by connecting smaller regions, a larger region with a more varied and effective labour market will emerge, thus providing greater opportunities for employment and economic growth, and a better matching of skills in the labour market. By improving the opportunities to commute, fluctuations in local labour markets may be levelled, and a buffer against unemployment created. The regional integration of labour markets may thus ideally serve three aims: reduce unemployment, improve access to labour, and maintain a decentralised settlement structure. The latter is an important political aim in a sparsely populated country as Norway.

The purpose of this paper is to examine the extent to which investments in infrastructure have contributed to the integration of labour markets, measured as increased commuting. In order to investigate the relationship between infrastructure investments and the integration of labour markets, we have focused on two infrastructure projects. The paper draws on a statistical analysis of commuting flows, settlement and employment patterns at a low level of aggregation, combined with qualitative interviews with firms and local authorities.

In the following, the method of study will be briefly presented, as well as a review of literature on the effect of infrastructure investments. The two case studies will be discussed in some detail. Then a comparison of the cases will follow, seeking to explain why, and in which ways, the local adaptations to infrastructure investments differ. By way of conclusion, the paper compares the diverging empirical findings with the theoretical perspectives on the effects of infrastructure investments.

Spatial analyses and qualitative interviews

The paper draws on a combination of official statistics (Statistics Norway) and geographically disaggregated databases on commuting flows, settlement and travel distances. We have tested the degree to which infrastructure investments have led to regional integration, concretised through increased commuting. We have compared commuting between basic statistical units before and after the infrastructure investment in order to reveal eventual changes in commuting patterns.[1] Data from Statistics Norway are specially adapted in order to detail the place of residence of the working population, the location of workplaces, and the commuting flows between residence and workplace. While commuting analyses traditionally have taken the municipality level as point of departure, the low geographical level of our analysis allows for a more nuanced analysis of commuting flows and labour markets.

The effect of road investments will be evaluated through an analysis of changes in commuting patterns, settlement, workplaces, retail distribution and employment. We will also consider the degree to which changes in the regional competitive conditions may influence commuting

[1] The location of data in the analyses is based on connections to basic statistical units, and all distances and travel times are therefore linked to these units rather than to municipality borders.

patterns. The size of commuting flows depends on a number of local and regional conditions such as settlement patterns and the location of workplaces and regional centres. This must be taken into account when analysing the effect of infrastructure investments. A suitable method for doing so is to compare concrete adaptations in a region with average national developments. We have compared commuting statistics from a particular area with an estimated commuting pattern, based on a spatial interaction model:

$$P_{ij} = k_i Y_i k_j A_j \left[e^{-0{,}09 \cdot d_{ij}} \lambda + d_{ij}^{-1{,}5} (1-\lambda) \right] \left[\sum_j k_j A_j \left(e^{-0{,}09 \cdot d_{ij}} \lambda + d_{ij}^{-1{,}5} (1-\lambda) \right) \right]^{-1}$$

$\lambda = 1$ *for* $d_{ij} < 68$ min, $\lambda = 0$ *for* $d_{ij} \geq 68$ min

$$Y_i = \sum_j P_{ij}; \quad A_j = \sum_i P_{ij}; \quad \sum_i Y_i = \sum_j A_j = \sum_{i,j} P_{ij}; \quad \sum_j p_{ij} = 1$$

P_{ij}: Estimated commuting from zone i to zone j, Y_i: Working population zone i,
A_j: Workplaces zone j, d_{ij}: Travel time by car from zone i to zone j, k_i and k_j balancing factors.
Zones = The Norwegian basic statistical units.

The model describes a typical level of commuting from a settlement zone to a work zone, given the number of workplaces in the region and alternative workplaces within a certain distance from the settlement zone (Engebretsen and Gjerdåker 2010). The calibration of the model is based on actual commuting between the Norwegian basic statistical units (constitute the zones in the model) along the west coast of Norway from the south to the north, excluding the units in Stavanger, Bergen and Trondheim greater urban regions. The route choices, the distances, and the travel times by car between the zones are estimated by means of the Norwegian electronic road network and a transport model. Basic statistical units[2] are used by Statistics Norway to provide stable and coherent geographical units for regional statistics in Norway. The units are subdivisions of municipalities, and are principally homogeneous with respect to e.g. communications and land use. Most basic statistical units include only a few hundred inhabitants. There are about 14 000 basic statistical units in Norway.

The model describes how commuting intensities increase when travel time is reduced and the number of available workplaces increases. The model does not consider the impact of specialisation, that is, the type of workplace and the skills of the working population. Deviations between actual and estimated commuting pattern thus provide an opportunity to reveal the importance of specific local conditions.

The statistical analyses are supplemented by interviews with firms and local authorities in the case study areas, with the aim to map the degree to which infrastructure investments lead to changes in the access to labour, trade patterns, settlement and commuting. Together, the two data sources provide insights into the local consequences of specific infrastructure investments.

The theoretical argument

An adequate transport infrastructure is important in order to expand and strengthen local labour markets and improve access to services, both for people and business. This dual aim of transport investments is expressed in the Norwegian government's focus on road investments as a means to create stronger regions (St meld nr 21, 2005-2006). Theories on the effects of

[2] Norwegian: Grunnkrets.

infrastructure investments take as point of departure travel time and transport costs, which in turn may affect factors such as access to markets, location of companies, employment, land use, settlement, labour market, and access to services (Lyche and Bråthen 2004, Bråthen et al 2003, Leitham et al. 2000, Ludvigsen 2001, Preston and Holvad 2005, Krugman 1991, Fujita et al. 1999). A reduction in transport costs due to infrastructure investments may also influence decisions to commute or migrate. Employees may be able to travel longer distances for the same generalised costs, which may contribute to the integration of regional labour markets. Reduced commuting costs may alternatively stimulate migration to an area where housing is less expensive. The trade-off between commuting and migration is in turn influenced by constraints in the respective markets. High housing prices in a region which is a net importer of labour may result in commuting rather than migration (Preston and Holvad 2005).

A well-functioning labour market depends on attaining a balance between the offer and demand of labour. Commuting may therefore be interpreted as a lack of correspondence between the number and skills of employable inhabitants in a region, and the qualification requirements of employers. Robust settlements in the periphery depend on the availability of a sufficient number of employment opportunities within an acceptable commuting distance. By improving the opportunities to commute, fluctuations in local labour markets may be levelled. Commuting therefore serves as a buffer reducing the risk of unemployment, offering an alternative to migration.

Commuting may also provide a better matching of skills in the labour market, which is important in an increasingly specialised labour market. Existing studies suggest that higher education translates into a larger willingness to commute (Harsman and Quigley 1998, Trendle and Siu 2005). A mobile work force facilitates the efficient matching of skills, which is an important element of regional competitiveness (Sandow 2008). The longer distances that can be covered within a given period of time, the larger is the number of workplaces and potential employees to choose from.

The mobility of the labour force is regarded very important in discussions on European regional development and economic growth (Sandow and Westin 2010:88). It is the mobility of the labour force, both geographically and between industries and workplaces, that facilitates the matching of local demand and supply of labour: "In a time of decreased inclination to migrate, increased commuting can improve the functionality of local labour markets." Contemporary working life is characterised by knowledge intensive tasks and more flexible forms of affiliation, and the demand for higher education and specialised skills is increasing (SNF 2008). The knowledge and skills of employees is therefore of great importance for the development of business. This implies that the most importance resource of regions is mobile or often dependent on commuting (Hansson 2003). Sandow and Westin (2010) note that from the perspective of industry, the ability to recruit competent labour is important, and from a national perspective, the integration of labour markets in terms of increased commuting gives important economic effects.

Investments in infrastructure facilitate economic growth through improved accessibility, which may be defined as the *potential for interaction* (Hansen 1959). The potential for interaction is influenced both by the quality of the transport system and by the particular land use. Since places differ in their potential for interaction, they will also have varying potential for development following an infrastructure investment (Straatemeier 2008). The potential to create regional development through transport infrastructure investments is also related to the distance between regional centres and the location of settlements (Linneker and Spence 1996, Vickerman 1995, 2000, Bråthen et al. 2003). It is argued that new road infrastructure as a rule should support existing settlement structure. Evidence suggests that changes in accessibility

reinforce existing trends rather than creating new trends (Banister and Berechman 2001, Bråthen et al. 2003).

According to SIKA (2001), the regional integration of labour markets through infrastructure investments has relatively limited effect if the connected labour regions are small. On the other hand, a small labour region may improve its conditions for growth if connected to a larger labour region. It is argued that infrastructure investments have the greatest effect in larger labour regions within labour- or research-intensive sectors. If neighbouring regions exhibit different levels of employment, the result may be the integration of labour regions. It is however unclear if greatest effect is achieved by connecting regions of similar or dissimilar business structure.

Our study aims to shed light on these issues. The case studies suggest that it is relevant to focus on the *differences and similarities* of the connecting regions in terms of industry and employment structure, and how this may affect the incentive to commute and the integration of labour markets, and in turn, whether this contributes to strengthen the region as a whole, or leads to the redistribution of growth. Banister and Berecman (2001) argue that infrastructure investments only supplement the *necessary conditions* for growth, which are positive economic externalities (such as access to qualified labour, local economic dynamics and agglomeration economies) and favourable investment and political factors.

A common objection to the argument that infrastructure investments stimulate growth is that investments may lead to redistributive rather than generative growth (Preston and Holvad 2005, Lyche and Bråthen 2004). Improved accessibility may contribute to enlarge the market share of companies, potentially giving rise to increased employment, or it may stimulate expansion in the opposite end of the investment (Linneker and Spence 1996). Existing companies in the core region may increase their market share, while companies in the peripheral region no longer are protected from external competition from stronger companies (Preston and Holvad 2005, Lyche and Bråthen 2004, Ludvigsen 2001). The introduction of external competition may thus reduce the income of local producers and increase unemployment. The net impact of an infrastructure investment may have distributional effects not only between regions, but also between actors within a single region (Vickerman 2000).

Infrastructure investments may thus change the relative attraction of regions, giving a *redistribution* of growth rather than new economic growth, favouring some places and actors at the expense of others (Banister and Berechman 2001, Preston and Holvad 2005). However, local redistributive effects, such as the centralisation of the service sector to the larger local centre, may on a regional level translate into a strengthening of the region vis-à-vis the larger regional centre. This example of a local redistributive effect translating into a regional growth effect will be explained in further detail in the following.

Norwegian trends

Infrastructure investments may lead to reduced travel times and the inclusion of a larger area within the reach of a certain travel distance (for instance 45 minutes) from a regional centre. The result is the regional integration of labour markets. For Norway as a whole, the average distance to work has increased by more than 20 per cent since the mid-1980s[3] (Engebretsen and Vågane 2008, 2009). The increase has been largest in the peripheral municipalities. Increased commuting distances may to some extent be attributed centralisation processes at both the local and regional levels, evidenced by increased commuting across municipality

[3] Estimated for commuting distances up to 150 km.

borders. However, half the increase in commuting across municipality borders concerns commuting to municipalities with *fewer* workplaces than the municipality of residence, suggesting a pattern of increased commuting in all directions, not only to the larger centres. This indicates increased regional integration of labour markets in response to improved accessibility and increased range.

Statistics from the Norwegian national travel survey confirm this view (Engebretsen and Vågane 2009). If centralisation had been the prime explanation for increases in commuting distance, then increased travel time should also be expected. This is however not the case. While the average travel *distance* to work has increased by 20 per cent since the mid-1980s, the average travel *time* has remained constant, which indicates improved reach. The question is whether this national trend of regional integration of labour markets is also found at a lower level of analysis, related to concrete infrastructure projects. Our statistical analysis aims to investigate whether infrastructure investments have resulted in the regional integration of labour markets. The point of departure of our analysis is concrete road investments in two different regions at the west coast of Norway: The Triangle Link in the county of Hordaland (opened in 2001) and the main road (Rv 5) between Florø and Førde in the county of Sogn & Fjordane (completed in 2005) (figure 1).

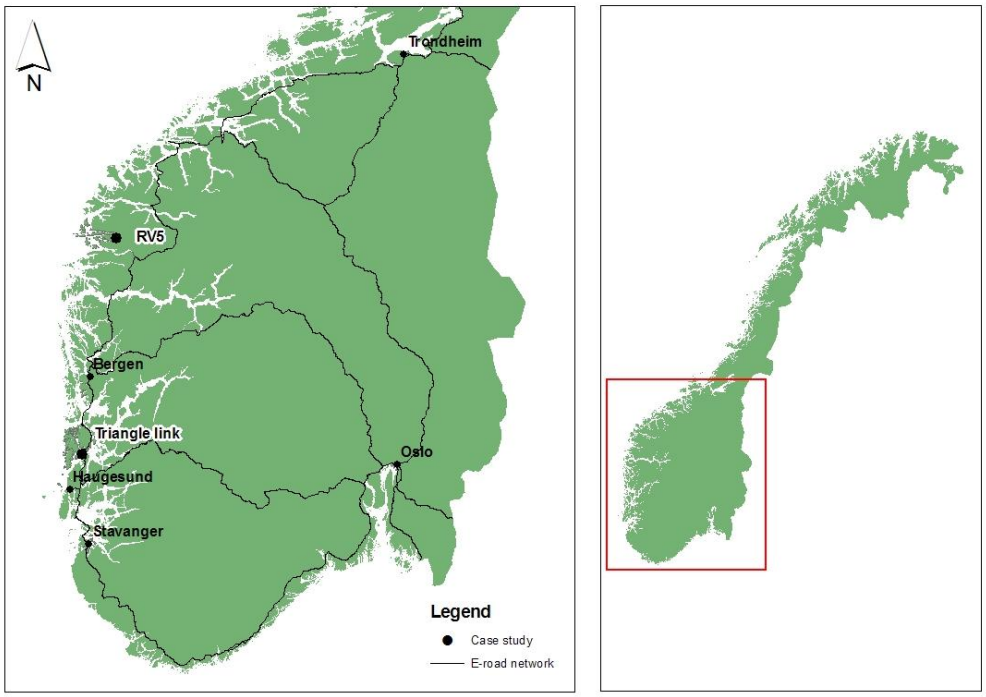

Figure 1: Location of the infrastructure projects Rv 5 and Triangle Link.

The two areas of study differ regarding type of infrastructural project, distance between regional centres, and employment and industry structure. The *Triangle Link* is a system of two bridges and an underwater tunnel connecting two islands to the mainland. The investments on the *Rv 5* consist of a series of road improvements, including a tunnel substituting a mountain road, reducing the travel time between the two local centres considerably. The final stage of the road improvement scheme was completed in 2005, the tunnel being finished already in 1995. In the following, the two cases will be presented in some detail.

The Triangle Link

The Triangle Link connects the islands of Stord and Bømlo to Sveio at the mainland (figure 2). The link replaces four ferry distances and consists of two suspension bridges, one subsea tunnel and a smaller bridge. The Triangle Link is part of the road E 39 between Stavanger and Bergen, and has also contributed to reduce the travel time between the two cities by half an hour. The project covers a total of 21,5 km of road, and is financed by road toll. The connection Stord-Sveio was finished in December 2000,and the connection to Bømlo opened in April 2001.

Our study area is delimited to settlements located within one hour and 40 minutes by car from the island Føyno, where the three links towards Stord, Bømlo and Sveio are connected and the toll station is located. Given the general sensitivity to daily travelling distances, the connection is likely only to have a marginal impact on commuting over distances above 60 minutes by car. Within this commuting distance, there are almost 90 000 residents (January 2008) and more than 40 000 workplaces (fall 2007). Approximately 90 percent of the workplaces are located in the community centres of Fitjar, Leirvik (Stord), Svortland (Bømlo), Førdesfjorden and Haugesund (figure 2).

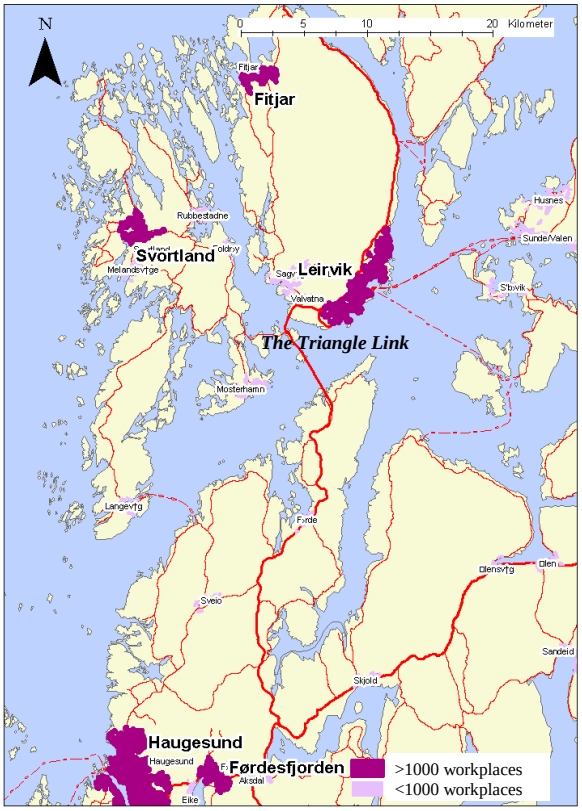

Figure 2: Communities of 1000 or more workplaces within 60 minutes by car from The Triangle Link (Føyno) (2007).

Regional competition

In order to evaluate the impact of the Triangle Link on labour markets, knowledge is needed on other mechanisms that, independently of the infrastructural investment, might have influenced commuting patterns. This includes changes in settlement, workplaces and trade that may have altered the competitive balance between the municipalities. Analyses of

population statistics do not suggest that the Triangle Link has influenced settlement, however. On the contrary, population growth within 30 minutes by car from the toll station has been slower after the completion of the mainland connection, and the trend is a consolidation of the existing settlement patterns since 2000.

The trade balance between the municipalities of the study area has also basically remained unchanged for the last decade. The city of Haugesund has a substantially larger population than the small community centres at Stord, Fitjar and Bømlo. The regional centre has a retail market share of almost 180 percent. Together, Stord, Fitjar and Bømlo have a retail market share of 90 percent. An analysis of trade statistics does not indicate that the Triangle Link has led to a redistribution of growth to the dominant centre of Haugesund. On the contrary, there is evidence that the island of Stord has improved its competitive position, especially since 2003 (figure 3). This may be an effect of the Triangle Link, in combination with the establishment of the recent shopping centre at Heiane, located in close proximity to the Triangle Link and the E 39 serving the traffic between Stavanger and Bergeb. Half of Stord's increase in retail market share since 2003 took place between 2007 and 2008, which may be attributed to the expansion of the shopping centre in 2008, which in turn may be related to the increased traffic over the Triangle Link.

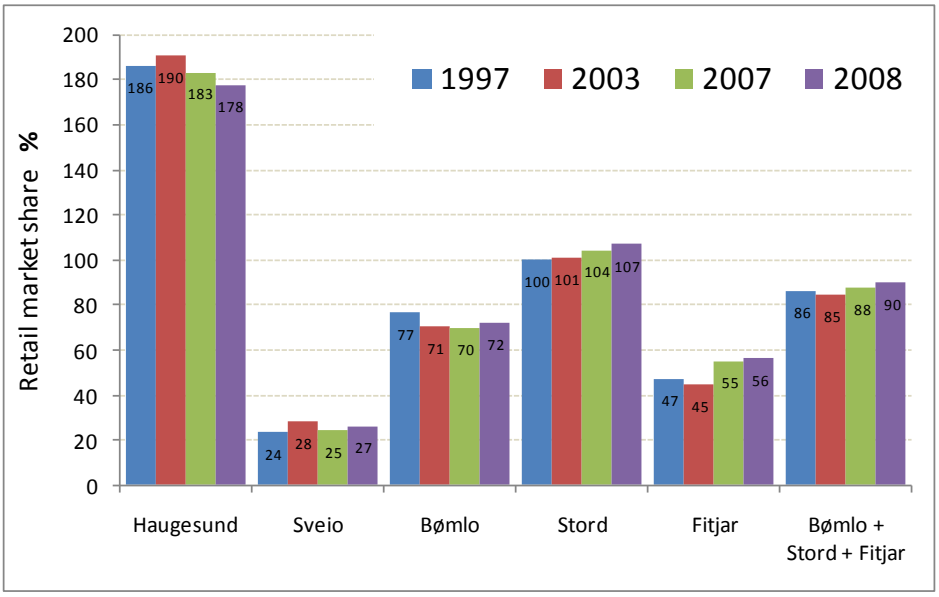

Figure 3: Retail market share by municipality and year.

The growth of the shopping centre at Heiane is to the disadvantage of those running business in the community centres of Leirvik (Stord) and (Svortland) Bømlo. In an interview with the mayor of Bømlo, we were told that local businesses are forced to seek out niche strategies in order to compete with the chain stores at Heiane. Despite local efforts, however, the trend is that the centre of gravity is moving from Bømlo to Stord.

Employment

The development in employment and workplaces indicates to some extent increased regional competition. All municipalities have experienced growth in the number of workplaces since 2000, with Haugesund accounting for the largest growth rate. Bømlo, Stord and Fitjar have had a slower growth and are thus in a relatively weaker position since the completion of the Triangle Link.

There is however no indication that the increased domination of Haugesund in the labour market is related to the Triangle Link. Between 2000 and 2007, the yearly growth has remained constant, with no rupture in the general tendency at the time of the opening of the Triangle Link between 2001 and 2002. In all municipalities, the number of workplaces boomed in 2006 and 2007, coinciding with a national peak in business activity. The number of workplaces relative to the number of employed residents has been relatively stable in the period 2000-2007. Haugesund and Stord have both had a surplus of workplaces and therefore a certain level of in-commuting. The remaining municipalities have been dependent on out-commuting.

The development in employment has also been relatively stable. Figure 4 shows unemployment levels in the four municipalities adjacent to the Triangle Link. The unemployment level was low in 2008, following a steady reduction in unemployment since 2003. The development has paralleled the developments at the national and county (Hordaland) level, albeit at a lower level in the four municipalities than the national and county average. Between 1999 and 2000, unemployment in the four municipalities increased, but was again reduced from 2000 to 2001. A plausible explanation is that the Triangle Link made it easier to find employment outside the municipality. The increased unemployment from 2002 to 2003 also coincided with a general increase in unemployment at the national and county level.

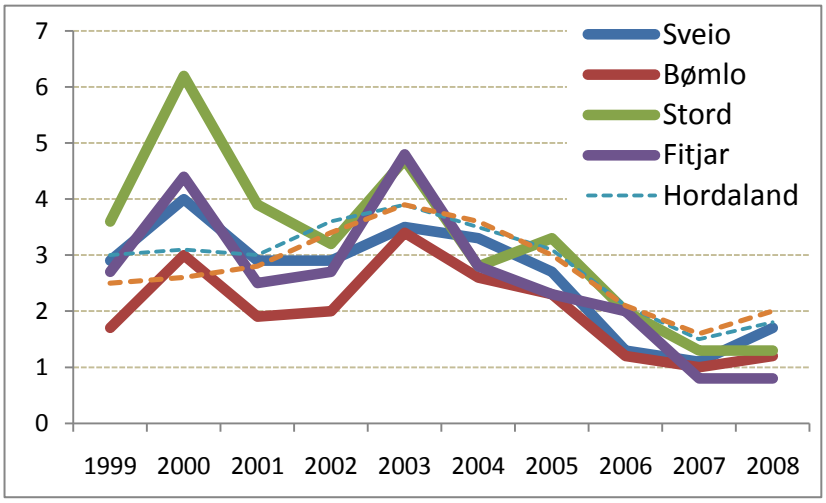

Figure 4: Unemployed by year and municipality as percentage of working population.

The developments described above do not indicate that the Triangle Link has had a strong impact on settlement, trade and employment. In other words, there is no reason to believe that there have been changes in the competitive balance between the municipalities that influence commuting patterns. Instead, increased commuting must be interpreted as a response to the improved accessibility resulting from the Triangle Link.

Increased commuting

The stability in the number of workplaces relative to the number of employed inhabitants conceals an increasing tendency to commute across municipality borders. At the county level the working population increased between 2000 and 2007 by 12 percent (Hordaland) and 18 percent (Rogaland). In the same period, the commuting across municipality borders increased by 20 percent and 25 percent respectively. *The commuting over the Triangle Link stands out*

by an increase of 55 percent. Figure 5 illustrates the development in commuting between 2000 and 2007. The strong growth in commuting must be interpreted as an increased regional integration of labour markets. The increase in commuting amounted to 7 percent between 2000 and 2001 (when the Triangle Link opened), and 9 percent the following year. Between 2006 and 2007, the growth in commuting amounted to 12.5 percent.

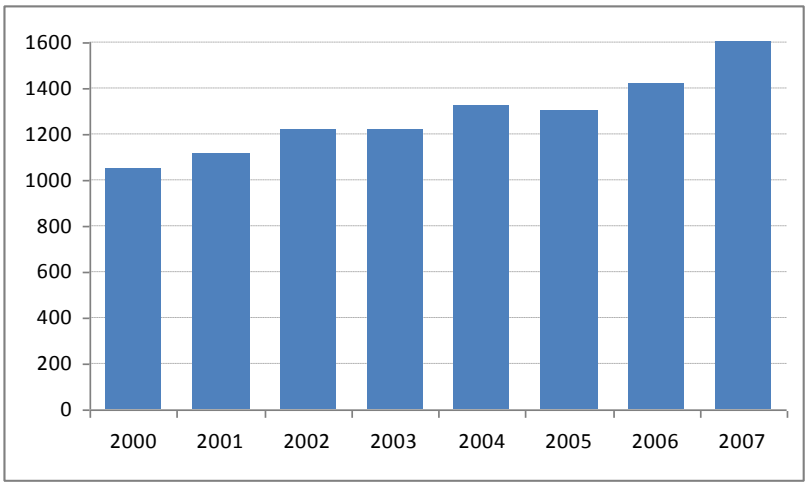

Figure 5: Number of commuters on the Triangle Link 2000-2007. All directions.

In order to exclude the effect of population growth on the increase in commuting, we have compared commuting patterns with the number of employed residents in the neighbouring municipalities of Stord, Fitjar, Bømlo and Sveio. Figure 6 shows commuting as a percentage of employed residents, giving evidence to a clear growth in commuting since the opening of the Triangle Link in 2000 and 2001.

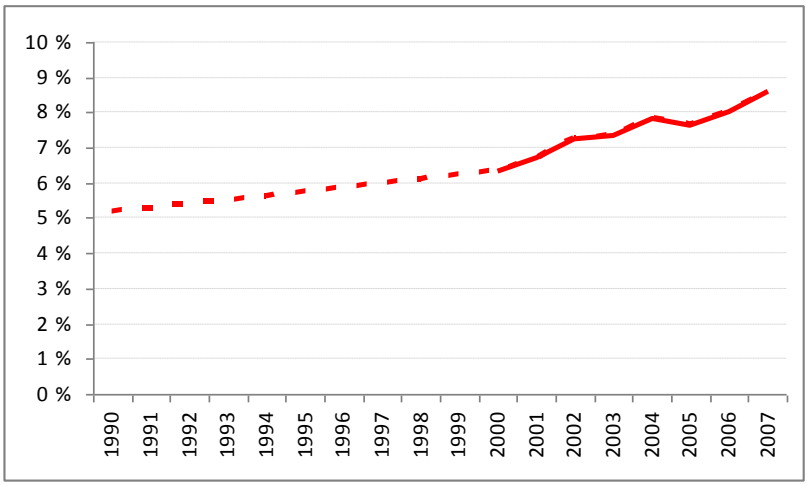

Figure 6: Commuting on the Triangle Link (1990-2007) as percentage of working population in the municipalities of Stord, Fitjar, Bømlo and Sveio.

There has been an increase in commuting for all travel distances. Relatively speaking, the increase is largest for distances between 50 and 70 km (65 %). Figure 7 illustrates the growth

in commuting over the Triangle Link between 2001 and 2007, categorised by distance to workplace concentrations. Although relatively few are willing to commute longer distances than 50 km (see for instance Sandow and Westin 2010), more than half of the *increase* in commuting over the Triangle Link involves such travel distances, which equals the distance to the regional centre of Haugesund.

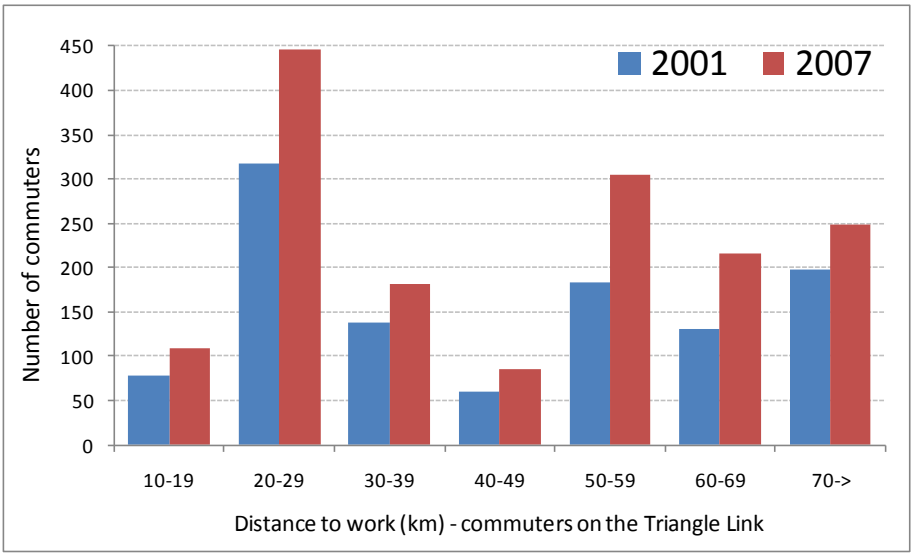

Figure 7: Number of commuters on the Triangle Link (2001 and 2007) by km to workplace concentrations.[4]

More than three quarters of the increased commuting over the Triangle Link is due to higher commuting *frequencies*, meaning that a larger share of the working population is commuting in 2007 than was the case in 2001 (figure 8). This indicates an increasing integration of labour markets.

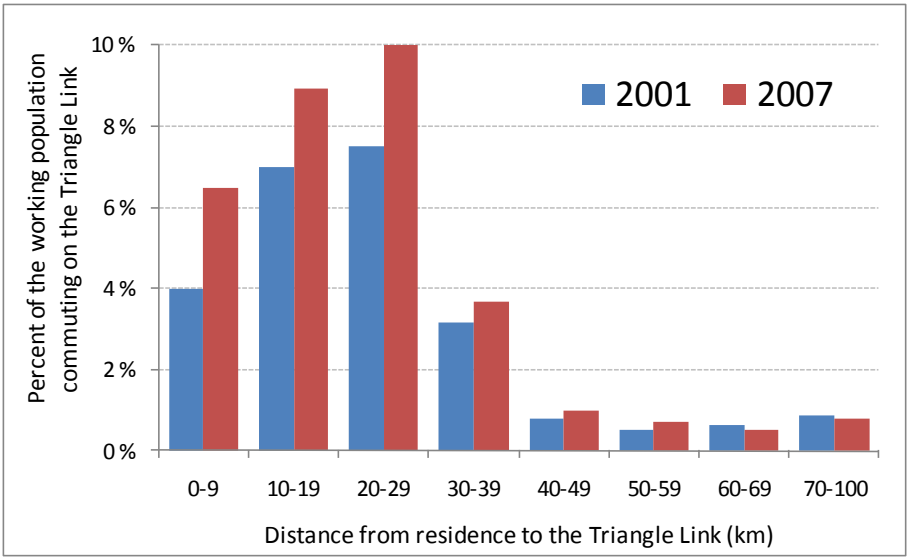

Figure 8: Commuting frequency on the Triangle Link by road distance from residence to the Triangle link (Føyno).

[4] Includes travel to work for residents within two hours by car from the Triangle Link (the toll station at Føyno).

Despite the substantial relative increase in commuting, the degree of regional integration is considerably lower than what might be expected. This conclusion is based on a comparison of the actual commuting pattern for 2007 with an "expected" commuting pattern estimated by means of the interaction model described earlier. The model shows an expected 80 percent increase in commuting on the Triangle Link. It is within a travel distance of approximately 50 km from the various workplace concentrations that expected commuting is higher than actual commuting. For commuting to areas at a distance further away than 50 km, the share of actual commuting is higher than expected (figure 9).

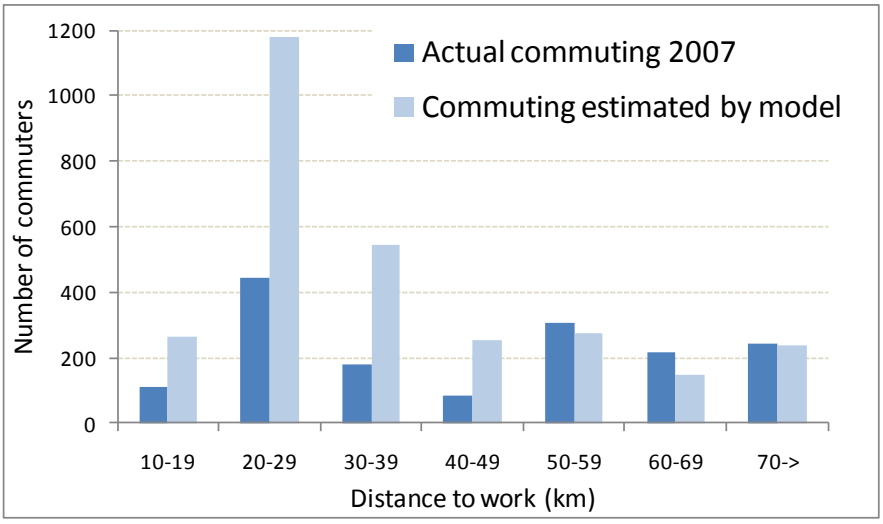

Figure 9: Actual and estimated number of commuters on the Triangle Link by km to workplace concentrations.

This finding illustrates that it is not only travel distance between workplace concentrations that influence commuting frequency, but that industry specific conditions, *not* considered in the model, explain variations in actual commuting patterns. That the actual level of commuting is lower than expected for shorter distances, and higher than expected for longer distances, may be explained by the fact that the workplace concentrations linked by the Triangle Link are *similar* in terms of type of workplaces and competence requirements, while long-distance commuting to Haugesund is necessary to find jobs that differ from those offered in the insular municipalities. In other words, the driving forces to commute between the insular municipalities may be relatively weak. All municipalities have low levels of unemployment, and both Bømlo and Stord are well endowed with workplaces relative to the size of the working population. The two municipalities have similar industry structure, with 25-30 percent of the workplaces within the industry sector.

Commuting between the neighbouring municipalities to the Triangle Link does therefore not greatly improve the *variety* of workplaces available. This may also explain that the degree of long-distance commuting to the larger town of Haugesund is relatively high. As communicated by the director of *Leirvik Module Technology* at Stord:

> "The greatest challenge for the periphery is lack of diversity in terms of workplaces."

It may however be too early to expect the impact of the mainland connection to be fully manifested. It is also plausible that the toll road has contributed to delay the full impact of the investment. More traffic is expected after the toll station is removed in 2012. It is also likely that commuting frequencies are higher than revealed by the statistics. In interviews with firms and local authorities, we are told that the Triangle Link brings flexibility both to employers

and employees. The industry in the area experiences great cyclical variations, making firms periodically dependent on hired personnel on short term contracts.

Interviews reveal large benefits for firms

We have interviewed selected workplaces at Stord and Bømlo on the extent to which the infrastructure investment has improved access to the particular competence and skills needed. *Leirvik Module Technology* is one of the firms that have experienced a positive effect of the Triangle Link. The firm has two yards at Stord, in addition to subsidiaries in the town of Haugesund and in Sweden. The Triangle Link has provided the firm with an enlarged labour market and a greater catchment area. The share of employees that commute from the mainland has increased, and we are told that the Triangle Link makes recruitment of personnel much easier. However, the firm also competes for labour (engineers) with firms at the mainland. Many employees use the industry at Stord as a foothold for eventually getting a position in Oslo or Stavanger. As emphasised in an interview with the local authorities of Stord, a larger professional environment is necessary if aiming to attract highly educated young couples:

> "The Triangle Link makes it easier to find relevant jobs for both. It gives more workplace concentrations to choose from, either at Bømlo, Stord or Haugesund. This is a favourable development in terms of attracting competent labour to the region."

In our interview with the mayor of Bømlo, we are told that although there has always been commuting from Bømlo to Stord, the new trend is more commuting in the opposite direction:

> "The Triangle Link has provided our firms with access to a larger labour market. It is of great importance for the firms to get access to the type of skills needed."

For the multinational firm *Wärtsilä* at Bømlo, one of the greatest challenges has been the recruitment of skilled labour. The Triangle Link has reduced this challenge considerably:

> "The Triangle Link has made Bømlo visible to Stord and the mainland, and the number of commuters has exploded."

The fish farms *Bremnes Seashore* and *Brandasund Fiskeforedling* at Bømlo have also experienced an increase in commuting from Stord and the mainland:

> "There would not have been three large fish farms with 300 employees at Bømlo were it not for the Triangle Link. There are continuous structural adjustments in the business, and without the link to the mainland it is likely that the business had been downsized at Bømlo and instead being moved to a more accessible locality."

The flexible use of hired labour

When the large industrial projects run at full speed, there is a lot of hired labour at Stord. According to the local authorities at Stord;

> "Since the construction of the Triangle Link, workers can now live in the neighbouring municipalities while commuting to Stord."

This commuting between a temporary accommodation and a temporary workplace is not reflected in the statistics, implying a greater number of commuters on the Triangle Link than what is reported in the statistics. *Aker Stord* is the assembly yard of Aker Solutions for modules and topsides for fixed and floating oil and gas production platforms. Of their 1155 employees in 2009, 950 were residents at Stord, while 130 were commuting from neighbouring municipalities. The company is also an extensive user of hired labour:

> "Approximately 60-70 percent of our labour is hired. In 2008, this amounted to 4000 workers. The floating hotel could not accommodate them all, and many had to find accommodation in neighbouring municipalities while commuting to Stord."

At any point in time, *Aker Stord* has approximately 1200 hired workers at short-term contracts. The Triangle Link provides improved flexibility to the firm in periods of great activity, and also facilitates cooperation with firms in both Haugesund and Egersund at the mainland. The Triangle link also improves the possibilities for workers to travel home between shifts. As we are told by the managing director at *Leirvik Module Technology*:

> "This implies a general improvement in the level of skills of the hired labour, because what we can offer is now attractive to a larger number of workers."

The main road (Rv 5) between Førde and Florø

The other infrastructure project studied differ from the Triangle Link in that it is not a fixed link replacing ferry services, but a continuous improvement of an existing road between two centres of approximately equal size. The road project has encompassed seven sub-projects opened in stages between 1999 and 2005. The Naustdal tunnel was completed already in 1995. The upgrading of the road has reduced the distance between Førde and Florø from 67 to 56 km, and shortened the travel time by car by 25 minutes. The road is financed by a toll system that was removed in March 2010.

The area of study is delimited to municipalities within the reach of a two-hour drive by car from the coastal town of Florø (figure 10). This area encompasses approximately 51 200 residents (spring 2008) and 26 000 workplaces (autumn 2007). The town of Førde has approximately 9 250 inhabitants, while Florø has 8 450.

Figure 10: Municipalities within the study area.

Historically, Florø has been the dominating centre of the area, but Førde is now developing into the main centre of the Sunnfjord region, due to its nodal position along the E 39. Førde is dominated by the service and trade sectors, which account for ¾ of employment. The county hospital is the largest employer in Førde with its 2000 employees. Florø, on the other hand, is dominated by export-oriented industry such as fishery, acquaculture, shipbuilding and supply

services to the oil and gas industry. The industry structure thus differs considerably between the two centres, potentially providing a larger incentive for commuting than was the case for the Triangle link. Before returning to this issue, we will briefly present the developments in settlement, workplaces and trade that may have altered the competitive balance between the municipalities, independently of the infrastructure investments.

Regional competition

There has been a stable population development in the study area, the trend being a continuous centralisation towards the centres of Førde and Florø. Since 1980, the population of Flora municipality[5] has increased by 25 percent, while the population of the municipality of Førde has increased by 57 percent. Since 2000, the population of the municipality of Flora has stagnated, while continuing to increase in Førde. In 2007, Førde surpassed Flora in the number of inhabitants.

Førde has since long been the dominating trade centre of the region, with a considerable trade surplus (figure 11). The trade leakage from the municipality of Flora almost doubled between 2003 and 2007 (from 9 % to 18 %), indicating a redistribution of the retail sector from Florø to Førde, as a response to improvements in infrastructure and the resulting increased accessibility. The mayor of Førde communicates in an interview that it is the service sector of Førde that has benefitted the most from the infrastructure investments.

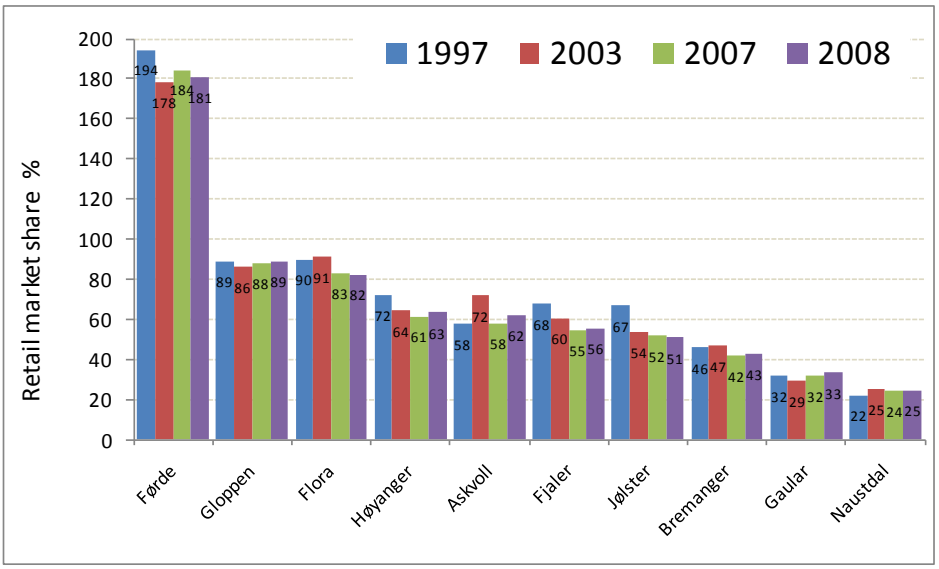

Figure 11: Contribution rate in retail trade by municipality and year.

Employment

Since the year 2000, the number of workplaces within the region has remained constant. For the region as a whole, there has been a small increase in the number of workplaces, following the increase in population. Førde has strengthened its role as the dominating regional centre, with a strong increase in the number of workplaces, parallel to the increase in population. Unemployment levels in the region have fluctuated with the general development at the county and national level. The municipality of Flora had particularly high unemployment levels in 2003. The increase in employment since 2004 may have been an effect of improved

[5] The town is named *Florø* while the municipality is called *Flora*.

opportunities to commute, in combination with an increase in the number of workplaces in Førde (figure 12). The director at *Handelshuset*, one of the shopping centres in Førde, notes that the new road has facilitated the creation of a common labour market, and that the centre in Førde now employs many residents in Florø, as well as attracting a lot of customers from Florø.

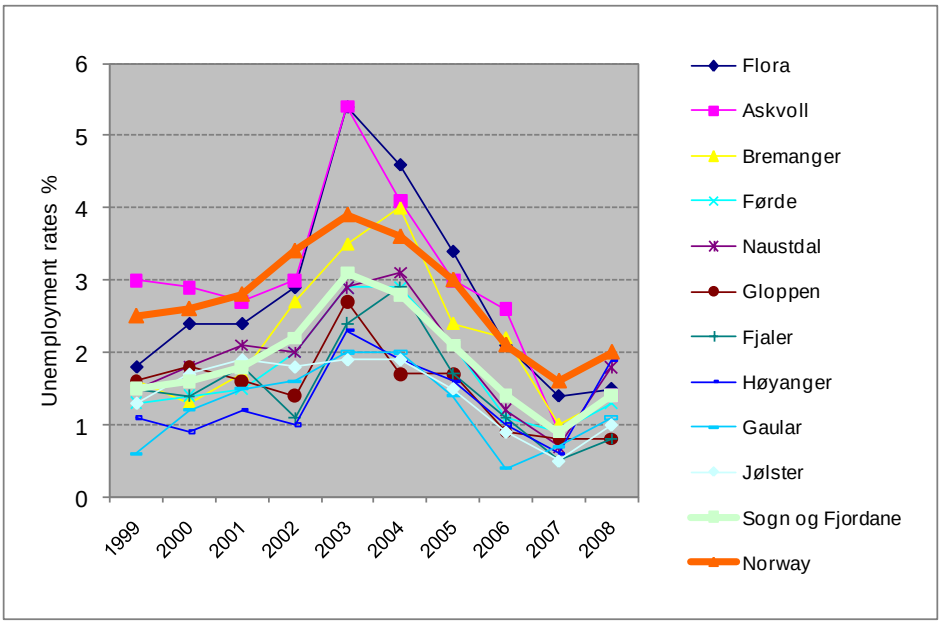

Figure 12: Unemployed by year and municipality as percentage of working population.

Increased commuting

The commuting on Rv5 in the municipality of Flora has increased by 40 percent since 2000. The largest increase has taken place since 2003. The increased commuting across the municipality border of Flora is a result of greater reach, which has contributed to deepen the regional integration of labour markets (figure 13 and 14).

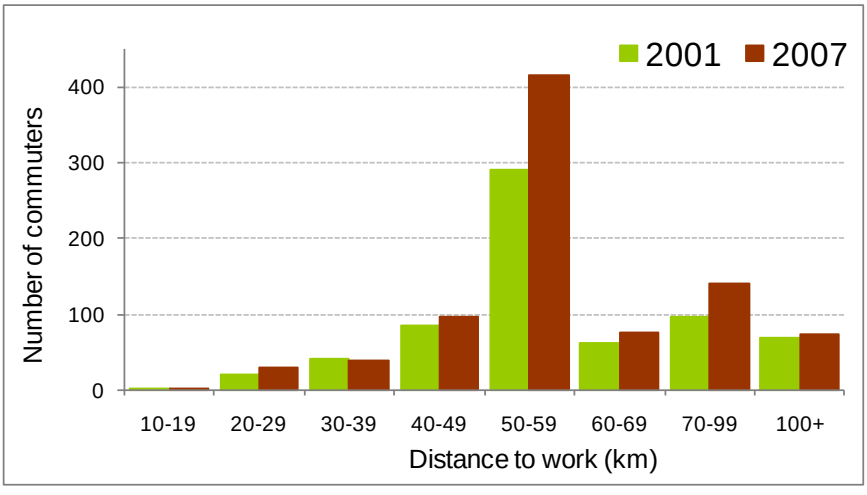

Figure 13: Number of commuters 2001 and 2007 on Rv5 by km to workplace.[6]

[6] The distances are calculated from place of residence (basic statistical units) to the centre of workplace concentrations. The figure includes travel to work that cross the municipality border of Flora, for residents within a two-hour travel distance from the centre of Florø.

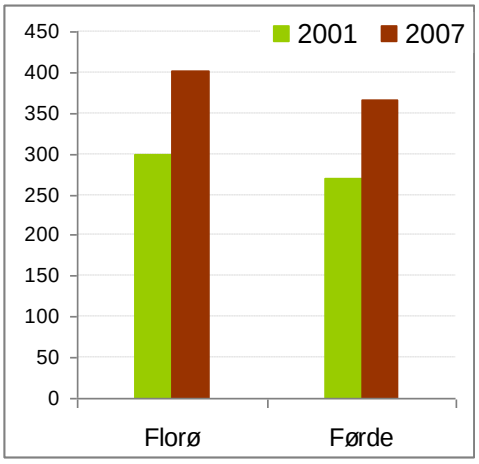

Figure 14: Number of commuters to Florø and Førde 2001 and 2007.[6]

The share of commuting on distances of 50-59 km, representing the distance between Førde and Florø, is relatively high. In figure 15, the actual commuting is compared to an estimated commuting pattern based on the interaction model described earlier. That the actual commuting between Førde and Florø is larger than estimated, may be explained by the fact that the model does not take into account differences in industry structure. If the two centres have had a similar industry structure, the level of commuting would expectedly have been lower.

The mayor of Førde observes that the infrastructure investments have led to a considerable increase in traffic between the two municipality centres. The real obstacle for commuting is not the distance, but the toll fee of 45 NOK for each passing, he argues. A further increase in commuting is expected after the toll system is removed in March 2010.

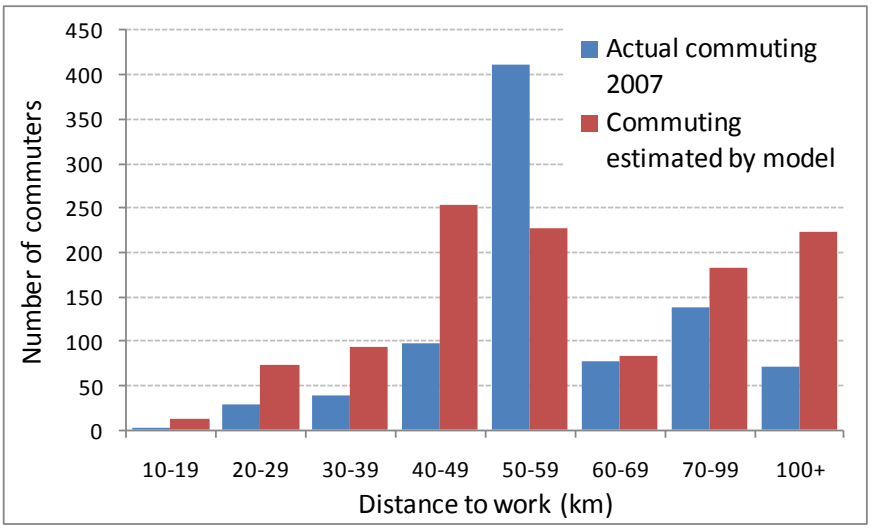

Figure 15: Actual and estimated number of commuters on Rv5 by km to workplace concentrations.[6]

It is also likely that the number of commuters is higher than reported in the statistics. As was the case with the industries affected by the Triangle Link, the use of hired labour has also been widespread in Florø. The shipyard *STX Europe* in Florø is one of several workplaces that in periods of high activity depend on hired labour. At the time of the interview (May 2009), the firm considered the recruitment of skilled personnel to be one of their greatest challenges:

> "We have a competent base of workers that have been with us for a long time. Skilled labour is short in supply in Florø, and good communications and accessibility towards Førde is therefore important."

Another challenge relates to attracting young and well-educated people to Florø on a permanent basis. For couples or families to settle, two persons are in need of employment. As commented in an interview with the local authorities of Flora:

> "For each family to settle in an area there is the need for two relevant jobs. Førde and Florø complement each other due to their differences in industry structure."

Summary and comparison

Our two cases defy a direct comparison. The type of infrastructure projects differ, the timing of completion is not comparable, and the municipality centres and workplace concentrations connected through the infrastructure project also differ. We may however contrast these two cases by returning to the comparison of actual commuting flows with the expected pattern estimated by the spatial interaction model. These estimations show that the commuting on the Rv 5 between Førde and Florø is greater than expected, while the opposite is the case for the Triangle Link.

In order to explain this deviation, we must return to issues that are not accounted for by the model. It is tempting to focus on differences in industry structure and competence requirements, and to conclude that the variation is explained by the stronger incentives to commute along the Rv 5, due to different employment opportunities between the two centres connected by the road. Returning for an instance to the initial theoretical review and the argument of Banister and Berechman (2001), we may also add that the infrastructure investment has improved the conditions required for growth, in this case the *positive economic externalities*, in the form of improved access to competent labour.

Does this suggest that the process of regional integration of labour markets has been more successful in Førde-Florø than in Bømlo-Stord? As mentioned initially, one of the aims of infrastructure investments is to stimulate the regional integration of labour markets. A larger labour market may give firms better access to the precise kind of competence needed, while simultaneously providing greater job opportunities for individual residents. This is important if the aim is to sustain settlements in peripheral areas.

Even though a growth in commuting may indicate an integration of labour markets, it is not necessarily so that the larger the commuting flows, the better matching of skills. The kind of competence or skill that commutes may be just a relevant a measure of the integration of labour markets as the size of commuter flows. In other words, it is not only the number of commuters that define whether one can speak of an integration of labour markets or not. Of relevance is also the type of commuters or the kind of skills that commute. Even a small increase in commuting may at a local level signify important resources for their respective employers.

The Triangle Link has led to a large increase in commuting between Bømlo, Stord and the mainland, although the increase is not as strong as estimated by the spatial interaction model. The islands of Bømlo and Stord have low levels of unemployment, and the industry structure is similar. Stord and Bømlo have become more closely connected as a consequence of the fixed link. This suggests that two places of similar industry structure together may grow stronger as a consequence of improved accessibility, rather than the one community growing

stronger at the expense of the other. The following quote from our interview with the local authorities at Stord summarises their view on the importance of the Triangle Link:

> "It has brought increased mobility between the municipalities, which now function as one integrated labour region. The Triangle Link has given a greater exchange between Stord and Bømlo."

Instead of being submerged within the Haugesund region, the Bømlo-Stord region has become strengthened since the completion of the Triangle Link. Haugesund is sufficiently far away for the insular communities to develop their own strengths, and there is enough activity going on to withstand the competition from the regional centre.

In the case of Rv5 between Førde and Florø, commuting has increased since the completion of the road, and the growth has been stronger than estimated by the model. The two regional centres differ in industry structure, which may partly explain the large increase in commuting. Florø's industry is dominated by the fishery, maritime and petroleum sectors, while Førde has a large service sector, the central hospital and various administrative functions. As a consequence of the road improvements, Førde and Florø have developed into an integrated labour and settlement area. Førde has strengthened its role as the dominating regional centre with a strong increase in the number of workplaces. Florø has not to the same extent been strengthened by the improved accessibility, due to increased competition from the service sector in Førde. The growth of Førde as a service centre is also related to the nodal position along the E 39, making the town an important transit node in western Norway. The improved road is however also a strength to Florø. Cyclical fluctuations and international competition make Florø's industries vulnerable to periodical workforce reductions. Improved opportunities to commute may thus prevent migration.

Increased traffic and redistribution of growth

While the integration of labour markets is stressed as a positive strategy for reducing unemployment, strengthening the competitiveness of business and securing a decentralised settlement structure, there may also be disadvantages associated with increased commuting. While improved opportunities to commute provide a wider range of workplace and residence choices, commuting may also imply disadvantages, both for the individual, the society and the environment. Improvements in infrastructure may change the competitive conditions between regions, for instance leading to local closures and regional concentration of services, tapping local centres of economic activity and forcing inhabitants to travel longer distances for their daily household errands. Our study and related research demonstrate that improved transport infrastructure and accessibility *do* lead to enhanced mobility and increased traffic.

While the insular municipalities of Bømlo and Stord together seem to have grown stronger as a consequence of the Triangle Link, instead of growth being redistributed to the regional centre of Haugesund, this does not mean that there are no redistributive effects between the municipalities. The shopping centre at Heiane (Stord) may have reduced the trade leakage to Haugesund, but has simultaneously outcompeted several local businesses in the community centres in Leirvik (Stord) and Svortland (Bømlo). A similar trend of redistribution and centralisation of trade is seen in the Førde-Florø case, where the upgrading of the Rv 5 has stimulated the growth of the service sector in Førde at the expense of local business in Florø. As pointed out by Vickerman (2000), distributional effects may be expected not only between regions, but also between actors within a single region. While the integration of labour markets increases the choice of workplaces or the number of potential employees, thus creating buffers against unemployment and structural fluctuations, some actors will become

negatively affected or even outcompeted by the increased competition facilitated by improved accessibility. When evaluating the long-term effects of an infrastructure investment, these trade-offs need to be considered. In this respect, many of the effects of the infrastructure investments studied in this paper are yet to come. As communicated by the director of *Leirvik Module Technology* at Stord:

> "It is only the next generation that will experience the full effect of the Triangle Link."

The delay between investments and the manifestation of effects constitutes the main challenge of evaluating the impact of infrastructure investments. The effect on short-term commuting patterns is however easier to evaluate. In both cases, there has been an increase in commuting flows, although to varying degrees. The variation may be explained by the different industry structure and employment opportunities within the local areas of the two regions. In the introduction of this paper, we argued that our aim was to shed light on an issue raised by SIKA (2001): Whether the greatest effect of infrastructure investment results from linking regions of similar or dissimilar industry structure.

The conclusion to be drawn from our two cases is that connecting regions of dissimilar industry structure stimulates increased commuting, but is also more likely to give a redistribution of growth from one region to the other. Connecting regions of similar industry structure may not produce the same level of commuting, but may nonetheless give a stronger regional integration of labour markets, creating a common competitive basis vis-à-vis a stronger regional centre. To what extent this remains true in other cases, remains to be seen. In order to study effects, data on commuting flows at a low level of aggregation, for instance basic statistical units, is necessary. For an improved evaluation of effects, the spatial interaction model should also be supplemented with parameters that include variations in industry structure, competence and skills (see for instance Vermeulen 2003). Nevertheless, these are issues that are not easily revealed by a statistical analysis, confirming the need for qualitative case studies in understanding the effect of infrastructure investments on commuting, labour markets and regional growth.

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