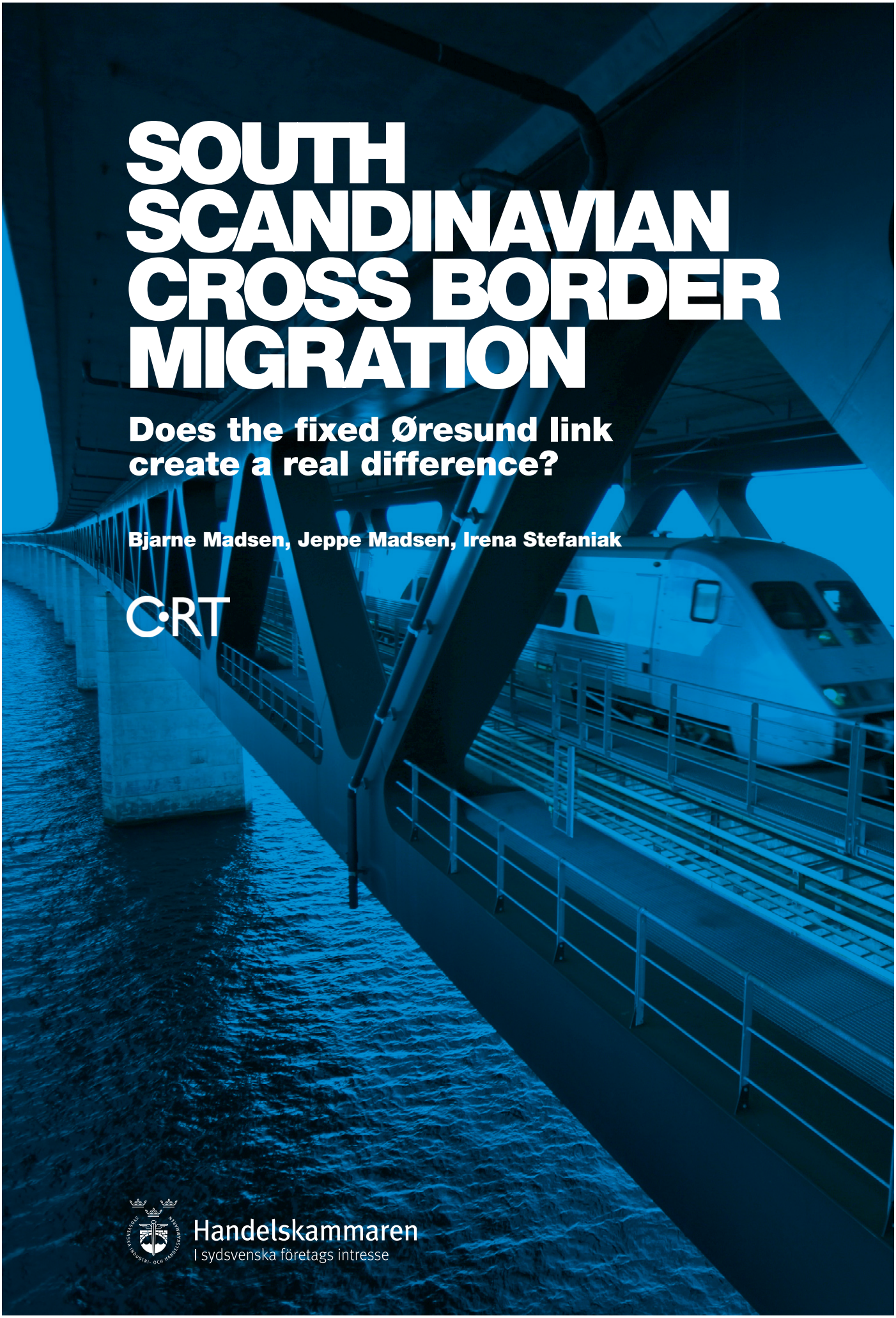

# SOUTH SCANDINAVIAN CROSS BORDER MIGRATION

## Does the fixed Øresund link create a real difference?

**Bjarne Madsen, Jeppe Madsen, Irena Stefaniak**

CRT

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# Förord

Migration är temat för denna delrapport i vårt forskningsprojekt om Öresundsregionen efter Öresundsbron som leds av Åke E Andersson och Christian Wichmann-Matthiessen.

Projektet inleddes på allvar 2009 och har avkastat sammanlagt sex delraporter. En avslutande bok publiceras 2013. Syftet är att lära mer om integrationsprocessen och vad den betytt för regionen. Kunskap om detta är viktigt för beslutsfattare inom politik, förvaltning och näringsliv och av stort intresse för alla som verkar i regionen eller intresserar sig för den.

I den här delrapporten studeras flyttningar och pendling över Öresund i mer detalj. Författare är Bjarne Madsen, Jeppe Madsen och Irena Stefaniak, samtliga verksamma vid CRT, Center for Regional- og Turismeforskning.

Rapporten är skriven på engelska och kommer att publiceras i annan form i internationella tidskrifter.

Forskningsprojektet är finansierat av Tekn Dr Ernst Wethjes Fond (som förvaltas av Handelskammaren), Sparbankstiftelsen Skåne, Region Skåne, Malmö Stad och Kraks fond.

Rapporten går igenom institutionella barriärer i regionen och granskar bland annat arbetsmarknaden och skattesituationen.

Malmö i november 2012

SYDVENSKA INDUSTRI- OCH HANDELSKAMMAREN

Per Tryding, Ph.D.
Vice VD

*"South Scandinavian cross border migration.*
*Does the fixed Øresund link create a real difference?"*

By Bjarne Madsen, Jeppe Madsen and Irena Stefaniak

October, 2012

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This project is supported by

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# Content

# 1 Summary

This report examines the patterns of migration flows in the light of the process of integration of the Danish and Swedish parts of the Øresund Region[1]. The point of departure has been the analysis by Matthiessen & Andersson (1993), who pointed to the potential gains from an integration of the two sub-regions. The opening of the fixed link between Copenhagen (Denmark) and Malmø (Sweden) in 2000 has changed the pattern of migration and commuting in the Øresund region leading to a more integrated labor and housing market. In the last 10 years, it has become advantageous to move from the Danish part ("Øresund, DK") to the Swedish part of the Øresund region ("Øresund, SE") and / or to have a job in the Danish part of Øresund region ("Øresund, DK"). Due to the improvements of the transport system it has become possible to live in "Øresund, SE" and (still) have a job in "Øresund, DK". As a consequence the migration from the Danish part ("Øresund, DK") to the Swedish part of the Øresund region ("Øresund, SE") has been substantial and the level of commuting across the Øresund has increased although both migration and commuting are still at a lower level than internal migration and commuting within the Danish and Swedish part of the Øresund Region.

In the same period – after the opening of the fixed Øresund Link - also other factors than transportation cost reductions have influenced the pattern of migration and commuting – and therefore the degree of integration of the two sub-regions: The exchange rate of Swedish to Danish kroner has depreciated since the 1980's, leading to a relative reduction in the prices for "Øresund, SE"-consumers goods compared with "Øresund, DK"-consumers goods, such as houses and cars, but also consumer goods in general as well as an increase in the relative income from having a job in "Øresund, DK" compared with a similar job in "Øresund, SE". These changes have determined the direction of migration and commuting flows and involved a re-location of families and jobs – especially after the opening of the fixed Øresund link - which implied a merge of the two housing and consumer markets allowing for a price equilibration. In other words, the opening of the fixed link combined with the changes of the exchange rate of Swedish to Danish kroner has made it possible to choose more profitable locations of job and home as well as place of shopping.

Also the housing and urban area development policies may have had an impact on migration although this has not been included in the present analysis: Because former building

[1] The Øresund Region includes the following NUTS 3 regions ("Oplande" for Denmark and counties for Sweden): Københavns By, Københavns Omegn, Nordsjælland, Østsjælland, Vest- og Sydsjælland and the county of Skåne.

restrictions have been abolished, new apartments and commercial real estate have been built in the new sub-urban areas in "Øresund Region, DK" and in the center of the municipality of Malmø close to the hub of the fixed Øresund link.

In the 90's and the 00's, general changes took place within the Øresund Region, which also have changed the pattern of migration and commuting and which are similar to the changes in most countries: In general, population and jobs tend to increase most in the most densely populated areas, which in the case of the Øresund Region is the center municipalities in Copenhagen metropolitan area followed by high ranked urban areas (such as the municipalities of Malmø and Lyngby-Taarbæk), which in turn is followed by old nearby cities (such as Helsingør, Hillerød, Roskilde and Køge on Zealand and Lund and Helsingborg in South Sweden).

Because of similarities in regional development and policies "Denmark divided into East and West" has been included as a case of reference for the analysis of the development in the Øresund Region: Firstly, "Denmark divided into East and West" has also been connected by the fixed Great Belt Link. Secondly, the urban structure in "Denmark divided into East and West" includes city number 3 (Odense in West Denmark vs. Malmø in the Øresund Region) as well as city number 2 (Århus in West Denmark vs. Gothenburg just North of the Øresund Region). Thirdly, the role of food production and manufacturing industry in rural or farm areas in Øresund Region and "Rest of Denmark" are comparable. What is clearly different is the national border in the Øresund Region, which provides a hindrance for full integration.

Finally, current reductions in volume of traffic crossing the fixed Øresund Link challenge the vision of an integrated Øresund Region as a region with "an accelerating and smoothly integration process". Some of the reductions are clearly a result of the economic and financial crisis, but do we have a slow down or even a turn-around of the integration process? Also the latest appreciation of Swedish kroner to Danish kroner has stressed the role of the exchange rate as a pendulum influencing labor and housing markets in the region bringing the integration into a "reverse development" with Danes moving back to Copenhagen eventually followed by incentives for Swedes to move to Denmark keeping their jobs in Sweden and replacing with shopping in Denmark.

In this report the development in migration flows and its consequences for integration in the Øresund Region is examined. In section 2 an overall description of migrations and commuting flows between Danish and Swedish regions, in total and by sub-groups is provided together with some rough indicators which can be assumed to explain the structure of migration, including the changes in commuting pattern. In section 4, a model to explain changes in

migration flows is presented. The model includes a ***general part***, which explains the migration flows (***the levels of migration flows***) in a circular situation, which means that some age groups or education groups move away from municipality$_i$ to municipality$_j$ while other age groups or education groups move from municipality$_j$ (and back) to municipality$_i$. In addition, prior to the opening the fixed Øresund link there has been an underline growth "disequilibrium", because the labor and housing was not merged. That meant that the circular flow had an excess of in-migrations compared to out-migrations in urban centers or vice versa for non-urban areas. A ***specific part*** includes modeling the relocation of population (***the changes in migration flows***) derived from major events such as the opening of the fixed Øresund link together with major changes in the economy, such as development in the exchange rate between Danish and Swedish kroner and the expansion of housing areas at the hub areas of the fixed Øresund link due to abolishment of building restrictions. In section 5, the data and the econometric model are presented. In section 6 summary results of an econometric analysis of number of migrants[2] with residence in Danish municipalities in 2001 and with residence in Danish and Swedish municipalities in 2008, divided into age and educational groups, are presented. The econometric analysis reflects the explanatory model presented in section 4.

In the 00's the fixed link induced a substantial relocation of population in the Sound region, which now seems to have come to an end. In the future exchange rate changes as a pendulum will determine, where it is optimal to reside and work: Further appreciation in Swedish to Danish kroner might lead to reverse location, whereas a depreciation will induce Danes to move to southern Sweden. New migration and transport flows will also occur due to political initiative such as the European Spallation Source (ESS), which is expected to open in 2019 and will be fully operational in 2025, which might drive a further integration of the region.

[2]Normally, migration analysis include "year to year"-migration. In this analysis, migration covers a longer time period looking at migrants who in 2001 lived in Denmark, but in 2008 lived in South Sweden (or living in other municipalities in Denmark).

# 2 Introduction

The integration of the Danish and the Swedish parts of the Øresund Region (see figure 4) has been on the regional agenda for many years. As pointed out by Matthiessen & Andersson (1993) there are substantial potential economic gains in an integration of the two sub-regions, not only with respect to trade relations, but especially in the field of commuting and migration: If jobs are located where marginal productivity is relatively highest and residential location is determined by living/consumption costs (to be minimal and including the cost of housing), the real output (such as the regional real GDP per capita) will increase.

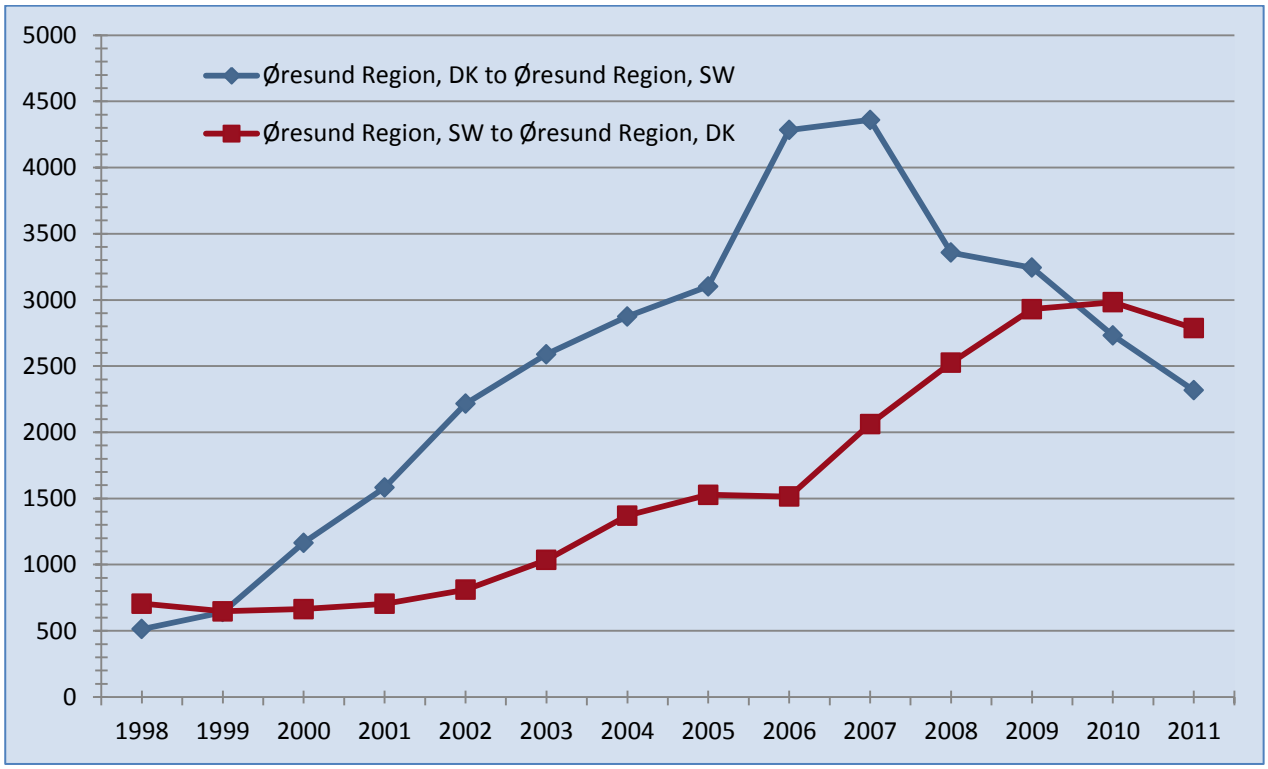
A major obstacle for integration gains was the missing fixed link between Copenhagen and Malmø, which made it almost impossible to have a job and a home on each side of Øresund. Therefore the opening of the fixed Øresund link in 2000 was a major step towards harvesting gains from a further integration of the two regional economies, especially of the labor and housing markets. The research question is therefore to which extent an integration process in the field of migration and commuting has taken place within the Øresund Region, whether a new equilibrium has been obtained and whether further integration can be expected within the coming years. And following these questions, which drivers – beside the fixed link as the overall catalyst for the integration process – are the main determinants for the integration process which already has taken place and might be deepened even more in the coming years. Especially we would like to examine the role of the exchange rate for the direction of migration and commuting flows and to discuss the impacts on these flows of future changes in exchange rate.

Since 1998[3] the yearly number of persons migrating from Øresund Region, DK to the Øresund Region, SE has increased from approximately 500 in 1998 to approximately 3.000 in 2010 peaking in 2006 with 4.500 persons, whereas migration from Øresund Region, SE to Øresund Region, DK also increased but much less rapid from 700 in 1998 to 3.000 in 2010 and peaking in 2010.

From a first glance it seems that there now is a balance in the migration flows, which leads to no further re-distribution of population between the Danish and the Swedish part of the Øresund Region[4].

[3] The choice of start year is determined by data accessibility.
[4] However, one may argue, that the fact that out-migration is equal to in-migration, is not the end of the story: If housing prices are yet not fully equilibrated and the fact that since the financial and economic crisis the Swedish economy has been doing better than the Danish one, we might have a situation where future re-distribution of population between the Danish and the Swedish part of the Øresund region might occur. On the other hand, if economic growth and urban concentration is the main driver of migrations between Denmark and Sweden, it should be the case that the number of migrants from Sweden to Denmark in the future will be higher than number of migrants

***Figure 1 Migration from the "Øresund Region, DK" to the "Øresund Region, SE" and vice versa for 1998 to 2011***

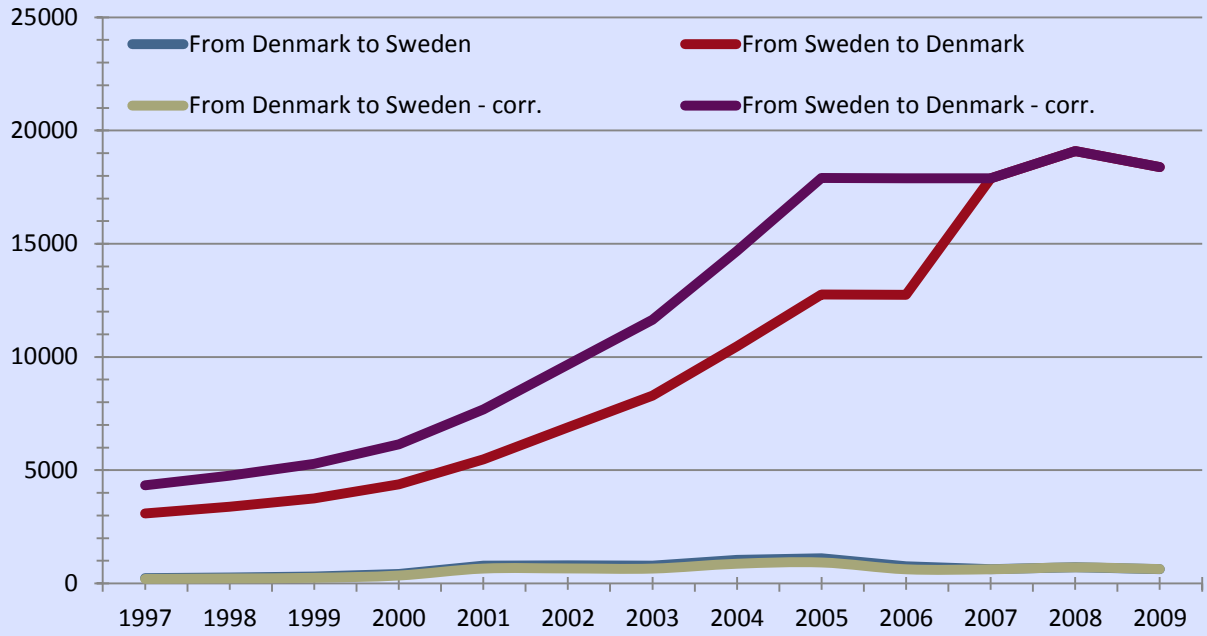



Source: Øresund Data Bank

From 1997 to 2009 the number of commuters from Øresund Region, DK to Øresund Region, SE and vice versa has increased from 3.300 to around 19.000. An overwhelming number of these cross border commuters have jobs in Denmark and live in Sweden, whereas the number of commuters working in "Øresund, SE" and living in "Øresund, DK" is less than 1.000. The total number of commuters peaked in 2008 and seems to have reached a balance, which beside ordinary economic growth and urban concentration will lead to no further increases in number of commuters.

from Denmark to Sweden (a return wave). As figure 2 shows, the number of net-migrations reached a turning point in 2009, where more people started migrating from Sweden to Denmark than from Denmark to Sweden.

***Figure 2 Commuting from Øresund Region, DK to Øresund Region, SE and vice versa from 1997 to 2009***[5]




Source: Øresund Data Bank

Even though there now seems to be a situation of no redistribution in both migration and commuting, the difference in the development in Denmark and in Sweden from 1998 to 2010 has given the Swedish part of the Øresund Region a net gain in population and the Danish part of the Øresund Region a net loss of population. However, this redistribution in population has not led to a decrease in the population of Copenhagen. On the contrary, because the overall trends in Denmark of concentration of the population in the major cities, other factors has led to a net increase in the population in the municipality of Copenhagen.

[5] There is a data break in commuting statistics from 2006 to 2007. Therefore commuting data before 2007 have been transformed into 2007-levels.

| *Table 1: Population in the Øresund region by subregions from 1999 to 2010* | | | |
|---|---|---|---|
| | 1999 | 2010 | |
| | Number | Number | Pct |
| **Copenhagen** | 638.181 | 692.876 | 108,6 |
| **Copenhagen City** | 501.634 | 516.751 | 103,0 |
| **North Zealand** | 424.961 | 447.864 | 105,4 |
| **Bornholm** | 44.238 | 41.802 | 94,5 |
| **East Zealand** | 221.523 | 235.519 | 106,3 |
| **West and South Zealand** | 564.228 | 584.244 | 103,5 |
| **South Skåne** | 662.608 | 749.856 | 113,2 |
| **Øresund Region, DK** | 3057.373 | 3268.912 | 106,9 |
| **North and West Skåne** | 162.062 | 168.236 | 103,8 |
| **North and East Skåne** | 299.116 | 325.237 | 108,7 |
| **Øresund Region, SE** | 461.178 | 493.473 | 107 |
| **Øresund Region** | 3518.551 | 3762.385 | 106,9 |

Source: Statistics Denmark and Øresund Data Bank

Evidence suggests, that the development on the one hand follows the overall trends in population and migration in Denmark and Sweden and on the other hand is a result of changes in the national and regional economy, such as

a. the opening of the fixed Øresund and Great Belt links establishing an efficient transport link between the Copenhagen metropolitan region/the rest of Denmark and the municipalities in South Sweden (see figure 5 – Denmark)
b. the substantial change in the real exchange rate between Danish and Swedish kroner, which has taken place for the last 30 years (see figures 5 and 6 for economic exchange rate gains for the residents in the Swedish part with jobs in the municipality of Copenhagen)
c. changes in the housing capacity in sub-urban "hub-areas" in the Øresund Region, DK and the Øresund Region, SE (lack of data prevents us from analyzing this factor)

***Figure 3: Population in the Øresund region by subregions from 1999 to 2010 (1999 = 100)***

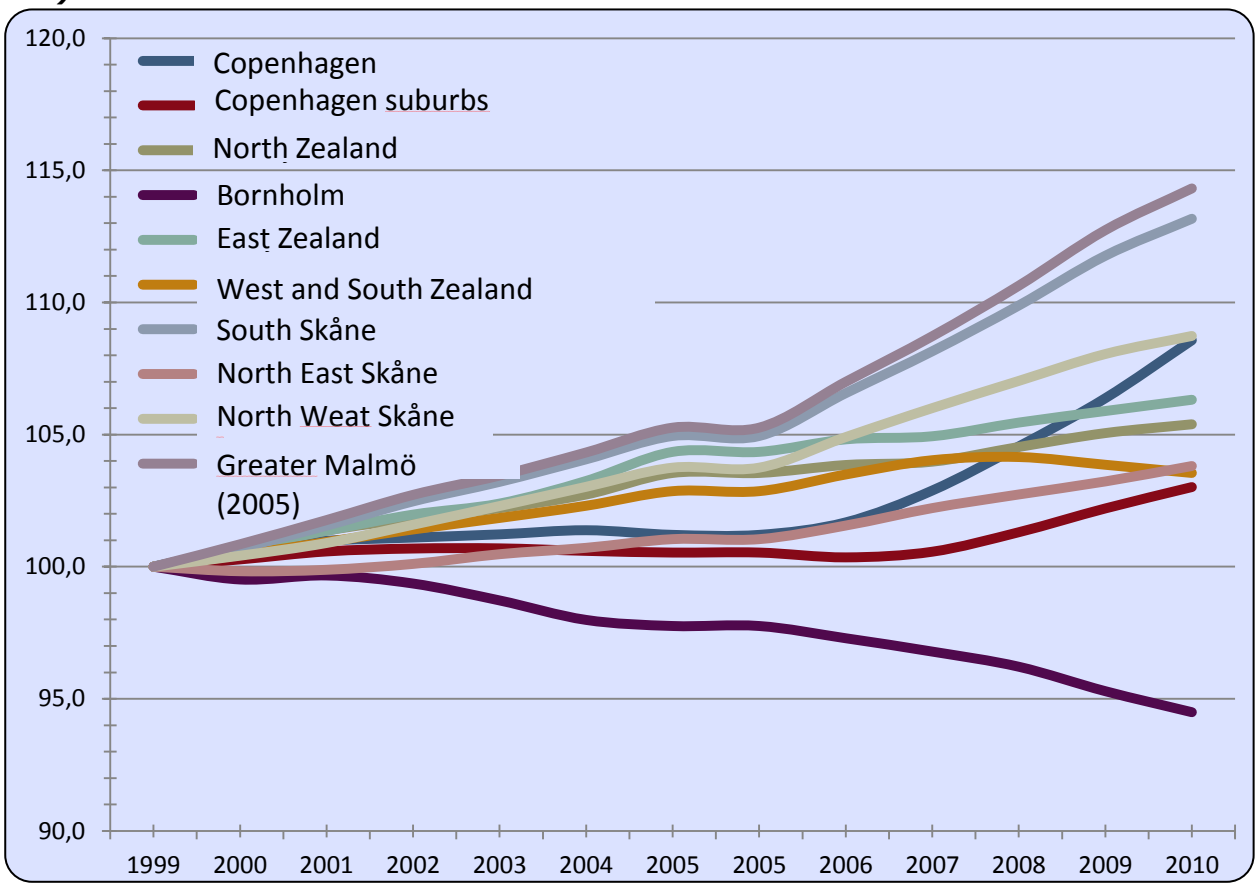
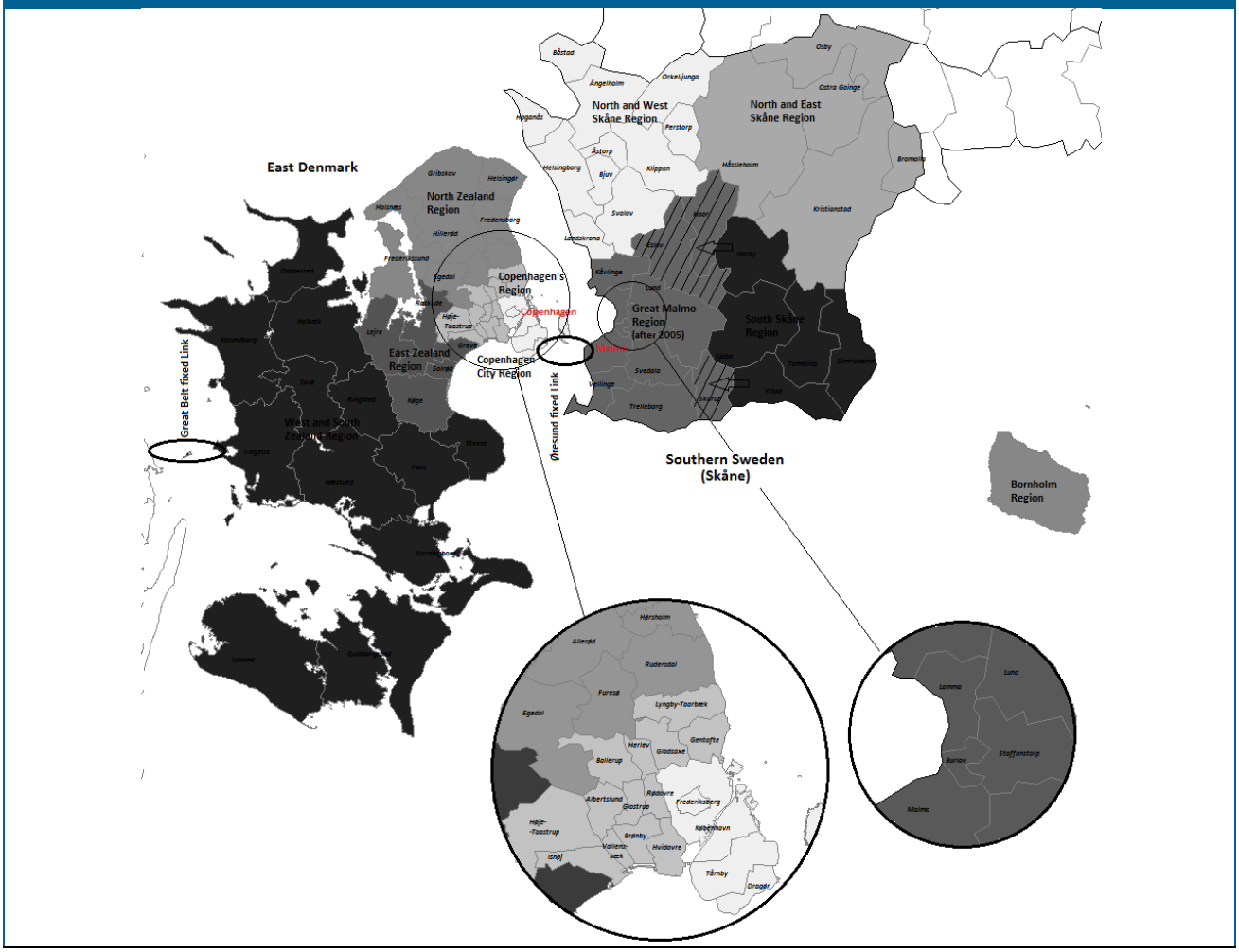
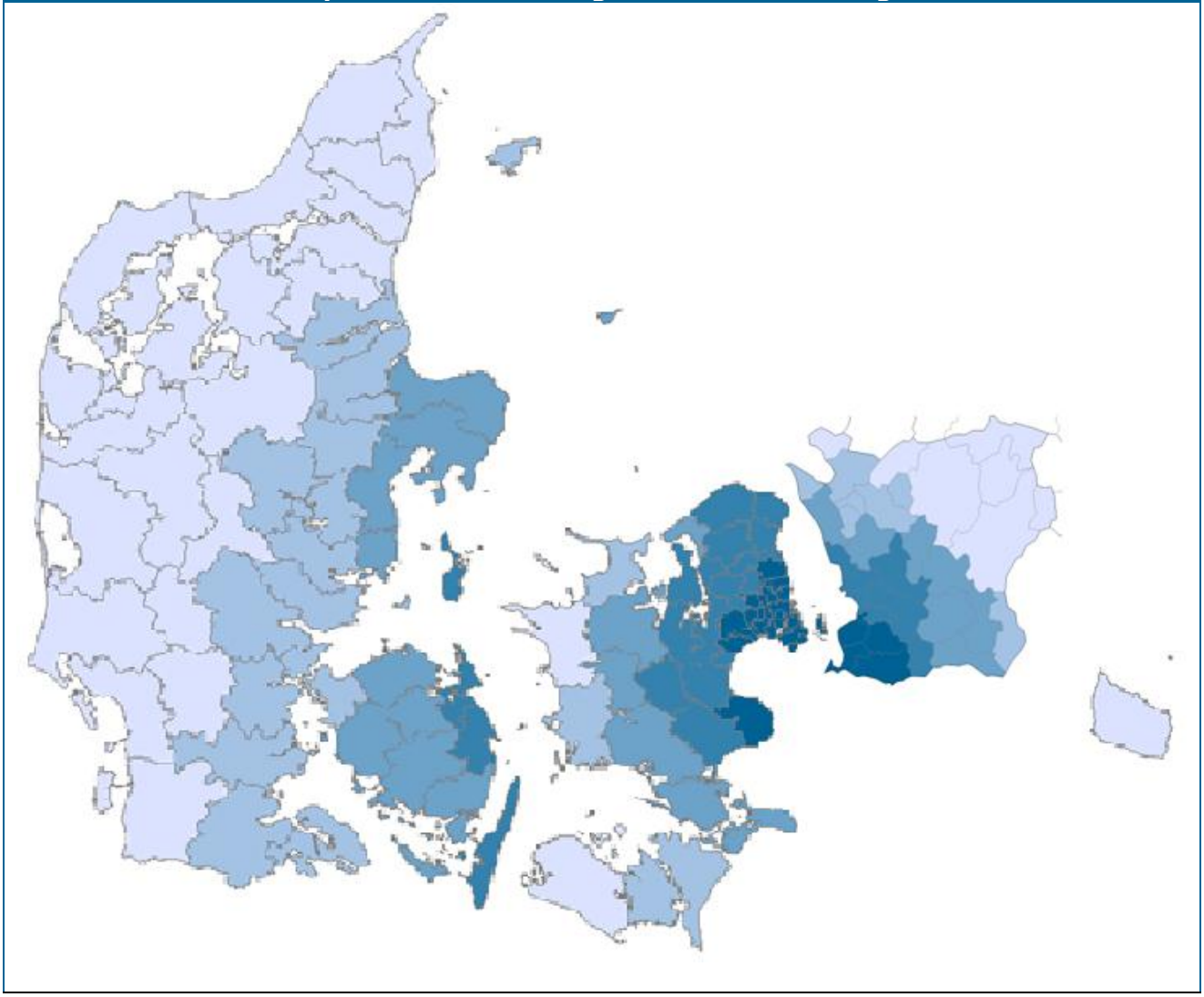


**Figure 4: The Øresund Region**




In figure 4, municipalities in Denmark and in South Sweden are shown together with the location of the fixed Øresund link connecting East Denmark and Southern part of Sweden with a combined bridge and tunnel and the fixed Great Belt link connecting the east and west parts of Denmark with a combined bridge and tunnel.

***Figure 5: Impacts from the opening of the fixed Great Belt and Øresund links:***
***a. Danish municipalities: The reduction in the km-distance in percentage between Malmø and municipalities in Denmark,***
***b. Swedish municipalities: the exchange rate effect of living in Skåne***



In the ***Danish part of the map in figure 5***, the percentage reductions in km-distance from Danish municipalities to the fixed Øresund link (Malmø) are shown: The percentage reductions in km-distance, due to the opening of the two fixed links, is higher for municipalities located closer to Malmø, such as the municipalities of Copenhagen, Frederiksberg, Tårnby and Dragør[6]. Examining changes in km-distance going from east to the west, for the municipalities to the east of the Great Belt link, the percentage reductions in km-distance become smaller. Examining the municipalities to the west of the Great Belt the percentage reduction in km-

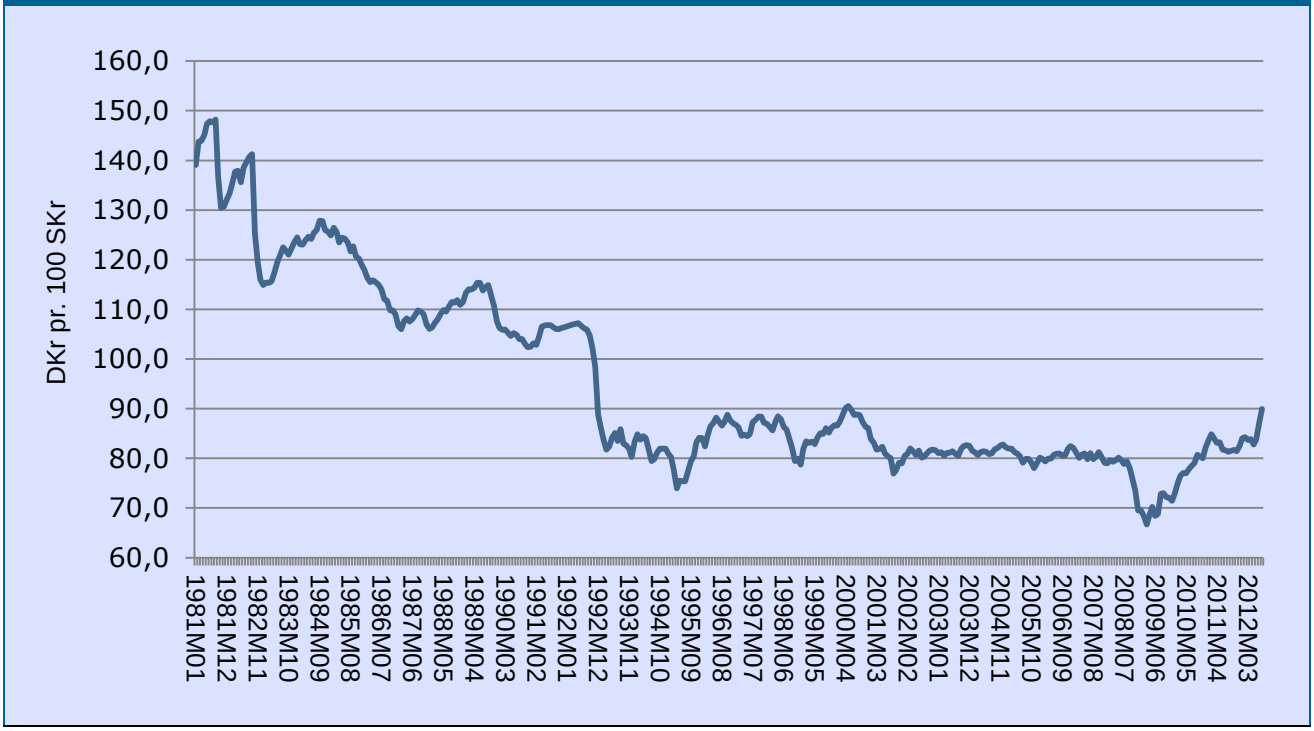
[6] Ideally one should include time reduction or even generalized transportation cost instead, as this is the real cost of transportation. However, due to not having a variable with the time or generalized cost of transportation using a variable with km distance is a proper substitute. Since time reduction and distance in km are highly correlated one would not expect a significant difference in the obtained results.

distance to Malmø in general is at a higher level, although the distance from Malmø increases. This is caused by the combined benefits from the opening of the fixed Øresund and the fixed Great Belt link.

The reduction in distance due to the two fixed links ceteris paribus has caused in-migration to South Sweden: The higher the percentage reduction in km-distance to South Swedish municipalities, the relative higher migration between origin and destination municipality can ceteris paribus be expected.

The increase in migration from the Øresund Region, DK to the Øresund Region, SE is also caused by the change in the relative exchange rate of Swedish to Danish kroner. The depreciation of Swedish kroner to Danish kroner has consequences for real prices and incomes for persons moving from Denmark to Sweden. From figure 6 it can be seen, that the exchange rate of Swedish (SEK) to Danish kroner (DKK) (for buying 100 SEK) has depreciated from app. 150 DKK pr. 100 SEK in the 1980's to 90 DKK pr. 100 SEK in 2012. This depreciation influences the choice of moving from Denmark to Sweden: Firstly, commodities bought in Sweden from persons residing in Denmark and evaluating whether to move to Sweden have become cheaper, especially in the case of prices on houses and on cars. Secondly, the depreciation in the annual average bilateral real exchange rate of SEK to DKK makes it profitable to move to Sweden, especially if the migrants are able to keep their jobs in Denmark. The profits of keeping the job in Denmark will decrease the farther away from Denmark the migrants move in to Sweden.

***Figure 6 The exchange rate between Swedish kroner (SEK) and Danish kroner (DKK pr. 100 SEK)***




Source: Statistics Denmark, Statistikbanken

Examining the impacts of the development of changes the annual average bilateral real exchange rate of Swedish to Danish kroner, there are synergetic effects to the opening of the fixed Øresund link: Before the opening of the fixed link, due to transport barriers it was almost impossible to live in Sweden and work in Denmark[7], and to profit from the real exchange rate development. For the same reason there were no impacts from the Danish demand on the housing market in the South Sweden: The prices on Swedish residential houses were not influenced by changes in the exchange of Swedish to Danish kroner.

After the opening of the fixed link, it has become possible to profit from price differences between the Danish and the Swedish markets. It became a question of interest whether the gain from lower consumer prices and higher income was sufficient to outweigh extra commuting costs. When the extra costs of travelling – and also adding to this the costs of changing place of residence and the border barriers between Denmark and Sweden - are too high, it will not be profitable to migrate.

[7] Numbers of commuters before the opening of the fixed Oresund link is estimated to app. 2.000 (Bacher et al. 1996)

To illustrate this ***in the Swedish part of the map in figure 5*** the reciprocal of the km-distance from Swedish municipalities to the bridge hub in Denmark (the municipality of Tårnby) is shown. It is obvious that the advantage of moving will decrease the farther away from the fixed link the Swedish Municipality is located. The more distant a Swedish location is from the bridge hub, the less the probability to migrate.

Looking at migration flows it is obvious that migration from Denmark to Sweden follows the general pattern presented above: In table 2.a the migration flows from Øresund Region, DK (2001), divided by Øresund Region, DK plus SE (2008), all divided by region parts are presented.

***Table 2a Number of migrants by Danish origin region parts (2001) to Danish/Swedish destination region parts (2008)***

| | Copenhagen | Copenhagen City | North Zealand | Bornholm | East Zealand | West and South Zealand | Municipality of Malmø | Rest of Skåne | Halland & Blekinge counties | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Copenhagen** | 33.305 | 41.051 | 26.100 | 1.443 | 12.190 | 19.212 | 7.911 | 3.557 | 11.468 | 156.237 |
| **Copenhagen City** | 31.669 | 26.346 | 15.306 | 732 | 8.976 | 14.775 | 3.296 | 1.617 | 4.913 | 107.630 |
| **North Zealand** | 21.898 | 10.569 | 26.088 | 689 | 3.021 | 7.963 | 1.129 | 2.668 | 3.797 | 77.822 |
| **Bornholm** | 2.047 | 644 | 421 | 19 | 207 | 742 | 45 | 81 | 126 | 4.332 |
| **East Zealand** | 9.734 | 5.432 | 2.720 | 300 | 8.600 | 11.836 | 755 | 530 | 1.285 | 41.192 |
| **West and South Zealand** | 16.960 | 6.900 | 3.808 | 604 | 6.361 | 36.541 | 1.113 | 1.175 | 2.288 | 75.750 |
| **Total** | 115.613 | 90.942 | 74.443 | 3.787 | 39.355 | 91.069 | 14.249 | 9.628 | 23.877 | 462.963 |

Note:The region division is NUTS 3, except for a) the county of Skåne, which has been subdivided into the "Municipality of Malmø" and "Rest of Skåne" and b) The counties of Halland and Blekinge, which have been merged. "Copenhagen" includes the municipalities of Copenhagen, Frederiksberg, Tårnby and Dragør.

Source: Statistics Denmark and Statistics Sweden, the transnational micro databank

In this analysis migrants are defined as "***long-term migrants***" – and not "year to year migrants": Long term migrants are defined as persons, who lived in Øresund Region, DK in 2001 and who moved to another municipality in 2008, where this municipality belonged to Øresund Region, DK or SE. From the table it can be seen that 33.305 persons in the period

from 2001 to 2008 moved from one of the municipalities in Copenhagen[8] to one of the other municipalities within Copenhagen, but to another municipality than their 2001 residential municipality.

Similarly, the table shows that 7.911 persons in the period from 2001 to 2008 moved from one of the municipalities in Copenhagen to the municipality of Malmø. And that 81 in the same period moved from Bornholm to Rest of Skåne. Looking at totals, 156.237 persons in the period from 2001 to 2008 moved out of Copenhagen to Øresund Region, DK or SE, whereas in total 14.249 persons moved to Malmø from Øresund Region, DK.

To have an indication of the "intensity of migration", the migration flows are compared with the population of the "destination municipalities":

***Table 2b Number of migrants by Danish origin region parts (2001) to Danish/Swedish destination region parts (2008) pr. 100 inhabitants in destination region parts***

| | Copenhagen | Copenhagen City | North Zealand | Bornholm | East Zealand | West and Sotuh Zealand | Øresund Region, Denmark | Municipality of Malmø | Rest of Skåne | Skåne | Skåne/East Denmark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Copenhagen** | 4,99 | 8,08 | 5,88 | 3,38 | 5,22 | 3,27 | 5,37 | 2,69 | 0,38 | 0,93 | 0,17 |
| **Copenhagen City** | 4,75 | 5,18 | 3,45 | 1,72 | 3,84 | 2,51 | 3,94 | 1,12 | 0,17 | 0,40 | 0,10 |
| **North Zealand** | 3,28 | 2,08 | 5,87 | 1,62 | 1,29 | 1,36 | 2,83 | 0,38 | 0,28 | 0,31 | 0,11 |
| **Bornholm** | 0,31 | 0,13 | 0,09 | 0,04 | 0,09 | 0,13 | 0,16 | 0,02 | 0,01 | 0,01 | 0,06 |
| **East Zealand** | 1,46 | 1,07 | 0,61 | 0,7 | 3,68 | 2,01 | 1,56 | 0,26 | 0,06 | 0,10 | 0,07 |
| **West and South Zealand** | 2,54 | 1,36 | 0,86 | 1,42 | 2,72 | 6,22 | 2,87 | 0,38 | 0,13 | 0,19 | 0,07 |

Note: The region division is NUTS 3, except for a) the county of Skåne, which has been subdivided into the "Municipality of Malmø" and "Rest of Skåne" and b) The counties of Halland and Blekinge, which have been merged. "Copenhagen" includes the municipalities of København, Frederiksberg, Tårnby and Dragør.

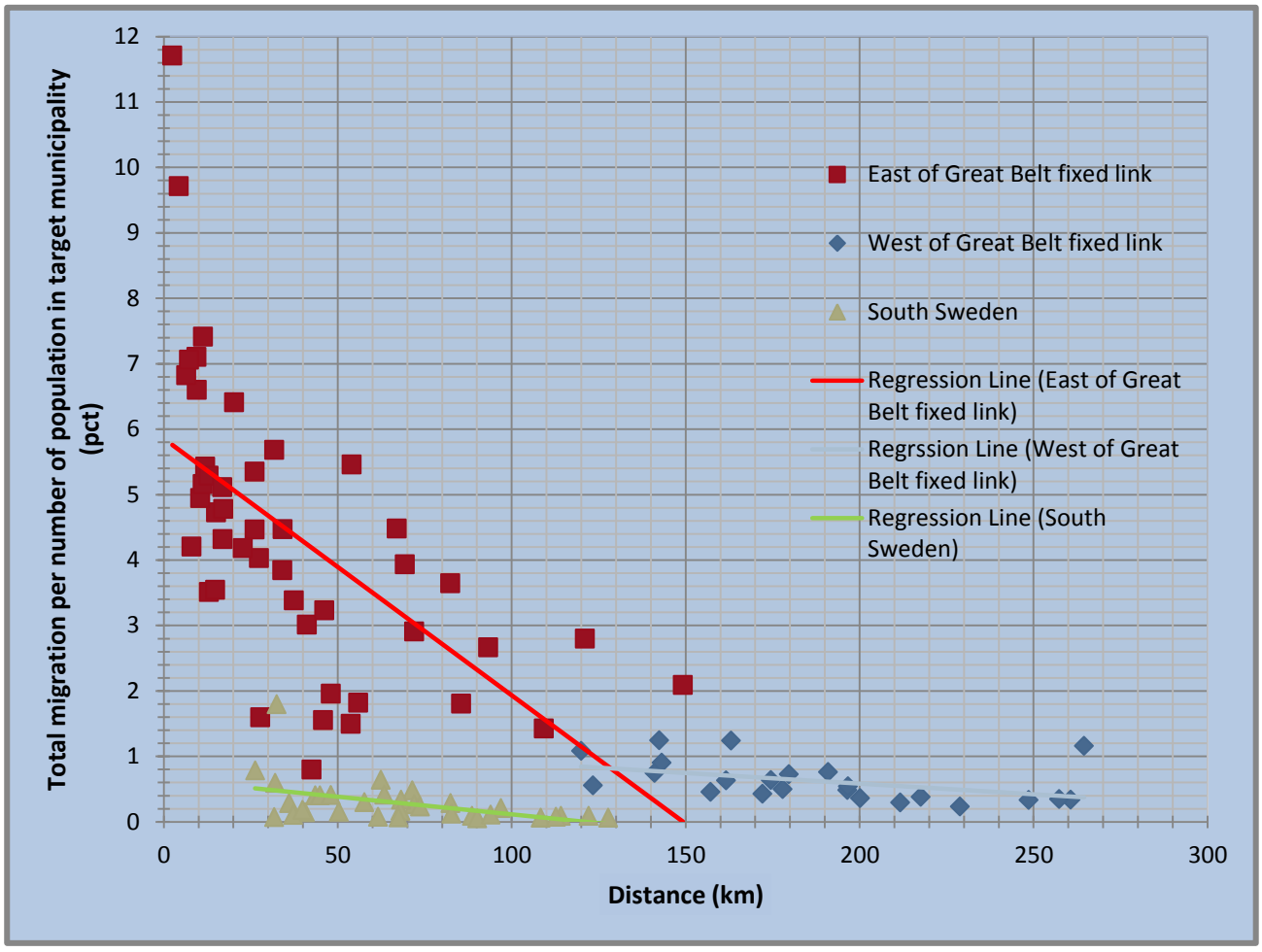
Source: Statistics Denmark and Statistics Sweden, the transnational micro databank and own calculations

[8]In the table NUTS 3 has been used, which implies that Copenhagen includes the municipalities of Copenhagen, Frederiksberg, Tårnby and Dragør.

From table 2b it can be seen that the share of migrants in Malmø coming from Copenhagen is 2,69 %, whereas the internal migration in Copenhagen is 4,99 %. Looking at the migration from Copenhagen to North Zealand, East Zealand and West and South Zealand the percentage (5,88 %, 5,22 % and 5,37 %), which from a distant point of view can be compared with Malmø, the migration rates are much higher. Similar results can be seen if migrations from other Danish region parts to region parts which are "competitive" to Malmø, are examined. Therefore one may conclude that although the migration to Malmø from Danish regions has increased, it is still at a much lower level compared to migration flows within Danish regions.

Looking at migration from the municipality of Copenhagen to the 97 other Danish municipalities and the 33 municipalities in South Sweden similar results are obtained:

***Figure 7 Linear regression of migration pr. Inhabitants from Copenhagen municipality to municipalities in Denmark and "Øresund, SE"***




Source: Statistics Denmark and Statistics Sweden, the transnational micro databank and own calculations

In the figure the migration per 100 inhabitants in the destination municipality from the municipality of Copenhagen to each municipality are shown as a function of the km-distance. The municipalities are divided into 3 sub-groups: In the first group, the municipalities in Sweden are included; the second group includes the Danish municipalities east of the Great Belt whereas the third group includes Danish municipalities west of the Great Belt. From the figure it can be seen that migration rates is a decreasing function of the distance from the municipality of Copenhagen: The higher distance the lower the out migration rate. From the figure it can also be seen that internal migration to municipalities in Denmark east of Great Belt is at a very high level. However, the migration to municipalities in Denmark west of Great Belt is at a much lower level (app. half of the level of East Denmark) and in turn the migration to the municipalities "Øresund, SE" is at the lowest level (app. ¼ the level of East Denmark). To this one might add that the low level of migration in "Øresund, SE" is a result of the permanent border barriers in combination with the depreciation of the exchange rate from Swedish to Danish kroner.

The distribution of migrants can be seen from the following table:

***Table 3. Migration from Denmark to South Sweden and to Denmark compared with the Danish population by age and educational groups from 2001 to 2008***

| | *Migration from 2001 to 2008* | | | | *2005* | |
|---|---|---|---|---|---|---|
| | *Migr. From DK to SW* | *pct* | *Migr. From DK to DK* | *pct* | *Population* | *pct* |
| ***Age groups:*** | | | | | | |
| ***Age 20 to 29 year*** | 7001 | 34% | 263783 | 36% | 624707 | 18% |
| ***Age 30 to 39 year*** | 7469 | 37% | 232295 | 31% | 786619 | 22% |
| ***Age 40 to 49 year*** | 3325 | 16% | 119362 | 16% | 783826 | 22% |
| ***Age 50 to 59 year*** | 1524 | 8% | 70135 | 9% | 738860 | 21% |
| ***Age 60 to 69 year*** | 984 | 5% | 55274 | 7% | 588645 | 17% |
| ***Total*** | 20303 | | 740849 | | 3522657 | |
| | | | | | | |
| ***Education groups*** | | | | | | |
| ***No or low educations*** | 6665 | 33% | 152910 | 21% | 3045361 | 56% |
| ***Medium level educations*** | 9029 | 44% | 334583 | 45% | 1588173 | 29% |
| ***High level educations*** | 4609 | 23% | 253356 | 34% | 791382 | 15% |
| | | | | | | |
| ***Total*** | 20303 | 100% | 740849 | 100% | 5424916 | 100% |

Source: Statistics Denmark and Statistics Sweden, the transnational micro databank and own calculations

Firstly, if migration is compared with the population structure, it can be seen, that especially the young and the high educated persons have a high migration propensity, whereas the elder aged and the low educational groups have a lower propensity to migrate. Looking at migration to southern Sweden in detail compared with Danish internal migration, it can be seen that the age group 30-39 year and the low educational group have a higher propensity to migrate, whereas the group of very young (20-29 year) and the group with high education have lower propensity to migrate.

Finally, the development might also be explained by changes in the housing capacity in the sub-urban areas within the Øresund Region close to the Danish and Swedish hubs. Unfortunately, it has not been possible to get data on changes in housing capacity for the Swedish housing capacity by municipality. Therefore, the article is not able to conclude whether the increase in housing capacity explains the changes in migration flows within the Øresund Region.

# 3 Former studies

From the previous section it may be concluded, that although the level of migration flows from the Øresund region, DK to the Øresund region, SE is at a lower level than domestic migration in Denmark, it has increased. The increase was explained by transport system improvements, the depreciation in Swedish kroner relative to Danish kroner and in the change in housing capacity in the hub-areas in the Øresund Region. In this section former relevant study of migration is presented. In appendix 1a presents a review of the literature behind the theoretical model is presented.

The development in population and labor market has of course been a key issue in the Øresund region for many years, especially after the decision on the fixed Øresund link was taken. In 2005 it was decided to start the "IBU-project[9]" on development in infrastructure and urban development in the Øresund region. The purpose was to know more about the relation between transport and urban development in the region. Before the IBU project, population and migration developments in the Øresund region have been analyzed within either a demographic or a transportation modeling framework. In the demographic approach, it involved conventional population and migration forecasts, which were restricted to include only demographic factors, with constant fertility, death rates and future migration flow structure to remain unchanged (see appendix 1). In the transportation model approach, a simple growth factor model assuming population and labor market development as exogenous and constant: The traffic passing the fixed Øresund Link was mainly assumed to be determined by simple growth and border barrier and integration factors, only in more ad hoc form and not going behind the transportation analyzing the population, migration and labor market. Due to changes in transport corridors and increase in the frequency of the use of the fixed link and transfer of traffic from other types of transport mode it was found or assumed that the traffic on the fixed link would continue to increase in the future.

The IBU-project (see WSP 2009) especially analyzed the migration and commuting flows to understand the background for future development in the integration in the Øresund Region, which involved building a regional economic and transportation model called MOCCA. The

[9] IBU-Øresund is short for Infrastructure and Urban Development and aims to generate knowledge to be used for the development of an attractive and competitive region for the partners involved in the development of the region. The project undertakes analysis within

1. Infrastructure and urban development in the Øresund region
2. Øresund as a hub for international traffic
3. Development in the Femern Belt and Øresund region, involving analysis of the impacts from the fixed Femern Belt link and eventually a fixed link between Helsingør and Helsingborg
4. Common analysis of transportation and cross border activities

intension was "to be able to forecast the future development of commuting over Øresund, under various scenarios f.ex. land use, infrastructure investment, transport systems and economic development" A model MOCCA[10] has been constructed, which comprises four sub-models:

Migration Model: Representing how Danes and Swedes, respectively, migrate over the Sound as a function of, inter alia, housing prices and travel time/travel distance from current place of residence.

Workplace distribution model 1(nation)….

Workplace distribution model 2 (zone)……

Transport model:….."

MOCCA is a dynamic model, where migration flows (in first sub-model in the model) are determined on the basis of information on the relative wage by municipality, the relative house prices as well as the travel cost:

The higher the relative wage, the lower the house price and the lower the travel cost, the higher the migration rate. It implied that the relative wage and house price was also a function of the exchange rate, if the municipality of origin and destination were on different sides of Øresund. In turn, on the basis of migration flows the future population can be determined by adding new born and in-migrants and subtracting death and out-migrants (se appendix 1).

In the second and the third step of MOCCA, the distribution of jobs or commuting is determined – again on the basis of relative wage between competing work municipalities and national borders and travel distances. Finally, in the transport model the number of travelers (commuters) is determined.

Then the MOCCA can be run for a number of years determining migration, the distribution of jobs and the number of travelers for future years.

The migration module in MOCCA is much in line with the analysis of migration in this report. First the model is presented (section 4.2). Then it is followed by a comparison with model structure and assumption in the MOCCA model.

[10]MOCCA: MOdel for Cross-border Commuting Across Öresund

# 4 The descriptive model

Migration flows can ***on the one hand*** be seen as a phenomenon taking place in a circular equilibrium or "steady state" world[11], where migration takes place, with either no or constant changes in the distribution of the population and ***on the other hand*** as a result of changes in regional and local economies.

## 4.1 The Steady State model

From a steady state or equilibrium point of view, there is a stable, natural flow of persons inside a meta region moving to and from sub-regions according to different functions of the sub-regions: Young people move from family home regions to regions with education institutions and with high population density, involving a high probability to find a partner. In the case of the Øresund Region this will involve migration from family home municipalities from rest of Denmark to municipalities such as Copenhagen or Lyngby-Taarbæk. After graduation and marriage, families move from education regions to residential regions. This involves migration from municipalities such as of the municipality of Copenhagen to residential sub-urban municipalities, such as the municipalities of Ballerup, Gladsaxe etc. Later families might move up in social and urban hierarchy to municipalities with high quality schools etc. Even later elder people might move to "elder-friendly" municipalities, when the children leave home. Finally, elder people move to municipalities with facilities relevant for the very old, such as elder houses/services and even hospitals and to municipalities with low population density (quietness). These movements do not change – or change at a constant rate - the net population of each municipality, because out and in flows cancel out.

A steady state population system may also involve border barriers, which might influence not only migration between countries (such as Denmark and Sweden in the Øresund case), but also migration within countries if natural barriers for geographical or cultural reasons exist (such as historical and geographical barriers between east and west Denmark). Even though barriers exist, steady state population / migration systems still exist in equilibrium, where flows cancel out and lead to stable constant or constant growing population in different types of regions and in different age groups.

[11]In the following and as indicated in the summary, the term "circular equilibrium or steady state" is used to describe a situation of stability, where only differences in regional growth patterns induce changes in the distribution of population and does not by necessity reflect a situation of equilibrium or steady state.

A steady state system might also involve special barriers, such as remoteness which is the case for islands where migration might be at a higher level, because young people have to move away to get an education and elder people from islands move back at higher rates.

On the other hand, migration flows represent adjustment of the equilibrium or steady state population structure to changes in the regional economy. These adjustments can occur both at the international, the national, the regional and the local levels: In the case of the international levels changes in the exchange rate can lead to changes in international migration flows. Changes in transportation costs related to two (or more) countries might change the migration flows. Changes in tax legislation between two countries, for example changes in the taxation of cross border commuters, can lead to changes in migration flows, which in turn leads to changes in the distribution of the population.

### 4.1.1 The division of the Steady State model

The presentation of the steady state model is divided into three parts: the first one describes the macroeconomic basis, the second one describes the microeconomic basis and the market and the third one is the meso-economic basis, which involves amenities and environmental characteristics for the region.

#### 4.1.1.1 Macroeconomic Aspect: Demographic Gravitation

The theoretical aspects of the Macroeconomic viewpoint are based on John Quincy Stewart's demographic gravitation model (Stewart, 1948). The model is based on Newton's law of gravity, i.e. the force attracting two objects to one another. The strength of the force depends on the mass of the objects and the distance between them. By applying this same concept and terminology to municipal populations, we can directly apply Newton's law of gravity to the two municipal populations, in the following referred to as the population in region $i$ denoted as $pop_i$ and the population in region $j$ called $pop_j$. If we also let $dist_{ij}$ indicate the geographical distance between the two municipal populations, we can define demographic force, F, of the population sub group $g$ as follows:

$$F_{ij}^{g} = (demografic\ force)_{ij}^{g} = \alpha_0^{g} \frac{pop_i^{\alpha_1} pop_j^{\alpha_2}}{dist_{ij}^{\alpha_3}} \quad \text{.....(1)}$$

Next by logarithm transforming equation (1), we get the following:

$$ln(F_{ij}^{g}) = \ln\left(\alpha_0^{g} \frac{pop_i^{\alpha_1} pop_j^{\alpha_2}}{dist^{\alpha_3}}\right) = ln(\alpha_0^{g}) + \alpha_1 \ln(pop_i) + \alpha_2 \ln(pop_j) - \alpha_3 \ln(dist_{ij}) \quad \text{.....(2)}$$

The logarithm-transformed model will be directly implemented in a subsequent regression. Here, it is expected, that $\alpha_1, \alpha_2 > 0$, as the attractive force between municipalities, depends on their size – as in Newton's law of gravity where the attractive force between objects depends on their mass. In addition, the attractive force also depends on distance, i.e. the greater the distance the lower the attractive force, which is why $-\alpha_3$ is expected to be negative.

An analysis of migration patterns based solely on the macro-economic aspect, in the form of the demographic gravitation hypothesis, will naturally have limitations. For this reason, the model has been enlarged to include other aspects, such as micro-economic and meso-economic aspects, to illustrate choices made by the migrants. For both the micro-economic and the meso-economic aspects, both origin and destination dimensions are included involving a comparative push- (origin-) and a pull- (destination-) approach.

#### 4.1.1.2 Micro-economic/market aspects

The micro-economic argument for deciding to migrate is the conventional classical: If one profits to migrate from one region to another region – and profits more to this region compared with other regions – then migration rate would ceteris paribus be high. In line with Espon (2011) the economic and human capital of the destination region will be high.

***Economic and human capital***

Within the micro-economic approach the individual migrant has two obvious choices: either relocate or remain in his/her present residence. The decision to relocate will depend on the perceived utility value for the individual of the present residence, compared to the utility value available by relocating. This model restricts its focus to migration between municipalities – not within municipalities – the individual compares the utility value in the home municipality (*i)* with the utility value of moving to another municipality (*j)*. The individual's disposable income potential is restricted by the level of income in both municipality $i$ and municipality $j$.

If we let $u_i$ represent the utility value, and $x_i$ be a vector of the various characteristics of the home municipality, on the one hand, and let $u_j$ represent the utility value and $x_j$ be a vector for the various characteristics in the potential target municipality, on the other, the individual residing in municipality *i* will relocate if the following imbalance is met:

$$\max_{x_i} u_i(x_i) \quad < \quad \max_{x_j} u_j(x_j)$$

$$s.t. \sum_{s=1}^{n} p_{si}\, x_{si} = m_i \qquad s.t. \sum_{s=1}^{n} p_{sj}\, x_{sj} = m_j$$

For all $j = Copenhagen, Frederiksberg, \ldots Ålborg, \ldots Hässleholm$ and $j \neq i$

where $\sum_{i=1}^{n} p_{si} x_{si}$ and $\sum_{i=1}^{k} p_{sj} x_{sj}$ indicate the chosen linear combination of goods and $n$ and $k$ are the number of commodities in the municipality $i$ and $j$. Finally, $m_i$ and $m_j$ indicate the level of income in municipality $i$ and the level of income in municipality $j$. Prices of commodities in principle include transportation costs, and income is net of commuting cost.

Migration flows are aggregates of the location decisions of individuals within a region. Some individuals decide to move and others decide to remain in the municipality. Although location choices are individual decisions, in the theoretical model a representative worker/consumer/citizen is assumed. Individuals belong to a group or an audience (Espon (2011)), such as an age group or educational groups, and in the model it is assumed, that all individuals in a group decide as a representative agent acting on behalf of the whole group. The level of income, spending patterns and the level of utility derived from this will vary depending on age, level of education etc.

This element of the migration model involves traditional classical economic variables which are compared between the region of destination and the region of origin, such as average income, unemployment rate, changes in basic jobs, local tax rates as the well as the average general grants and equalization (before municipality tax).

For commodities prices on houses and cars in the region of destination compared with the region of origin also should be included in decision of location. The more an individual or a family profits in terms of reduction in house expenditures and transportation costs from migrating from one municipality to another, the higher the migration.

Some aspects of the representative agent formulation given above are of course hard to address with a macro model. For instance, family and friends' connections are crucial elements of the utility function. This fact is almost impossible to address in a macro model since we are not able to track individuals, but only groups of people.

When you do not take the family and friends' connection into account our macro model will be biased in such a way that it will predict more migrations than actually observed. This is

because the unit decisions, i.e. family and friends' connection are mostly related to the origin municipality.

In a pure micro formulation of the model these could be taking into account by a variable with the number of years an individual has been living in the home municipality, which would be a good approximation of how connected the individual is to the municipality.

#### 4.1.1.3 Meso-economic Aspect

The meso-economic aspect is about general amenities for the individual in the home region compared with other regions. Some of these amenities have to do with human made amenities while other amenities have to do with environmental and climatic properties in the potential destination municipality compared with the municipality of origin.

##### *Socio-cultural capital*

The first group of amenities is the age and the educational composition of the region, the social satisfaction etc. According to Espon (2011) this refers to the socio-cultural capital of a region: If an individual moves to a region with a high share of his/hers own group (again compared with other destination regions) this will improve welfare for the migrant. This might be homogeneity in terms of age groups, where young individuals seek towards regions with a high share of young people. Or in terms of educational composition, the migration rates would be higher for individuals with high education to move to regions with a high share of population with a high education. This might also lead to low migration rates if the social problem index is high in destination regions compared with the region of origin.

However, the opposite might also be the case, i.e. some people might prefer population diversity (Florida 2002). This may refer to what Florida calls "the creative class", where people feel inspired by living in a society with different classes and cultural background.

##### *Anthropic capital*

Another group of factors attracting migrants is man-made features of a region such as population density, cultural heritage, tourism facilities, accessibility etc. These types of attractions can be referred to as the Anthropic capital of a region according to Espon (2011).

In the case of population density, the attraction can be different for different age groups: For the young population the migration is directed towards regions with higher population densities than the region of origin. For older age groups there is a flow in the opposite direction towards regions with low population densities, Espon (2011).

In the case of tourism facilities there might be an attraction from a high share of tourism spendings and shares of activity within hotel and restaurants. Depending on the tourism composition, the young individuals are more attracted to regions with a high intensity in foreign tourism, whereas the older population is more attracted to regions with a high share of domestic tourism.

### *Institutional capital*

Another group of amenities has to do with level of public service. According to Espon (2011) these territorial assets might be characterized as a regions institutional capital. The institutional capital might in turn be divided according to the level of the public sector, divided into state and municipality services and according to the age group which the services are related to, such as kinder garden, school, university and other higher educations, culture-/library, elder care and health services. Another kind of institutional capital which is not related to a specific age group can be "cultural and entertainment services".

Whether inhabitants benefit from the level of municipal services will naturally depend on whether the individual inhabitant is interested in or benefits from the services provided. As a result, an inhabitant's willingness to relocate will not depend on the general level of service offered by the target municipality in relation to the home municipality but will depend more on whether the target municipality prioritizes the inhabitant's preferred areas of service in relation to the home municipality.

Of course municipality services are attractive, but only to the extent where taxation is not too high. This means that a person might face a trade-off between a higher level of tax and a higher level of municipality service. Ideally, one would include a tax rate variable to address this trade-off, but because of different tax systems in Sweden and in Denmark this is hard to deal with.

### *Environmental capital*

Migration can also be assumed to depend upon climate variability, geographic characteristics, protected green areas etc.: The smaller climate variability, the better geographical characteristics and the higher share of protected green areas, the more attractive or the higher the environmental capital a region has (Espon (2011)). Migration tends to increase ceteris paribus the higher the environmental capital of a region of destination is compared to the environmental capital of the region of origin. The impact from differences in environmental capital might be the difference in forested hectares in the target municipality in relation to the home municipality. This effect is expected to be positive, i.e. people move to municipalities with an abundance of nature areas. This is because most people give priority to being able to

relax by going for a walk or run in the woods, also because of the health benefits associated with these activities (Andersen 1997, Holm & Tvedt, 1998).

## 4.2 Changes

In section 4.1 the steady state model was presented, including a macro-economic part, a micro- or market economic part and a meso-economic part. The steady state model was characterized by equilibrium migration flows, where the population moves around between regions according to the age of the population. The migration flows were explained by five types of territorial capital (Espon (2011)) involving the micro- and meso-economic parts). Although the variables are not the same for all regions, the model may create a development which is stable, and at the same time follows a pattern of concentration, where regions with high population density get more in-migrations.

Changes from one steady state development path to another can appear if basic changes in one or more of the territorial capital occur. The important example in this article is the establishment of a fixed link between Øresund Region, DK and Øresund Region, SE, the depreciation in the exchange rate between Swedish and Danish kroner and the introduction of new urban areas such as the Ørestad, in the core of the municipality of Copenhagen and new sub-urban and urban areas in the municipality of Malmø, Sweden.

Using the concept of territorial capital, the fixed link can be seen as a combination of changes in the anthropic capital and in the economic and human capital: The accessibility especially for residents in south Sweden has changed as described in section 4.1.1.3, both as a direct element in the anthropic capital – the internal and external accessibility in the Øresund Region improves – and as a direct element in economic capital, because residents profit from the possibility of maintaining a job in Øresund Region, DK and living in Øresund Region, SE, which as described in section 4.1.1.3 can be seen as an increase in the economic and human capital.

# 5 Data

This section provides a presentation of the data used in the analysis of migration flows. In general, it is important to notice that data are not available for all variables presented in the model in section 4. Compared with the analysis of domestic migration flows in Denmark (Madsen et.al. 2011) the present analysis is reduced with respect to explanatory variables. Especially, it is not possible to get data from both municipalities in Denmark and in the Øresund Region, SE on level of public service at the municipality level (institutional capital), for private service for variables for shopping facilities and for tourism revenue (anthropic capital) and for the data on house prices (economic and human capital) and on housing capacity (macro-economic or gravitation model). For this analysis only 3 education groups are involved in opposite to 5 education groups in the domestic Danish analysis (Madsen et al 2011).

## 5.1 Description of the Dependent Variable

The dependent variable in the model, presented in section 4, is migration flows by place of origin and by place of destination. The data have been divided into migrations by 5 age groups and by 3 education groups giving 15 tables on migration flows. The migration data are aggregated from micro data from the national Danish register data from Statistics Denmark and from the transnational register data from Statistics Denmark and Statistics Sweden. The transnational register data is a micro dataset, which includes information on the place of residence for persons, who in the period before 2008 lived in either Denmark or Sweden and in the period 2001 to 2008[12] have moved to the other country. From the transnational register 15 tables on migration from Danish municipalities (98) to municipalities in Øresund Region, SE (33) together with rest of Sweden have been processed. From the national register for Denmark 15 tables on domestic migration from Danish municipalities to Danish municipalities have also been processed. Finally, the two sets of tables forming 15 (98 by (98+33)) matrices, have been established. In appendix 3 the data processing of the dependent variable is described in detail.

## 5.2 Description of the Independent Variables

The independent variables in the model have different forms: The first type of independent variables has values for all combinations of origin and destination municipalities, which is the

[12]Migration data based on micro data is only available until 2008 opposite to the aggregated statistics on migration and commuting flows, which is available for 2010

case for the (change in) transportation costs between the region of origin and the region of destination. The second type of variables is the difference between the value of the variable for the municipality of destination minus the value for the municipality of origin. This type of variable shows the change – positive or negative – in the independent variable when a person from an age and education group moves from municipality of origin to municipality of destination. A third type of variable is place of origin or repel variables, which has the same value for all municipalities of destination and place of destination or attraction variables, which are identical for all municipalities of origin. In appendix 3 the data processing of the independent variable is described in detail.

# 6 The Econometric Model

The econometric model is important to consider, because an erroneously specified model could lead to imprecise estimates and thus ultimately to erroneous conclusions. Especially the problem of omitted variables, where data are not available, represents a basic problem.

Linear regression was initially selected for estimating the relation between the number of migrations and the explanatory variables described in the previous section. Insofar as some values of the dependent variables are concerned, the model could expect a negative number of migrations and not be stated as integer numbers. A regression model that takes account of the dependent variable not being negative and which is stated in integer numbers is a Poisson Regression, which was naturally the next choice. However, a Poisson Regression is somewhat restricted by the fact that the conditional mean and the variance must be the same.

A model which adjusts the variance so it can vary from the mean is the so-called Negative Binomial Regression (Verbeek 2008).

Generally, the variance will be greater than the mean ("over dispersion"), and for this reason it was obviously necessary to test whether this was also true in our model.

In brief, a likelihood ratio test was performed between the log-likelihood value in the Poisson Regression and the log-likelihood value from the Negative Binomial Regression. As a result, in a chi-square distribution with one degree of freedom, the test appears to be significant at a level of less than 0.01% in the 15 models estimated, thereby rejecting the hypothesis that the variance and the mean are equal. For this reason, we finally decided on the Negative Binomial Regression. It is used in the following section and its log-likelihood function is reviewed in the Appendix 2.

## 6.1 The migration model – a comparison with the IBU-MOCCA-model

As it can be seen, the migration model is much in line with the MOCCA (see section 3): Basically, both models find that differences in relative wages and relative house prices together with the travel distances are important for migration flows. In MOCCA a logit model has been used to determine the probability to move to a given municipality, whereas in this analysis a gravity model including the absolute number of migrants has been determined.

In MOCCA, migration behaviour has been analysed for Danes and Swedes, whereas in this analysis migration has been divided into 3 educational and 5 age groups.

In this analysis, the explanation of migration flows has been divided into explanation of "levels" and of "changes", whereas MOCCA does not include this distinction in the model.

In MOCCA, few other variables than economic variables have been included to explain migration patterns, whereas this analysis has included a number of variables on territorial capital, such as population density, urban facilities, etc.

Among economic variables, MOCCA uses differences in wages and house prices, whereas the present analysis uses the exchange rates combined with the distances to the other country, where a job is available, reflecting that the relative advantages of improvements in exchange rates depend upon the distance to jobs and goods in the other country.

In MOCCA, migration is modelled together with commuting and transport flows, which capture the simultaneity in the choice of residence and place of work.

In MOCCA, logit models have been used in the estimation of probability to migrate, whereas in this analysis a Negative Binomial Regression has been used to explain migration flows.

Although, the two models are different in the detailed specification, they are very similar in the basic approach to changes in migration flows – and whether a continuous development in migration, jobs and integration will occur: If differences in relative wages and house prices diminishes the incentive to move residence and job is much less. This also involves changes in the exchange rate, which is the most important factor in generating changes in relative wages and house prices.

# 7 The Empirical Results

Now that the econometric model and the theoretical framework for explaining migration patterns have been selected, 15 regressions have been estimated using the Negative Binomial Regression – 5 age groups combined with 3 education groups. Results are showed in tables 4 and 5. In table 5 the statistics on variables in the regression model / analysis are presented, whereas in table 4 columns show the 15 different regressions results. Rows show the variables, giving in total 33 variables.

***Table 4: Regression results - summary table***

| | HU01_2029 | HU02_2029 | HU03_2029 | HU01_3039 | HU02_3039 | HU03_3039 | HU01_4049 | HU02_4049 | HU03_4049 | HU01_5059 | HU02_5059 | HU03_5059 | HU01_6069 | HU02_6069 | HU03_6069 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **log_ny_afstand_km** | -1,09 | -1,16 | -1,01 | -1,18 | -1,23 | -1,12 | -1,20 | -1,23 | -1,12 | -1,26 | -1,28 | -1,14 | -1,13 | -1,13 | -1,02 |
| **Chi-Square** | 3902 | 4675 | 2312 | 4224 | 6028 | 4534 | 3857 | 5530 | 4047 | 3215 | 4498 | 3168 | 2288 | 3011 | 1994 |
| **log_befolk_fra** | 1,03 | 1,05 | 1,17 | 0,78 | 0,90 | 1,18 | 0,82 | 0,86 | 0,99 | 0,72 | 0,78 | 0,88 | 0,81 | 0,80 | 0,93 |
| **Chi-Square** | 1485 | 1627 | 1184 | 823 | 1476 | 2174 | 929 | 1412 | 1553 | 408 | 626 | 647 | 580 | 738 | 767 |
| **log_befolk_til** | 0,97 | 1,16 | 1,37 | 0,82 | 0,87 | 0,99 | 0,73 | 0,79 | 0,96 | 0,84 | 0,87 | 0,93 | 0,76 | 0,75 | 0,93 |
| **Chi-Square** | 1477 | 2209 | 1794 | 1213 | 1881 | 2069 | 1000 | 1627 | 2005 | 809 | 1186 | 1209 | 582 | 739 | 923 |
| **sw_dk** | -6,05 | -6,58 | -4,69 | 1,09 | -0,79 | -2,41 | 0,43 | -0,99 | -1,00 | 2,12 | -0,50 | -1,90 | 2,52 | 2,41 | 0,88 |
| **Chi-Square** | 79,29 | 104,06 | 23,67 | 2,13 | 2,40 | 14,96 | 0,48 | 5,17 | 3,59 | 5,18 | 0,57 | 7,38 | 5,85 | 8,53 | 1,22 |
| **Bridge_fra** | 0,65 | 0,86 | 0,61 | -0,08 | 0,23 | 0,45 | -0,25 | 0,41 | 0,62 | 0,13 | 0,45 | 0,98 | 0,38 | 0,12 | 1,03 |
| **Chi-Square** | 46,91 | 91,10 | 22,90 | 0,57 | 6,16 | 18,54 | 4,43 | 17,60 | 31,06 | 1,06 | 15,88 | 67,28 | 7,93 | 0,97 | 64,94 |
| **Bridge_til** | -0,02 | -0,05 | 0,59 | -0,42 | 0,21 | 0,73 | -0,15 | 0,24 | 0,73 | 0,21 | 0,34 | 0,90 | 0,41 | 0,53 | 0,98 |
| **Chi-Square** | 0,03 | 0,17 | 17,04 | 13,90 | 4,95 | 56,83 | 1,85 | 6,89 | 50,20 | 3,02 | 10,25 | 64,61 | 10,70 | 25,29 | 71,46 |
| **ink_xxxx_til** | 0,00 | -0,01 | -0,01 | -0,01 | -0,01 | 0,00 | -0,01 | 0,00 | 0,00 | -0,01 | -0,01 | 0,00 | -0,01 | 0,00 | 0,00 |
| **Chi-Square** | 17,1 | 131,4 | 92,0 | 616,4 | 341,7 | 52,4 | 395,5 | 214,4 | 13,4 | 388,5 | 287,8 | 25,0 | 247,0 | 114,8 | 7,6 |
| **ink_xxxx_fra** | 0,00 | 0,00 | -0,01 | -0,01 | 0,00 | 0,00 | -0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Chi-Square** | 22,75 | 15,64 | 43,37 | 208,87 | 22,38 | 3,17 | 275,55 | 43,30 | 8,13 | 123,70 | 35,72 | 6,65 | 31,30 | 0,05 | 14,53 |
| **sw_dk*interaction** | 0,02 | 0,02 | 0,00 | -0,02 | -0,01 | 0,00 | -0,01 | -0,01 | -0,01 | -0,02 | -0,01 | 0,00 | -0,02 | -0,02 | -0,01 |
| **Chi-Square** | 33,48 | 21,83 | 0,28 | 45,61 | 16,95 | 0,43 | 38,97 | 15,14 | 8,07 | 28,07 | 10,91 | 0,76 | 25,36 | 35,90 | 12,33 |
| **unempl_01_diff** | 0,17 | 0,13 | 0,07 | 0,22 | 0,07 | -0,31 | 0,12 | -0,08 | -0,24 | 0,03 | -0,20 | 0,04 | 0,03 | -0,07 | -0,09 |
| **Chi-Square** | 24,45 | 9,95 | 0,82 | 26,48 | 1,34 | 24,29 | 8,59 | 1,45 | 12,52 | 0,38 | 6,92 | 0,24 | 0,77 | 2,45 | 1,53 |
| **unempl_xxxx_diff** | -0,09 | -0,02 | -0,03 | -0,24 | -0,09 | 0,01 | -0,21 | 0,07 | 0,01 | -0,08 | 0,12 | -0,02 | -0,09 | 0,05 | 0,04 |
| **Chi-Square** | 14,87 | 1,05 | 2,04 | 28,36 | 3,85 | 0,24 | 13,82 | 1,06 | 0,10 | 2,27 | 3,14 | 0,35 | 1,42 | 0,63 | 0,36 |
| **pop_density_diff** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Chi-Square** | 1,85 | 112,44 | 147,01 | 0,00 | 3,36 | 0,20 | 34,51 | 45,63 | 33,30 | 0,92 | 4,17 | 0,76 | 26,72 | 13,90 | 0,11 |
| **share_agexxxx_diff** | 4,27 | 4,62 | 3,01 | -0,77 | 6,08 | 12,62 | -6,34 | -5,67 | 1,56 | 13,22 | 10,34 | 6,53 | 4,63 | 4,22 | 7,06 |
| **Chi-Square** | 64,08 | 80,75 | 21,19 | 0,57 | 49,51 | 182,47 | 12,37 | 15,28 | 0,98 | 55,64 | 44,37 | 15,50 | 13,95 | 16,04 | 34,33 |
| **empl_hotel_diff** | 0,01 | -0,02 | -0,01 | 0,02 | 0,02 | 0,05 | 0,00 | 0,01 | 0,03 | 0,00 | 0,03 | 0,04 | 0,06 | 0,07 | 0,08 |
| **Chi-Square** | 1,06 | 2,82 | 0,79 | 3,62 | 5,76 | 24,64 | 0,02 | 1,98 | 9,71 | 0,01 | 9,19 | 14,09 | 20,37 | 37,22 | 36,17 |
| **empl_edu_diff** | 0,00 | 0,03 | 0,00 | 0,01 | -0,01 | -0,03 | 0,02 | 0,01 | 0,01 | 0,03 | 0,03 | 0,02 | 0,04 | 0,02 | 0,02 |
| **Chi-Square** | 0,27 | 16,18 | 0,09 | 2,86 | 2,81 | 28,53 | 5,31 | 2,36 | 2,38 | 12,71 | 12,81 | 5,18 | 14,83 | 5,99 | 8,29 |
| **empl_kultur_diff** | -0,02 | -0,06 | -0,02 | -0,05 | -0,06 | -0,05 | -0,07 | -0,10 | -0,05 | -0,05 | -0,07 | -0,03 | -0,12 | -0,13 | -0,08 |
| **Chi-Square** | 1,05 | 15,15 | 1,04 | 11,16 | 20,33 | 8,81 | 16,57 | 46,26 | 8,40 | 7,61 | 18,68 | 1,79 | 31,98 | 45,56 | 14,46 |
| **forest_diff** | 0,29 | -0,13 | -0,09 | 0,17 | 0,01 | 0,46 | 0,57 | 0,49 | 0,32 | 0,77 | 0,84 | -0,04 | 1,24 | 1,32 | 0,69 |
| **Chi-Square** | 3,65 | 0,74 | 0,21 | 1,15 | 0,01 | 9,87 | 12,04 | 12,33 | 4,16 | 16,93 | 26,56 | 0,04 | 35,90 | 55,37 | 11,57 |
| **kyst_line_diff** | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Chi-Square** | 0,01 | 130,25 | 80,91 | 14,77 | 6,53 | 6,37 | 35,62 | 12,50 | 0,06 | 24,86 | 26,11 | 12,37 | 107,60 | 211,61 | 36,77 |
| **lev_fra** | -0,30 | 0,47 | 0,84 | 0,50 | 1,75 | 3,18 | -0,80 | -0,12 | 0,29 | -1,52 | -1,13 | -0,95 | -2,46 | -3,27 | -1,62 |
| **Chi-Square** | 6,92 | 17,64 | 34,76 | 9,72 | 162,22 | 481,41 | 40,95 | 1,19 | 5,86 | 86,24 | 63,39 | 39,83 | 56,14 | 127,96 | 24,22 |
| **skilt_fra** | 0,76 | -0,08 | -1,49 | 0,78 | 0,83 | -0,41 | 1,01 | 1,03 | -0,14 | 1,15 | 1,13 | 0,13 | 1,16 | 1,28 | 0,11 |
| **Chi-Square** | 13,51 | 0,15 | 32,89 | 11,37 | 17,67 | 3,75 | 17,47 | 25,00 | 0,36 | 17,21 | 21,68 | 0,24 | 15,61 | 23,69 | 0,15 |

Note: Critical values in a Chi-Square distribution with 1 degree of freedom 3,8, 6,6 and 10,8 for variables being significant on a 5 %, 1% and 0,1 % level respectively.

| Table 5: Statistics on variables in the regression model/analysis | | | | | | |
|---|---|---|---|---|---|---|
| | DEPENDENT VARIABLES | Names of variables | MEAN | STD | MIN | MAX |
| | Migrated people at age 20-29 and education level 01 | HU01_2029 | 4,73 | 19,14 | 0,00 | 766 |
| | Migrated people at age 20-29 and education level 02 | HU02_2029 | 11,67 | 60,71 | 0,00 | 1435 |
| | Migrated people at age 20-29 and education level 03 | HU03_2029 | 4,85 | 34,01 | 0,00 | 1811 |
| | Migrated people at age 30-39 and education level 01 | HU01_3039 | 2,80 | 11,73 | 0,00 | 453 |
| | Migrated people at age 30-39 and education level 02 | HU02_3039 | 7,14 | 35,29 | 0,00 | 1383 |
| | Migrated people at age 30-39 and education level 03 | HU03_3039 | 8,87 | 69,87 | 0,00 | 3869 |
| | Migrated people at age 40-49 and education level 01 | HU01_4049 | 2,16 | 7,84 | 0,00 | 235 |
| | Migrated people at age 40-49 and education level 02 | HU02_4049 | 4,05 | 16,39 | 0,00 | 621 |
| | Migrated people at age 40-49 and education level 03 | HU03_4049 | 3,42 | 19,39 | 0,00 | 855 |
| | Migrated people at age 50-59 and education level 01 | HU01_5059 | 1,49 | 5,36 | 0,00 | 111 |
| | Migrated people at age 50-59 and education level 02 | HU02_5059 | 2,26 | 8,22 | 0,00 | 254 |
| | Migrated people at age 50-59 and education level 03 | HU03_5059 | 1,87 | 7,86 | 0,00 | 312 |
| | Migrated people at age 60-69 and education level 01 | HU01_6069 | 1,34 | 4,76 | 0,00 | 124 |
| | Migrated people at age 60-69 and education level 02 | HU02_6069 | 1,85 | 6,53 | 0,00 | 219 |
| | Migrated people at age 60-69 and education level 03 | HU03_6069 | 1,23 | 5,08 | 0,00 | 239 |
| | INDEPENDENT VARIABLES | | | | | |
| 1. STEADY-STATE MODEL | | | | | | |
| 1.1. GRAVITY MODEL | Distance between municipalities | log_ny_afstand_km | 148,18 | 82,81 | 2,01 | 432 |
| | Logarithm of number of people in each municipality | log_befolk_fra | 10,62 | 0,77 | 7,69 | 13,12 |
| | Logarithm of number of people in each municipality | log_befolk_til | 10,49 | 0,81 | 7,69 | 13,12 |
| | Two groups: Sweden and Denmark | sw_dk | 0,25 | 0,44 | 0,00 | 1,00 |
| | Two groups: municicpalities with no bridges, islands dum. | Bridge_fra | 0,05 | 0,22 | 0,00 | 1,00 |
| | Two groups: municicpalities with no bridges, islands dum. | Bridge_til | 0,04 | 0,19 | 0,00 | 1,00 |
| 1.2. ECONOMY | | | | | | |
| - incomes per employment | Incomes per person by employment, by age group | ink_2029_fra | 239,39 | 27,77 | 179,42 | 292 |
| (increases disposable incomes) | Incomes per person by employment, by age group | ink_3039_fra | 362,78 | 39,32 | 275,44 | 510 |
| | | ink_4049_fra | 399,67 | 65,99 | 298,58 | 700 |
| | | ink_5059_fra | 386,25 | 56,06 | 301,32 | 643 |
| | | ink_6069_fra | 325,44 | 62,19 | 220,89 | 640 |
| | | ink_2029_til | 218,64 | 43,24 | 120,33 | 292 |
| | | ink_3039_til | 332,76 | 62,93 | 216,45 | 510 |
| | | ink_4049_til | 369,72 | 78,94 | 243,46 | 700 |
| | | ink_5059_til | 362,05 | 65,76 | 255,02 | 643 |
| | | ink_6069_til | 310,05 | 61,63 | 220,89 | 640 |
| - Interactions with | Interactions between dummy | sw_dk*ink_2029_til | 40,01 | 68,81 | 0,00 | 172 |
| dummy variable | variable: 'sw_dk' and incomes | sw_dk*ink_3039_til | 62,07 | 107,16 | 0,00 | 339 |
| | variables for specific age: | sw_dk*ink_4049_til | 71,50 | 124,00 | 0,00 | 416 |
| | | sw_dk*ink_5059_til | 73,85 | 127,63 | 0,00 | 390 |
| | | sw_dk*ink_6069_til | 67,22 | 116,19 | 0,00 | 345 |
| - labor market | Unemployment share by education group | unempl_01_diff | 0,60 | 1,61 | -4,44 | 8,46 |
| (improves job opportunities) | Unemployment share by education group | unempl_02_diff | 0,18 | 0,80 | -3,65 | 3,65 |
| | Unemployment share by education group | unempl_03_diff | 0,18 | 0,59 | -1,64 | 2,59 |
| | Unemployment share by age group | unempl_2029_diff | 0,39 | 1,61 | -5,81 | 5,81 |
| | Unemployment share by age group | unempl_3039_diff | 0,13 | 0,96 | -4,20 | 4,20 |
| | Unemployment share by age group | unempl_4049_diff | 0,09 | 0,84 | -3,47 | 3,53 |
| | Unemployment share by age group | unempl_5059_diff | 0,01 | 0,84 | -4,46 | 4,46 |
| | Unemployment share by age group | unempl_6069_diff | 0,21 | 0,62 | -2,10 | 2,63 |
| 1.3. ATTRACTIONS | | | | | | |
| - accessibility / congestion | Population density | pop_density_diff | -90,68 | 1757 | -10637 | 10637 |

| | | | | | | |
|---|---|---|---|---|---|---|
| - homogenity /social problems | Share of the same group of people, by age 20-29 | share_age2029_diff | 0,00 | 0,43 | -0,20 | 0,20 |
| | Share of the same group of people, by age 30-39 | share_age3039_diff | 0,00 | 0,02 | -0,12 | 0,12 |
| | Share of the same group of people, by age 40-49 | share_age4049_diff | 0,00 | 0,01 | -0,06 | 0,06 |
| | Share of the same group of people, by age 50-59 | share_age5059_diff | 0,00 | 0,02 | -0,09 | 0,09 |
| | Share of the same group of people, by age 60-69 | share_age6069_diff | 0,00 | 0,03 | -0,12 | 0,12 |
| - private sector | Employment in hotels | empl_hotel_diff | 0,15 | 1,75 | -9,00 | 9,00 |
| - public sector | Employment in education, teaching | empl_edu_diff | 0,73 | 2,57 | -9,68 | 9,68 |
| | Employment in culture and entertainment | empl_kultur_diff | 0,49 | 1,32 | -4,84 | 4,84 |
| - nature attractions | Area of forest by total land | forest_diff | 0,02 | 0,12 | -0,26 | 0,61 |
| | Coast line of municipality | kyst_line_diff | -9,68 | 100 | -385 | 385 |
| 1.4. DEMOGRAPHIC EVENTS | New born in each municipality | lev_fra | 1,09 | 0,17 | 0,59 | 1,64 |
| | Divorced | skilt_fra | 0,52 | 0,07 | 0,15 | 0,66 |
| | Share of the same age group, 0 – 9 | share_0009_fra | 0,12 | 0,01 | 0,08 | 0,15 |
| | Share of the same age group, 10 – 19 | share_1019_fra | 0,13 | 0,01 | 0,07 | 0,15 |
| | Share of the same age group, 20 – 29 | share_2029_fra | 0,09 | 0,03 | 0,03 | 0,23 |
| | Share of the same age group, 30 – 39 | share_3039_fra | 0,13 | 0,02 | 0,08 | 0,20 |
| 2. CHANGE MODEL | | | | | | |
| 2.1. TRANS-PORTATION COSTS | Change in distance through Great Belt Link | change_afs_belt | -4,71 | 5,29 | -48,66 | 0,00 |
| | Change in distance through Oresund Link | change_afs_sund | -3,45 | 7,71 | -76,64 | 0,00 |
| 2.2. EXCHANGE RATE | Distance between Malmo and SW municipalities, 0 = DK | afstand_malmo | 0,02 | 0,09 | 0,00 | 1,00 |

In both tables the variables are sorted into two main groups:

a) The steady state model, which in turn are divided into
    a. The gravity (or macro-economic) model
    b. The micro-economic / market factors (economic and human capital)
    c. Attractions divided into
        i. Population density (anthropic capital)
        ii. Homogeneity/social problems (socio-cultural capital)
        iii. Private sector amenities (anthropic capital)
        iv. Public service (institutional capital)
        v. Nature attractions (environmental capital)
    d. Demographic events (rigidities for migrations)
b) The changes in migrations, which in turn are divided into
    a. Transport infrastructure improvements (anthropic capital)
    b. Exchange rate development (economic and human capital)

For the sake of clarity, results will be presented with one hypothesis at a time, but it should be noted that the estimated results are not separate analyses, but are based on a model which includes all variables.

## 7.1 The steady state model

The demographic macro-economic model (gravity-model) is significant with positive signs for population by municipality of origin as well as municipality of destination: The higher the

population at both place of origin and place of destination the higher migration flows in a steady state regional economy. This result is in accordance with Newton's law of gravity described in section 4.1.1.1.

To be more precise about the size of the effects, it can be seen that the group which is most drawn towards big population masses is the 20 to 29 years old in the highest education group. In this case a 1 % increase in the population yields a 1,17 % and 1,37 % increase in migrations from the municipality of origin and municipality of destination respectively. In the other end of the scale the 50 to 59 years old in the lowest educated group only have elasticises of 0,72 % and 0,84 % respectively. However, one has to be cautious, when interpreting the model, as there might be a feedback effect from the dependent variable to the independent variable. When the migrations increase the population also increases, which is captured by the coefficients in the gravity-model, i.e. we cannot be sure whether the observed positive effect is because a population increases gives rise to more migrations or the other way around. Nevertheless, looking at the numbers on average only about 8,5 % of the population in the Danish municipalities from 2000 to 2008 actually consists of migrants (see table 2a). As mentioned, the elasticises are ranging from 0,72 % to 1,37 %, which indicates that the feedback effect can only contribute to a very small part of the total correlation and therefore the main effect must be due to the gravity-model.

In accordance with the theoretical description, the estimates of the gravity model shows further that higher transport costs between two municipalities result in fewer migrations. Furthermore, when running the model with the distance between two municipalities in level, the transportation costs seem to be a bigger barrier for the old people than the young people. However, this pattern is not found, when running the model in accordance with the theoretical description given in section 4.1.1.1, i.e. with the distance variable being log-transformed. Still there seems to be a tendency that the medium educated seem most constrained by the distance and the high educated seem least constrained. In the case of a 1 % increase in the distance between two municipalities for the 20 to 29 year olds yields a decrease of 1,16 % and 1,01 % for the medium educated and highest educated respectively.

The model also highlights the importance of the gravity model, which ceteris paribus seems to be the most important factor, when explaining migrations. This can be seen by noticing that the variables in the gravity model are many times more significant than the rest of the variables in the model indicating higher explanatory power.

Another important factor is the dummy, which reflects border barriers between Denmark and Sweden and explains that migration flows across a national border – even after the opening of

the fixed Øresund link – are significantly negative, i.e. migration flows between Denmark and Sweden are lower than domestic migration flows. For the most part the border barrier dummy shows that young people are more reluctant to move across the border than old people, while the tendency, when looking across education groups do not show a similar clear pattern. However, also internal geographical barriers such as the Great Belt barrier is significantly reducing migration flows between east and west Denmark, although also the fixed Great Belt link contributes to an increase in the east - west migration flows (see under changes). Further this effect of both higher in-and out-migrations seems to be more remarkable for people with longer educations, especially among the people older than 50 years. A similar trend that population moves towards urban areas and away from rural/peripheral areas is also derived from parameters estimated in the model. In particular the group of 20 to 29 years old is attracted to a much higher degree to densely populated municipalities compared to other age groups. To be specific an increase of 1 inhabitant pr. square kilometres from the origin municipality to the target municipality will on average result in an increase in migration flows of 0,01 % among the 20 to 29 years old with a long education. As mentioned earlier there is a potential feedback effect from the left hand side variable to the right hand side variable, namely when migrations increase the population also increases and as a consequence ceteris paribus population density will also increase. For the same reason as earlier this effect is believed to be minor and the correlation must mainly be driven by the effect from population density to migrations and not the other way around.

In regards to economic and human capital factors, we unexpectedly observe that people move away from municipalities with high incomes and move to municipalities with low incomes. At first this result does not seem very intuitive; as one would expect people to move towards income gains. There might be several reasons, why the model shows this result. Firstly, we might observe reversed causality, as migrations increase population also increases, which in turn will lead to a somewhat proportional increase in the labour force competing the wages down. Secondly, as mentioned in the beginning of the report, we did not include housing prices in the model. As a fact, people with more money are also able to pay more in housing expenditures, and the lower economic group might find themselves bounded to live in municipalities where housing is especially cheap. This would imply a tendency for people with a low education to move to places with low incomes, implicitly driven by housing prices. Looking at the income effects it is indeed a decreasing function of education. As an example amongst the 30 to 39 years old a 1.000 DKK income increase in the target municipality implies an average decrease in migrations of 1,15 % and 0,27 % for the lowest and highest education group respectively.

A flip side of the wage level is the unemployment rate. Here the young people seem to react to a larger extent to labour market improvements. For instance a 1 % point increase in the difference between the unemployment rates from the municipality of origin to the target municipality lowers migrations by -0,31 % amongst the 30 to 39 years old with a high education. Changes in basic jobs compared with national average in municipality of destination compared with municipality of origin and unemployment rates in municipality of destination compared with municipality of origin.

Examining results for factors related to the anthropic capital, the population density gives as mentioned positive effects on migration flows for young people, but negative for the elder population, although by far not as influential on the elder as on the young people. In general there seems to be a positive impact from improving the share of same age group, which means that population moves towards municipalities with the same age. This effect is very modest for the elder people, but of great importance for the 20 to 29 and 30 to 39 years old. Affected the most is the medium educated in the age group 30 to 39 years old with a 1 % increase. Further tourism activities seem in general to have a positive impact on migration, which suggests that there is a correlation between attraction for tourism as well as migrants. However, the tendency seems very weak for the young people, but gets significantly stronger for elder people. In comparison a 1 % point increase in the share of people employed in the hotel industry increases migrations by 0,08 % and -0,01 % for the medium educated in age group 60 to 69 and 20 to 29 respectively, where the latter effect is insignificant. This could indicate that tourism activity is not an important attractor in determining migration flows. Further it is very likely that the attraction on elder people is not a result of improved employment activity, but merely that elder people are attracted to municipalities with tourism attributes. This is also underlined by a few tourism attributes namely km of coastline and square km of forest to total land, which are both very positive significant for elder people and negative significant for younger people.

Young people are on the other hand attracted by education activities, the effect however is not major. For a 1 % point increase in the share of employed in the education sector migration flows increases by 0,03 % amongst the 20 to 29 with a medium education.

An opposite pattern for the young people is observed when looking at the effect of culture and entertainment activities, which lowers migrations by 0,06 % for a 1 % point increase for the medium educated. This negative tendency is consistent across education and age and is most strong with an effect of -0,13 % amongst the 60 to 69 years old with a medium education.

Lastly, looking at demographic events, there seems to be positive effects on migration from share new born, from share of divorces for especially the young and mid age groups.

## 7.2 Changes

Looking at the impacts from the opening of the fixed Øresund link shows, that for the most sub-models the transportation reduction due to Øresund link does not have a significant effect. In this sense the opening of the Great Belt link has actually been a bigger success than the opening of the Øresund link. In comparison a 1 % reduction due to opening of the Great Belt link for the medium educated people in the age group 30 to 39 years old increases migrations by 0,05 %. In contrast for the same group this effect is not significant and only -0,0033 %, when we look at a 1 % reduction due to the Øresund link. Further the transportation reduction due to the opening of the Great Belt link seems to affect people with less education more. For instance, the lowest educated group among the 40-49 years old get a 0,05 % increase in migrations, when the distance is reduced by 1 % due to the Great Belt link. On the other hand this effect is only 0,03 %, when considering the same age group, but the highest educated.

As mentioned the model cannot explain the migration flows to Sweden with the reduction in transportation costs due to the Øresund link. However, looking at the reciprocal of the distance to Malmø this might be the key explanation. For most of the sub-models this variable is a major contributing factor in explaining the migration flows. This reflects the gains from the exchange rate change in the 90'es, which through low prices on houses, cars and other private consumption commodities together with high income from jobs in Denmark leads to migration inflows to the Malmø region. There are also positive impacts on migration flows from the Great Belt link.

# 8 Conclusion

In this article, changes in migration in the Øresund Region, leading to relocation of population from ”Øresund, DK” to ”Øresund, SE” is examined. Changes in migration flows can be explained by three partly interrelated explanations: The opening of the fixed link from Copenhagen to Malmø, the depreciation in the exchange rate for Swedish to Danish kroner and changes in stock of houses as part of regional development policy.

In general, the young and the high educated people have a high migration propensity, whereas the elder age and the low educational groups have a lower propensity to migrate. Looking at migration to southern Sweden in detail, the age group 30-39 year and the low educational group have a higher propensity to migrate to “Øresund, SE”, whereas the group of very young (20-29 year) and the group with high education have lower propensity to migrate.

In the article a model including both steady state long run-factors explaining migration patterns and factors changes migration flows has been examined. The steady state mechanism is included in the model to separate out development in migration patterns, which can be expected to happen anyhow, due to general regional development, such as the trend towards concentration in urban and metropolitan areas. The steady state development explains migration driven by population densities (denoted the anthropic capital), where young people move towards urban areas and older people move towards low density areas. Location of tourism attractions (also part of the anthropic capital) explains the drift in net population towards urban and metropolitan areas. Location of state service (institutional capital) such as intensity of education facilities also has a positive impact on migration.

After statistically removing the general trends from migration flows, the model can be used to discuss the overall hypothesis, which has to do with factors explaining population changes through migration flows from ”Øresund, DK” to ”Øresund, SE”. The results confirm the impact from the opening of the fixed Øresund link, which works through the role of exchange rate changes as the most important factor explaining the migration flows. It is also important to stress that it has not been possible to test the impacts of housing and development decision in the Ørestad region and the new town close to the hub of the fixed Øresund link in the municipality of Malmø.

The fixed link induced a substantial relocation of population in the Sound region in the 00’s. But market forces working through the exchange rate determines as a pendulum, where it is optimal to reside and work: The merge of commodity and housing markets after opening of the fixed link led to a equalization of house prices bringing further relocation to a still stand.

But new migration and transport flows might occur: Increase in the exchange rate of Swedish to Danish kroner might lead to new relocations as well as policy decision such as the opening of the European Spallation Source (ESS) together with the synchrotron radiation facility (MAX IV) in Lund, which will be fully operational in 2025.

# 9 Litterature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# 10 Appendix 1 - The migration model

The simplest way to examine population changes – including migration, death and birth – is to assume that "everything is unchanged": In simple population forecast models, such as Statistics Denmark (2011), Demifer (2011) the population in region r in year t can be determined as

$$population_t^R = population_{t-1}^R + new\ born_t^R + inmigration_t^R - death_t^R - outmigration_t^R$$

In the model, the fertility rates are often assumed to be equal to the rates of last year, death rates as well as out-migration rates which are assumed to be unchanged. Using these rates in forecasting and assuming that in-migration is constant, population in next period follows by definition. Although the simple population forecast model seems simplistic, especially if the model is used to evaluate attraction or demographic policy changes, the classical demographic model is an efficient tool in basic evaluation of population development and as a bench marking tool to evaluate what happens if everything else is unchanged.

Before examining factors behind migration, some general references to the understanding of the determinants of the migration flows are presented: In general Lee (1966) identifies four general factors which would influence an individual's decision to migrate:

- Factors associated with area of origin
- Factors associated with the area of destination
- Intervening obstacles
- Personal factors

Most studies of migration flows only refer to factors associated with area of destination – or attractions. The point in this analysis is, that the migration should be seen as both push and pull problem, which also from a policy point of view is relevant, where the question is two-folded: How to attract population to and how to retain the population in a region.

Adding to this, the distinction between a situation of concentration, i.e. where migration flows move towards densely populated municipalities, and a situation where there is a concentration effect from the opening the bridge applies. For factors explaining migration it is important to distinguish between permanent and temporary factors, which have very different impacts on migration flows: An improvement in infrastructure such as the opening of the fixed link between "Øresund, DK" and "Øresund, SE" generates a temporary change in migration flows, which in turn generates a redistribution of the population. Another temporary effect is the previously mentioned effect of concentration, where people move to dense municipalities. This

effect cannot be permanent, because for example housing prices would eventually, due to population growth, rise to a level where the loss, i.e. higher housing prices, would exceed the benefit of living in dense areas. When the short run effect of opening the bridge dies out, the migration flows will be back to the starting point, where the concentration effect is still present. On the opposite, if a university is opened, which every year will attract young people from other regions, a permanent change in migration flows will occur.

However, more complex models are needed if factors behind migration flows and consequences of population or migration/attraction policies should be understood. A very first step is to follow the basic economic model for migration flows: In this model migration is explained by the advantages, which can be obtained if a family or an individual decides to move from one region to another. In principle all regions should be compared – within the framework of economic evaluation of migration decisions – to pick the region which maximises the outcome of location and where migration costs are lower than the advantages of migration. As a consequence in a migration model, where basic economic and labour market factors are included, in-migration is explained by economic variables, such as income differences, differences in commodity prices, especially prices on real estate, as well as employment options. In this type of model income, consumer /real estate prices, employment, unemployment are variables, which typically is included in the demographic model, if economic and labour market factors are included in the demographic model. In line with these factors, also various transaction costs are involved in the process of migration: High costs in buying and selling house are examples on factors reducing migration flows.

### *Economic and human capital*

In Espon (2011) the concept of territorial capital is used to analysis factors, which induces migration. In the case of pure economic factors, the concept of ***economic and human capital*** is the part of territorial capital which is used to explain migration flows motivated by economic and human capital factors. Human capital is the knowledge embodied in labour. A higher level of human capital results in higher productivity, which implies a higher wage rate. Only part of this productivity is captured by the wage rate while the other part is captured in higher housing prices. This is due to the fact that workers with high level of human capital benefit other workers by spreading their knowledge, making it more attractive to be located near their environment.

In the literature, very different results on the importance of economic and human capital factors are found. In general, differences in income and prices on commodities (such as

houses) seem to be significant factors the more deregulated and market oriented the economy is. For example there seems to be a general agreement that level of migration between states in US is much higher than between countries in Europe (Borjas et al. 1990, Katseli 2004) and economic factors such as income and employment/unemployment (Goodrich 1936, Thomas 1938) are most significant in US and less significant in Europe. In Espon (2011) differences in income and employment are included to explain changes in population or "net-migration" for European regions at NUTS-2-level. In general employment/unemployment compared with differences in income seems to be more important in economies with strong labour unions and sticky non-decreasing prices. In general there seems to be the effect that land values capitalize location advantages of a region.

Adding to this, we might observe high wage or unemployment rate differences between municipalities. However, due to path dependency people might prefer staying at places where they have built personal networks and personal relations. This means even though people might get an income gain or an increase in probability of getting a job by moving, they still prefer staying at their current location because they feel a stronger affiliation.

Due to long path dependency of old people, we might observe less reaction to wage or unemployment rate differences for old people than young people.

In migration studies based upon micro data an optimisation model for potential migrants (Deding 2010 for Danish studies, Backman & Bjerke (2011) for Swedish studies) will normally conclude, that income, prices and employment possibilities are important issues for migration decisions. From micro studies it can be seen, that different age or education groups (or "audiences" see Espon (2011)) have different migration behaviour ( Backman & Bjerke 2011, Taylor 2011 for a survey). For young age groups with longer time horizon, migration (rates) will be higher, because the advantages of relocation involve a longer period of time. Therefore it makes sense to estimate migration behaviour for sub-groups.

The pure employment/unemployment driven models for migration can be found in the "two-equation model", which is based on »people follow jobs« or »jobs follow people« (Kristensen & Henry 1998 for Denmark for a survey on this type of models). Although there are ambiguity on the causal direction, there is no doubt that a simultaneous relation between people (migration) and jobs can be identified and should be included in an analysis on attraction policies: In-migration is stimulated through job creation and employment is in turn stimulated through population changes. An uni-directional analysis, where account only is taken to the impacts from attractions to migration and population does not give an adequate picture of the economic and human capital factors explaining migration and population (Madsen et al. 2011).

### *Agglomeration economies*

Agglomeration economy is an important factor for regional development. Location and urban externalities improve productivity of firms either through the participation in clusters or in the urban pool of resources, such as sharing labour market, markets for intermediate consumption goods etc. This attracts firms and it increases income and employment. Especially the importance of creating and sharing ideas as a key element in agglomeration economies is introduced by Smith (1776), Von Thünen (1826) and Marshall (1920). From production side agglomeration factors are important to understand the economic attractiveness of a region.

Contrary to the Marshallian tradition, Jacobs (1961, 1969) emphasised the role of urbanisation economies, and therefore the sectoral diversity to enhance economic development. In relation to this, the outcome of agglomeration economy is the existence of an attraction capacity of agglomerated areas on migration flows for different "audiences" – and not for specific sectors. The attraction capacity is related to the regional attractiveness in general and the attractiveness for different "audiences", such as people with high education and creative skills. If regions are able to attract the "creative class" (Florida 1961, 1969 & 2002), then growth will be higher, and then the region will attract even more people – and especially increase the creative mass, which in turn has impacts on the productivity of the region. The process can be described as cumulative in the sense, that population changes driven by attractions will increase the productive and creative mass of a region, which in turn will increase productivity. This will attract more people increasing the pool of creativity etc. On the opposite: For the loosing regions, the agglomeration process might lead to downward going spiral, which will lead to further reduction in creativity, which in turn will induce out-migration etc.

### *Anthropic capital*

The agglomeration economy contributes to the territorial capital, especially what Espon (2011) refers to as anthropic capital. Following Espon (2011) anthropic capital is defined as "man-made features of the territory like cultural heritage, population density, have a large metro area within, tourism infrastructure". These indicators reflect the region as a "knowledge society", which involves sectors such as "high-technology industry, neo-artisanal manufacturing, business and financial services, cultural and creative industries....associated with situated knowledge and it's articulation with global cultural and information flows" (Espon (2011)). Cultural heritage and other tourist attractions and sights are included in the assets of a region, and important cultural markers are not only an important engine of tourism but also of the creative industry that may get involved in the heritage value chain and a location factor

for new residents and firms selecting areas of status.  Associated with this and from a residential perspective, the "local milieu" and "innovative milieu" "focusing on the capacity of regions to develop and/or attract new productive capacities.....simultaneously addressing the needs of those who live there (i.e. in terms of employment and services)" will induce migration. Another dimension involves the temporal aspects of migration, where migrants are segmented into mobility patterns such as different time horizons and levels of "stickiness" or resilience of such flows, where factors exert different degrees of pull for specific groups of migrants. (Espon (2011)).

### *Socio- cultural capital*

There are other elements in the agglomeration economy, out of which can be included in what Espon (2011) refers to as socio or socio-cultural capital: Due to the fact that greater network linkages to other people will lead to higher trust, this will, in turn, imply lower transaction costs, because agreements can be based on higher flexibility and less formalisation. According to Espon (2011) socio-cultural capital is defined as "population age and education, social satisfaction". Social and culture assets include the effect of being together with people with the same age and educational background as well as the degree of social problems and "satisfaction with life as a whole". Part of the socio-cultural capital are factors such as crime rates (Gabriel & Mattey 1996). One might add that Denmark and Danish cities have very high levels of trust (2$^{nd}$ highest in the world after Norway) according to the World Values Survey, and that Danes have the highest level of life satisfaction (WVS)), and additionally that high levels of satisfaction and social trust were reported in a survey of European cities (especially in Aalborg, but also in Copenhagen, which were the two Danish cities that were included in an EU-administered survey).

### *Institutional capital*

Next, the institutional capital is the territorial capital. People seek "good institutions" and "freedom and openness" (Taylor 2011), which is embedded in the concept of institutional capital (Espon 2011, Taylor 2011).

What is meant by "good institutions" is in the core of the Tiebout (1956) "voting with the feet"-argument: People/families evaluate not only the general level of local and regional taxation in a region, but also the level of services within specific areas of interest (such as the level of service within elder care for old population). The level of local and regional taxation includes the general level of taxation to the general level of services. The level of service involves more

specific areas of interest, such as the level of service within elder care for old population. Level of service within specific areas of interest also includes the more subjective valuation of quality of local services. "Good institution" includes local and regional taxes on commodities such as taxes on transportation (road pricing, tolls etc.) as well as non-market institutions, which formally are outside the public but still located in a geographical area for local and non-market reasons. "Housing policy" is also included in the sense that areas and plans for new towns, renewal of houses is also included in the institutional capital. Finally, the size of governments (small government) seems to play a role for migration decisions (Cebula & Alexander 2006).

Freedom and openness is the other part of the institutional capital, which perhaps is more related to the modern concept of institutional capital and which are included in the concepts of creativity, creative class and "creative centres" (Florida 2002). Freedom and openness include economic freedom and personal freedom (Taylor 2011). Economic freedom involves the classical economic rights, such as securing property rights without using power, fraud or theft. Personal freedom also involves agglomeration economies, arising from the knowledge externalities. Andersson and Andersson (2006) emphasize the importance of diversity and creativity. Taylor (2011) finds that both good institutions and economic and personal freedom is an important determinant for migration especially for the higher educated and creative population.

### *Environmental capital*

Finally, geographical, climatological and topographic factors are generally accepted to influence migration. Espon (2011) defines environmental capital as the value of climate variability, geographic characteristics and protected green areas. A good or a bad climate in the form of sun belt or frost belt regions explains migration flows (Partridge, Richman, Olfert and Ali 2011). Also the risk of natural disasters, such as earth quakes, tsunamis or the risk of technological hazards (such as land fill sites or nuclear waste repositories) are push factors and might explain out-migration flows (Greenwood 1997).

# 11 Appendix 2 - The Log-Likelihood Function for the Negative Binomial distribution

Assuming that the number of migrants follows a negative binomial distribution, we can use the density function to find each contributing factor to the likelihood function from each observed migration. Assuming that the observations are independent, we can set the simultaneous density function as a product of the factors contributing to the likelihood (which is possible when we assume independence). After a logarithm-transformation the likelihood function is given by (Cameron and Trivedi, 1998).

$$\log\big(L(\alpha,\beta)\big) = \sum_{i=1}^{n}\left(\left(\sum_{j=0}^{y_i-1}\log(j+\alpha^{-1})\right) - \log(y_i!) - (y_i+\alpha^{-1})\log(1+\alpha\exp(x_i'\beta)) + y_i\log(\alpha) + y_i x_i'\beta\right)$$

The equation denotes the log-likelihood function, which is a function of the unknown parameters α and β. In the equation, β indicates the regression coefficients: α is the parameter which adjusts the variance for over dispersion, $y_i$ is the observed relocation $i$, and $\exp(x_i'\beta)$ is the mean value.

Partial differentiating the log-likelihood function results in the so called score vector, which is a vector function with the partial derivatives as elements. Setting this equal to zero gives the 1. order conditions, which is a non linear system and cannot be solved algebraically. Therefore, the problem is solved on a purely numerical basis using the SAS statistics program.

# 12 Appendix 3 - Data and data processing

## 12.1 Data processing of the dependent variable

The model's dependent variable is the number of migrants by municipality of origin by municipality of destination, by education and by age group.

The analysis is based on a 98 ($From$) x (98+33) ($To$) matrix, shown in the matrix below (the values in the matrix are presented for age group: 20-29 and education level: No education):

$$\text{Dep} = \begin{pmatrix} From \setminus To & \text{Copenhagen} & \text{Frederiksberg} & \dots & \text{Hässleholm} \\ \text{Copenhagen} & 9208 & 357 & \dots & 3 \\ \text{Frederiksberg} & 495 & 713 & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \text{Ålborg} & 172 & 12 & \dots & 0 \end{pmatrix}$$

The element "Copenhagen/Frederiksberg" (1st row, 2nd column) indicates the number of people who migrated from the municipality of Copenhagen to the municipality of Frederiksberg 2001 to 2008.

Generally speaking, "municipality$_i$/municipality$_j$" ($i$ row, $j$ column) indicates the number of people who moved from municipality$_i$ to municipality$_j$ from 2001 to 2008

The diagonal elements indicate the number of people residing in the municipality in 1996, and, as the model aims to describe migration behaviour, they are of no interest.

Next, each row vector is vertically aligned. This is done by using the so called VEC-function, which takes the columns of our 98x(98+33) matrix and stacks them as a column vector.

$$VEC\left(\begin{pmatrix} 9208 & 357 & \dots & 3 \\ 495 & 713 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 172 & 12 & \dots & 0 \end{pmatrix}\right) = \begin{pmatrix} 9208 \\ 495 \\ \vdots \\ \vdots \\ 172 \\ 357 \\ 713 \\ \vdots \\ \vdots \\ 12 \\ \vdots \\ \vdots \\ 3 \\ 0 \\ \vdots \\ \vdots \\ 0 \end{pmatrix} \rightarrow \begin{pmatrix} deleted \\ 495 \\ \vdots \\ \vdots \\ 172 \\ 357 \\ deleted \\ \vdots \\ \vdots \\ 12 \\ \vdots \\ \vdots \\ 3 \\ 0 \\ \vdots \\ \vdots \\ 0 \end{pmatrix}$$

98x(98+3

12.838 x 12.740 x

Finally, the diagonal elements are deleted, reducing the vector from 12.838 x 1 to 12.740 x 1, which is used in the regression analysis.

## 12.2 Data processing of the independent variable

The model's independent variables represent a slightly different structure than the dependent variable. And the independent variables are constructed in different ways. In the case, where migration flows (the dependent variable) are explained by the change in the independent variable relocating from municipality $i$ to municipality $j$, such the change in the share of forest area by moving from municipality $i$ to municipality $j$, data are processed in the following way:

$$\text{Indep}(forest\_diff) = \begin{pmatrix} \text{Copenhagen} & -0.0121 \\ \text{Frederiksberg} & 0.00684 \\ \vdots & \vdots \\ \text{Ålborg} & 0.06432 \\ \vdots & \vdots \\ \text{Hässleholm} & 0.41941 \end{pmatrix}$$

The vector of values of the independent variables is transformed into a "difference-matrix" by subtracting the value of the municipality of the origin ($From$) the value of the municipality of destination ($To$):

$$\text{Indep}\,(forest\_diff) = \begin{pmatrix} From \setminus To & \text{Copenhagen} & \text{Frederiksberg} & \text{Ålborg} & \dots & \text{Hässleholm} \\ \text{Copenhagen} & 0 & -0.012 & 0.064 & \dots & 0.419 \\ \text{Frederiksberg} & 0{,}012 & 0 & 0.076 & \dots & 0.432 \\ . & \vdots & \vdots & \dots & \dots & \vdots \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ \text{Ålborg} & -0.064 & -0.076 & 0 & \dots & 0.355 \end{pmatrix}$$

Next, like the dependent variable, the rows are stacked as column vectors and the diagonal elements are removed, so the independent variables also become 12.740 x 1 vectors and can be used in a regression to explain the number of relocations.

For other independent variables the value is constant for all destination municipalities, if the variable is a push/repelling variable for the municipality of origin, and vice versa for municipalities of origin, if the variable is a pull/attraction variable for the municipality of destination. These vectors are then expanded to column vectors of the dimension 12.740 x 1.

# SOUTH SCANDINAVIAN CROSS BORDER MIGRATION

## Does the fixed Øresund link create a real difference?

Detta är den sjätte delrapporten från forskningsprojektet Skåne–Själland och handlar om migration över Öresund efter Öresundsbron. Möjligheten för svenskar och danskar att ta jobb och söka bostad på andra sidan sundet är huvudsyftet med den fasta Öresundsförbindelsen. En analys av migration är därför central för studier av Öresundsregionen.

Författarna Bjarne Madsen, Jeppe Madsen och Irena Stefaniak är alla forskare knutna till CRT i Danmark. Analysen försöker fånga brons effekt men även andra faktorer som påverkar i form av valutakurser och bostadsplanering.

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Projektet har finansierats av Tekn Dr Ernst Wethjes Fond (som förvaltas av Handelskammaren) Sparbanksstiftelsen Skåne, Region Skåne, Malmö Stad och Kraks Fond.

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Sparbanksstiftelsen Skåne
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