To what extent is location of immigrants in different municipalities in Norway determined by local public services?

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Abstract

The growing inflow of immigrants to Western Europe and the US has increased the importance of understanding immigrants' location decisions within their host country. While this decision is shaped by many factors, the focus of the thesis is on the effect of the local public sector. A common approach in the literature has been to use public spending as a proxy for the level of local public services. However, such a variable is endogenous because of unobserved variations in service production cost across regions. The exogenous variation in municipal revenues in Norway allows to use an instrumental variable approach to overcome endogeneity issue. Using the change in immigrant stocks between 2005 and 2015 as a dependent variable, the results suggest that on average the effect of local public services on immigrant location is zero, however there is an indication of some positive effect for municipalities with significantly high level of income.

Acknowledgement

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1 Introduction

Continuous and large inflows of immigrants to the US and Western Europe in recent decades have increased importance of understanding the nature and determinants of immigrant location decisions.

Empirical evidence suggests that the main determinant of immigrant locational choice is the presence of fellow immigrants from the same country or region (Bartel (1989), Zavodny (1999), Borjas (1999), Åslund (2005)). However, when it comes to factors that are of direct relevance to policy design, such as labor market conditions, welfare generosity and public services, the literature remains quite inconclusive.

This master thesis contributes to the existing research by estimating the effect of local public services on immigrants' location decisions at the municipal level in Norway.

To perform this analysis, one would need to define a variable that represents the quality of public services. The common approach in the literature is to use public spending (Åslund (2001), Dahlberg and Fredriksson (2001), Quigley (1985)). It would be necessary to assume, however, that the cost of service production and the demand for those services are the same across municipalities. Such an assumption, though, is quite restrictive as regions could differ with respect to their economic, social, demographic and geographic characteristics. In addition, the central government at the national level may influence local public spending by redistributing income to equalize the quality of the services across the country. Such reasoning suggests that using public spending as a proxy for the local public services without proper controls will lead to an endogeneity problem. Consequently, the estimates obtained using the simple least squares estimator will be biased. Thus, the main challenge in estimating the effect of local public services on immigrant location decisions is empirical identification.

The main strength of my research is an instrumental variable approach, which helps to overcome the endogeneity problem described above. The analysis is performed using Norwegian data in the period 2005-2015. There are several reasons why Norway is an ideal candidate for this study. First, Norway is known for its large public sector, represented regionally by local governments that are responsible for the provision of local public services in the municipalities. Second, the period of the study, 2005-2015, is characterized by high inflow of immigrants, which provides data for the question of interest. Finally, the unique natural experiment allows to estimate the causal effect.

The identification strategy of this analysis is based on the observation that municipal income is not entirely redistributed by the central government across regions. Consequently, some municipalities happen to be richer than others. As evidence suggests, they spend more on public goods and can offer better services for the population (Aaberge and Langørgen (2003)). These fortunate municipalities owe their wealth to nearby waterfalls, which are a key resource for hydropower production and a source of additional tax revenue that is not fully redistributed by the central government. Since the location of waterfalls, and by extension hydropower plants, was randomly determined by nature, the variation caused by tax revenues from this industry could be considered exogenous and used as an instrument to resolve the endogeneity issue. This approach allows estimating the causal effect of local public services on immigrant location choice.

Knowledge about the value of local public services for immigrant location could be valuable for regional policy design. Policymakers may use it to adjust their policies to improve immigrant integration process and maximize the contribution of immigrants to regional development.

Intuitively, municipal spending is expected to be positively correlated with immigrant inflows. Relatively richer Norwegian municipalities spend more on such things as culture, infrastructure and child care (Aaberge and Langørgen (2003)), which may attract and retain immigrants. In addition, the local public sector could be considered by risk-averse immigrants as an "insurance" against losing a job or earning a low income. The quality of healthcare and education could be also important considerations for location choice. Empirically, however, the literature remains uncertain about the effect of the public sector on immigrant location decisions. Moreover, this topic is mostly discussed in context of the location decisions of residents of the country, without distinguishing between immigrant and non-immigrant populations. Quigley (1985) finds negative effect of the public services on location choice of the US residents. In contrast, Dahlberg and Fredriksson (2001), using the US data but a different sample, suggest that the effect is positive. Åslund (2001) explores the determinants of immigrant location choices in Sweden and shows that public services do not have a significant effect on immigrants' initial location choice (i.e. their first place of arrival in Sweden), but do have a positive effect on subsequent relocations within the country. He explains such findings by the imperfect information about the regions on the initial stage of immigration. To my knowledge, though, there is no similar research in Norway. Thus, this study aims to contribute to the literature.

The findings of this empirical analysis suggest that the effect of local public services is on average insignificant, but there is a positive effect for municipalities with very high revenues. Sensitivity analysis shows that this positive effect is mainly driven by immigrants from Asia.

The data used in this research is downloaded from the Statistics Norway website. All calculations are performed in STATA.

This paper is structured in eight sections. Section 2 presents some background information about Norwegian municipalities, immigrants and hydropower industry. Section 3 provides overview of relevant literature. Section 4 describes the data. Section 5 provides explanations on the empirical approach. Section 6 presents the main results followed by sensitivity checks. Section 7 discusses the results and Section 8 concludes and summarizes the findings.

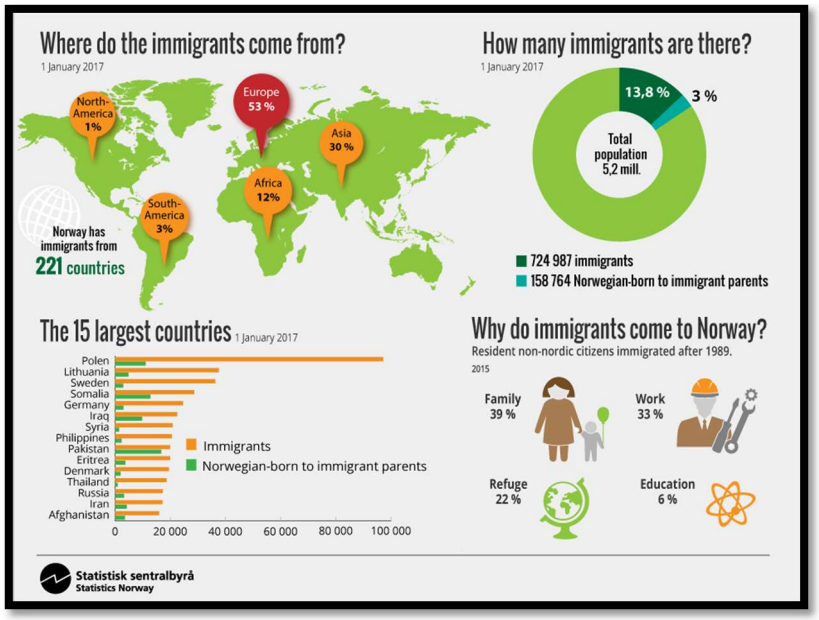
2 Background

General knowledge about the immigration to Norway during studied period, municipal revenues (particularly, from hydropower production) and expenditures on public services are important for interpreting the results and will be discussed in detail in this section.

2.1 Characteristics of recent immigration to Norway

During the last decades, many refugees and asylum seekers have come to Norway from many countries. However, since 2004, labor immigration started to dominate in immigrant flows (Stambøl, 2013). The reason for that was the EU enlargement in 2004. Such countries as Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia became new members of the European Union. The immigrant share has been strongly increasing since that time. According to the information on the website of Statistics Norway, on the 1st of January 2017 immigrants constituted near 16.8% of the population, e.g. 884 000 people with immigrant background (immigrants and children who were born in Norway to two immigrant parents), while in 2005 the share of immigrants was only around 4% of the whole population, e.g. 362 720 individuals. Norway has immigrants from 221 different countries and autonomous regions. The largest share of immigrants is from Poland, Lithuania, Sweden and Somalia. Figure 1 summarizes the described data and provides more characteristics of immigrants in Norway.

Figure 1. Statistics on immigrants in Norway, 01.01.2017



Source: www.ssb.no

The settlement pattern of immigrants has also changed. In 2007, there were few municipalities that had many immigrants, while the rest had very few immigrants or no immigrants at all (Aalandslid and Østby, 2007). Since that time immigrant location has become more dispersed. Municipality with the highest share of immigrants in 2015 was still Oslo municipality, though its share has reduced in comparison with the previous years (Stambøl, 2014).

Location decision of immigrants may depend on many factors. For example, those who immigrate to their families most likely settle in the municipalities, where their relatives live, while the location choice of immigrant workers and refugees is more likely to be influenced by socio-economic conditions and potential welfare benefits in municipalities.

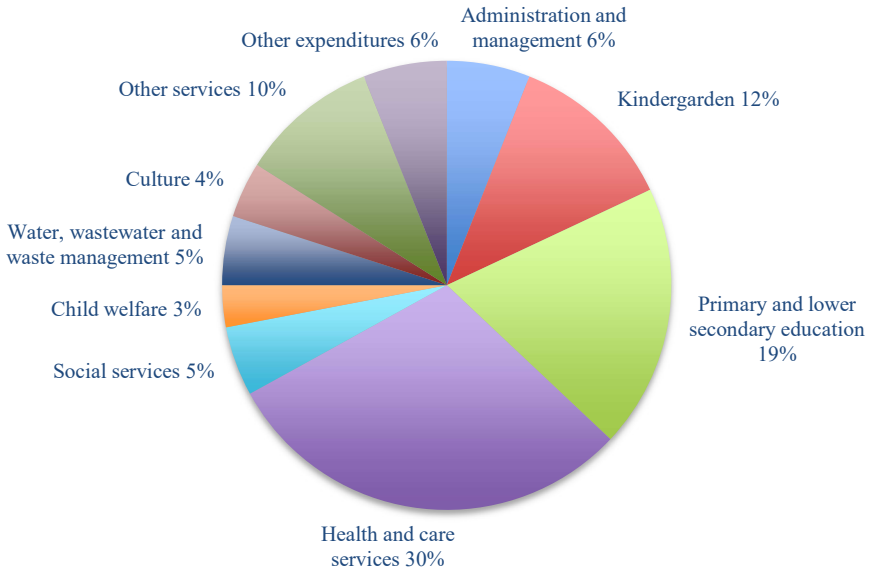
However, not all categories of immigrants may choose their initial location in Norway. In accordance with the settlement policy that was introduced in 2002 (BLD, 2011), refugees are settled in municipalities by IMDi (The Directorate of Integration and Diversity) through collaboration between the municipalities and the Directorate. It does not mean, though, that refugees will continue living in the same municipality for a long time. It was observed by Stambøl (2014) that refugees tend to move to central regions more often than labor immigrants, despite that first being settled in rather remote areas.

Successful inclusion of immigrants into the Norwegian society and labor markets, while, at the same time, maintaining regional settlement, is an important aim of the Norwegian government (Stambøl, 2014). That is why, understanding the determinants of immigrant location decisions is quite relevant for Norway.

2.2 Municipal revenues and expenditures

Main responsibilities of the municipalities are the following: public services (e.g. healthcare, primary and lower secondary schools, kindergartens, social services, culture), administrative services (for example building permits) and municipality development (Angell E. et al., 2016). In Norway municipalities are important providers of public services. Such services constitute approximately 70% of the municipalities' gross expenses (Figure 2).

Figure 2. Gross operating expenditure by municipal service areas, 2016

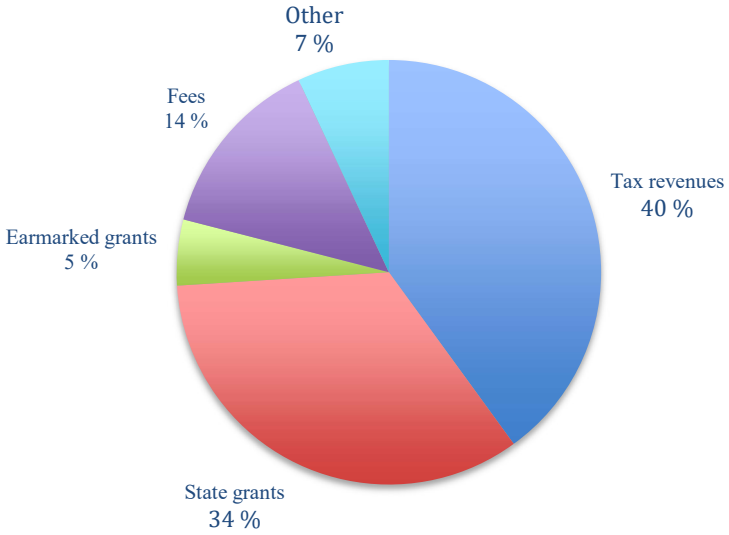


Source: ssb.no

Norwegian municipalities are very different in terms of geography, demography and socio-economic characteristics. However, visiting every municipality one will find out quickly that services such as education, health care, care for elderly and disabled etc. are of high quality everywhere in Norway. The reason for that is only partial autonomy of municipalities. The state designed some guidelines for municipal scope and adopted common laws and regulations to ensure fulfillment of minimum standard of local services. Due to differences, mentioned above, local governments face different costs when trying to achieve minimum standard requirements. Those bounded costs cannot be changed and are different for every municipality (Langørgen A. et al., 2015).

Municipalities cover their expenses by tax revenues, state grants and user payments. Figure 3 illustrates municipal revenues by sources.

Figure 3. Municipal revenues by sources, 2016



Source: www.statsbudsjettet.no

There are some municipalities that do not get enough income to cover bounded costs, while other have extra incomes. To secure quality of services provided by municipalities, the State redistributes income according to the needs through the scheme called "General purpose grant scheme" (Angell E. et al., 2016). This scheme takes into consideration structural differences across municipalities.

Revenues from hydropower industry

Hydropower industry in Norway was established 100 years ago. The very first hydropower plant started producing energy in 1891 in the northern town of Hammerfest. Nowadays Norway is the number one producer of hydropower in Europe and number six in the world (Ministry of Petroleum and Energy, 2016).

Due to the hydropower production, there are high variations in municipal revenues across municipalities. This industry generates large incomes for local governments in the form of taxes and fees, which are of the following types (LVK, 2016): commercial property tax, concession fees, revenues from concession power and tax on natural resources. Commercial property tax and concession revenues are not redistributed by the central government across

municipalities. Consequently, income from those sources could be used by municipalities freely within laws and regulations. More details on tax revenues from hydropower industry are presented in Table 16 in Appendix.

There are several reasons listed by LVK (2016), why municipalities with hydropower plants on their territory, maintain tax revenues from these plants:

- *Municipal taxation right*

  Local self-governance is an important part of Norwegian democracy. A key element of the local autonomy is local taxation rights. For many municipalities hydropower production is the largest and most important economic activity. And thus municipality should have a right to tax this activity.
- *Right for a share in created value*

  Since the development of the first hydropower plant, there was consensus among politicians that municipalities with natural resources should retain part of the value created in municipality.
- *Compensation for damages and disadvantages*

However, not only presence of natural resources on the territory of municipality matters for high municipal income per capita, but usually low population in such municipalities is an important factor as well.

3 Literature review

Interest around the determinants of the location choice of immigrants has motivated many researchers to conduct an empirical analysis on this topic. Different regional characteristics were claimed to influence immigrants' choice. The ones that drew most of the attention in the literature were the following:

- welfare generosity;
- presence of immigrants from the same ethnic group;
- labor market characteristics;
- local public services.

This section presents general literature overview and describes main findings. The last part of this section focuses specifically on literature related to the role of local public services for location choices.

Welfare generosity

Observation that immigrants tend to cluster in ethnic "enclaves" created many political and social concerns, as ethnic segregation is usually associated with generosity dependency, poverty, low participation in the labor market and crime. These concerns got especially much attention in the US literature (Zavodny (1999), Dodson (2001), Borjas (1999)).

George J. Borjas (1999) studies location choices of immigrants in the US. He focuses on the question whether states, which offer more generous welfare programs, act like "magnets" for immigrants. His basic hypothesis is that it is less costly for immigrants to decide to move to other state than it is for natives, since immigrants already incurred cost related to the move to the US. Considering the income-maximizing behavior of immigrants, hypothesis predicts formation of immigrants' clusters in states with high welfare benefits. He shows that immigrants, who receive benefits from welfare programs, are mostly clustered in states with highest benefits. In addition, his analysis reveals that immigrants are more sensitive to changes in benefit levels. By contrast, Madeline Zavodny (1997) shows that welfare benefits do not correlate with the number of immigrants, once it is controlled for fixed effects across states and stock of earlier immigrants from the same country of origin. She conducts her research using

US data on immigrant stocks. However, when disaggregating immigrant stocks by birth country, she finds a positive welfare effect at 5% significance level for immigrants from China, Philippines and Vietnam and at 10% for immigrants from Post-Soviet states and EI Salvador.

Presence of immigrants from the same ethnic group

The empirical evidence of researches done in the US and Europe supports importance of the presence of immigrants from the same ethnic group for location choice of new ones. Zavodny (1999) sums up the US literature by concluding that the most important factor determining locational choice of new immigrants is the presence of individuals from the same ethnical group. Åslund (2001) explores this question on Swedish data and finds statistically significant evidence of ethnic concentration being important for initial and subsequent location choices. In addition, he checks whether overall presence of immigrants attracts even more immigrants to the same region. The results turn to be positive. Aslan Zorlu & Clara H. Mulder (2008) also confirm conclusion of Zavodny (1999) by conducting the research on the Dutch data.

The previous research, however, also reveals several factors that may lead to the reduction of ethnical concentration. Ann Bartel (1989) finds that for highly educated people, social networks are not so important, while Funkhouser (2000) concludes that immigrants move out from ethnically concentrated areas after many years in the host country.

Labor market characteristics

Borjas (1999) observes that new immigrants are much more likely to choose states, which offer the highest wages for their skills. David A. Jaeger (2000) confirmed Borjas (1999) finding that labor market conditions matter for immigrant choice of the state. He contributes by checking the effect of wage level separately for every admission category of immigrants and concludes that wage level matters for location choice of all immigrant categories, while unemployment rate mostly matters for labor immigrants. Åslund (2001) shows that high unemployment decreases the probability of choosing a municipality for refugees.

Local public services

The literature regarding the effect of local public services on location choices in context of immigration is quite scarce. Dahlberg and Fredriksson (2001), Nechyba and Strauss (1998) and Quigley (1985) explore this question for residents of the country, without distinguishing between immigrant and non-immigrant populations. They arrive to contradictory conclusions. Quigley (1985) concludes that effect of public services is negative for Pittsburg, Pennsylvania. On contrary Nechyba and Strauss (1998) find positive effect for New Jersey. They conclude that 1 % increase in per pupil public spending on education increases the probability of choosing community from 1.65% to 3.06%. Dahlberg and Fredriksson (2001) find positive effect for location choices of short-distance movers in Stockholm. However, for long-distance movers the result is insignificant.

To my knowledge, the only available research on Nordic countries, which investigates the effect of local public services in immigration context, was done by Åslund (2001) using Swedish micro data on refugees of 1981-1983 and 1987-1989 cohorts. He finds that the effect of local public services is insignificant for the initial locational choice of immigrants. However, it becomes significantly positive for subsequent choices. He concludes that immigrants have limited knowledge about differences in public services across municipalities on the initial immigration stage. However, such knowledge improves over time and local public services are considered in subsequent choice.

Such differences in the results could be due to differences in studied samples and applied settings (e.g. analyzing stayers or movers). All researchers discussed above conducted their analysis on micro data, using logit model. The authors take municipal spending as a proxy for the quality of local public sector. However, such an approach disregards possible endogeneity problem, which was preliminary discussed in the Introduction. In my study, I am aiming to resolve this issue using Instrumental Variable approach.

Thus, given scarce research on this topic and endogeneity challenge, analysis on Norwegian data, using available instrument, could be a valuable contribution to the literature.

4 Data description

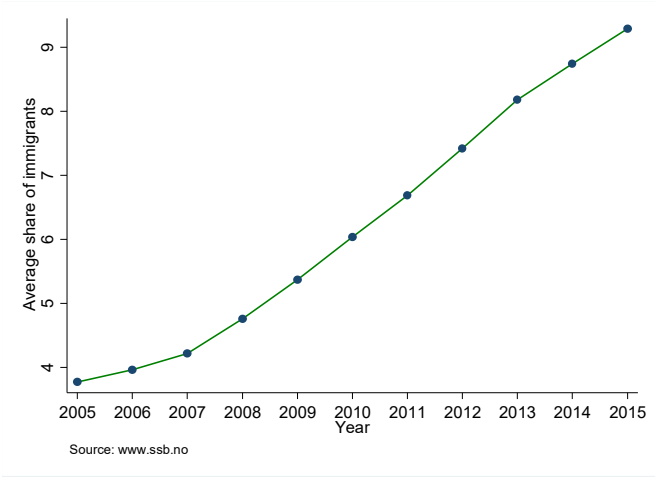
This empirical analysis is performed using aggregated data on municipality level over the period of 2005-2015 from Statistics Norway (SSB). The empirical analysis is restricted to municipality list used by SSB since 2013.

This section describes the data used in the analysis. In the first part of the section the choice of the study period is discussed. Further I provide the overview of data on immigrants, followed by the description of the municipal data, including municipal revenues from hydropower plants. In addition, all variables used in the analysis are defined in this section.

4.1 Period selection

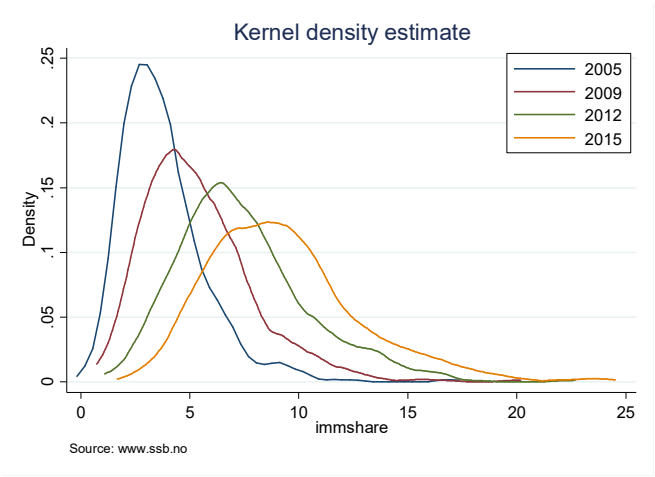
During the last decade, the share of immigrants has been increasing every year. The main reason for that is the enlargement of the EU in 2004, which led to the large inflow of labor immigrants from new member countries. Figure 4 illustrates the changes in share of immigrants occurred during 2005-2015. Before, mainly refugees and their families has been coming to Norway, though since 2007 labor immigrants dominate in the immigrant flows (Stambøl, 2014).

Figure 4. Share of immigrants by year in Norway (2005-2015)



Furthermore, the study period is characterized by more disperse location of immigrants across municipalities, which is shown on Figure 5.

Figure 5. Kernel density distribution of immigrants' share across municipalities in Norway



Hence, the interest in the latest tendencies and the available data are the reasons for the choice of 2005 – 2015 period for this analysis.

4.2 Immigrant stocks

SSB provides the following definition of an immigrant: "*Immigrant* is a person born abroad of two-foreign born parents and four foreign-born grandparents". As all data was gathered from SSB website, this definition should be considered when interpreting the results.

The empirical analysis is based on the aggregated data on immigrant stocks at municipality level for the period 2005-2015. Individual characteristics of immigrants are unobserved in this analysis.

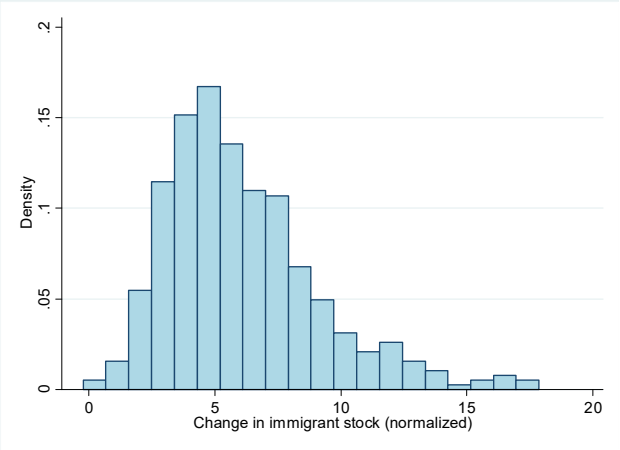
Immigrant inflows to municipalities may indicate the location preferences of immigrants. In case of this analysis, the data on flows is unavailable. That is why to proxy the flow of immigrants, the change in immigrant stock, during the period 2005-2015, is used. Furthermore, for reducing possible scale effects, it is divided by the population of the base period, 2005. Such normalization removes some variation from the data and redistributes the noise from large municipalities to small ones, which are more sensitive to changes. Scale effects could not be entirely eliminated in such way, but they are assumed to be limited. Hence, the dependent variable of this analysis is specified as:

$$\Delta Immchange_{m2005/2015} = ((Imm_{m2015} - Imm_{m2005})/population_{m2005}) * 100$$

where Imm_{m2005} and Imm_{m2015} define immigrant stocks in 2005 and 2015 in municipality *m* normalized by population 2005.

Figure 6 illustrates the density distribution of the dependent variable. It shows that changes in immigrant stock during the period of 2005-2015 were unevenly distributed across municipalities, which suggests that immigrants may consider some municipalities being more attractive.

Figure 6. Density of change in immigrant stocks during 2005-2015



Note: Change in immigrant stocks is normalized by municipality population (2005).

Table 1 compares the immigrant stocks in two periods, separately by world regions. It could be clearly seen that the largest share in total number of immigrants is represented in both years by the immigrants from Europe. The reason of their immigration is mostly work. Average share of immigrants from Asia has decreased in 2015, while average share of African immigrants increased. Immigants from North America, South America and Oceania constitute very small share in total number of immigrants, which decreased even more in 2015.

Table 1. Immigrant stock compostion, Norway 2005-2015

Characteristics		**Immigrant share, %**	
		2005	**2015**
Immigrant shares by part of the world in overall immigrant stock	Europe	60.29	66.16
	Asia (including Turkey)	24.96	19.03
	Africa	8.58	11.19
	North America	2.85	1.20
	South America	3.15	2.27
	Oceania	0.17	0.15

Source: Statistics Norway

4.3 Municipalities' characteristics

The original data set consists of aggregated observations on 428 municipalities (according to municipality list used by SSB since 2013) for the period 2005-2015. For the reason, that there were no large fluctuations in variables of interest (Figure 11 in Appendix), all RHS variables used in the analysis are presented by the data of 2005. In addition, such specification eliminates simultaneity issue. Municipalities with partially missing data such as Aure, Harstad, Inderøy, Kristiansynd, Torsken, Stokke, Larvik, Andebu and Vindafjord are excluded from the analysis. These municipalities do not receive revenues from the hydropower production. And since the data is partially missing only for 2005, possibly due to some reporting issues, it may be considered as random and thus, their exclusion should not influence the result a lot.

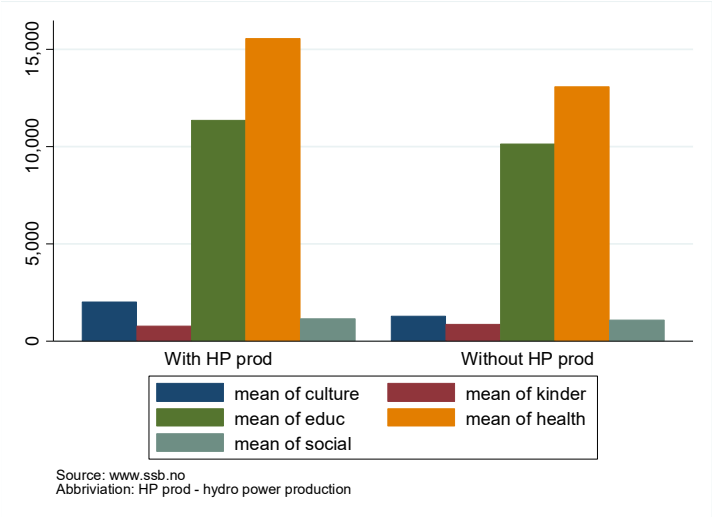
Municipal spending on local public services

As the interest of this study lies in estimation of the effect of the local public services, the variable that would represent public service sector should be defined. Following the common approach in the literature (Dahlberg and Fredriksson (2001), Nechyba and Strauss (1998) and Quigley (1985)), I am using municipal spending as a proxy of the variable of interest. However, as it has already been mentioned in the Introduction, such choice of a proxy should be done with care. By only observing high(low) local government expenditures, the quality of public services is likely to be under(over)estimated if it is not adjusted for unit costs (Aaberge and Langørgen, 2003).

In Norway, minimum standard of public services across municipalities is ensured by the central government. However municipal revenues from hydropower in the form of commercial property tax and concession fees are not redistributed. Thus, some fortunate municipalities with hydropower production are left with extra revenues. As evidence shows such municipalities spend more on public services (NOU 2005: 18). For example, Aaberge and Langørgen (2003) find that hydropower municipalities spend more on culture activities such as libraries, sport fields, infrastructure and child care. Figure 7 demonstrates the difference in per capita municipal spending between municipalities with hydropower production and without. It could be clearly seen, that hydropower municipalities spend on average more. Thus, in case of Norway municipal spending could be a good proxy for public service sector, when it is instrumented by the exogenous variation in municipal revenues in form of revenues from

hydropower production. The empirical approach will be described in detail in the Empirical model section.

Figure 7. Municipal spending on public services in NOK, 2005



Understanding that immigrants consider the public services not separately, but in combination, when making their location choices, the main variable of interest is defined as:

$$Munspending_{m2005} = Culture_{m2005} + Health_{m2005} + Social_{m2005} + Kinder_{m2005} + Educ_{m2005}$$

where:

$Culture_{m2005}$ is net operating expenses[1] on culture per capita (NOK) in municipality *m* in 2005

$Health_{m2005}$ is net operating expenses on health and care per capita (NOK) in municipality *m* in 2005

$Educ_{m2005}$ is net operating expenses on education per capita (NOK) in municipality *m* in 2005

$Social_{m2005}$ is net operating expenses on social services per capita (NOK) in municipality *m* in 2005

$Kinder_{m2005}$ is net operating expenses on kindergartens per capita (NOK) in municipality *m* in 2005

Municipal characteristics (control variables)

Norwegian municipalities differ by geographical position, topography, demography and socio-economic characteristics. Control variables may reduce possible systemic differences between municipalities with and without hydropower production. The following two variables were used as controls in this analysis: share of immigrant stock and median income per household. Both variables are for 2005 and are aggregated at municipality level.

The choice of the first variable was determined by the conclusion from the reviewed literature that immigrants tend to settle in regions with fellow immigrants from the same ethic

[1] Net operating expenses are part of expenses, which are covered by unrestricted income of municipality (namely income received in the form of taxes or general subsidies from the state, which could be used freely by municipality).

group or large share of overall immigrant population (Zorlu & Mulder (2008), Åslund (2001), Zavodny (1999)). Thus, the marginal effect of the increase in immigrant stock is expected to be positive.

The second variable represents the labor market conditions of the municipality. The empirical evidence suggests that labor market conditions may be especially important for labor immigrants (Jaeger (2000), Borjas (1999)).

Revenues from hydro power industry

Municipalities get their revenues from the hydropower in the form of taxes and fees such as (LVK, 2016): commercial property tax, concession fees, revenues from concession power and tax on natural resources. Detailed description of all municipal revenues from hydropower production is provided in Appendix, Table 16.

Table 2. Percentile distribution of revenues from tax on natural resources, 1000 NOK

1 %	2
5 %	9
10 %	79
25 %	862
50 %	3 923
75 %	12 317
90 %	24 364
95 %	35 882
99 %	45 818
N	83

Source: Statistics Norway

There is no such accountancy practice to provide taxes by industry. For this reason, all tax revenues of municipalities are presented on the website of Statistics Norway as aggregate values. Tax on natural resources, though, is paid only by hydropower industry. Therefore, it was chosen for identification purposes of this analysis. *Tax on natural resources* is profit-independent and is calculated based on average electricity production by the plant over the last seven years. The tax rate is 1.3 cents per kWh (1.1 cent is paid to municipality and 0.2 cents to county). Table 2 shows percentile distribution of municipal revenues from tax on natural resources within hydropower municipalities. Number of municipalities that receive such revenues is 83. Even though tax on natural resources is redistributed by the central government and only paid by plants with a minimum output of 5500kwh, such instrument still could be used to identify municipalities with high revenues from hydropower production. To make the tax on natural resources consistent with other variables, it is divided by the population of 2005 and thus, is specified as:

$$HPtax_{m2005} = TotalHPtax_{m2005}/Population_{m2005}$$

where $TotalHPtax_{m2005}$ is a total municipal revenue from tax on natural resources received in 2005 by the municipality *m*.

Descriptive statistics

Table 3 provides summary statistics on characteristics of municipalities used in the analysis. Columns (1) and (2) present statistics separately for municipalities with revenues from tax on natural resources and without. Columns (3) and (4) include only small municipalities, with population up to 4 999 individuals. The last column provides summary statistics on all observations in total. More descriptive statistics on municipalities are provided in Appendix, Table 17.

Table 3. Summary statistics of municipal characteristics.

	All municipalities		Small municipalities (population<4 999)		All
	With HP (1)	*Without HP* (2)	*With HP* (3)	*Without HP* (4)	(5)
Normalized change in immigrant stock					
o Mean	*5.47*	*6.20*	*4.98*	*5.74*	*6.06*
o Standard deviation	2.93	3.08	2.68	3.33	3.06
o Min	0.30	-0.23	0.30	-0.23	-0.23
o Max	16.57	17.86	16.57	17.86	17.86
Municipal spending (1000 NOK)					
o Mean	*30.80*	*26.41*	*33.61*	*29.27*	*27.28*
o Standard deviation	8.65	5.29	8.67	5.37	6.34
o Min	18.52	17.55	23.08	20.98	17.55
o Max	62.89	60.12	62.89	60.12	62.89
Median income (NOK)					
o Mean	*318 024.10*	*330 011.87*	*312 482.76*	*315 954.55*	*327 642.9*
o Standard deviation	27 331.74	40 622.75	21 176.98	36 236.97	38 631
Share of immigrant stock					
o Mean	*3.84*	*3.74*	*3.25*	*3.14*	*3.76*
o Standard deviation	2.37	1.87	1.55	1.6	1.97
Population					
o Mean	*13 907.22*	*9 885.2*	*2 448.38*	*2 494.02*	*106 80.03*
o Standard deviation	60 391.07	18 265.85	1 177.12	1 235.34	31 366.7
Number of municipalities	419	419	233	233	419

Note: all variables are for 2005, except normalized change in immigrant stock, which is calculated as difference between immigrant stocks of 2005 and 2015 divided by population of 2005. Municipal spending is per capita, median income is per household. All variables are at municipality level.
Abbreviation: HP – hydropower production

5 Empirical Model

Given that there is no endogeneity problem, the baseline regression to estimate the effect of interest would look the following way:

$$(1)\ \Delta Immchange_{m2005/2015} = \alpha + \beta_1 Spending_{m2005} + \beta_2 Muncontrols_{m2005} + v_{m2005}$$

$\Delta Immchange_{m2005/2015}$ is the change in immigrant stock during the period 2005-2015 normalized by municipal population of 2005. $Spending_{m2005}$ is municipal spending on local public services per capita. $Muncontrols_{m2005}$ includes municipality controls such as median income per household and share of immigrant stock in 2005. All variables are aggregated at municipality level.

When government cares about the level of public services provided by municipalities and compensates for differences by income redistribution, municipal spending ($Spending_{m2005}$) does not reflect the quality of local public services. Consequently, the simple least square estimator would bias the results.

Instrumental variable approach

Instrumental variable approach may help to overcome the endogeneity issue described above. Exogenous variation of revenues across municipalities, caused by tax income from hydropower plants could serve as an instrumental variable in this analysis.

The IV equation takes the form of the OLS equation, which is presented in equation (1) above, but the variable of interest is replaced by the predicted values for municipal spending:

$$(2)\ \Delta Immchange_{m2005/2015} = \alpha + \beta_3 Spênding_{m2005} + \beta_4 Muncontrols_{m2005} + v_{m2005,}$$

where $Spênding_{m2005}$ is predicted by the first stage regression of the following form:

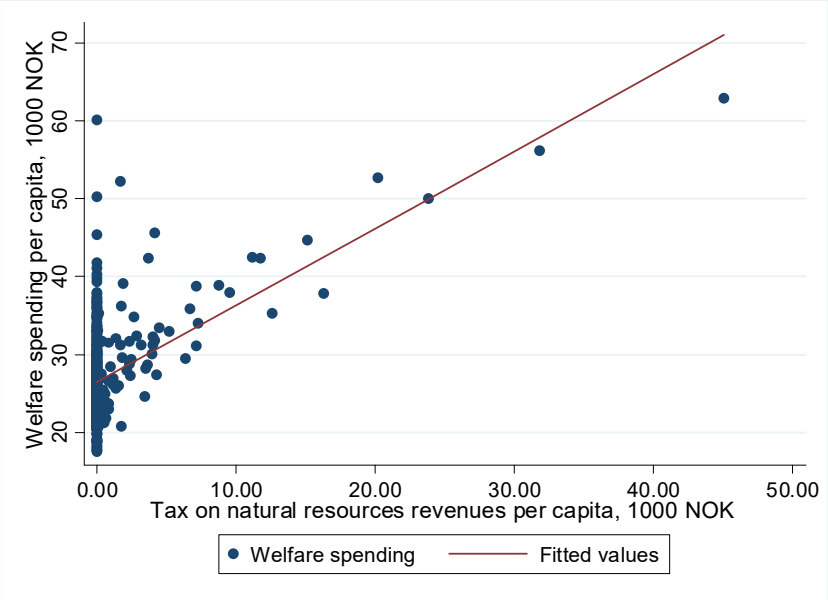
$$(3)\ Spênding_{m2005} = \alpha + \beta_5 HPtax_{m2005} + \beta_6 Muncontrols_{m2005} + u_{m2005}$$

β_3 is a coefficient of the main interest of this analysis. $HPtax_{m2005}$ is an instrumental variable, which represents municipal revenues from tax on natural resources paid by hydropower plants. Due to potential differences between municipalities with hydropower production and without, control variables are included, $Muncontrols_{m2005}$.

To resolve the endogeneity issue, the instrumental variable must be valid, which means that it should correlate with municipal spending and does not correlate with an error term

(Angrist and Pischke, 2008). The first part of the validity definition says that the instrument should be relevant, in other words it should have clear effect on the treatment variable. In terms of this analysis, it means that municipal revenues from tax on natural resources should be significantly correlated with municipal spending. This could be tested with a help of the first stage regression. Figure 8 illustrates the first stage regression and shows strong relation between the municipal spending and revenues from tax on natural resources. It is clear from the graph that both variables are positively correlated. Also, F-statistic could be calculated and checked. In this case it equals 161, which means that the result is highly statistically significant.

Figure 8. First-stage regression



The second part of the validity assumption refers to exclusion restriction (Angrist and Pischke, 2008). This requirement consists of two parts, the first one is that instrument should be randomly assigned, meaning that there should be some exogenous component in municipal revenues to satisfy this assumption. As location of resources used to produce hydro power was determined randomly, by nature, chosen instrument will satisfy this requirement. In addition, as hydro power industry was established in Norway more than 100 years ago, it eliminates the need to think that there could be some connection between the location of hydro power plants and improved economic conditions in municipality. Thus, location of the hydro power plants could be think of as a natural experiment. The second part of the exclusion requirement is that the instrument should have no effects on outcomes other than through the first stage. In terms of this analysis it means that municipal revenues from tax on natural resources should effect the change in immigrant stock in municipality only through municipal spending on different

public services. Unfortunately, fulfillment of this requirement could not be tested mathematically, that is why the only way to prove it is a theoretical argument. Thus, the exclusion restriction would fail if change in immigrant stock is effected by revenues from hydropower in the different way than through municipal spending. The main argument is that hydropower industry could not be a reason of someone's immigration to certain municipality, except if it is due to work possibilities. Since the largest hydropower plants were built many years ago and there were almost no new developments during studied period, not many work possibilities were opened. In addition, hydro power industry is highly automated, that is why there are not many jobs that could be created by this industry. Thus, it could be concluded that exclusion restriction holds.

For measuring Local Average Treatment Effect (LATE), monotonicity assumption must hold. This assumption implies that there is no "defiers", which means that all those affected by the instrument affected in the same way (Angrist and Pischke, 2014). In this analysis, it means that municipalities with revenues from hydropower production spend more on public services. The fact that it is so, described in detail in Data description section.

Thus, as relevance assumption, exclusion restriction and monotonicity hold, instrumental variable estimates the Local Average Treatment Effect (LATE), Angrist and Pischke, 2008.

6 Results

This section is divided into two parts. The first part presents the main findings. While the second part is devoted to the sensitivity analysis.

6.1 Main results

The results of the baseline estimation are presented in Table 4. It includes both, estimation using OLS and IV. Column (1) reports ordinary least squares regression coefficients and shows that municipal spending on public services is negatively correlated with a change in immigrant stock at 5% significance level. When observed municipality characteristics are included into regression in column (2), the effect becomes positive. The preferred instrumental variable approach in column (3) and (4) suggests that the effect of municipal spending is insignificant. The table also presents the first stage regression, which shows highly significant effect of hydropower tax revenues on municipal spending. Increase in municipal revenues from tax on natural resources by 1000 NOK per capita increases municipal spending by 990 NOK per capita or by 940 NOK, when control variables are included. Both control variables, namely median income and share of immigrant stock, are, as expected, positively correlated with the change in immigrant stock.

Table 4. Baseline estimation (linear form)

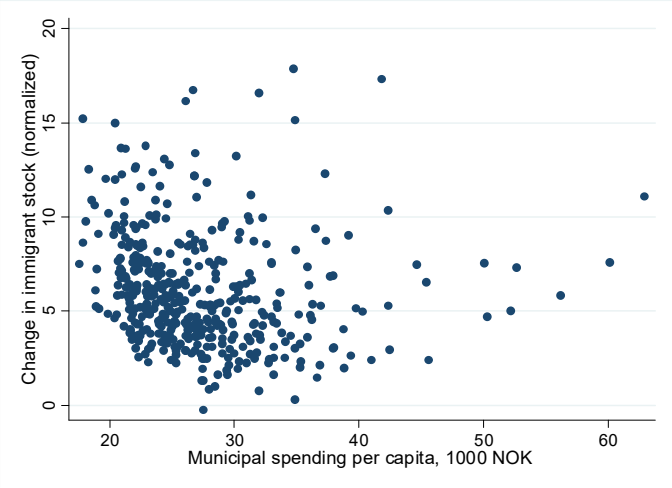
	(1) OLS	(2) OLS+controls	(3) IV	(4) IV+controls	(5) First stage	(6) First stage+controls
Municipal spending	-0.07 (0.03)**	0.04 (0.02)*	-0.01 (0.05)	0.01 (0.04)		
Share of immigrant stock		0.55 (0.07)***		0.53 (0.07)***		-0.59 (0.12)***
Log income		8.88 (1.31)***		8.22 (1.59)***		-20.05 (2.10)***
Tax on natural resources					0.99 (0.08)***	0.94 (0.06)***
Constant	7.86 (0.78)***	-109.89 (16.76)***	6.33 (1.37)***	-100.63 (20.93)***	26.46 (0.26)***	283.20 (26.52)***
N	422	422	422	422	422	422

Note: Robust standard errors are in parentheses. ***The dependent variable*** is the normalized change in immigrant stock during the period 2005-2015 at the municipality level. ***Control variables*:** share of immigrant stock, namely stock of immigrants present in municipality in 2005 divided by municipal population of 2005; log income is a log of median income per household in municipality for 2005. Municipal spending and tax on natural resources are in **1000 NOK.**

* Indicates statistical significance at the 10%.
** Indicates statistical significance at the 5%.
*** Indicates statistical significance at the 1%.

The shape of Figure 9 suggests that there might be nonlinear relation between the change in immigrant stock and municipal spending. That is why the quadratic specification is used to estimate the model. The results are expected to show better data fit than the baseline linear model.

Figure 9. The change in immigrant stock and municipal spending on public services



The OLS equation with added squared term is specified as:

$$(4)\ \Delta Immchange_{m2005/2015} = \alpha + \beta_7 Spending_{m2005} + \beta_8 Spending_{m2005}\text{^}2 + \beta_9 Muncontrols_{m2005} + v_{m2005},$$

To estimate quadratic model, using the IV approach, one would need to use two instruments to calculate predicted values for both terms of municipal spending. As instrumental variable is continuous, it is common to use the original instrument and its square (Angrist and Pischke, 2008). Therefore, I am using municipal revenues from tax on natural resources squared as another instrument. The following two equations constitute the first stage of IV estimation:

$$(5)\ Spênding_{m2005} = \alpha + \beta_{10} HPtax_{m2005} + \beta_{11} HPtax_{m2005}\text{^}2 + \beta_{12} Muncontrols_{m2005} + u_{m2005}$$

$$(6)\ Spênding_{m2005}\text{^}2 = \alpha + \beta_{13} HPtax_{m2005} + \beta_{14} HPtax_{m2005}\text{^}2 + \beta_{15} Muncontrols_{m2005} + v_{m2005}$$

Table 14 in the Appendix presents the results of the first stage estimation. Next step is to replace the linear and squared terms of the main equation with the predicted values obtained in the first stage:

$$(8)\ \Delta Immchange_{m2005/2015} = \alpha + \beta_{16} Spênding_{m2005} + \beta_{17} Spênding_{m2005}\text{^}2 + \beta_{18} Muncontrols_{m2005} + v_{m2005}$$

Table 5 presents the results. The estimates of the OLS are negative and becomes insignificant, when control variables are included. IV estimates, both linear and quadratic terms, are statistically significant at 1%. It implies that the quadratic functional form fits the data better. Hence, the marginal effect of municipal spending on change in immigrant stock is not constant. The positive squared term indicates U-shaped function, which suggests that the marginal effect of public services on the change in immigrant stock increases with municipal spending. Median income, though, becomes insignificant in such specification. Since, it is difficult to interpret the coefficients of the quadratic model from the Table 5, I present marginal effects separately in Table 6.

Table 5. Baseline estimation (quadratic form).

	(1) OLS_Quadratic	(2) OLS_Quadratic+controls	(3) IV_Quadratic	(4) IV_Quadratic+controls
Municipal spending	-0.684 (0.107)***	-0.072 (0.111)	-0.986 (0.147)***	-0.812 (0.192)***
Municipal spending (squared)	0.009 (0.001)***	0.002 (0.001)	0.013 (0.002)***	0.011 (0.002)***
Share of immigrant stock		0.531 (0.070)***		0.360 (0.087)***
Log income		8.377 (1.374)***		3.028 (2.140)
Constant	17.422 (1.797)***	-101.591 (18.168)***	22.970 (2.714)***	-19.882 (30.055)
N	422	422	422	422

Note: Robust standard errors are in parentheses. ***The dependent variable*** is the normalized change in immigrant stock during the period 2005-2015 at the municipality level. ***Control variables*:** share of immigrant stock, namely stock of immigrants present in municipality in 2005 divided by municipal population for 2005; log income is a log of median income per household in municipality for 2005. Municipal spending and tax on natural resources are in **1000 NOK.**

* Indicates statistical significance at the 10%.
** Indicates statistical significance at the 5%.
*** Indicates statistical significance at the 1%.

To calculate the marginal effects, the coefficients obtained from the IV estimation should be used:

without controls:

$$(8)\ \Delta \hat{Immchange}_{m2005/2015} = 22.97 - 0.99 * Spending_{m2005} + 0.01 * Spending_{m2005}\text{^}2$$

with controls:

$$(9)\ \Delta \hat{Immchange}_{m2005/2015} = -19.88 - 0.81 * Spending_{m2005} + 0.01 * Spending_{m2005}\text{^}2 + 0.36 * Immshare_{m2005} + 3.03 * lnincome_{m2005}$$

By partial differentiation of these functions with respect to $Spending_{m2005}$ and equating the derivative to zero, the turning points[2] are found, which are 49.5 for equation without controls and 40 for the equation with controls. Increase of municipal spending above the turning point has a positive effect on change in immigrant stock in municipality. To see this, marginal effects are calculated and presented in the Table 6.

Table 6. Marginal effects, IV regression (quadratic form)

Municipal spending, 1000 NOK	Marginal effects	
	(1) IV_Quadratic	(2) IV_Quadratic+controls
20-21	-0.58***	-0.40***
40-41	-0.18***	0.00***
49-50	0.00***	0.18***
50-51	0.02***	0.20***
59-60	0.20***	0.38***

Note:
* Indicates statistical significance at the 10%.
** Indicates statistical significance at the 5%.
*** Indicates statistical significance at the 1%.

The results of baseline estimation shows that the quadratic specification offers better data fit and provides the statistically significant results for the IV estimation. The results of the quadratic model suggest the positive effect of public services on location choice of immigrants for municipalities with high revenues.

6.2 Sensitivity analysis

This section presents sensitivity analysis for findings in section 6.1. Firstly, it is checked whether estimates are sensitive to disaggregation of immigrant stocks by part of the world. Secondly, to reduce possible systemic differences between municipal characteristics of the treatment and control groups, the sample is restricted only to small municipalities, up to 4 999 individuals. Finally, the sensitivity of the results is checked by using log dependent variable instead of the normalized change in immigrant stocks, which is an alternative way of scale effects elimination.

[2] The turning point is a point, at which the slope of the curve is zero.

Disaggregation of immigrant stocks by world regions

Empirical evidence suggests that immigrant location choice could be highly determined by individual characteristics such as age, education, reason of immigration, birth country etc. (Bartel (1989), Jaeger (2000)). The individual characteristics are not observed in this research. Available data on Statistics Norway, however, allows to disaggregate immigrant stocks by parts of the world. To check the sensitivity of the results, the IV linear model is estimated. The dependent variable is specified as a normalized change in immigrant stock separately for each world region.

The results of the estimation are presented in Table 7. Estimates for immigrants from Europe, Asia, South America, and Oceania are statistically insignificant. For immigrants from Africa, the effect is negative and statistically significant at 5%. The estimate predicts that 1000 NOK increase in municipal spending per capita decreases the change in immigrant stock by 0.012 percent points. The effect of public spending on location of North Americans is also negative and even smaller, then it is for Africans. However, there are not so many immigrants from North America, so this estimate is not reliable (see Figure 10).

As for control variables, share of immigrant stock in municipality has, as expected, positive effect on location of immigrants from all world regions. It is, though, not statistically significant for North America. Log income is positive for immigrants from Europe, Asia, South America and Oceania. The effect is insignificant, however, for immigrants from Africa and North America. It should be noticed also that the estimate for log income is the highest for Europeans. The large size of income effect for the location choice of Europeans could be explained by the reason of their immigration, which is mostly work.

Table 7. IV regression by world regions

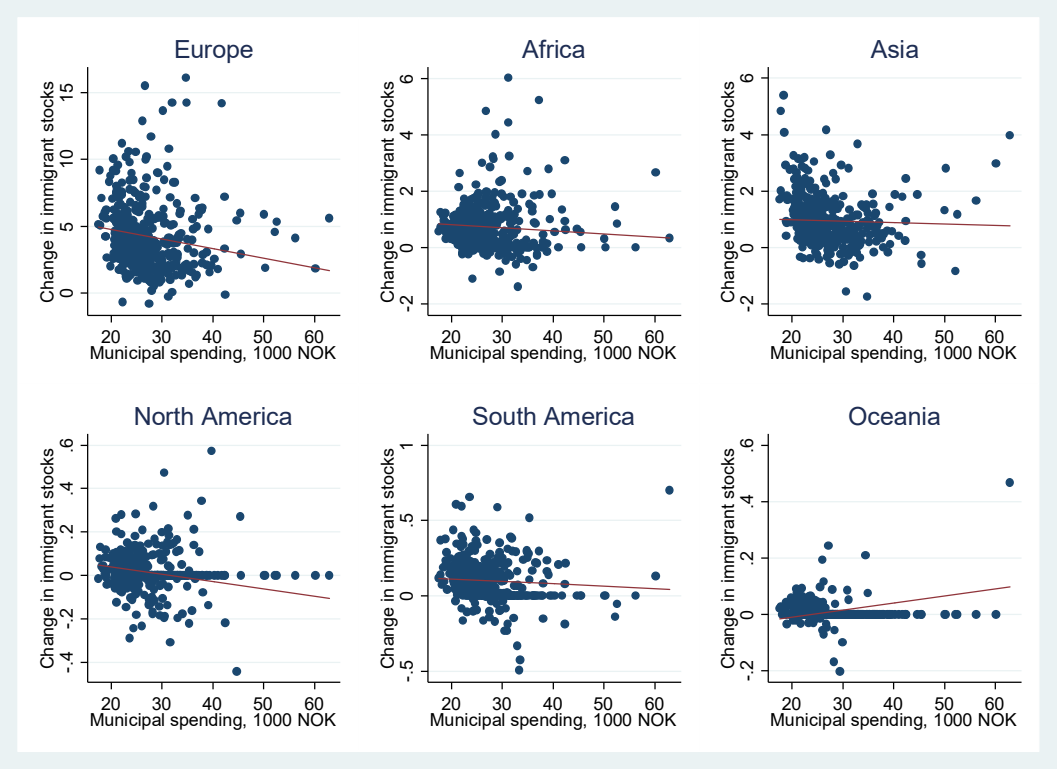
	(1) Europe	(2) Africa	(3) Asia	(4) North America	(5) South America	(6) Oceania
Municipal spending	-0.002	-0.012	0.024	-0.004	0.002	0.004
	(0.024)	(0.006)**	(0.016)	(0.002)**	(0.005)	(0.003)
Share of immigrant stock	0.244	0.058	0.209	0.001	0.013	0.006
	(0.057)***	(0.017)***	(0.028)***	(0.002)	(0.005)**	(0.003)**
Log income	6.670	-0.676	1.821	-0.046	0.335	0.116
	(1.358)***	(0.428)	(0.452)***	(0.060)	(0.114)***	(0.061)*
Constant	-81.283	9.416	-23.616	0.691	-4.252	-1.587
	(17.602)***	(5.549)*	(6.059)***	(0.796)	(1.576)***	(0.854)*
N	422	422	422	422	422	422

Note: Standard errors are in parentheses. **Dependent variable** – normalized change in immigrant stocks during the period of 2005-2015. ***Control variables*:** share of immigrant stock, namely stock of immigrants present in municipality in 2005 divided by municipal population for 2005; log income is a log of median income per household in municipality for 2005. Municipal spending and tax on natural resources are in **1000 NOK**

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 10 illustrates the scatter plots with fitted values. The linear model seems to be a good fit for all world regions. The only exception could be the effect of municipal spending on location of immigrants from Asia, which seems to be not constant. Nonlinearity is checked by using the quadratic specification of the model for Asia. The results are presented in Appendix, Table 15 and they confirm the suspicion. The squared term is positive, which implies that the effect of public services for the location choice of Asians increases with municipal spending.

Figure 10. Scatterplots by part of the world with fitted values (Dependent variable – normalized change in immigrant stock)



This part of the sensitivity analysis revealed that the baseline results are sensitive to immigrant stock disaggregation. This indicates their potential sensitivity to individual characteristics of immigrants, which should be investigated further using less aggregated data.

Exclusion of the potential outliers from the sample

Norwegian municipalities differ with respect to geographic, economic, social and demographic characteristics. Such diversity may raise a concern about the systemic differences in municipal characteristics between treatment and control groups, which may lead to imprecise estimates. Knowing that most municipalities with revenues from hydropower plants

(the treatment group) are small in terms of population, large municipalities could be excluded from the data set. This will reduce possible systemic differences, though will not fully eliminate them. After excluding all municipalities with population above 4 999 individuals, there are still 233 municipalities left in the sample, among which 58 municipalities receive hydropower revenues.

The results of the estimation using the reduced sample are presented in Table 8. Estimates for Europe, South America, Africa and Oceania are insignificant. The effect of municipal spending on the location choice of immigrants from North America is negative, as before. However, its significance is reduced to 10%. Though, as it has already been mentioned, due to the small number of immigrants from North America, it is hard to draw conclusions. For Asia, the estimate becomes significantly positive at 5%. It suggests that an increase in municipal spending by 1000 NOK increases change in immigrant stock by 0.042 percent points.

As for control variables, most of them become insignificant for the reduced sample. The reason could be less variation of those variables across small municipalities. The log income has, though, significantly positive effect for Europeans and South Americans. And the share of immigrant stock in municipality positively affects location choice of immigrants from Europe.

Table 8. IV regression by part of the world (reduced sample)

	(1) Europe	(2) Africa	(3) Asia	(4) North America	(5) South America	(6) Oceania
Municipal spending	-0.018 (0.028)	-0.008 (0.007)	0.042 (0.018)**	-0.004 (0.002)*	0.004 (0.006)	0.005 (0.003)
Immigrant share	0.353 (0.126)***	0.026 (0.033)	0.057 (0.041)	-0.003 (0.004)	-0.005 (0.007)	0.004 (0.003)
Log income	5.186 (2.100)**	-0.869 (0.709)	0.459 (0.502)	-0.071 (0.091)	0.270 (0.129)**	0.072 (0.054)
Constant	-62.111 (26.852)**	11.795 (9.090)	-6.576 (6.649)	1.026 (1.177)	-3.431 (1.756)*	-1.062 (0.771)
N	233	233	233	233	233	233

Note: Robust standard errors are in parentheses. ***The dependent variable*** is the normalized change in immigrant stock during the period 2005-2015 at the municipality level. ***Control variables*****:** share of immigrant stock, namely stock of immigrants present in municipality in 2005 divided by municipal population for 2005; log income is a log of median income per household in municipality for 2005. Municipal spending and tax on natural resources are in **1000 NOK.**

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The estimation using the reduced sample shows that the results are quite sensitive to the exclusion of municipalities with large population. Systemic differences, though, are not fully eliminated and the lower number of observations weakens the statistical power.

Log-linear functional form

Normalized difference in immigrant stocks reduces the scale effects a lot, but not totally eliminates them. That is why it could be a good idea to check the sensitivity of the results by using different form of the dependent variable, namely log difference in immigrant stocks, which could be specified as:

$$(4) \quad ln\Delta Immchange_{m2005/2015} = log\ (Imm_{m2015}) - log\ (Imm_{m2005}),$$

where Imm_{m2005} is number of immigrants settled in municipality m in 2005, Imm_{m2015} is correspondent variable for 2015.[3] The results of the regression are presented in Table 9.

Table 9. Log-linear form

	(1) OLS	(2) OLS+controls	(3) IV	(4) IV+controls
Municipal spending	0.006 (0.003)**	0.005 (0.002)**	0.002 (0.004)	0.003 (0.004)
Share of immigrant stock		-0.097 (0.011)***		-0.098 (0.012)***
Log income		0.807 (0.134)***		0.758 (0.153)***
Constant	0.830 (0.076)***	-9.025 (1.718)***	0.950 (0.122)***	-8.343 (2.002)***
N	422	422	422	422

Note: Robust standard errors are in parentheses. ***The dependent variable*** is log change in immigrant stock during the period of 2005-2015 at the municipality level. ***Control variables*:** share of immigrant stock, namely stock of immigrants present in municipality in 2005 divided by municipal population for 2005; log income is a log of median income per household in municipality for 2005. Municipal spending and tax on natural resources are in **1000 NOK.**

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

OLS estimation indicates significantly positive effect of municipal spending. Results of IV regression, though, are insignificant, which is in line with the estimates obtained using the normalized change in immigrant stock as dependent variable. The effect of the log income is significantly positive at 1%. An increase in median income on 1% is expected to increase change in immigrant stocks on 0.76%. Share of immigrant stock, however, has negative effect on the location choice of immigrants.

To check how sensitive the results are, when log dependent variable is used, the estimation is performed for the disaggregated immigrant stock by the world regions and using the reduced sample. Table 10 and 11 present the results of the analysis. The signs of estimates are the same as those obtained with normalized dependent variable, except that the effect of municipal spending is positively significant for Asia even for the full sample. Another

[3] To maintain all municipalities including those with no immigrants in 2005, zeros are transformed to 0.0001 in the log-linear model.

difference is that share of immigrant stock seems to have significantly negative effect on log change in immigrant stock for immigrants from Europe and Asia. As for the reduced sample, the effect of municipal spending becomes even more statistically significant for the immigrants from Asia, which suggests that an increase of municipal spending by 1000 NOK will increase change in immigrant stock by 2%. Thus, the results are quite robust to change to different specification form of the dependent variable.

Table 10. Log-linear form, regression by world region

	(1) Europe	(2) Africa	(3) Asia	(4) North America	(5) South America	(6) Oceania
Municipal spending	-0.002 (0.004)	0.004 (0.013)	0.015 (0.009)*	-0.020 (0.008)**	-0.009 (0.016)	0.004 (0.009)
Share of earlier immigrants	-0.108 (0.015)***	-0.025 (0.023)	-0.045 (0.014)***	0.004 (0.013)	-0.021 (0.019)	0.055 (0.014)***
Log income	1.188 (0.217)***	0.690 (0.584)	0.186 (0.281)	-0.266 (0.304)	0.961 (0.443)**	1.273 (0.285)***
Constant	-13.502 (2.815)***	-7.609 (7.662)	-1.854 (3.724)	4.011 (4.004)	-11.267 (6.002)*	-16.257 (3.789)***
N	422	422	422	422	422	422

Note: Robust standard errors are in parentheses. ***The dependent variable*** is log change in immigrant stock during the period of 2005-2015 at the municipality level. ***Control variables*****:** share of immigrant stock, namely stock of immigrants present in municipality in 2005 divided by municipal population for 2005; log income is a log of median income per household in municipality for 2005. Municipal spending and tax on natural resources are in **1000 NOK.**

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11. Log-linear form, regression by world region (reduced sample)

	(1) Europe	(2) Africa	(3) Asia	(4) North America	(5) South America	(6) Oceania
Municipal spending	-0.002 (0.005)	0.006 (0.015)	0.020 (0.009)**	-0.019 (0.009)**	-0.003 (0.017)	0.012 (0.010)
Share of earlier immigrants	-0.152 (0.021)***	0.012 (0.047)	-0.079 (0.030)***	0.003 (0.025)	-0.004 (0.030)	0.017 (0.015)
Log income	1.051 (0.343)***	1.194 (0.912)	-0.506 (0.421)	-0.217 (0.461)	1.240 (0.548)**	0.433 (0.235)*
Constant	-11.624 (4.394)***	-14.211 (11.728)	6.861 (5.410)	3.410 (5.931)	-15.092 (7.202)**	-5.872 (3.160)*
N	233	233	233	233	233	233

Note: Note: Robust standard errors are in parentheses. ***The dependent variable*** is log change in immigrant stock during the period of 2005-2015 at the municipality level. ***Control variables*****:** share of immigrant stock, namely stock of immigrants present in municipality in 2005 divided by municipal population for 2005; log income is a log of median income per household in municipality for 2005. Municipal spending and tax on natural resources are in **1000 NOK.**

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7 Discussion

This section presents a discussion of the results provided in Section 6, followed by the description of the research limitations and suggestions for further research.

7.1 Discussion of the results

The baseline results show that the effect of local public services on immigrant location is on average insignificant. However, there is an indication of the nonlinear relation between the municipal spending and the change in immigrant stock. The positive squared term suggests that the marginal effect of public services on immigrant location choice increases with municipal spending. The potential explanation of such results could be that only municipalities with significantly high revenues could provide much better services for the population. Thus, only significant difference in public services attracts immigrants to municipality.

As Sensitivity analysis has revealed, the baseline results are sensitive to immigrant stock disaggregation. This implies that the effect of public services on immigrant location may differ with respect to individual characteristics. The findings of the analysis suggest that there is a positive effect for immigrants from Asia. There are many refugees from Asia in Norway. Refugees are more likely to be at lower income range, at least for some period. That is why it could be beneficial for them to locate in municipalities with large public sector. This could be a potential explanation of the positive effect for this immigrant group. Such result was also found by Åslund (2001) for subsequent choice of refugees in Sweden. These results, though, should be examined further, as there might be also an influence of settlement program for refugees implemented by the government. The effect for immigrants from North America is significantly negative, but it is hard to conclude whether there is any effect of local public services on their location as the number of immigrants is very small. As for Europeans, which constitute the largest share of immigrant population in Norway, the effect is insignificant. Europeans are coming to Norway mostly for work reasons. Stambøl (2014) shows that labor immigrants have higher probability to emigrate back to their native country after some period, especially those who come from Nordic countries. Since in this analysis the change in stock is used to proxy the flow of immigrants, the real inflow of Europeans to municipalities remains

unobserved. This may bias the results of the estimation, in case there were people, who returned home during studied period.

7.2 Limitations of the analysis

The first limitation concerns the dependent variable. Data aggregation may lead to some information loss, which could be the case in this analysis. Statistics Norway provides data only on immigrant stocks per year. The change in immigrant stock between 2005 and 2015 proxies the flow of immigrants during decade, however, ideally it would be better to use the inflow of new immigrants as the dependent variable. When using stocks, it should be kept in mind that difference in stocks between two years is not equal to inflow of new immigrants, because some immigrants could have died, returned or migrated to the different country during the decade. Thus, the difference between the stocks in two points of time does not reflect the real inflow of immigrants to municipality. This may potentially bias the results.

Another limitation is the validity of the results. There exists internal and external validity (Angrist and Pischke, 2008). A good instrument captures an internally valid causal effect. External validity of this research is less clear. As most hydropower municipalities are scattered and small, it would be hard to compare them with larger municipalities and cities. Even though results of these research are not externally valid, meaning that they could not be applied directly to other types of regions, the question of this analysis is highly relevant for Norway, which consists of small municipalities and aims to achieve even settlement of immigrants, to avoid ethnic "enclaves" and maximize overall outcomes from the immigration.

7.3 Further research

Many heterogeneous effects could be lost in analysis on aggregated data. That is why, the suggestion for an extension of this study could be a research using less aggregated data or even individual-level micro data. Then it will be possible to see how the effect of public services on location choice of immigrants varies with individual characteristics such as gender, education, reason of immigration, age, marital status etc. In addition, it would be a good idea to re-examine this analysis using the flows of immigrants instead of stocks to get unbiased and more precise results. One more suggestion for the further research arises due to potential policy implications. Policymaker might be interested in more specific information, e.g. the effect of

certain public service. Such knowledge will help to understand, for example, which public service has the strongest effect on the location choice of immigrants and thus, the regional policy could be adjusted accordingly.

8 Conclusion

The main purpose of this research has been to investigate empirically to what extent local public services may determine location choice of immigrants. Norway with its large public sector and exogenous variation in the level of local public services provided a unique possibility to identify the causal effect of interest.

To investigate the immigrant location choice, municipality is used as the basic unit of this analysis. Municipalities with relatively higher revenues can provide better public services to their population. The exogenous variation in municipal revenues in Norway is caused by hydropower production. As location of such plants was determined randomly, by nature, it provided data for an instrumental variable to identify municipalities, with extra financial resources. Thus, to find the causal effect of interest, the change in immigrant stocks, which occurred during the period 2005-2015 was regressed on municipal spending instrumented by revenues from hydropower production.

The results of this analysis suggest that local public services have on average no effect on location choices of immigrants. However, there is an indication of the positive effect for municipalities with high revenues. The sensitivity analysis showed that the result changes, when immigrant stocks are disaggregated by world regions. This suggests that individual characteristics, for example, country of origin or the reason of immigration, may influence the location choice of immigrants. The positive effect of public services is mainly driven by immigrants from Asia. Many of them come to Norway as refugees. It could be expected that this category of immigrants will benefit the most from living in the municipalities with large public sector. However, the size of the effect is quite small.

The sensitivity of the results and the small size of the found effect suggest that further research on less aggregated data is required for final conclusions on this topic. The results might be of high value for the design of regional policies in Norway.

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Appendix

Table 12. List of used acronyms

Acronyms	
IMDi	Directorate of Integration and Diversity
IV	Instrumental variable
OLS	Ordinary Least Squares
LVK	Association of Hydropower Municipalities
NVE	Norwegian Water Resources and Energy Directorate
RHS	Right-hand side
SSB	Statistics Norway

Table 13. Detailed description of variables

Variables	Description of variables
Change in immigrant stock	Displays an absolute change in immigrant stock between two years 2005 and 2015. For baseline results, it is normalized by municipal population of 2005, for sensitivity checks the change is obtained by taking logs of immigrant stocks separately for two years and then taking the difference.
Municipal spending on public services	Municipal spending represents local public sector of the municipality. It is calculated by summing up municipal spending on culture, education, kindergartens, social services and health care. For convinience in displaying the results, the total sum was divided by 1000 NOK, which should be considered when interpreting the results.
Log income	The log of median income per household in municipality, which is used to control for labor market conditions.
Share of earlier immigrants	Empirical evidence shows that immigrants that already reside in the country attract more immigrants to the region. It is calculated by dividing stock of immigrants of every municipality of 2005 by the municipal population of 2005.
Municipal revenue from the tax on natural resources	Municipal revenue from the tax on natural resources is used as Instrumental Variable in this analysis to identify rich municipalities with better public services. It is calculated by dividing mucipal revenue from this tax of 2005 by munipal population of 2005. It is presented in 1000 NOK.

Note: Data for 2005 is used for all variables, except the change in immigrant stock, which is calculated as difference between immigrant stocks of 2015 and 2005.

Table 14. First stage of IV estimation (quadratic form)

Dependent variable	(1) $Spending_{m2005}$	(2) $Spendingsqr_{m2005}$	(3) $Spending_{m2005} + controls$	(4) $Spendingsqr_{m2005} + controls$
Tax on nature resources	1.009 (0.130)***	63.979 (10.473)***	1.042 (0.126)***	66.018 (10.328)***
Tax on nature resources (squared)	-0.006 (0.003)*	0.139 (0.252)	-0.005 (0.003)	0.159 (0.255)
Log wage			-3.798 (0.722)***	-214.182 (50.265)***
Share of immigrant stock			0.155 (0.280)	12.142 (20.590)
Constant	29.147 (0.374)***	876.707 (26.026)***	72.214 (8.080)***	3294.329 (559.366)***
r2	0.36	0.43	0.42	0.46
N	233	233	233	233

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15. IV regression, quadratic form (Asia)

	Asia
Municipal spending	-0.32 (0.072)***
Municipal spending (squared)	0.004 (0.001)***
Log income	-0.32 (0.60)
Share of Immigrant stock	0.14 (0.03) ***
Constant	9.65 (8.77)
N	419

Note: Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 11. Municipal revenues from tax on natural resources and municipal spending on public services by year during 2005-2015

Average municipal revenue from tax on natural resources per year, 1000 NOK

Total municipal revenue from tax on natural resources per year, 1000 NOK

Average municipal spending per capita, 1000 NOK

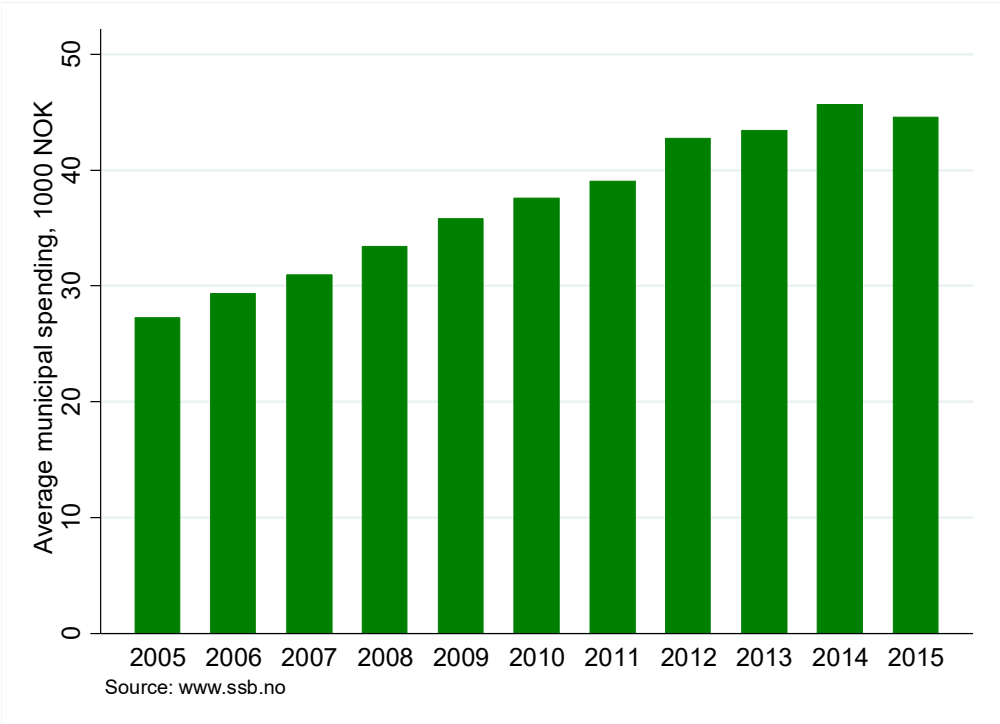

Table 16. Description of municipal revenues from hydropower industry

Taxes and fees	Description
Tax on natural resources	*Tax on natural resources* is profit-independent and is calculated based on average electricity production by the plant over the last seven years. The tax rate is 1.3 cents per kWh (1.1 cent is paid to municipality and 0.2 cents to county). As from 2004, the tax base includes only generators with a minimum output of 5500kwh. The natural resource tax is included into the revenue equalization program. It means that it is redistributed through state transfers. *Source: Statistics Norway*
Property tax	The property tax basis is calculated on the market value of the property. The market value of the property among other factors depends on the market price of hydropower over the last 5 years. The minimum basis of the property tax is NOK 0.95 kWh, and the maximum is NOK 2.35 kWh. The local governments decide on the tax rate, which should be between 0.2 and 0.7 percent. The property tax applies to plants larger than 10.000 Kilovolt Amperes (kVA). The property tax could be used by the municipality freely. *Source: Norwegian Tax Administration*
Concession power and concession fees	Hydropower municipalities have the right to buy concession power fom hydropower plants. In addition, consession fees are paid by hydropower plants for caused damages and inconveniences. *Source: SNL*

Table 17. Characteristics of municipalities

Characteristics		Number of municipalities (428)	
Population (2015)	Small: 0-4 999	225	52.5%
	Medium: 5 000 – 19 999	148	34.5%
	Large: 20 000 – more	55	13%
Centrality (2014)	Remote (Level 0)	149	34,8%
	Fairly remote (Level 1)	51	11,9%
	Fairly central (Level 2)	78	18,2%
	Central (Level 3)	150	35,1%
Share of immigrants (2015)	0 – 5.99	49	11.5%
	6 – 9.99	169	39.5%
	10 – more	208	49%
Category (2013)	Large cities	4	0,94%
	Richest municipalities	10	2,34%
	Small municipalities:		
	category 3	21	4,92%
	category 4	60	14,05%
	category 5	35	8,20%
	category 6	15	3,51%
	category 7	40	9,37%
	category 8	47	11,01%
	Medium municipalities:		
	category 9	31	7,26%
	category 10	23	5,39%
	category 11	2	0,47%
	category 12	20	4,68%
	category 13	53	12,41%
	category 14	17	3,98%
	category 15	1	0,23%
	Large municipalities:		
	category 16	14	3,28%
	category 17	30	7,03%
	category 18	2	0,47%
	category 19	1	0,23%
	category 20	1	0,23%

Source: ssb.no

Note: Categories: **small municipalities:** (3) medium bounded costs per capita and low unrestricted income; (4) - medium bounded costs per capita and medium unrestricted income; (5) medium bounded costs per capita and high unrestricted income; (6) high bounded costs per capita and low unrestricted income; (7) high bounded costs per capita and medium unrestricted income; (8) high bounded costs per capita and high unrestricted income; **medium municipalities:** (9) low bounded costs per capita and low unrestricted income; (10) low bounded costs per capita and medium unrestricted income; (11) low bounded costs per capita and high unrestricted income; (12) medium bounded costs per capita and low unrestricted income; (13) medium bounded costs per capita and medium unrestricted income; (14) medium bounded costs per capita and high unrestricted income; (15) high bounded costs per capita and low unrestricted income; **large municipalities: :** (16) low bounded costs per capita and low unrestricted income; (17) low bounded costs per capita and medium unrestricted income; (18) low bounded costs per capita and high unrestricted income; (19) medium bounded costs per capita and low unrestricted income; (20) medium bounded costs per capita and medium unrestricted income.