Regional income in Norway, 1900-2010

Jørgen Modalsli, Research Department, Statistics Norway

Draft chapter prepared for Rosés and Wolf: *Europe's Regions*

This version: 15 Dec 2014 (some small revisions made 21 Sep 2016)

Introduction

Norway has experienced substantial economic growth since the early twentieth century. However, until now, no consistent calculation has been made of how the gains from economic growth have been allocated across the country. This article presents, for the first time, a unified estimate of "gross regional product" from 1900 to 2010, based on existing GDP estimates, census data and contemporary income tabulations.

The geography of Norway

Norway is one of Europe's largest and most sparsely populated countries, with a total land area of 323 771 square kilometers. The Norwegian mainland extends north to the 71st parallel, at the same latitude of the northernmost reaches of Alaska or Russia. The southernmost point of Norway is closer to London, Florence and St. Petersburg than it is to Kirkenes in the far north-east. In 1900, Norway was a country of 2.2 millionpeople. According to the Maddison database, Norwegian GDP per capita in 1900 was 42 per cent of that in Great Britain and 90 per cent of Swedish GDP per capita. By 2010, Norway had grown to become one of the most well-off countries in the world, with a GDP per capita of 57,539 USD[1] - higher than all major European countries - and a population of 4.85 million.

In 1900, there was large regional heterogeneity in economic activity across Norway. In the county of Sogn og Fjordane, eighty per cent of the population belonged to the primary sector in 1900, compared to only sixteen per cent in the capital region. By 2010, all regions had more than two thirds of the population employed in the tertiary sector. Moreover, communications between regions have greatly improved; in 1909, the railway between Eastern and Western Norway opened, in 1962, Bodø in Northern Norway was connected to the railway network and from the late 1960s onwards a large network of short-runway airports have been in operation in the far Western and Northern parts of the country.

It is of central interest to know how economic development and increased integration affected economic growth in the various regions of Norway. Did improved communications and mobility lead to convergence, or did industrial development and cluster effects lead some regions to move ahead faster than others? This chapter contributes to the knowledge about Norwegian regional productivity in three ways. First, existing regional GDP estimates from 1965 onwards are collected and harmonized. Second, historical income data is used to extend the estimates back to 1900. Third, a preliminary analysis of the data is conducted. For brevity, the term "regional GDP" will be used when referring to the gross regional products.

[1] International dollars from 2011 ICP, source: World Bank

Availability of historical data

The collection of data on Norwegian society has long been extensive. The first full-count census was conducted in 1801, and the statistical agency was established in 1876. Since the mid-nineteenth century Norway has been divided into 19 or 20 counties (called *Amt* before 1919, *Fylker* thereafter), which have formed the basis for the central government's execution of various policies. In the nineteenth century, governors' reports (Amtmannsrapporter) laboriously detailed economic, social and geographic aspects of the various parts of the countries, though mostly in a narrative format that is not amenable to quantitative analysis. Decennial censuses contain detailed information on the population structure and occupations from 1865 onward, and the re-institution of the state income tax in 1893 marks the start of a nearly continuous series on income.

Norway first published national GDP estimates in 1952; regional GDP at the county level was first reported in 1965. As in any reporting of long-run GDP series extending prior to the development of GDP methodologies, the data in this paper must be based on new applications of historical data, subject to the constraints given by the data that was collected at various times.

A natural starting point for the construction of historical regional GDP series would be the method used by Geary and Stark (2002) for Great Britain and Ireland between 1861 and 1911. Geary and Stark use data on the size of the labor force in the sectors of the economy combined with a data set of regional wages to approximate the level of output in each region. While the rich Norwegian census data easily facilitates an allocation of the labor force in each region to a set of sectors, sectoral wage statistics frequently lack data on the regional composition of wages. As there is no consistent series available for wages by region and sector for the period under study, a direct application of the Geary-Stark method is not feasible. However, it is still possible to construct regional estimates by shifting the focus from wages to income.

The most accurate data on Norwegian incomes comes from the tax statistics. The municipality of residence of the individual taxpayer is recorded by the tax authorities, and for most years since 1893, lists of mean income and mean taxes paid by municipality are published. Notably, publication of the data continued uninterrupted through both political independence from Sweden (1905) and military occupation by Nazi Germany (1940-1945). These tax data will form the basis for the construction of regional GDP prior to 1970 presented in this paper.

Some academic studies exist that describe regional economic development in Norway in the last four decades. Østbye and Westerlund (2011) use a unified series based on the regional GDP statistics from 1980 to 2000, and find strong signs of convergence across counties in Norway. The only other existing estimates of regional growth known to this author are the income-based convergence measures used by Rattsø and Stokke (2014), where wage incomes from the tax statistics are used to construct a measure of regional productivity at the level of 89 labor market regions. Rattsø and Stokke find convergence in income between these regions from 1972 and 2008.

Constructing a regional GDP series 1900-2010

Regional units

The division of Norway into regional units has been relatively stable at the county level between 1900 and 2010. There have been two major changes to county borders. In 1948, Oslo was merged

with the neighboring municipality of Aker, transferring 131,000 people from Akershus county to Oslo county. In 1972, the county of Bergen, Norway's second largest city, with a population of 112,000, was merged with the surrounding county of Hordaland, reducing the number of counties from 20 to 19.

When combining income estimates (by residence of the income recipient) and production estimates (based on area of economic activity), high commuting flows can be a challenge, as incomes are then taxed at a different location than where the economic activity takes place. However, with the exception of Oslo and Bergen, the counties are of large geographic extent and there is limited commuting across county borders. This is in particular the case when the data is extended back in time. To alleviate possible mismeasurement of Oslo's and Bergen's regional GDP, the following analysis will merge the cities with their surrounding counties: Oslo with Akershus, and Bergen with Hordaland. This gives 18 counties, corresponding to NUTS3 regions with the exception of Oslo+Akershus which is a combination of two NUTS3 regions. These can further be aggregated to seven NUTS2 regions.[2]

Regional GDP estimates

To construct a data series for gross regional product in Norway, the natural starting point is the regional GDP indices produced by Statistics Norway. These were first published in 1965 and later approximately every three to six years, at uneven intervals (Zahirovic and Berge 2013). However, while the national accounts in general have been revised for historical consistency, this is not the case for the regional GDP estimates. In particular, the inclusion and omission of particular industries that are hard to allocate regionally has changed between the publications. In all official estimates, the non-allocated activity is added to a fictional county to maintain compatibility with national estimates.

In 2011, the national accounts for Norway were revised and updated for the entire period 1970-2012 (Gimming et al 2011). While the main national accounts do not contain a regional decomposition, there is a split of aggregate production between a "mainland" and "non-mainland" category. "Non-mainland" production refers to petroleum activities and ocean transport (GNI Inventory, p. 10). These activities are sensitive to international price and business cycle movements, and are industries of low labor intensity. For this reasons, domestic discussion of fluctuations in Norwegian GDP usually refer to "mainland GDP" only. Non-mainland GDP constituted 8 per cent of GDP in 1970 and 19 per cent in 2010.

Regional GDP estimates do not explicitly refer to mainland and non-mainland activity. As it is not evident which county the non-mainland activity should be allocated to, in this article only the mainland activity will be allocated explicitly to counties.

Existing regional GDP estimates are available for 1965, 1973, 1976, 1980, 1983, 1986, 1990, 1992-1993, 1995 and 1997 - 2010. In 1980 and earlier, a substantial part of economic activity was not allocated to any specific sector because of data limitations.

In the 1973 and 1980 official regional GDP estimates, the documentation clearly states that the following components were not allocated to counties:

[2] Norway is part of the NUTS scheme despite not being a member of the European Union.

1. Export, imports and inventory changes
2. Production activities in shipping abroad, petroleum activities, coal mining on Svalbard
3. Air and railway transport, telecommunications
4. Parts of consumption and investment in central government, including defense
5. Redistributive sectors in the national accounts
6. Parts of the commodity trade sector

The composition for 1965 is not given in similar detail but it is reasonable to expect the list of omitted sectors to be longer. In 1990 and later estimates, points 3, 4 and 5 are allocated to counties, as well as some of the mainland based petroleum activities. There were also some changes in definitions between 1990 and 2000. However, these are less important than the 1980-1990 changes, and harder to correct for. For this reason, the ambition of the correction must be restricted to making the 1973 and 1980 estimates comparable to the 1990 estimate. For 1965, a similar exercise is conducted to compare the adjusted regional GDP data to information from the income statistics.

To achieve this objective, data from the 1960 to 1980 censuses was used to obtain data on employment in the industries that were allocated in the 1990 regional GDP estimates but not in earlier estimates. This was done based on registry files of all individuals in the two censuses. For each county, a tabulation of the total number of people in key industries and occupations was made. A detailed overview of the relevant classification can be found in Vassenden (1987). The key industries are extraction of oil and natural gas, supply of electricity and gas services, or post and telephone communications (codes 22, 41 or 72, respectively) as well as the sub-industries of land or sea transport (codes 711 or 712). In addition, occupations related to railways (codes 63 and 652) and military occupations (code A) were included. This corresponds as closely as possible to the difference in classifications between the 1973-1980 regional GDPs on the one hand and the 1990 and onwards on the other hand. The key assumption for the allocation of the remaining GDP share in the regional GDP estimates of 1973 and 1980 is then that there are no systematic unobserved productivity differences in these sectors across regions, so that the unallocated economic activity is proportional to the share of the population working in the unallocated sectors. In 1990 and later years, the non-allocated activity was not included in the estimates used here; this is equivalent to scaling the allocation of this activity by regional GDP shares.

[Table 1 here]

Table 1 gives the official and revised estimates of (gross) regional GDP in Norway between 1965 and 2010. The revision of the 1973 and 1980 estimates conducted here scales down the level of activity in the capital region (Oslo+Akershus), while the activity in some coastal counties, in particular in Western Norway, is scaled up. To extend the series back to 1900, we turn to the income data. To better be able to evaluate the transition from income-based to GDP-based estimates, 1965 and 1973 shares are calculated using both methods.

Income-based estimates

For historical GDP values, estimates are based on income data. The income variable reported is that of "assessed income" (*alminnelig inntekt*), a wider income concept than simply taxable income. Both capital and labor income is included. Total income for counties was digitized from annual reports from 1900 to 1960, as well as for 1965 for comparison to the official regional GDP estimate. For

1973, a similar extract was made from the registry income file held at Statistics Norway (digitized individual incomes are available from 1967 onward).

[Table 2 about here]

For each county, total income was taken as a proxy for total economic activity. The resulting county shares are reported in Table 2. For 1965 and 1973, adjusted GDP shares are also reported. The discrepancies are in general on the order of a couple of tenths of a percentage points or less, though for the county of Nordland it is as large as 0.7 and 0.6 percentage points. As the documentation for the 1965 official regional GDP estimates is not as detailed as for the later estimates, income data will be used up to and including 1965 and regional GDP data from 1973 onwards.

National GDP

The main focus of the analysis in this chapter is on the relevant shares of national GDP within Norway rather than comparisons to other countries. However, it is still important to keep in mind how the data should be scaled if used in international comparisons, or to study growth over time. The official GDP series is based on the 2012 revision going back to 1970 spliced with earlier estimates; the version as available in February 2014 was used.[4] If one wants to estimate total "county GDP", the appropriate estimation method would be

$$GDP_{county} = share_{county} * share_{mainland} * GDP_{Norway}$$

where the regional shares are obtained from the adjusted official regional GDP estimates (1973 and later) and income statistics (1965 and earlier) explained above. The mainland share is taken from the 2012 revision back to 1970; before 1970, no official estimates are available. While petroleum activities were negligible before 1970, international shipping was a major source of employment and income for the Norwegian economy. In lieu of good data on the size of the shipping sector compared to the national economy before 1970, the 1970 share of 7.695 per cent of total GDP were used for all years 1900-1965. For this reason, the non-mainland portion reported before 1970 should be considered as a scaling factor when comparing Norwegian countries to counties without large-scale international shipping rather than a reflection of economic trends in the offshore economy. Moreover, it is assumed that the regional distribution of domestically-reported incomes of seamen in international shipping is proportional to the general level of income in each county.

While estimates of regional GDP give valuable insights in themselves, GDP per capita is usually a more relevant variable for studies of economic development. We now turn to the estimates of population by county.

Population

The population data is obtained from the Norwegian decennial census, which was conducted every ten years from 1900 onwards, with the exception of 1940 (postponed to 1946 because of the German occupation) and 2000-2010 (conducted in 2001 and 2011, respectively). Until the establishment of the Central Population Register in the 1960s, there was no attempt by the central statistical authorities to calculate intra-country migration between census years. This could potentially cause problems for the 1940 observation. However, a special population count was

[4] Downloaded from http://www.ssb.no/a/histstat/aarbok/ht-0901-bnp.html

conducted in August 1939 for the purpose of coffee and sugar rationing; the results, previously unpublished, are used here as an estimate of the 1940 population.[5] For 2000 and 2010 regional population numbers are available from the Central Population Register.

Sector employment shares (primary, secondary, and tertiary) are obtained from official statistics (the census for 1900-1930 and 1950-1990, other sources for 2000 and 2010, no observations for 1940). While these are not used directly in the generation of the regional GDP estimates presented here, they are included in the final tabulations for comparison with the industry structure of other countries.

Population numbers are reported in table 3. There are large differences in the size of the regions; Oslo and Akershus hold 15 per cent of the population in 1900 and 23 per cent in 2010. The smallest in terms of population is Finnmark in the far north with around 1.5 per cent of the population both in 1900 and 2010. There are only a few cases of population decline in absolute numbers. Aust-Agder experienced continuous decline between 1900 and 1940. This was a time of substantial overseas emigration and (in the 1930s) low birth rates; some neighboring counties also had negative population growth in some of the decades. Since 1990, the northern counties of Nordland and Finnmark have also experienced population decline, though the population of Northern Norway as a whole has grown.

[TABLE 3 HERE]

Estimates of regional GDP per capita

With these results one can proceed to calculate regional GDP per capita shares by dividing GDP shares by population shares. All results are presented scaled, that is, as a ratio to national GDP per capita.

Trends

[FIGURE 1 HERE]

Figure 1 shows the development of relative GDP per capita by county for all counties, grouped by NUTS2 regions. In the first panel, we observe that the capital region (Oslo and Akershus) have much higher GDP per capita than any other region. In 1900, the level was 81 % higher than the national average; in 2010, this excess was down to 36 %. While the inland counties of Hedmark and Oppland have lower than average GDP per capita in the entire time period, most of the coastal counties in Southern Norway have higher than average levels at some point in time. The southeastern coastal counties (Østfold, Buskerud, Vestfold and Telemark) show a similar trend of moderate secular decrease from higher-than-average to lower-than-average GDP per capita. In the southwest, the trend is flatter; we see an effect of the oil boom in Rogaland after 1980; while offshore oil activities are not allocated to any specific region, there are still spillovers to local economic activities, and much of the administration of the oil extraction takes place in the Stavanger region in Rogaland. Within the three Western counties of Hordaland, Sogn og Fjordane and Møre og Romsdal, there is convergence; this is related to the diminishing rural-urban divide between Bergen and the rest of the region. The Trøndelag counties in central Norway have relatively flat trends, with Sør-Trøndelag

[5] I am grateful to Halvard Skiri for providing the 1939 population data.

(including Trondheim) exhibiting higher GDP per capita than Nord-Trøndelag. Finally, while Northern Norway is still considerably poorer than the national mean, we see a strong catch-up effect between 1930 and 1970. The population of the county of Finnmark was forced to evacuate by the Germans at the end of the Second World War, and a large portion of the buildings destroyed; despite of this, the estimates show only a minor decrease in Finnmark GDP per capita from 1940 to 1950.

The question of whether levels of GDP per capita across countries have become more equal over time can be studied using the coefficient of variation of the county GDP per capita level (sigma-convergence). The development of the coefficient of variation is shown in Figure 2.

[FIGURE 2 HERE]

It is evident that the coefficient of variation has decreased markedly over time. However, there was an increase between 1910 and 1920 and again between 1980 and 1990. The question of convergence can be further investigated using a simple regression approach where economic growth is regressed on the initial productivity level. The result of such an exercise is shown in Figure 3, where the horizontal axis gives log GDP in 1900 and the vertical axis the difference between log GDP in 2010 and 1900.

[FIGURE 3 HERE]

From 1900 to 2010, there are strong tendencies towards convergence - regions with lower initial GDP levels grow faster. If we split the sample in 1950, there is strong convergence in the latter period but much lower convergence in the initial period. In Figure 2, we observe that the period of strongest sigma-convergence was between 1920 and 1980; this is confirmed by examining beta-convergence over the same period, where we get an R-squared of 94 % (compared to 65 % for the entire period 1900 to 2010).

Divergence, convergence, divergence

When we examine Figure 2 it is clear that the across-county growth pattern in Norway can be divided into three periods, as marked by two upward jumps (1910 to 1920 and 1980 to 1990) in the coefficient of variation with a more gradual decrease in variation between these jumps.

The first jump coincides with the dramatic changes in Europe identified by Atkinson and Piketty (2007, 2010) and Piketty (2014). These are usually explained by physical destruction and inflationary policies during the first World War. Norway did not actively participate in the war, though there were still many consequences for the Norwegian economy, such as high inflation. The estimates of top income shares by Aaberge and Atkinson (2010) do show an increase in top income shares between 1913 and 1929, suggesting an increase in inequality in this period. If it is the case that top income earners are disproportionately concentrated in regions with higher average incomes, it is reasonable to expect such a co-movement between regional and inter-personal income inequality.

The cross-county inequality increase appears to be driven by income increases in coastal counties. Comparing county growth rates to shipping tonnage per capita in 1920 does show a significant positive relationship between the variables, suggesting a role of shipping in this growth. However, other conditions probably also played a role.

The second jump coincides with liberalization of capital markets in the 1980s and is largely driven by income growth in the capital region of Oslo, and also coincides with an increase in top income shares and income inequality in general. There is also some evidence of an increase in regional GDP in Rogaland following the discovery of oil in the North Sea and the establishment of Stavanger as Norway's "oil capital". In this case, the per capita increase is somewhat moderated by a corresponding increase in population. In addition, regions further away from the oil fields also gained substantially from the oil boom through supplier contracts and other related activity, such as finance.GDP per capita and employment shares

Employment shares by sector in Norway have followed the traditional development pattern, with the share of the primary sector decreasing from 50 per cent in 1900 to 3 per cent in 2010. Secondary sector employment has increased from 29 per cent in 1900 to 39 per cent in 1960 and further decreased to 20 per cent in 2011, while employment in the tertiary sector has increased in the period studied here. With county data, we can see whether the same relationships hold in cross section. This was investigated using simple univariate regressions with relative GDP per capita as dependent variable and employment shares as independent variable, for each year separately (except 1940, where there is no census data, and 1960, where there is no regional GDP estimate).

As expected, there is a negative relationship between employment shares in the primary sector and the regional GDP share per year. The relationship is statistically significant for all years except 2010. The point estimate of the coefficient varies between -1.37 in 1910, meaning that a one percentage point increase in the employment share of the primary sector is associated with a decrease in regional GDP per capita of 1.37 percent of the national GDP per capita, and -2.82 in 2000. The coefficient on secondary sector employment is significantly positive for all years until 1960, with point estimates from 3.58 in 1930 to 1.69 in 1960. The coefficient on tertiary sector employment shares is positive and significant in all years except 2010.

It does appear that traditional economic mechanisms contributed to regional growth in Norway. As migration flows are often explained by economic factors, it could be expected that population growth would be positively associated with GDP share growth. However, there is no systematic correlation between the decennial growth rates of population and the growth of regional GDP per capita.

Data challenges, interpretations and robustness checks

The data presented here constitute a preliminary view of regional growth patterns and we should expect more refined estimates to emerge in the future. One limitation of this chapter is that only one data point is provided for each decade; this constraint was largely imposed to fit the scope of this book. Annual data would increase the data entry job for the pre-1967 estimates tenfold. There are also some other issues that merit discussion.

Ownership, income and activity

A concern with the use of the income methodology compared to official regional GDP estimates or the Geary-Stark method is the treatment of income to absentee owners. Ownership of farms, forestry, ships or other assets could be concentrated in cities, while the actual economic activity took place in the countryside. Norwegian counties are large and most contain one or several cities. While

we do not observe ownership rates directly, the large geographic distances and (historically) inconvenient communications should alleviate the problem of misallocation of income data. There is one data point supporting this assertion: in a 1915 tabulation of the income statistics, income is split between taxpayers resident within and outside the municipality in which the income is generated. For the tax year 1913-1914, 98 per cent of taxpayers were located in the municipality of taxation, accounting for 96 per cent of income, 88 per cent of wealth, and 92 per cent of taxes paid on income and wealth.[6] It would however be reasonable to assume that the problem of cross-regional ownership increases slightly over time.

In the official regional GDP estimates, used here from 1973 onwards, efforts have been made to correct for this problem. However, the issue of absentee ownership and possible over-reporting of productivity of urban areas should be kept in mind while analyzing the historical data. One example cited by Sørensen (1997) is the allocation of income from electricity production; in a previous estimate of 1990, all income to individuals in the electricity-production sector was allocated proportional to the incomes of individuals working in the sector. In the revised numbers (used in this chapter), some of the activity was instead allocated by the actual location of power generation, leading to an upward revision of activity in counties with large hydroelectric power plants.

There are, however, several arguments for why income data can be preferable to the Geary-Stark method of employment shares and wages. First, the data on service industry wages are often hard to obtain. Indeed, Geary and Stark (2002) use a weighted average of manufacturing and agriculture wages to proxy for service wages. Because the composition of the service sector has changed greatly over time, it is hard to judge the representability of these wages. Second, a substantial share of GDP is income that accrues to capital and land; it is not clear that this should be allocated by wage data. This is an important concern for historical studies of Norway, as the primary sector did to a large extent consist of owner-occupier farmers and independent (non-wage-earning) fishermen.

Crafts (2005) uses income data to allocate regional GDP for Great Britain in the same period as Geary and Stark. As the British taxable income to a large extent derives from capital, Crafts argues that it should be combined with the Geary-Stark wage-based data to arrive at a regional GDP estimates that incorporate the regional distribution of both labor and capital income. As regional wage data is missing, this is not possible for Norway; however, "assessed income" in the Norwegian data includes both labor, capital and self-employment income, and tabulations of income by occupation and social group confirm that substantial income is allocated also to occupation groups like farmers, servants and factory workers.[7]

Spikes in the data

There are some spikes in the data shown in Figure 1 that merit further discussion. This is a problem with decennial data, where it is hard to know whether outliers represent a one-off misreporting or part of a larger trend. The two jumps in the regions of Oslo and Akershus (1910-1920 and 1980-1990) drive some of the national trends. As the 1980 and 1990 regional GDP estimates are not directly comparable, it cannot be ruled out that this jump derives from a change in methodology, though it

[6] NOS VI 57 (published 1915), page 6. In addition, a publication from 1876 (NOS C 13) states that in 1870, out of 2400 industrial establishments (factories), 2047 were owned by individuals residing in the same municipality as the plant, 333 were owned by domestic individuals residing elsewhere, and 20 by foreigners.
[7] See, for example, NOS VI 59 p. 7.

does coincide with a growth of incomes in the financial sector, which is to a large extent located in Oslo.

There are also large jumps in Bergen and Hordaland (a peak in 1930) and in Vestfold (peak in 1940). While the large positive jump in Bergen's GDP per capita from 1920 to 1930 could be related to a general trend of higher income growth in cities (there is also substantial income growth in Oslo and Akershus from 1920 to 1930), the high incomes in 1940 remain unexplained here. Income data from 1940 reflect the special circumstances of the year of German invasion, and may not be indicative of the general development of the regional economy in the 1930s.

Concluding comments

This chapter has documented the regional development of economic activity in Norway from 1900 to 2010. It shows strong income convergence for the period seen as a whole. The convergence trend is interrupted by divergence episodes between 1920 and 1930 and between 1980 and 1990.

Many characteristics of the modern Norwegian economy are shown to have been more "extreme" in the historical data. The high level of economic activity in the capital region, for example, was higher historically. Similarly, all counties in Northern Norway have regional GDP per capita below the national average, but in the first half of the twentieth century, they were even further behind than what they are now.

There is scope for improvement of the data in the future. Income statistics at the county level are in principle available annually, and could be used for a more detailed analysis of the time trends in regional development. There are, however, to the knowledge of this author not sufficient data to merit a full-scale revision of the official regional GDP data back to 1970 in the same way as has been done for the national GDP estimates.

Tables and figures

Table 1: Estimates of regional GDP shares: Official and adjusted estimates

	1965		1973		1980		1990	2000	2010
	Adjusted	Official	Adjusted	Official	Adjusted	Official	Official	Official	Official
Østfold	5,5 %	5,6 %	5,3 %	5,4 %	5,1 %	5,3 %	4,5 %	4,3 %	3,9 %
Oslo+Akershus	28,9 %	30,4 %	28,5 %	29,9 %	26,4 %	28,7 %	32,4 %	32,9 %	31,3 %
Hedmark	3,8 %	3,8 %	3,7 %	3,7 %	3,9 %	3,8 %	3,4 %	3,2 %	2,8 %
Oppland	3,3 %	3,3 %	3,5 %	3,5 %	3,6 %	3,6 %	3,1 %	3,0 %	2,8 %
Buskerud	4,9 %	5,0 %	5,2 %	5,3 %	5,2 %	5,4 %	4,9 %	4,5 %	4,6 %
Vestfold	4,5 %	4,4 %	4,4 %	4,2 %	4,0 %	3,9 %	3,7 %	3,8 %	3,6 %
Telemark	4,6 %	4,8 %	3,8 %	3,8 %	4,0 %	4,4 %	3,4 %	3,0 %	2,8 %
Aust-Agder	1,8 %	1,6 %	1,9 %	1,8 %	2,0 %	1,8 %	1,8 %	1,9 %	1,6 %
Vest-Agder	2,9 %	2,8 %	3,0 %	2,9 %	3,5 %	3,4 %	3,2 %	3,0 %	3,4 %
Rogaland	6,1 %	5,9 %	6,9 %	7,0 %	7,3 %	7,3 %	8,3 %	8,6 %	10,5 %
Bergen+Hordaland	8,9 %	8,5 %	9,0 %	8,7 %	9,1 %	8,5 %	9,1 %	9,4 %	10,0 %
Sogn og Fjordane	2,0 %	2,0 %	2,0 %	2,0 %	2,6 %	2,5 %	2,2 %	2,2 %	2,0 %
Møre og Romsdal	4,7 %	4,5 %	5,0 %	4,9 %	5,1 %	4,9 %	4,4 %	4,8 %	5,1 %

Sør-Trøndelag	5,4 %	5,3 %	5,6 %	5,5 %	5,6 %	5,3 %	5,0 %	5,3 %	5,6 %
Nord-Trøndelag	2,2 %	2,1 %	2,3 %	2,2 %	2,4 %	2,3 %	2,2 %	2,1 %	1,9 %
Nordland	5,8 %	5,4 %	5,3 %	4,9 %	5,4 %	4,7 %	4,2 %	4,2 %	4,1 %
Troms	2,7 %	2,5 %	2,9 %	2,7 %	3,1 %	2,7 %	2,9 %	2,7 %	2,7 %
Finnmark	1,8 %	1,8 %	1,6 %	1,5 %	1,6 %	1,4 %	1,3 %	1,2 %	1,3 %

Table 2: Regional income shares

	1900	1910	1920	1930	1940	1950	1960	1965		1973	
County	Inc	Inc	Inc	Inc	Inc	Inc	Inc	Inc	GDP	Inc	GDP
Østfold	7,3 %	7,5 %	5,8 %	6,5 %	5,8 %	6,6 %	6,1 %	5,8 %	5,5 %	5,8 %	5,3 %
Oslo+Akershus	27,9 %	26,6 %	32,5 %	34,1 %	34,2 %	30,2 %	30,4 %	29,3 %	28,9 %	28,6 %	28,5 %
Hedmark	4,9 %	5,1 %	3,6 %	3,2 %	3,5 %	4,0 %	4,1 %	3,9 %	3,8 %	4,0 %	3,7 %
Oppland	3,5 %	3,7 %	2,8 %	3,3 %	3,1 %	3,6 %	3,7 %	3,6 %	3,3 %	3,8 %	3,5 %
Buskerud	5,4 %	5,9 %	4,8 %	4,9 %	4,6 %	5,1 %	5,0 %	5,2 %	4,9 %	5,4 %	5,2 %
Vestfold	5,1 %	4,8 %	4,8 %	6,6 %	4,8 %	5,6 %	5,2 %	4,7 %	4,5 %	4,6 %	4,4 %
Telemark	4,7 %	4,8 %	4,9 %	4,3 %	3,9 %	4,3 %	4,2 %	4,2 %	4,6 %	3,6 %	3,8 %
Aust-Agder	3,3 %	2,8 %	1,9 %	2,2 %	2,1 %	1,8 %	1,8 %	1,9 %	1,8 %	1,8 %	1,9 %
Vest-Agder	3,1 %	2,8 %	2,5 %	2,4 %	3,2 %	2,6 %	2,8 %	2,9 %	2,9 %	3,0 %	3,0 %
Rogaland	4,6 %	5,0 %	6,1 %	5,1 %	6,3 %	6,1 %	6,0 %	6,3 %	6,1 %	6,6 %	6,9 %
Bergen+Hordaland	8,9 %	9,0 %	12,5 %	9,8 %	9,3 %	9,4 %	8,8 %	9,2 %	8,9 %	9,1 %	9,0 %
Sogn og Fjordane	2,2 %	2,0 %	1,3 %	1,5 %	1,4 %	1,9 %	1,9 %	1,9 %	2,0 %	2,0 %	2,0 %
Møre og Romsdal	4,2 %	4,2 %	3,9 %	3,3 %	3,1 %	4,1 %	4,2 %	4,5 %	4,7 %	4,8 %	5,0 %
Sør-Trøndelag	5,3 %	5,8 %	5,5 %	5,0 %	5,7 %	5,2 %	5,1 %	5,3 %	5,4 %	5,6 %	5,6 %
Nord-Trøndelag	2,6 %	2,5 %	1,8 %	2,0 %	2,1 %	2,2 %	2,3 %	2,2 %	2,2 %	2,3 %	2,3 %
Nordland	4,1 %	4,3 %	2,9 %	3,4 %	3,7 %	4,0 %	4,8 %	5,0 %	5,8 %	4,7 %	5,3 %
Troms	2,0 %	2,1 %	1,5 %	1,4 %	1,9 %	1,9 %	2,2 %	2,6 %	2,7 %	2,8 %	2,9 %
Finnmark	1,1 %	1,2 %	0,9 %	1,1 %	1,3 %	1,2 %	1,4 %	1,5 %	1,8 %	1,6 %	1,6 %

Table 3: Regional population (1000s)

County	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010
Østfold	137	152	160	167	170	185	202	219	232	238	248	272
Oslo+Akershus	344	370	438	490	549	617	698	800	822	873	975	1 123
Hedmark	126	135	150	158	161	173	178	179	187	187	187	191
Oppland	116	119	129	138	145	160	166	172	180	182	183	185
Buskerud	113	124	137	143	143	156	168	196	214	225	237	258
Vestfold	105	109	124	134	135	155	172	173	186	197	213	231
Telemark	99	108	125	128	124	136	150	157	162	163	165	168
Aust-Agder	80	76	75	74	70	76	77	80	90	97	102	108
Vest-Agder	82	82	83	81	88	97	108	123	136	144	156	170
Rogaland	128	141	166	173	184	211	237	266	302	336	373	428
Bergen+Hordaland	208	223	248	263	276	311	339	371	391	409	435	477
Sogn og Fjordane	89	90	90	92	92	98	100	101	105	107	108	107

Møre og Romsdal	136	145	159	165	169	191	212	223	236	238	243	251
Sør-Trøndelag	135	148	167	175	182	198	211	232	244	250	263	291
Nord-Trøndelag	83	85	89	96	98	110	117	118	125	127	127	132
Nordland	152	165	174	187	198	222	239	243	244	240	239	236
Troms	74	82	91	97	103	117	127	137	146	147	151	156
Finnmark	33	38	44	53	60	64	72	76	79	74	74	73

Figure 1: GDP per capita, relative to national mean

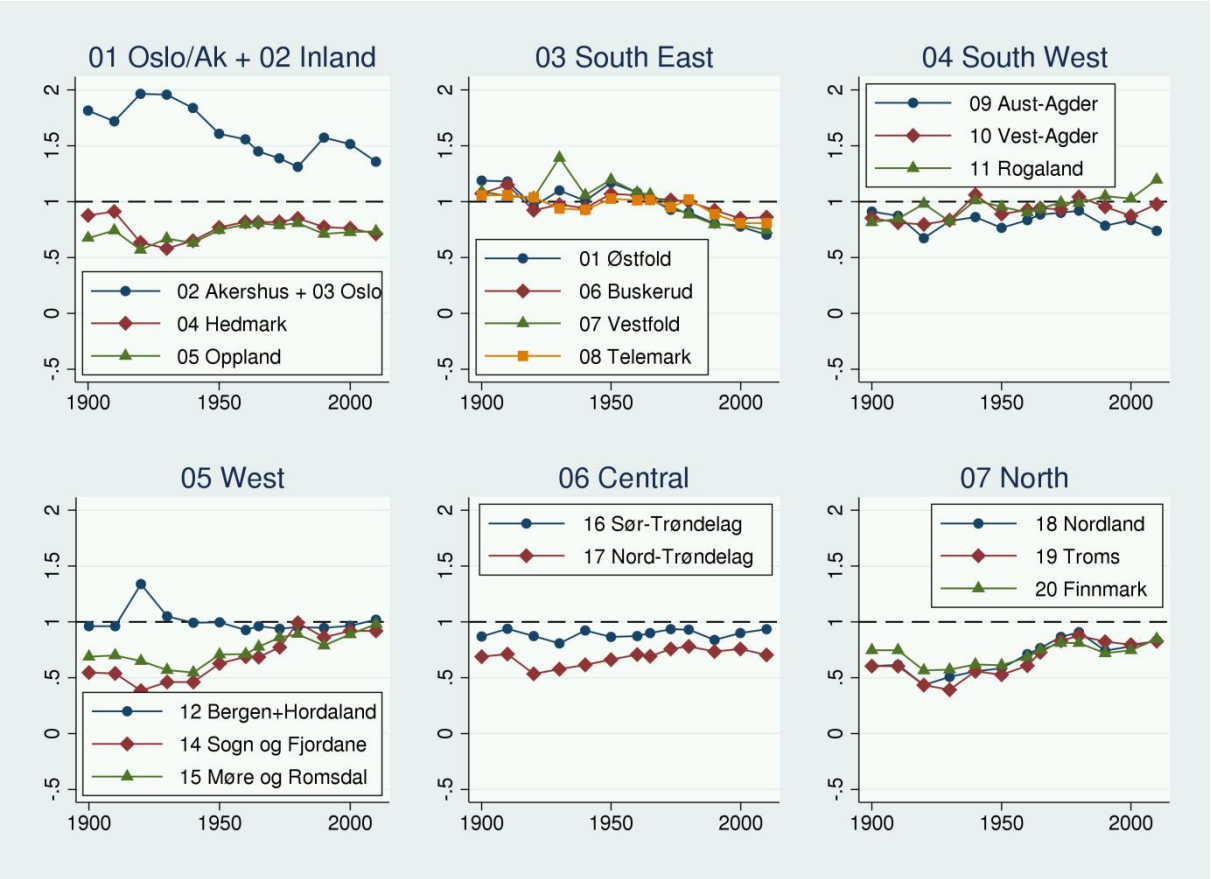


Figure 2: Between-region coefficient of variation (unweighted and population-weighted)

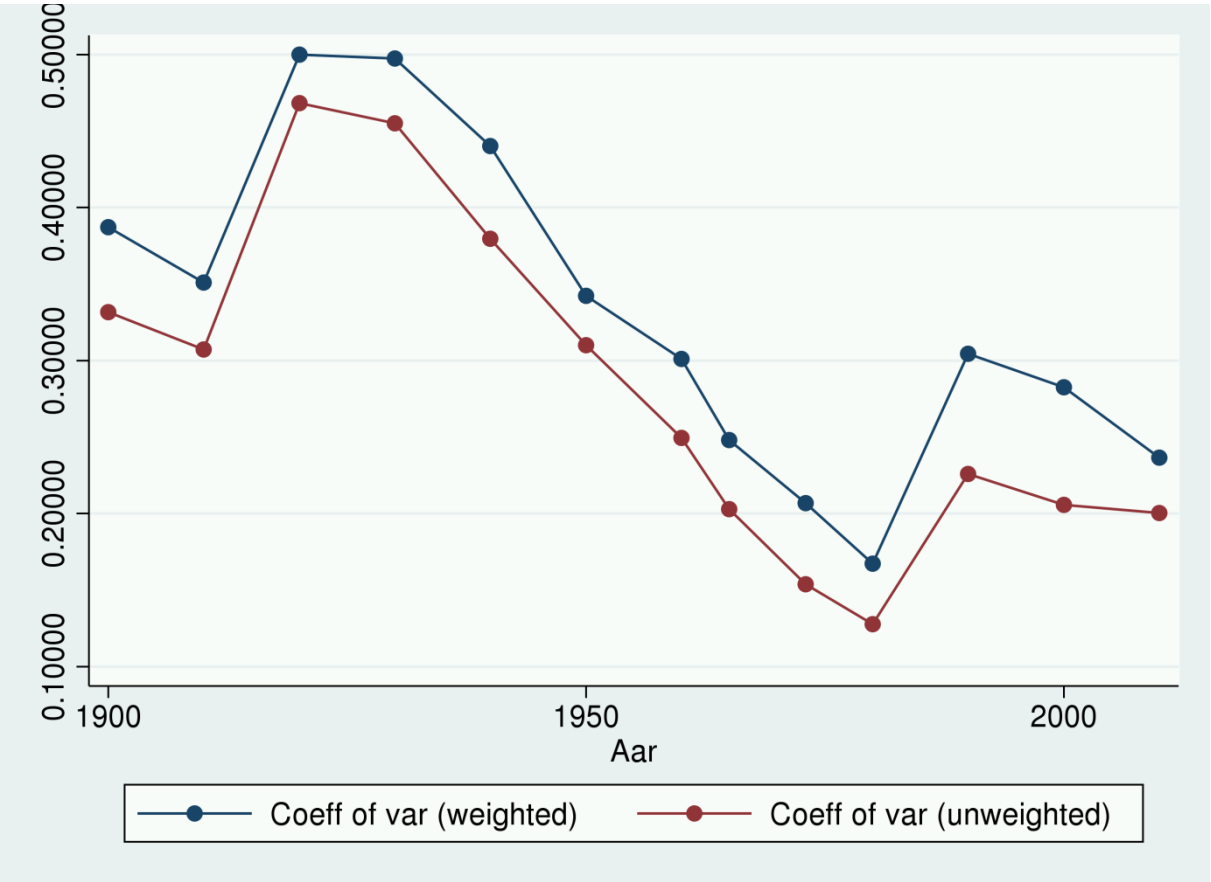
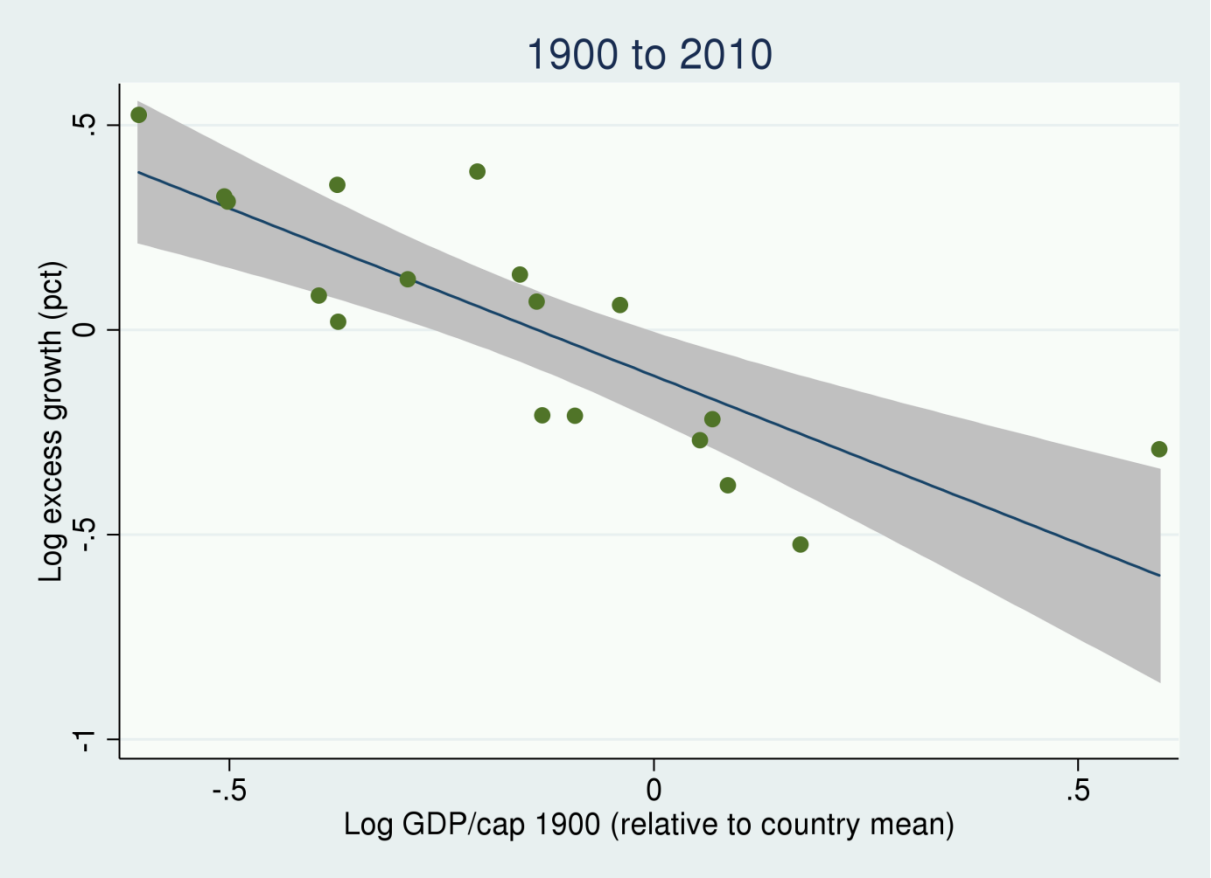


Figure 3: Convergence 1900 to 2010 (average regional growth compared to initial position)



ID (national code)	NUTS2	Name	NUTS3	Name	Area (2013) (sq km)
2 and 3	NO01	Oslo og Akershus	NO011+NO012	Oslo+Akershus	5372
4	NO02	Hedmark og Oppland	NO021	Hedmark	27398
5	NO02	Hedmark og Oppland	NO022	Oppland	25192
1	NO03	Sør-Østlandet	NO031	Østfold	4181
6	NO03	Sør-Østlandet	NO032	Buskerud	14911
7	NO03	Sør-Østlandet	NO033	Vestfold	2225
8	NO03	Sør-Østlandet	NO034	Telemark	15296
9	NO04	Agder og Rogaland	NO041	Aust-Agder	9158
10	NO04	Agder og Rogaland	NO042	Vest-Agder	7277
11	NO04	Agder og Rogaland	NO043	Rogaland	9376
12	NO05	Vestlandet	NO051	Bergen+Hordaland	15438
14	NO05	Vestlandet	NO052	Sogn og Fjordane	18623
15	NO05	Vestlandet	NO053	Møre og Romsdal	15101
16	NO06	Trøndelag	NO061	Sør-Trøndelag	18839
17	NO06	Trøndelag	NO062	Nord-Trøndelag	22415
18	NO07	Nord-Norge	NO071	Nordland	38482
19	NO07	Nord-Norge	NO072	Troms	25863
20	NO07	Nord-Norge	NO073	Finnmark	48631

Table 4: NUTS definitions, ID numbers, and land area, by county

Table 5: Employment shares (Excel appendix: table5formatted.xlsx)

Map 1: GDP per capita relative to national mean; 1900, 1960 and 2010. See attachment map3.png (there also exist maps for the other years)

Year	GDP (Mill 2005 NOK)	Share non-mainland
1900	60878	
1910	75808	
1920	104989	
1930	148103	
1940	173217	
1950	259553	
1960	387237	
1965	491178	
1970	602677	7,7 %
1973	700077	8,0 %
1980	952501	17,1 %
1990	1221175	23,9 %
2000	1756996	27,1 %
2010	2034520	19,3 %

Table 6: GDP, as well as mainland and non-mainland, 1900-2010.

Appendix: Source list

Existing official estimates of regional GDP are listed below. All publications in the NOS series are available in pdf versions at http://www.ssb.no/a/histstat/nos/

1965: Regionalt nasjonalregnskap 1965, NOS A376 1970

1973: Fylkesfordelt nasjonalregnskap 1973, NOS A925 1978

1976: Fylkesfordelt nasjonalregnskap 1976, NOS B116 1980

1980: Fylkesfordelt nasjonalregnskap 1980, NOS B486 1984

1983: Fylkesfordelt nasjonalregnskap 1983, NOS B687 1987

1986: Fylkesfordelt nasjonalregnskapsstatistikk 1986, NOS B920 1990

1990: Sørensen, Knut: "Økonomisk utvikling i fylkene 1990-1992 belyst med fylkesfordelt nasjonalregnskap". Økonomiske Analyser 2, 1997 (available at http://www.ssb.no/a/histstat/oa/)

1992: Fylkesfordelt nasjonalregnskapsstatistikk 1993, NOS C323 1996

1997-2004: Fylkesfordelt nasjonalregnskap 1997-2004, NOS D389 2008

2000-2013: Statistics Norway web pages, http://www.ssb.no/nasjonalregnskap-og-konjunkturer/statistikker/fnr/aar?fane=arkiv (this page also contains links to regional GDP 1993-1996 and GDP by county 1993)

Sources of income data: All numbers are taken from the series on municipal finances or tax statistics, published in the NOS series as:

1900: NOS IV 94

1910: NOS VI 14

1920: NOS VII 107

1930: NOS IX 7

1940: NOS X 42

1950: NOS XI 158

1960: NOS XII 95

1965: NOS A 202

The 1973 income data is obtained from the microdata registry file at Statistics Norway.

Aggregate GDP series can be obtained from:

http://www.ssb.no/nasjonalregnskap-og-konjunkturer/tabeller/aarlig-nasjonalregnskap-fra-1970-csv-filer , table 2 (the 2011 revision, data back to 1970)
http://www.ssb.no/a/histstat/aarbok/ht-0901-bnp.html (historical series; modern estimate is spliced with earlier data)

References

Aaberge, R. and A. B. Atkinson (2010): Top Incomes in Norway. In: Atkinson and Piketty (eds): *Top Incomes – A Global Perspective*. Oxford University Press, Oxford.

Atkinson, A. B. and T. Piketty (Eds.) (2007): *Top Incomes over the 20th Century: A Contrast between European and English-Speaking Countries*. Oxford University Press, Oxford.

Atkinson, A. B. and T. Piketty (Eds.) (2010): *Top Incomes A Global Perspective*, Oxford University Press, Oxford, 448-482.

Crafts, Nicholas (2005): Regional GDP in Britain, 1871-1911, some estimates. Scottish Journal of Political Economy 52 (1)

Geary, F and T Stark (2002): Examining Ireland's post-famine economic growth performance. Economic Journal 112

Gimming, Kristian, Tore Halvorsen, Tor Skoglund og Knut Ø. Sørensen (2011): Reviderte nasjonalregnskapstall 1970-2010. Økonomiske analyser 6

Juvkam, Dag (1999): Historisk oversikt over endringer i kommune- og fylkesinndelingen. Rapport 99/13

Piketty, Thomas (2014): Capital *in the Twenty-First Century*. Belknap.

Rattsø, Jørn and Hildegunn Stokke (2014): Population Divergence and Income Convergence: Regional Distribution Dynamics for Norway. Regional Studies 48, p. 1884-1895

Statistics Norway. Norwegian National Accounts: GNI Inventory for ESA95, June 2012 version. Available at http://www.ssb.no/nasjonalregnskap-og-konjunkturer/norwegian-national-accounts-gni-inventory-for-esa95

Sørensen, Knut: Økonomisk utvikling i fylkene 1990-1992 belyst med fylkesfordelt nasjonalregnskap. Økonomiske Analyser 2, 1997

Vassenden, Kåre (1987): Folke- og boligtellingene 1960, 1970 og 1980, dokumentasjon av de sammenlignbare filene. Rapport 87/2

Zahirovic, Edita and Øystein Berge (2013). Fylkesfordelt nasjonalregnaskap 2010, Verdiskapingen i Oslo og Rogaland på topp. Økonomiske analyser 2

Østbye, Stein and Olle Westerlund (2011): Industrial structure, regional productivity and convergence: The case of Norway and Sweden. European Urban and Regional Studies 18