

STAFF MEMO

Evaluation of the regional network

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Evaluation of the regional network

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Norges Bank's regional network supplies important information about developments in the Norwegian economy. We show that the survey's data for actual and expected growth in output and employment provide good forecasts of output and employment growth in the national accounts one to two quarters ahead. Our analyses suggest that the network supplies better leading information about mainland GDP growth in the current and the next quarter than house prices, equity prices and indicators from other business surveys. The network's forecasts of gross fixed capital formation over the next year have been relatively good since 2012. Its forecasts of wage and employment growth have been roughly as good as those in Epinion's expectations survey.

1. Introduction

Norges Bank's regional network (RN) was established in 2002 and consists of around 1 500 enterprises, organisations, local authorities, hospitals and other public bodies right around the country. Through regular interviews with network contacts, Norges Bank obtains fresh and useful information about their assessment of the current situation and outlook for their own activities. The responses are summarised in interview notes, reports and data series for key economic variables at national, regional and sector level. Both qualitative and quantitative information from the network is used in Norges Bank's forecasting work. Here, we look only at the quantitative information from the network.

The value of the network for forecasting work will depend largely on the following factors:

- how well the network describes the current situation in the Norwegian economy
- its predictive power in relation to official statistics
- whether other data, including data from other business surveys, provide better leading information than the RN

The first two issues have been discussed previously in Kallum et al (2005) and Brekke and Halvorsen (2009). Both studies concluded that the network provided good early signals of developments in key variables such as output and employment. In this study, we extend the evaluation period to include data through to the end of 2016. We also look at whether the RN data series provide better leading information than other available indicators.

¹ The views and conclusions in this publication are those of the authors and are not necessarily shared by Norges Bank. They should not therefore be reported as Norges Bank's views. The authors would like to thank Ida Wolden Bache, Solveig Erlandsen, Anne Sofie Jore, Ingrid Solberg and Per Espen Lilleås for valuable input and comments.

Network contacts are normally interviewed in the fourth to the seventh weeks of each quarter (slightly later in the third quarter). The responses to the questions on output and employment growth over the past three months therefore contain information about both the current and the previous quarter. Similarly, the responses to questions about expected growth in output and employment contain information about both the rest of the current quarter and the months after that. We show that the series for actual and expected growth in output provide reliable estimates of mainland GDP growth in the current quarter. The estimates are slightly better if we use an average of the two series to estimate GDP growth. We obtain similar results for employment. Since the RN results are published nine to ten weeks before the quarterly national accounts (QNA) for the same period, this means that the network provides good leading information about the current situation in the economy. Enterprises' expectations of growth in output and employment provide good estimates of mainland GDP and employment growth in the next quarter.

Our analyses suggest that the RN supplies better leading information about mainland GDP growth in the current and the next quarter than house prices, equity prices and indicators from other business surveys. With regard to employment, we find that a combination of the employment series from RN and Epinion's expectations survey supplies better leading information about near-term developments in employment than the series from the two surveys individually.

There has been a relatively close correlation between RN data on investment plans and gross fixed capital formation in the QNA since 2012. The RN estimates for annual wage growth have proved good indicators of annual wage growth as measured in the official statistics and roughly as good as those from Epinion's expectations surveys.

2. Growth in output

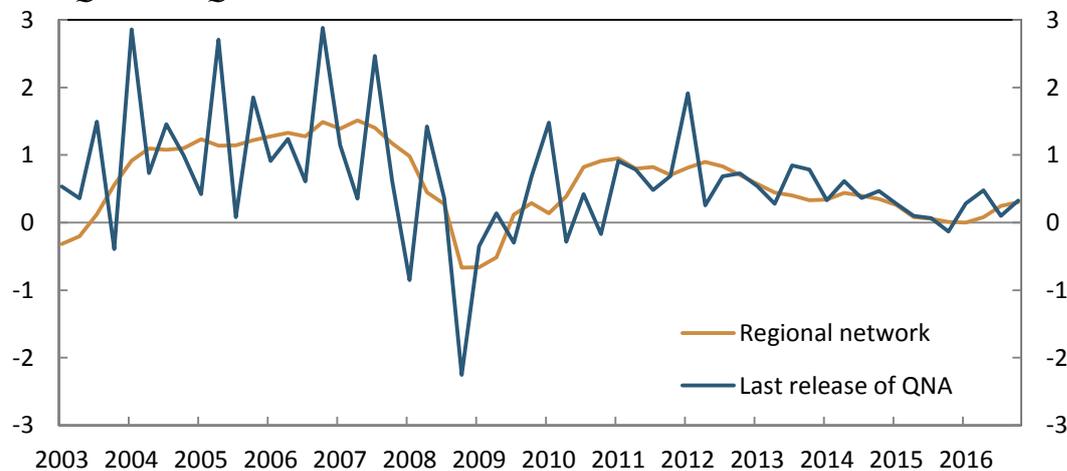
2.1. Growth in output over the past three months

Enterprises in the regional network are asked about seasonally adjusted growth in their own production volumes over the past three months compared with the previous three-month period (Question 1.1 in Appendix A). They are also asked whether this is representative of their sector. The response from each enterprise is categorised on a scale from -5 to +5, where -5 corresponds to a decrease in output of 2½ percent or more, and +5 to an increase in output of 2½ percent or more. The responses are weighted together to create indices for the individual sectors at regional level. These indices in turn are weighted together to produce national sector indices using regional weights based on Statistics Norway's regional accounts (Norges Bank 2015). Finally, the sector weights are used to calculate an aggregated output series. Since production growth at each enterprise is categorised with a score that is roughly equal to the percentage quarterly change multiplied by two, we obtain estimates of quarterly output growth by dividing the indices by two. The series for employment and investment are calculated in a similar way.

The panel of enterprises in the network is intended to reflect activity in the mainland economy. However, the agricultural, forestry and power sectors are not represented. In the public sector, the network includes local governments and hospitals, but these contacts are not asked about developments in output. The rest of the public sector is not included in the network. Although parts of the mainland economy are not covered by the network, we compare the aggregated output series from the survey with data for mainland GDP growth from the QNA.

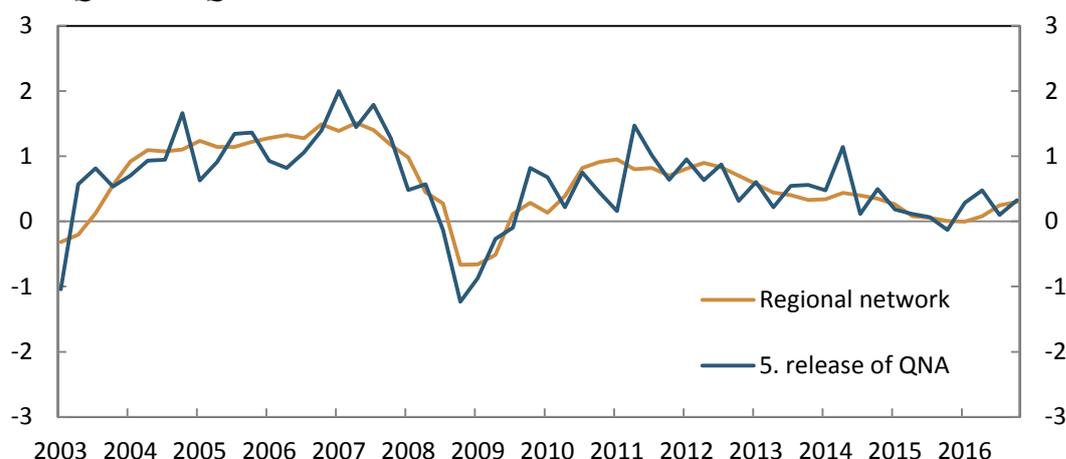
The RN output series has been much less volatile than the QNA series for growth in mainland GDP except in recent years (Chart 2.1). The considerable swings in the QNA series reflect the increased fluctuations once information from the annual structural statistics is incorporated into the accounts, six to seven quarters after the initial release of QNA data for each year. Real-time data for mainland GDP fluctuate much less from quarter to quarter than the official time series for mainland GDP. The RN output series has over time been close to quarterly mainland GDP growth when we use the first to sixth estimate of GDP for the quarter. Chart 2.2 shows the RN output series and quarterly mainland GDP growth measured by the fifth estimate of GDP growth for the quarter.² Major swings in power production help explain why the RN series and the QNA differ considerably in some quarters.

Chart 2.1: RN series for growth in output over the past three months and quarterly growth in GDP for mainland Norway in the last release of the QNA. Seasonally adjusted. Volume. Percent. 2003 Q1 – 2016 Q4



² The figures for 2016 in the chart and the calculations are from the QNA for 2016 Q4.

Chart 2.2: RN series for growth in output over the past three months and quarterly growth in GDP for mainland Norway in the fifth release of the QNA. Seasonally adjusted. Volume. Percent. 2003 Q1 – 2016 Q4



Sources: Norges Bank and Statistics Norway

The RN series for output growth over the past three months is more strongly correlated with quarterly growth in mainland GDP in the fifth release of the QNA than in earlier releases (Table 2.1). This probably has to do with activity in some sectors being based on projections in the initial releases of QNA data for a quarter. The RN output series is more or less equally strongly correlated with GDP growth in the same quarter and GDP growth in the previous quarter. This reflects that the interviews are held in the first half of the quarter. The output growth reported for the past three months will therefore contain information about both the current and the previous quarter.

Table 2.1: Correlation coefficients for the RN series for output growth over the past three months compared with quarterly growth in GDP for mainland Norway in the QNA. 2003 Q1 – 2016 Q4

	QNA release 1	QNA release 5	QNA final
RN vs QNA growth in the current quarter	0.78	0.81	0.52
RN vs QNA growth in the previous quarter	0.77	0.81	0.53

On average, the RN series for output growth over the past three months has deviated from quarterly growth in mainland GDP by 0.29 percentage point since 2003 when we use the fifth release of the QNA (Table 2.2). The deviation between the RN series and the QNA series was generally slightly smaller in the period 2010-2016 than in the period 2003-2009. This reflects the higher and more variable rates of growth in 2003-2009. There are no signs of the RN series having systematically over- or underestimated GDP growth in the QNA. Since the network's inception, output growth as reported in the survey has, on average, been the same as the growth reported in the QNA.

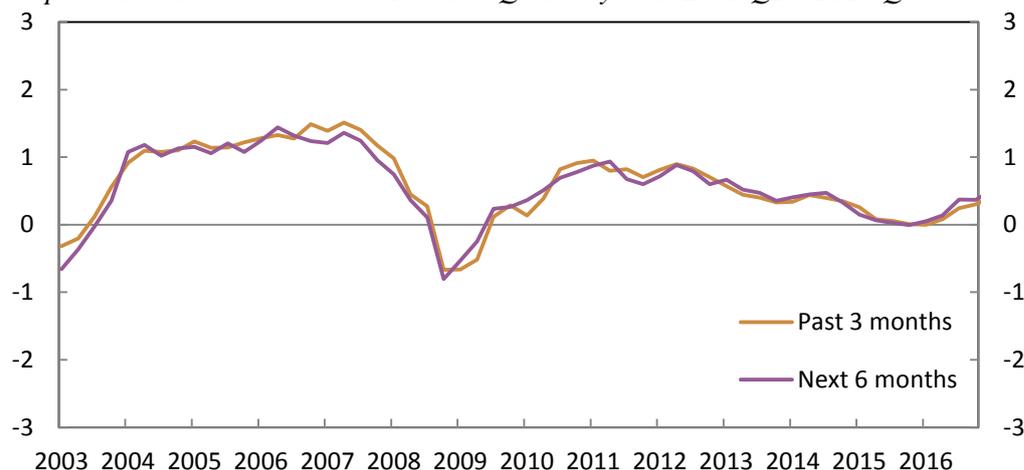
Table 2.2: Deviation between the RN series for growth in output over the past three months and quarterly growth in GDP for mainland Norway in the fifth release of the QNA. 2003 Q1 – 2016 Q4

	2003-2016	2003-2009	2010-2016
Mean absolute deviation	0.29	0.34	0.24
Mean deviation	0.00	0.03	-0.02

2.2. Expected growth in output over the next six months

Enterprises are also asked about expected output growth over the next six months (Question 1.2 in Appendix A). The series for expected growth in output over the next six months is closely related to the series for growth in output over the past three months (Chart 2.3). This suggests that enterprises largely base their expectations on recent developments in output.

Chart 2.3: RN series for growth in output over the past three months and expected growth in output over the next six months. Percent. Quarterly rate. 2003 Q1 – 2016 Q4



Source: Norges Bank

The RN series for expected growth in output over the next six months is more strongly correlated with GDP growth in the current quarter than with GDP growth in the next two quarters (Table 2.3). The correlation between the RN expectations series and GDP growth in the current quarter is the same as the correlation between GDP growth and the RN series for growth in output over the past three months. The results in Table 2.3 suggest that the RN expectations series has primarily captured developments during the remainder of the interview quarter and the next quarter. GDP growth is clearly more correlated with the RN expectations series one and two quarters earlier than with GDP growth lagged one and two quarters.

Table 2.3: Correlation coefficients for the RN series for expected growth in output over the next six months compared with quarterly growth in GDP for mainland Norway in the fifth release of the QNA. 2003 Q1 – 2016 Q4

RN vs QNA growth in the current quarter	0.81
RN vs QNA growth in the next quarter	0.70
RN vs QNA growth two quarters ahead	0.57

The mean deviations and mean absolute deviations between the RN series for expected output growth and GDP growth also indicates that the expectations series mainly have picked up the development in the rest of the current quarter and the next quarter, see Table 2.4. In the period 2003-2009, the deviation was much greater one to two quarters ahead than in the current quarter (Table 2.4). Much of this can be explained by GDP growth

being lower during the autumn 2008 financial crisis than anticipated by contacts in the network one to two quarters before. In the period 2010-2016, the deviation is roughly the same whether the expectations series is compared with GDP growth in the current quarter, next quarter or two quarters ahead.

The RN expectations series has not systematically over- or underestimated growth. GDP growth was slightly higher than expected by the network in the period 2003-2009, but the mean deviation is not statistically significant.

Table 2.4: Deviation between the RN series for expected growth in output over the next six months and quarterly growth in GDP for mainland Norway in the fifth release of the QNA. 2003 Q1 – 2016 Q4

Mean absolute deviation	2003-2016	2003-2009	2010-2016
RN vs QNA growth in the current quarter	0.30	0.36	0.23
RN vs QNA growth in the next quarter	0.32	0.43	0.22
RN vs QNA growth two quarters ahead	0.40	0.53	0.26
Mean deviation	2003-2016	2003-2009	2010-2016
RN vs QNA growth in the current quarter	-0.02	-0.04	-0.01
RN vs QNA growth in the next quarter	-0.05	-0.10	-0.01
RN vs QNA growth two quarters ahead	-0.05	-0.08	-0.01

2.3. Comparison with other indicators

In this section, we look at whether the RN series for actual and expected output growth provide better leading information about mainland GDP than other indicators available at the time the projections are produced for Norges Bank's *Monetary Policy Report*. We do this by estimating and comparing models including different indicators. Our analyses suggest that the RN output series are better leading indicators of mainland GDP growth in the current and the next quarter than house prices, equity prices, the Norwegian PMI or Statistics Norway's Business tendency survey. Previous studies have shown that house and equity prices can be good leading indicators of developments in the real economy (Gerdrup et al. 2006, Ellingsen 2017).

Economic developments in the short term can be forecasted with leading indicators such as housing prices, stock prices and series from RN and other business surveys. Previous studies have shown that housing prices and stock prices can be good leading indicators of short-term GDP growth, see Gerdrup et al. (2006) and Ellingsen (2017). In addition to RN, there are four business surveys that are published regularly: Norwegian PMI, Statistics Norway's Business Survey, Epinion's Expectation Survey and NHO's survey among member companies. PMI is published on the first working day of each month, while the other surveys are published quarterly. The PMI and the Business tendency survey cover only manufacturing and mining, but have figures for production and order situation that can be good leading indicators of growth in mainland Norway GDP. The surveys from NHO and Epinion cover a larger part of the economy, but have no information about

developments in production. The companies in Epinion's survey are being asked about expected development in operating margin next year, while companies in NHOS survey are being asked about the market situation and expected change in the market situation in the future. In addition, the NHO survey has only quarterly figures from 2010. We find that the indicators in these surveys have yielded somewhat worse estimates of GDP growth than the indicators from the RN, PMI and the Business tendency survey. In the following we only show models with data from the last three surveys.

In its forecasting work, Norges Bank has access to data from the regional network for the current quarter, data from the Business tendency survey for the previous quarter, and PMI data for the first two months of the current quarter. We therefore compare the leading properties of the RN series with data from the tendency survey for the previous quarter and the PMI's production sub-index for the first two months of each quarter. When it comes to house and equity prices, the Bank has access to data for two-thirds of the current quarter when making its projections. For the sake of simplicity, we use normal quarterly figures for these variables.

Table 2.5 compares models for quarterly growth in GDP for mainland Norway with house prices, equity prices and series RN, the PMI and the Business tendency survey as explanatory variables. The estimation period runs from 2004 Q1 to 2016 Q4.³ Models M1 to M5 constructed to forecast GDP growth in the current quarter, while models M6-M8 are constructed to forecast growth in the next quarter.

We showed earlier that the series for output growth over the past three months and expected output growth over the next six months provide almost equally good estimates of growth in mainland GDP in the current quarter. Both variables have coefficients of 0.5 with about the same standard deviation when included together in a model for mainland GDP growth. This model fits slightly better than models containing just one of the two output series. We therefore include the average of the two series as the explanatory variable in model M1 in Table 2.5. The estimated effect of the RN variable is strongly significant. The coefficients in the model indicate that the variable provides unbiased estimates of quarterly growth in mainland GDP. This hypothesis is not rejected by formal tests (we test whether the constant is equal to 0 and the parameter for the RN variable is equal to 1). Model M1 fits much better than models where GDP growth is determined (only) by GDP growth in previous quarters.

Model M2 contains the production sub-index in the PMI and the industrial confidence indicator from the Business tendency survey⁴ (backdated one quarter), while model M3 contains growth in Norwegian house and equity prices. The dynamics in M3 have been selected to give the best possible fit. M2 and M3 fit less well than the model with the RN

³ The PMI series starts in 2004 Q1.

⁴ The industrial confidence indicator is the average of the answers (net figures) to the questions on expected volume of production, total stock of orders and inventories of own products (the latter with inverted sign). We find that this indicator is a better leading indicator than has better leading properties than the series for expected production in the Business tendency survey.

output series (M1). In model M4, we extend M1 with the series from the PMI and the tendency survey. The RN output series still have a clearly significant effect, while the effects of the indicators from the PMI and the tendency survey are far from statistically significant. Model M5 extends M1 with movements in house and equity prices. The RN variable still has a strongly significant effect, while the effects of house and equity prices are statistically insignificant. The effect of equity prices is almost significant at a 10 percent level, however.

Table 2.5: Models for quarterly growth in GDP for mainland Norway from the fifth release of the QNA. Percent. T-values in parentheses. Estimation period 2004 Q1 – 2016 Q4

Variable	M1	M2	M3	M4	M5	M6	M7	M8
Constant	-0.01 (-0.20)	-1.27 (-1.30)	-0.14 (-0.13)	-0.35 (-0.38)	-0.03 (-0.35)	0.02 (0.17)	-0.01 (-0.06)	-0.03 (-0.24)
Average of output growth over the past three months and expected output growth in the regional network (quarterly rates)	1.01 (10.95)			0.82 (3.33)	0.68 (3.70)			
Industrial confidence indicator in the Business tendency survey. Net figures. Backdated one quarter		0.04 (3.08)		0.01 (0.49)				
Production sub-index in the PMI. Diffusion index. Average of the first two months of the quarter		0.03 (1.70)		0.01 (0.43)				
Six-quarter change in Norwegian house prices (log scale)			5.44 (5.00)		1.79 (1.29)			
Four-quarter change in Oslo Børs benchmark index (log scale)			0.82 (3.19)		0.40 (1.58)			
Expected output growth in the regional network. Backdated one quarter						0.97 (8.90)		0.62 (2.77)
Six-quarter change in Norwegian house prices. Backdated one quarter (log scale)							5.71 (5.15)	2.33 (1.46)
Three-quarter change in Oslo Børs benchmark index. Backdated one quarter (log scale)							0.79 (2.58)	0.38 (1.19)
Model evaluation								
Adjusted R ²	0.70	0.64	0.64	0.69	0.71	0.61	0.56	0.62
Standard deviation	0.34	0.38	0.37	0.34	0.33	0.39	0.41	0.38
Durbin-Watson	2.00	2.03	1.48	2.06	2.01	1.72	1.57	1.80

Note: The adjusted R² is the R² adjusted for degrees of freedom. The adjusted R² increases if a model is extended with an explanatory variable that has a coefficient with an absolute t-value greater than 1. The standard deviation decreases when the adjusted R² increases (and vice versa).

Next, we look at whether the regional network provides better leading information about GDP growth in the next quarter than house prices, equity prices and indicators from the PMI and the Business tendency survey. Model M6 includes the RN series for expected growth in output backdated one quarter. The series has a strongly significant effect, with a

coefficient close to 1. We cannot reject a hypothesis that the RN series provides unbiased forecast of growth in mainland GDP in the next quarter. Model M7 contains backdated effects of house and equity prices, and produces weaker estimates of GDP growth than M6. Model M8 contains all of the variables from M6 and M7. The RN variable still has a strongly significant effect, whereas the effects of house and equity prices are statistically insignificant. The expectations series from RN obtains a significant effect if M6 is augmented with the order sub-index in the PMI (backdated one quarter) and the industrial confidence indicator from the Business tendency survey (backdated two quarters). By contrast, the series from PMI and the Business tendency survey obtain insignificant effects.

We conclude that the RN provides better leading information about growth in mainland GDP in the current and the next quarter than house prices, equity prices and other business surveys available at the time the projections are produced for Norges Bank's *Monetary Policy Report*.

3. Growth in employment

3.1. Growth in employment over the past three months

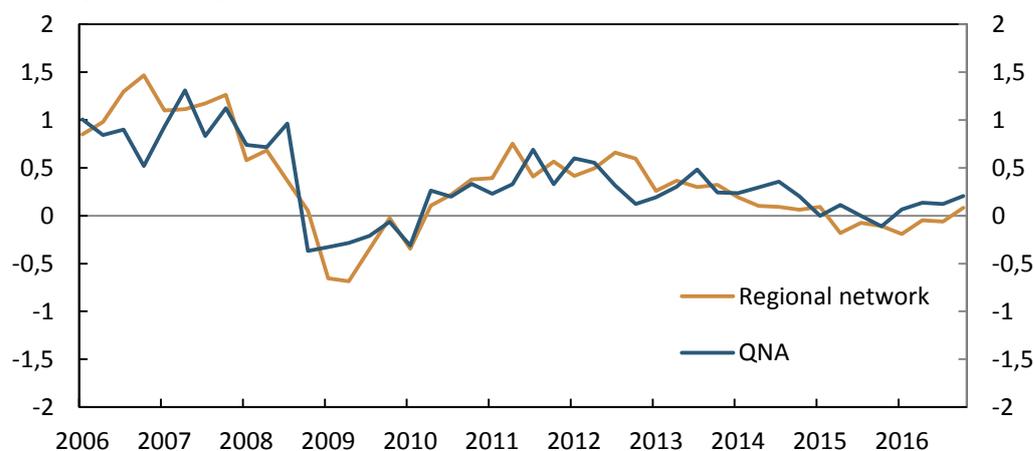
Contacts in the regional network are asked about the change in the number of full-time equivalent employees over the past three months compared to the previous three-month period (Question 3.1 in Appendix A and Question 1.2 in Appendix B). The responses are categorised on a scale from -5 to +5, where -5 corresponds to a decrease in employment of around 5 percent or more, and +5 to an increase in employment of around 5 percent or more.

We use the same methods to evaluate the RN employment series as we used in the evaluation of the output series. Our conclusions about the employment series largely coincide with those we drew for the output series.

The RN series for employment growth over the past three months predicts the change in employment in mainland Norway in the QNA (as measured in the fifth release) relatively well (Chart 3.1 and Table 3.1).⁵ The RN series is almost equally strongly correlated with employment growth in the QNA in the previous quarter and the current quarter. This reflects that the interviews are held in the first half of the quarter. The employment growth reported for the past three months will therefore contain information about both the current and the previous quarter.

⁵ Real-time data for this variable are available only from 2006.

Chart 3.1: RN series for growth in employment over the past three months and quarterly growth in employment in mainland Norway in the fifth release of the QNA. Seasonally adjusted. Percent. 2006 Q1 – 2016 Q4



Sources: Norges Bank and Statistics Norway

Table 3.1: Correlation coefficients for the RN series for growth in employment over the past three months compared with quarterly growth in employment in mainland Norway in the fifth release of the QNA. 2006 Q1 – 2016 Q4

RN vs QNA growth in the current quarter	0.84
RN vs QNA growth in the previous quarter	0.81

On average, the RN series for growth in employment over the past three months has deviated from quarterly growth in employment in mainland Norway by 0.23 percentage point since 2006 (Table 3.2). The deviation was smaller in the period 2012-2016 than in the period 2006-2011. The mean deviations in Table 3.2 are minor and not statistically significant.

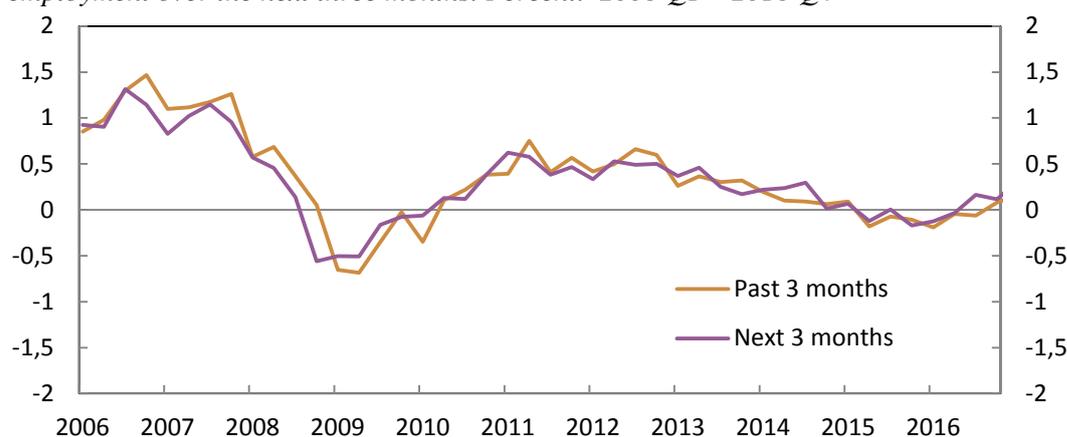
Table 3.2: Deviation between the RN series for growth in employment over the past three months and quarterly growth in employment in mainland Norway in the fifth release of the QNA. 2006 Q1 – 2016 Q4

	2006-2016	2006-2011	2012-2016
Mean absolute deviation	0.23	0.28	0.17
Mean deviation	0.02	0.06	-0.03

3.2. Expected growth in employment over the next three months

Contacts also estimate the change in employment over the next three months (Question 3.2 in Appendix A and Question 1.3 in Appendix B). The series for expected growth in employment over the next three months is closely related to the series for employment growth over the past three months (Chart 3.2).

Chart 3.2: RN series for growth in employment over the past three months and expected growth in employment over the next three months. Percent. 2006 Q1 – 2016 Q4



Source: Norges Bank

The RN expectations series is strongly correlated with employment growth in the QNA in the current and the next quarter (Table 3.3). The correlation between the RN expectations series and employment growth in the current quarter is the same as the correlation between employment growth and the RN series for employment growth over the past three months.

Table 3.3: Correlation coefficients for the RN series for expected growth in employment over the next three months compared with quarterly growth in employment in mainland Norway in the fifth release of the QNA. 2006 Q1 – 2016 Q4

RN vs QNA growth in the current quarter	0.84
RN vs QNA growth in the next quarter	0.83

The deviation between the RN expectations series and employment growth in the QNA is roughly the same for the current quarter and the next quarter over the period 2006-2016 as a whole (Table 3.4). The deviation is slightly greater for the next quarter than for the current quarter in the period 2006-2011. The mean deviations in Table 3.4 are minor and not statistically significant.

Table 3.4: Deviation between the RN series for expected growth in employment over the next three months and quarterly growth in employment in mainland Norway in the fifth release of the QNA. 2006 Q1 – 2016 Q4

Mean absolute deviation	2006-2016	2006-2011	2012-2016
RN vs QNA growth in the current quarter	0.19	0.23	0.13
RN vs QNA growth in the next quarter	0.22	0.32	0.11
Mean deviation	2006-2016	2006-2011	2012-2016
RN vs QNA growth in the current quarter	-0.02	-0.02	-0.03
RN vs QNA growth in the next quarter	-0.04	-0.05	-0.04

3.3. Comparison with other surveys

In this section, we look at whether the RN employment series provide better leading information about developments in employment than series for other business surveys. The results suggest that the RN employment series provide more accurate information about developments in employment than information from the PMI, the Business tendency survey and NHO's survey, while the RN and Epinion series provide almost equally good forecasts of movements in employment. We get better forecasts when combining information from the RN and Epinion series than when using either source on its own.

The NHO survey only contains quarterly data from 2010. A model analysis (not shown) indicates that the series in this survey have yielded somewhat poorer forecasts of employment growth than the series in RN.

Table 3.5 compares models for quarterly growth in employment in mainland Norway with series from the Rn, the PMI, the Business tendency survey and Epinion's survey as explanatory variables. The estimation period runs from the first quarter of 2006 to the fourth quarter of 2016. Models M1-M6 are constructed to forecast employment growth in the current quarter, while models M7-M8 are constructed to forecast employment growth in the next quarter.

Initial analysis revealed that an average of the series for actual and expected employment growth is better at explaining employment growth in the current quarter than the two series individually, in line with discussion above. Model M1 contains the average of the two series as the explanatory variable. The coefficients in the model do not support a hypothesis that the RN variable gives unbiased estimates of employment growth: the coefficients for the RN variable are significantly less than 1, and the intercept is significantly different from 0. The intercept become insignificant, however, if we impose that the coefficient for the RN series is equal to 1. The results therefore suggest that the RN variable gives unbiased estimates, in line with the results in Table 3.4, but that we obtain better estimates using model M1. This model fits much better than models where employment growth is determined (only) by employment growth in previous quarters.

Models M2 and M3 show that the employment sub-index in the PMI and the indicator for expected employment in the tendency survey give slightly weaker forecasts of employment growth in the current quarter than the RN series.

The Epinion survey measures Norwegian enterprises' expectations for their own workforce 12 months ahead. Model M4 shows that this expectations series has a clearly significant effect if included with a one-period delay. The model produces estimates of roughly the same quality as model M1. Model M5 includes all four series simultaneously. The RN and Epinion series have an almost significant effect when tested at a 10 percent level, while the effects of the indicators from the PMI and the tendency survey are far from significant.

Model M6 shows that the RN and Epinion series have a clearly significant effect when only these variables are included in a model.

Model M7 includes the RN employment expectations backdated one quarter and fits almost as well as the model that includes only the Epinion employment expectations series (M4). Model M8 shows that both variables have a clearly significant effect when included simultaneously in a model for employment growth.

Table 3.5: Models for quarterly growth in employment in mainland Norway. Percent. Fifth release of the QNA. T-values in parentheses. Estimation period between 2006 Q1 and 2016 Q4

Variable	M1	M2	M3	M4	M5	M6	M7	M8
Constant	0.09 (2.14)	-2.14 (-7.98)	-2.12 (-7.61)	-2.57 (-8.98)	-1.53 (-2.21)	-1.28 (-2.42)	0.08 (1.88)	-1.55 (-2.62)
Average of employment growth over the past three months and expected employment growth in the regional network	0.75 (10.40)				0.33 (1.63)	0.41 (2.79)		
Expected employment growth in the next quarter in the Business tendency survey. Diffusion index. Backdated one quarter		0.05 (9.33)			0.01 (0.32)			
Employment sub-index in the PMI. Diffusion index. Average of the first two months of the quarter			0.05 (8.91)		0.01 (0.45)			
Expected employment growth over the next 12 months in the Epinion survey. Net figures. Backdated one quarter				0.05 (10.24)	0.02 (1.71)	0.03 (2.59)		0.04 (2.77)
Expected employment growth over the next three months in the regional network. Backdated one quarter							0.77 (9.66)	0.34 (1.96)
Model evaluation								
Adjusted R ²	0.72	0.67	0.65	0.71	0.74	0.75	0.69	0.73
Standard deviation	0.22	0.24	0.25	0.22	0.21	0.21	0.23	0.22
Durbin-Watson	1.89	1.48	1.35	1.35	1.78	1.76	2.14	1.76

Note: The adjusted R² is the R² adjusted for degrees of freedom. The adjusted R² increases if a model is extended with an explanatory variable that has a coefficient with an absolute t-value greater than 1. The standard deviation decreases when the adjusted R² increases (and vice versa).

The analyses above suggest that better forecasts of growth in employment in the current and the next quarter can be obtained using models that include both the RN and Epinion series than from models that use only one of these surveys. The series from the Norwegian

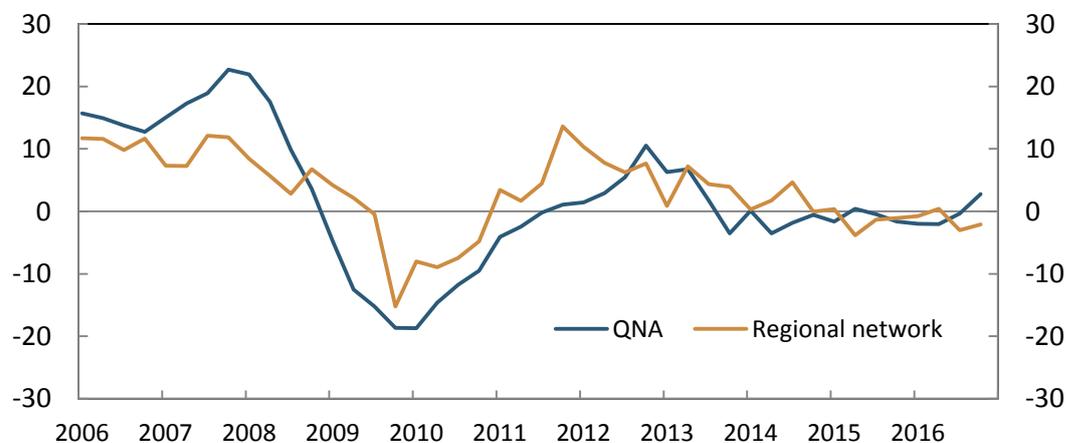
PMI and Statistics Norway’s Business tendency survey do not provide any material information about developments in employment over and above those captured by the RN and Epinion surveys.

4. Growth in investment

Since 2005, contacts have reported on their investment plans for the next 12 months compared to investments made during the previous 12-month period (Question 2.1 in Appendix A and Question 3.1 in Appendix B). Responses are categorised on a scale from -5 to +5, where -5 corresponds to a decrease in investment of around 50 percent or more, and +5 to an increase in investment of around 50 percent or more. We look only at investment in the private sector here.

There has been a relatively close correlation between investment plans in the regional network and gross fixed capital formation in the QNA since 2012 (Chart 4.1). Before that, however, the forecast errors were considerable. In the period 2006-2008, the RN series systematically underestimated gross fixed capital formation. After the financial crisis and until the summer of 2012, on the other hand, the RN series over-predicted gross fixed capital formation.

Chart 4.1: RN series for expected growth in business investment¹ and annual gross fixed capital formation in the QNA.² Percent. 2005 Q1 – 2016 Q4



¹Shows enterprises’ expectations one year earlier. Thus the last observation of the RN series in the chart is for 2015 Q4.

²The “annual” gross fixed capital formation in a quarter is the sum of gross fixed capital formation in the most recent four-quarter period compared with the sum of gross fixed capital formation in the four-quarter period before that. Thus the annual gross fixed capital formation in Q4 is the same as annual gross fixed capital formation for the year. We have used data from the final release of the QNA here, as real-time data are available only from 2011.

Sources: Statistics Norway and Norges Bank

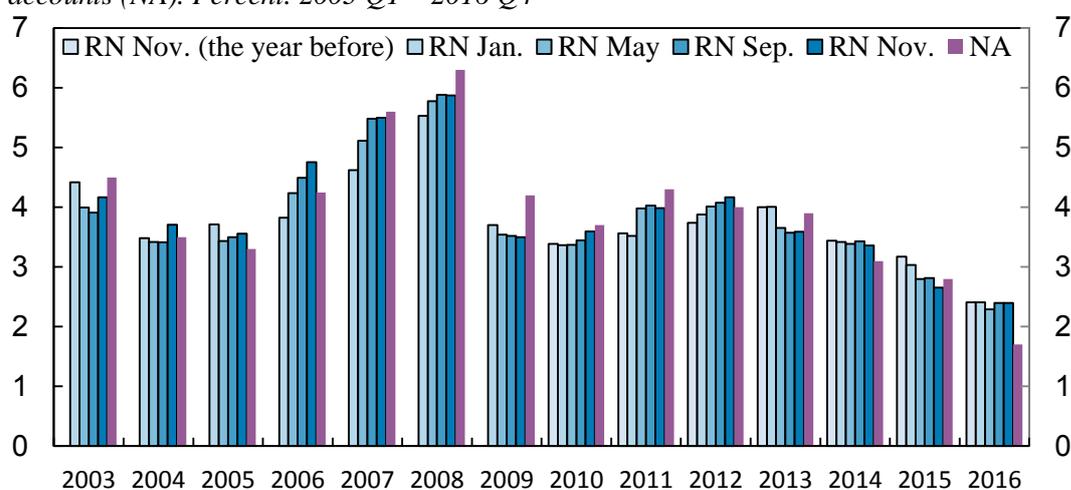
5. Growth in wages

Contacts are asked about expected annual wage growth in their own enterprise/organisation in the current calendar year (Question 4.1 in Appendix A and Question 2.1 in Appendix B). Since 2009, they have also been asked about expected annual wage growth in the next calendar year in the survey for the fourth quarter.

5.1. Estimates of annual wage growth

The regional network's estimates of annual growth in wages have captured annual wage growth as measured by Statistics Norway relatively well (Chart 5.1 and Table 5.1).

Chart 5.1: RN estimates of annual wage growth and growth in annual earnings in the national accounts (NA). Percent, 2003 Q1 – 2016 Q4



Sources: Statistics Norway and Norges Bank

The early estimates of annual wage growth given in November the previous year and January of the current year have been less accurate than the estimates made from May onwards (Table 5.1). This reflects that contacts know little about the outcome of the annual collective bargaining process the first times they are asked, while most pay talks are completed by May.

The deviation between estimated and actual wage growth was somewhat greater in the period 2003-2009 than in the period 2010-2015. This reflects the higher and more variable wage growth in the former period. On average, contacts slightly underestimated wage growth in the period 2003-2015.

Annual earnings growth in the national accounts ended up at 1.7 percent in 2016, well below the wage settlement norm of 2.4 percent. Enterprises in the regional network predicted wage growth in line with this norm from the end of 2015 to the end of 2016. The considerable deviation between the norm and actual wage growth last year reflects the much weaker employment growth in the oil service sector than elsewhere and pay levels

that are higher on average in that sector than in the rest of the economy. The regional network is not well-suited to capturing structural effects of this kind.

Table 5.1: Deviation between RN estimates of annual wage growth and figures for annual wage growth from Statistics Norway. Percentage points. 2003 Q1 – 2016 Q4

	Previous November ¹	January	May	September	November
Time period	Mean absolute deviation				
2003-2016	0.40 ²	0.41	0.30	0.31	0.32
2003-2009		0.45	0.34	0.33	0.36
2010-2015	0.35	0.32	0.20	0.21	0.22
2016	0.71	0.71	0.59	0.70	0.70
	Mean deviation				
2003-2016	0.03 ²	-0.16	-0.15	-0.08	-0.02
2003-2009		-0.34	-0.30	-0.21	-0.08
2010-2015	-0.08	-0.10	-0.10	-0.07	-0.07
2016	0.71	0.71	0.59	0.70	0.70

¹Estimates provided since the end of 2009.

²Average for the period 2010-2016.

5.2. Comparison with other surveys

Epinion conducts quarterly surveys in which economists, business leaders, employers organisations and trade unions estimate expected annual wage growth for the current and the next year. We compare the RN estimates with those from Epinion's survey for the same quarter.

The RN wage estimates have been roughly as good as those from economists and the social partners in Epinion's expectations survey (Table 5.2). The business leaders in Epinion's survey are asked the same questions as contacts in the regional network but generally deviate more.

Table 5.2: Mean absolute deviation between different surveys' estimates of annual wage growth and official figures for annual wage growth. 2003 Q1 – 2016 Q4

	Previous Q4 ¹	Q1	Q2	Q3	Q4
Regional network	0.40	0.41	0.30	0.31	0.32
Social partners	0.43	0.37	0.35	0.31	0.32
-Employer organisations	0.40	0.42	0.35	0.38	0.43
-Trade unions	0.53	0.35	0.38	0.28	0.27
Business leaders	0.50	0.83	0.80	0.74	0.78
Economists	0.36	0.37	0.35	0.35	0.42
-Economists in academia	0.37	0.41	0.37	0.40	0.40
-Economists in financial sector	0.40	0.33	0.35	0.30	0.40

¹Average for previous Q4 calculated for the period 2010-2016 only.

6. Conclusion

In this article, we have explored the regional network's quantitative accuracy in predicting output, employment, investment and wage growth. We conclude that accuracy is good for output, employment and wage growth, while the forecasts for business investment have been relatively good since 2012.

Our analyses indicate that the developments in output and employment reported by the network largely coincide with those reported in the QNA. Since information from the network is available two months earlier than the QNA, the network contributes valuable information about the current situation in the Norwegian economy. Enterprises' expectations for output and employment are clearly coloured by recent developments in these variables, but we find that these expectations series provide reliable information about near-term developments in output and employment. Our analyses also indicate that the RN output series are better leading indicators of mainland GDP growth in the current and the next quarter than house prices, equity prices and indicators from other business surveys. With regard to employment, we find that a combination of the employment series from the regional network and Epinion's expectations survey supplies better leading information about near-term developments in employment than the series from the two surveys individually.

Forecasts of wage growth from the regional network have proved to be good indicators of the official figures for annual wage growth and have been roughly as good as those from Epinion's expectations survey.

References

Brekke, H. and K. Halvorsen (2009): “Norges Bank’s regional network: fresh and useful information”, *Economic Bulletin* 2/2009, pp. 16-33, Norges Bank.

Ellingsen, J. (2017): “Relationship between nominal GDP and financial variables in OECD countries”, *Staff Memo* 2017/4, Norges Bank.

Gerdrup, K., R. Hammersland and B. Naug (2006): “Financial variables and developments in the real economy”, *Economic Bulletin* 3/2006, pp. 133-146, Norges Bank.

Kallum, J., M. Sjøtil and K. Haugland (2005): “Norges Bank’s regional network”, *Economic Bulletin* 3/2005, pp. 155-161, Norges Bank.

Martinsen, K. and F. Wulfsberg (2009): “Beregning av vektorer til Regionalt nettverk” [Calculation of weights for the regional network], *Staff Memo* 2009/11, Norges Bank.

Norges Bank (2015): “New sector classification and new weights in Norges Bank’s regional network”.

Appendices

A. Interview guide for the private sector

The points below outline the themes we primarily wish to discuss. We are interested in how actual developments compare with budget/expectations, and whether important driving forces behind these developments are specific to the enterprise or apply generally to the sector/region.

1. Demand and output (volume)

- 1.1. Developments in output over the past three months relative to the previous three-month period (seasonally adjusted)
 - 1.1.1. For manufacturing, as distributed between the export and domestic markets
 - 1.1.2. For services, as distributed between the business sector and households
- 1.2. Developments in new orders over the past three months relative to the previous three-month period (seasonally adjusted)
 - 1.2.1. For manufacturing, as distributed between the export and domestic markets
 - 1.2.2. For services, as distributed between the business sector and households
- 1.3. Outlook for output over the next six months
 - 1.3.1. Driving forces
- 1.4. Capacity: Will the enterprise find it difficult to meet a rise in demand?
 - 1.4.1. If so, why?

2. Investment

- 2.1. Investments made and plans for the next 12 months. Growth relative to the previous 12 months
- 2.2. Types of investment: what (capacity expansion, maintenance, rationalisation) and where (abroad or in Norway)?
- 2.3. If no investment, why? (low demand, low utilisation of fixed assets, insufficient/expensive capital, high costs)

3. Employment/labour market

- 3.1. Change in number of full-time equivalent employees over the past three months
- 3.2. Plans to reduce/increase employment over the next three months
- 3.3. Labour supply: Will labour supply be a constraint on output/turnover if there is a rise in demand?

4. Costs and prices

- 4.1. Annual wage growth in the enterprise/sector for the current calendar year. This includes carry-over from the previous year, pay increases in the current year and wage drift through the year. It also includes bonuses.
- 4.2. Changes in other important input costs
- 4.3. Changes in selling prices over the past 12 months

- 4.4. Expected price developments over the next 12 months
- 4.5. Driving forces behind price developments (changes in input costs, margins, the competitive situation)
- 4.6. Developments in profitability in terms of the operating margin (EBITDA relative to turnover) over the past three months relative to the same period last year

B. Interview guide for the public sector

Important themes will be employment growth, wage growth/formation and investment plans. We are interested in how actual developments compare with budget, and which driving forces are behind these developments.

The following are the themes we primarily wish to discuss with contacts in the public sector.

1. Activity levels/employment

- 1.1. Scope of operations (size of budget, full-time equivalent employees or similar)
- 1.2. Change in full-time equivalent employees over the past three months
- 1.3. Plans to reduce/increase the workforce over the next three months
- 1.4. Labour supply: Will labour supply be a constraint on increasing output?

2. Costs

- 2.1. Annual wage growth in the organisation for the current calendar year. This includes carry-over from the previous year, pay increases in the current year and wage drift through the year
- 2.2. Coverage of costs

3. Investment

- 3.1. Investments made over the past 12 months and plans for the next 12 months
- 3.2. Types of investment
- 3.3. Driving forces behind changes in investment levels (insufficient/expensive capital, population growth, etc.)