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DO MACROECONOMIC FORECASTS INFLUENCE FIRMS' EXPECTATIONS?

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ABSTRACT: The hypothesis that firms' output expectations are influenced by macroeconomic forecasts of the demand situation is tested using Finnish business survey data and ETLA's macroeconomic forecasts in the period 1976-1986. A time series of forecasts is formed using the principle that the forecasts have been available when output expectations have been made. Since output expectations deal with quarterly changes and the forecasts with annual changes, it is assumed that expectation of a quarterly output change may be affected by the forecast of change in a macroeconomic variable in the year in which the quarter is. The test of the influence of forecasts on expectations is made by regressing the aggregate shares of answers from the business survey on the forecast time series and past realized output change from the survey. The test is made for five different industries and using forecasts for several alternative macroeconomic variables. The results show that in most cases the relevant demand variables are positively correlated with the expectations. There is also signs of adaptivity in expectations formation, since past output change affects output expectations. The survey expectations show signs of asymmetry, since the shares of increase and decrease answers do not respond similarly to the forecasts.

KEY WORDS: Business survey, expectation formation, macroeconomic forecasting

1. Introduction

There has been much research on testing whether different directly observed expectations series conform to the hypothesis of rational expectations. In these studies the unbiasedness and efficiency of expectations is usually tested assuming the information set to consist of past forecast errors and/or past realized values of the variables to be forecasted. The actual information set of the economic agents would be very difficult to determine.

It is sometimes argued that publicly available macroeconomic forecasts may form an important part of the information set on which expectations are based. Kaufman and Woglom (1983), Peel et al. (1986), and Daub (1987), for example, have presented some arguments and anecdotal evidence supporting this view. In particular, macroeconomic forecasts are easily available, at no or very low cost. The forecasters are likely to known the "model" according to which the economy works better than individual consumers or firms, so that it is rational to base expectations on forecasts.

Peel et al. (1986) have found that published inflation forecasts affect stock prices, which gives indirect support to the hypothesis that forecasts affect expectations. Sometimes it is assumed a priori that this is the case and forecasts are used in econometric research as proxies for expectations. For example, Bond (1988) has used GDP forecasts as proxies for output expectations in a labour demand model. Interestingly, Wren-Lewis (1986) has used output expectations derived from a business survey in a fairly similar model. However, there seems to have been no research on testing whether forecasts and directly observable expectations are in fact correlated.

The purpose of this paper is to test with Finnish business survey data on output expectations and data on macroeconomic forecasts whether the survey expectations are affected by the macro forecasts. In Section 2 of the paper a theoretical relationship between macroeconomic variables and firm-level variables is derived. This shows the condition under which firm output is likely to be correlated with macroeconomic demand variables. In Section 3 the data and the testing strategy are explained. Particular attention is paid to the formation of a time series of forecasts that have been available when corresponding business surveys have been made. These forecasts and realized past output changes form the assumed information set of the firms. Section 4 presents empirical results on the impact of the macroeconomic forecasts on the aggregate shares of different answers in the business survey in five industries. The testing is done so that possible asymmetries in the survey responses can be handled. Section 5 concludes the paper.

2. The link from the macro level to the firm level

Let us consider at the theoretical level, how macroeconomic developments are reflected at the firm level. Demand theory is applied to justify a link from the macroeconomic variables to the micro level (this is developed in Ilmakunnas (1989b) in more detail).

Consider first the demand for consumer goods. If it is assumed that consumers use a stepwise decision process so that they first decide on consumption of large product groups, given their total income and the price indexes of these product groups. Within each large product group, consumers decide on consumption of narrower product groups, given the price indexes of these groups and the expenditure allocated to the large product group. Finally, consumers decide between fairly similar brands produced by different firms, given the prices charged by the firms and the expenditure allocated to the narrow group. Of course, there can be several stages in the decision process. The condition under which this decision process can be separated into different stages is weak separability of the consumers' preferences. The firm-level demand can be made a function of demand for the narrow product group, demand for a larger product group, total consumption, disposable income etc., and the relevant price variables. In addition, e.g. demographic variables or any other variables specific to the product in question can be added.

A firm's demand expectations can be affected by the forecasts available for some of the demand variables. Typically, forecasts are publicly available for the demand for fairly large product groups, for total consumption or for total disposable income. Demand forecasts for narrower product groups can be obtained from market researchers, but at a considerably higher price than the macroeconomic forecasts. For the purposes of this paper, the link from the macro level to the micro level can be illustrated using a log-difference form function for the firm-level demand for products in product group i

(1) $$Dln(q_i) = \alpha_i + \beta_i Dln(p_i/P_i) + \theta_i Dln(I_i)$$

where q_i is the firm's real sales in product group i, p_i is the firm's sales price in that product group, P_i is the product group's price index, and I_i is a real demand variable relevant for the product group, e.g.

real expenditure allocated to product group i. This form has been derived by Sato (1972) as an approximation from an additive utility function.

To obtain a relation between the firm's total real sales and a macroeconomic variable, the demand equations should be aggregated over the product groups. Let w_i denote the share of product group i in the nominal sales of the firm. Then $\Sigma_i w_i Dln(q_i) = Dln(q)$, the logarithmic change in the volume of total sales. In practice, when discrete time data is used and the variables are differences $Dln(q_i)=ln(q_{it})-ln(q_{i,t-1})$, the weights w_i are calculated e.g. as averages of the weights of two periods.

Denote the log-change in the price index of the firm's sales $Dln(p)=\Sigma_i w_i Dln(p_i)$ and the sales share weighted average of the log-changes of the product group price indexes $Dln(P^*)=\Sigma_i w_i Dln(P_i)$. If the shares of different product groups in total nominal consumption are w_i', the log-change in the volume of total consumption is $Dln(I)=\Sigma_i w_i' Dln(I_i)$ (by weighting the product group price indexes by w_i' instead of w_i, one would obtain the aggregate consumers' price index instead of P^*). When equation (1) is multiplied by w_i and summed over i, the resulting equation for the log-change in the volume of the firm's total sales is

$$(2) \quad Dln(Q) = \alpha^* + \beta^* Dln(p/P^*) + \theta^* Dln(I) + cov(\beta_i, Dln(p_i/P_i)) + cov(\theta_i, Dln(I_i)) + \Sigma_i (w_i - w_i')\theta_i Dln(I_i)$$

where $cov(\beta_i, Dln(p_i/P_i))=\Sigma_i w_i(\beta_i-\beta^*)(Dln(p_i/P_i)-Dln(p/P^*))$, $cov(\theta_i, Dln(I_i))=\Sigma_i w_i'(\theta_i-\theta^*)(Dln(I_i)-Dln(I))$, $\alpha^*=\Sigma_i w_i \alpha_i$, $\beta^*=\Sigma_i w_i \beta_i$ and $\theta^*=\Sigma_i w_i' \theta_i$.
This kind of decompositions are often used in aggregation theory (e.g. Vartia (1979), van Daal and Merkies (1984)). The covariance terms describe

the deviations of the product group price and income effects from the average. The last term takes into account the difference in the shares of the product groups in the sales of the firm and in total consumption.

The equation has interesting consequences for the way firms may forecast their sales with the help of macroeconomic variables. Assume a firm-level demand model is estimated, where change in total real sales is explained by the change in a macroeconomic variable. Alternatively, the "estimated model" can be a rule-of-thumb based relationship. In any case, estimating the model in this way causes an omitted variable bias if the covariances and the last term in (2) are not constants. If they are, they can be included in the constant term α^* of the equation. Alternatively, one could estimate separate product group demand models and obtain an estimate of the covariance terms from past data. However, the main idea in using the aggregate model rather than the disaggregate models (1) is that often it is difficult to obtain the necessary information for estimating the disaggregate models or for forecasting with them. If the covariances are not otherwise taken into account, one can, however, make judgmental adjustments to the constant term when forecasting with the model, for example when it is felt that demand is going to grow fastest in product groups with largest income elasticities θ_i. In this case the corresponding term in the covariance would be particularly large and a serious forecast error could be made if it were omitted. Also if the change in demand happens in product groups, where the firm's sales share deviates considerably from the expenditure shares of the consumers, an error is made unless some judgmental adjustment is applied to the model-based forecast. This kind of reasoning has been used by Pylkkänen and Vartia (1986) in the reverse case of aggregating micro equations for forecasting a macro variable.

Consider next the case of intermediate products, where firm-level demand equation can be derived from production theory. Assume that industry j uses the intermediate input produced by the firm. Again a stepwise decision process is assumed. In the first stage, the firms in industry j choose between intermediate inputs and the value added aggregate (capital and labor), given expected gross production and the price indexes of the materials and value added aggregates. In the next stage, a decision is made between different types of intermediate inputs, given total demand for intermediate inputs and the price indexes of the different types. There can be several other stages and in the last stage, a decision is made between fairly similar products produced by different firms in an industry. This decision process is possible under weak separability of input groups in the production technology.

The sales of a firm in a product group i to industry j can then be explained by industry j's total demand for some product groups, total demand for intermediate inputs, or gross production. However, often available forecasts for different industries' output refer to real value added rather than to gross production. Sometimes it is assumed that value added is in a fixed relationship to gross production and hence gross production can be replaced by value added. An alternative is to assume that demand equations are derived for total intermediate inputs and total value added as functions of gross production. The demand for the value added aggregate is solved for gross production as a function of value added. This is inserted in the demand for intermediate inputs, which now gives demand for intermediate inputs as a function of value added. There may, however, be some econometric probles involved in the estimation of this kind of equations, since value added is likely to be correlated with the error term of the resulting equation (see Ilmakunnas (1989b)).

A log-difference form demand equation is postulated. This can be justified by assuming a Cobb-Douglas technology in the industry j purchasing the intermediate inputs. Assuming for simplicity that only one type of product is produced and that the firm sells the production at the same price p to all industries, the firm-level demand equation is

$$(3) \qquad \mathrm{Dln}(q_j) = \alpha_j + \beta_j \mathrm{Dln}(p/P_j) + \theta_j \mathrm{Dln}(V_j)$$

where q_j is the firm's real sales in product group i to industry j, p is the price charged by the firm, P_j is industry j's value added deflator, and V_j is industry j's real value added.

The shares of different customer industries in the firm's total sales are denoted w_j and the corresponding industries' shares of total industrial value added are w_j'. Then the log-change in the volume of total sales of the firm is $\mathrm{Dln}(q)=\Sigma_j w_j \mathrm{Dln}(q_j)$, the log-change in the volume of total industrial value added is $\mathrm{Dln}(V)=\Sigma_j w_j' \mathrm{Dln}(V_j)$ and the sales share weighted average of the log-changes of the different industries' value added deflators is $\mathrm{Dln}(P^*)=\Sigma_j w_j \mathrm{Dln}(P_j)$. When equation (2) is multiplied by w_i and summed over i, the resulting log-change in the volume of the firm's total sales is

$$(4) \qquad Dln(Q) = \alpha^* + \beta^* Dln(p/P) + \theta^* Dln(V)$$
$$+ cov(\beta_j, Dln(p/P_j)) + cov(\theta_j, Dln(V_j)) + \Sigma_j (w_j - w_j')\theta_j Dln(V_j)$$

where $cov(\theta_j, Dln(V_j)) = \Sigma_j w_j'(\theta_j - \theta^*)(Dln(V_j) - Dln(V))$, $cov(\beta_j, Dln(p/P_j)) = \Sigma_j w_j(\beta_j - \beta^*)(Dln(p/P_j) - Dln(p/P^*))$, $\alpha^* = \Sigma_j w_j \alpha_j$, $\beta^* = \Sigma_j w_j \beta_j$ and $\theta^* = \Sigma_j w_j' \theta_j$. Now the last term describes the difference in the shares of different customer industries in the sales of the firm and in total industrial value added. Similar arguments as above can be used for justifying judgmental adjustments in forecasting, when model (4) has been estimated without the covariance terms.

The above demand models are based on some simple principles of demand theory. It is possible that many firms consider their future developments according to a "principle of analogy", i.e. they assume the firm's sales volume q to develop the same way as the whole industry's sales volume Q, or at least they know how well the firm's sales are correlated with the industry's sales. A forecasting model could therefore be

$$(5) \qquad Dln(q) = \alpha + \beta Dln(Q) \ .$$

If it is assumed that variations of inventories are small and random, the above models (2), (4) and (5) can be used as forecasting models for the firm's production instead of sales volume. Assuming further that changes in the industry value added approximate changes in gross production, the explanatory variable in (5) could be industry real value added.

For the firm's exports one could form similar demand models. The explanatory variables could be variables describing economic activity in the foreign countries, or according to the principle of analogy, the whole industry's exports. Of cource, the latter can also be interpreted as demand for exports by foreign countries from the industry under consideration.

Since log-differences approximate percentage changes when the changes are small, the above models can also be understood as relationships between percentage change of firm output and percentage change of the explanatory variables. Then macroeconomic forecasts, which are typically in the percentage change form, can be directly inserted in the models.

3. The testing strategy

If the kind of models derived above are used by firms, either explicitly or unconsciously, when they are forming their expectations, the expectations should be correlated with the forecasts for the explanatory variables of such models. This can be used as a basis for testing the influence of macroeconomic forecasts on expectations.

The expectations that are used here are from the business survey conducted by the Confederation of Finnish Industries. The survey is done four times a year in the middle of the last month of each quarter, i.e. in March, June, September and December. Since the answers are qualitative ("increase" (+), "no change", "decrease" (-)), one could either quantify them (e.g. Pesaran (1987)) or use the proportions of different answers or the balance figure, i.e. the difference of the shares of "increase" and "decrease" answers. Here both the balance and the "+" and "-" shares are used. In the calculation of the shares, the answers have been weighted by the annual turnover of the firm. The questions that are the most interesting for this study ask whether output in three months is expected to be larger, smaller or unchanged compared to the time of answering, and whether output in six months is expected to be larger, smaller or unchanged compared to expected output in three months. There is also a question on whether output at the time of answering is larger, smaller or unchanged compared to the situation three months ago. The limits of the "no change" category are defined as ± 2 percent. Especially in the short run the answers should perhaps be interpreted as output plans rather than expectations (cf. Rahiala and Teräsvirta (1988)). However, since output plans are based on expectations on future demand, it is not important to distinguish the two concepts here.

Denote the business survey answers DQ(i,t;j,t+k), which means survey answered during month i of year t, concerning the increase of output in the three month period ending in month j of year t+k; i,j= 3 (March), 6 (June), 9 (September), 12 (December), and k=0,1. The expectation horizon is 3 or 6 months. The case k=1 is possible only when i=9 and the horizon is 6 months or i=12 and the horizon is 3 or 6 months. When i=j and k=0, the survey answer refers to realized change in the previous three month period. A subscript "B", "+" or "-" is used in DQ to denote that the figure refers, respectively, to the balance, the share of "increase" answers and the share of "decrease" answers in the survey. The business survey data is available for five industry groups: food, beverage and tobacco industries, textile, garment and leather industries, forest industries, chemical industries, and metal and engineering industries, starting from the first quarter of 1976.

There are several available forecasts in Finland. Here the ones published by the Research Institute of the Finnish Economy (ETLA) are used. (For a recent study of the properties of ETLA's forecasts, see Ilmakunnas (1989a).) Before 1987, two forecasts were published annually, in May and November. Each time both the ongoing year and the following year were forecasted. Each year was hence forecasted four times. From 1987, four forecasts have been published annually, in March, June, September and December. To avoid difficulties caused by the change in the timing of the forecasts, only data from the period 1976-1986 is used.

The forecasts are denoted in the following way: let Z be a variable that is forecasted and DZ its annual percentage change. DZ(h,t-n;t+k) denotes a forecast of the change in Z made in month h of year t-n, concerning year t+k; h= 5 (May), 11 (November), n=0,1 and k=0,1. The case k=1 is possible only when n=0, since no forecasts are made two years ahead. Realized annual percentage changes are denoted DZ(t).

Consider which forecast has been available when each survey has been made. In the March survey the forecast from November of the previous year is available and in June the forecast from May is known. In September the May forecast is still the most recent one of ETLA's forecasts and in December the November forecast is part of the information the firms have. Since the expectations refer to quarters and the forecasts to years, such macro forecasts are selected that refer to the same year in which the quarter under consideration is. To make it apparent which forecast was available when a survey was made in month i, an index i is included in h and n, so that the forecasts are denoted $DZ(h_i, t-n_i; t+k)$. According to the above argument, the months when the relevant forecasts were released are $h_3=11$, $h_6=h_9=5$, $h_{12}=11$, and the years when these forecasts were made are $t-n_i$, where $n_3=1$, $n_6=n_9=n_{12}=0$.

There is one exception to the rule according to which the surveys and forecasts are related. Survey answers DQ(9,t;3,t+1) and DQ(12,t;3,t+1) refer to the period from December 15 of year t to March 15 of year t+1, so that there is a two week overlap in year t. It is assumed for simplicity that the only relevant macroeconomic forecasts possibly affecting these expectations are those concerning year t+1. In any case, the last two weeks of December include Christmas holidays, so that the actual number of days the firms are operating during the overlapping period is fairly small.

The testing strategy is to regress the survey answers on the relevant forecasts and some control variable, which represents other information the firms have had. By using only the forecasts made before the expectations were formed one avoids the difficulty that the forecasts themselves may be affected by business survey expectations. Teräsvirta (1986) describes a model where business survey data is used for forecasting the output the metal and engineering industries. This model is used by ETLA in the forecasting process, so that the firms' past expectations may indeed influence the forecasts.

There is evidence that in the Finnish business survey the shares of the "increase" and "decrease" answers behave asymmetrically over the business cycle (see Teräsvirta (1986); Rahiala and Teräsvirta (1988) study the behavior of output plans using qualitative micro data). In particular, it seems that the firms are more hesitant to answer "increase" than to answer "decrease". Therefore the share of the "decrease" answers is more sensitive to changing business conditions and it is probably a more reliable indicator of the influence of forecasts on expectations. The impact of forecasts on the business survey answers is therefore tested separately for the balance figure DQ^B, and for DQ^+ and DQ^-, the shares of the "+" and "-" answers, respectively.

To specify which macroeconomic forecasts are likely to be the ones that affect expectations in different industries, a two-step procedure is used. First some candidate variables are chosen by preliminary judgment which is based on the theoretical relationships outlined in Section 2. Then regressions are run to see whether realized quarterly changes reported in the business survey are in fact correlated with the realized changes in these macroeconomic variables in the years to which the quarters belong to. The quarterly time series of realizations from the business survey is regressed on a time series of the macroeconomic realizations which is formed by repeating each annual percentage change in the macro variable four times. The following models are estimated for each industry and for each of the variables Z that were chosen by preliminary judgment:

$$\begin{aligned} & DQ^B(i,t;i,t) = \alpha(i) + \beta DZ(t) + \epsilon(it) \\ (6)\quad & DQ^+(i,t;i,t) = \alpha(i) + \beta DZ(t) + \epsilon(it) \\ & DQ^-(i,t;i,t) = \alpha(i) + \beta DZ(t) + \epsilon(it) \\ & \qquad i=3,6,9,12, \quad t=1976,\dots,1986 \end{aligned}$$

The firms are requested to remove seasonal variation when answering to the survey. However, there is apparently some seasonality left so that it is advisable to use seasonal intercepts $\alpha(i)$ in the models.

Those variables that have a statistically significant slope coefficient in one of the models (6) are chosen as candidates for the test of the influence of forecasts on expectations. It is, of cource, possible that an industry's output during a year is correlated with the macroeconomic variables, but that the distribution of changes in output wihin the year is so uneven that no correlation is found between quarterly output changes and annual changes of the macro variables in the above models. On the other hand, as equations (2) and (4) show, it is possible that the composition of a firm's output differs from that of the whole industry, so that at the firm level there may be several firms for which at a given point of time the correlation between output and a macroeconomic variable is low or negative. In this case a negative covariance term in (2) or (4) outweights the positive demand effect. Aggregated over all firms in an industry, this may give insignificant slope coefficients in models (6), although in principle the average demand effect is positive for all firms (i.e., parameters θ^* are positive in (2) and (4)).

The realized change in output in the three months preceding the survey is also information that is available to the firms when they are forming their expectations. If there is an adaptive element in the formation of expectations, this realization should be correlated with the expectations. On the other hand, it is information that was not available to the forecasters, so that the variable should not be correlated with the forecasts. Hence the realization can be used as a control variable in the tests. Table 1 shows the different survey answers and the corresponding information set (forecasts and realizations).

=== Table 1 ===

The balance figure of realized output change is used as the control variable for the balance figure of expectations, the share of realized output increases for the share of expected output increases, and the share of realized decreases for the share of expected decreases. This reflects the view that there may be some persistence in pessimism or optimism, i.e. firms that expect a decrease in output have probably already experienced a decrease rather than an increase in output. Correspondingly, firms expecting an increase have probably already experienced increased output. Naturally, the aggregate shares conceal information on which firms are actually in each category.

The influence of forecasts on expectations is tested by regressing the quarterly time series of output expectations from the survey on a time series of macroeconomic forecasts which was formed from the forecasts relevant for each survey according to the principles outlined above. As an additional regressor is used the past realization from the survey. The following models are estimated for each industry, for each variable chosen from the models (6), and for both expectation horizons, 3 and 6 months:

$$
\begin{aligned}
& DQ^{B}(i,t;j,t+k) = \alpha(i) + \beta DZ(h_i,t-n_i;t+k) + \theta DQ^{B}(i,t;i,t) + \epsilon(it) \\
(7)\quad & DQ^{+}(i,t;j,t+k) = \alpha(i) + \beta DZ(h_i,t-n_i;t+k) + \theta DQ^{+}(i,t;i,t) + \epsilon(it) \\
& DQ^{-}(i,t;j,t+k) = \alpha(i) + \beta DZ(h_i,t-n_i;t+k) + \theta DQ^{-}(i,t;i,t) + \epsilon(it) \\
& \qquad i=3,6,9,12, \quad t=1976,\ldots,1986
\end{aligned}
$$

A statistically significant coefficient of the forecast variable DZ is interpreted as an influence of the forecast on output expectation. A significant coefficient of the past realization, on the other hand, is interpreted as evidence of adaptivity in the formation of expectations. Again the intercepts $\alpha(i)$ are allowed to vary seasonally.

4. Estimation results

Since the food etc. industries and textile etc. industries produce consumer goods, consumption was chosen as one macroeconomic variable that may influence these industries' output. Much of the forest industries' production goes to exports, so that a priori one could argue that domestic demand variables may not have much influence on output. Since part of the chemical industries' and metal and engineering industries' production goes to the other industries as intermediate inputs, industrial production is used as a candidate variable. For the metal etc. industries, also investment is used, because much of the production consists of the investment goods of the other sectors. In addition, GDP is used as a candidate variable for all industries. Finally, the principle of analogy suggests that for each industry that industry's output (real value added) and exports should be important variables.

Results from the estimation of models (6) for the realization series are shown in Table 2. In the food, chemical and metal industries the coefficients of the industry's exports were not significant, and in the forest industries, the coefficient of GDP was significant only in the equation for the realized "decrease" answers. Since no or only weak relationship was found between these macroeconomic realizations and business survey realizations, it is unlikely that corresponding macroeconomic forecasts would be correlated with the output expectations. Hence these variables in the industries mentioned will be dropped from further analysis. In all other cases the slope coefficients were significant and had expected signs: the coefficients were positive in the models for the balance figures and for the shares of the "increase" answers, and negative in the models for the shares of the "decrease" answers. There seems to be some asymmetry in the survey realizations in the sense that the coefficients of the same macroeconomic variable were not equal in the "increase" and "decrease" models. However, there is no systematic asymmetry into one direction. The low Durbin-Watson values in some cases may be caused by the peculiar nature of the explanatory variables, which always have the same value for four consecutive observations.

=== Table 2 ===

Table 3 shows the estimation results for models (7). In the food etc. industries only the consumption forecast seems to influence output expectations in the very short run, three months ahead. There is asymmetry in the response because the "increase" answers are positively related to the consumption forecast, whereas the "decrease" answers do not seem to respond to the macro forecasts. Also the balance figure has a positive relationship with the consumption forecast, which results from the effect of the optimistic answers. In the longer run, six months ahead, the forecasts do not seem to have any influence on the firms' expectations. Equality of the seasonal intercepts is clearly rejected, so that there is some seasonal patterns in the survey answers. Also seasonal slope coefficients $\beta(i)$ were tried, but equality of the slopes was accepted in all industries.

=== Table 3 ===

In the textile etc. industries all the forecasts, except consumption, have a statistically significant effect on the balance figure of output expectations in the three month horizon. However, they do not have a significant effect on the share of the "increase" answers. All of them, including consumption, have a negative effect on the share of the "decrease" answers. When demand conditions are expected to improve, the firms that have previously expected output to decrease perhaps respond by answering "no change" so that the share of decreases diminishes and the share of increases is not much affected. This confirms the views expressed above that the "decrease" answers are more sensitive to business cycle fluctuations. There is also an adaptive component in the expectations, since the coefficients of the past realization terms are positive and significantly different from zero.

In the three month horizon the macroeconomic forecasts have no influence on expectations in the forest industries, whereas the past realizations have. In the six month horizon, the conclusion reverses. Past realizations have now no effect, which is natural, since they are not from the immediately preceding quarter when the expectation horizon is two quarters. Forecasts of forest industry production and exports both have a positive effect on the balance figure and on the share of the "increase" answers, and a negative effect on the share of the "decrease" answers. This shows that there is much less asymmetry than in some of the other industries. The responses of the "decrease" answers are still slightly smaller than the responses of the "increase" answers. The balance figure shows the strongest response (largest coefficient) which is due to the combined effect of decreasing pessimism and increasing optimism when demand is forecasted to increase.

In the chemical industries the macroeconomic forecasts do not seem to have any significant influence on expectations in either expectation horizon. Also the impact of the past realizations seems small or nonexistent so that there is little adaptivity in the formation of expectations.

Finally, the results for the metal and engineering industries show that in the three month horizon only industrial production and metal etc. industry production forecasts have a positive and significant effect on the balance figure. In the six month horizon only the metal etc. industry production has a significant effect. The "increase" answers do not seem to react at all to the forecasts, whereas the share of the "decrease" answers reacts negatively to investment, industrial production and metal etc. industry production forecasts in both forecast horizons. There is again asymmetry in the expectations of the firms: pessimism decreases when demand is forecasted to increase, but there is no strong increase in open optimism. The significant coefficients of the past realizations show a strong adaptive element in the expectations as well. The significant seasonal intercepts show also some seasonal effects in the survey answers.

5. Conclusions

In general, the results are in line with the a priori considerations: a relationship is found between output expectations and forecasts for relevant demand variables (consumption, investment, industrial production). The relationship of expectations to the forecast of a "wider" demand variable, GDP, is weak, although realized GDP changes are correlated with the firms' realized output changes. The results also support the principle of analogy, since own industry's production forecasts seem to influence output expectations. There is some asymmetry in the survey responses so that in two of the five industries studied the negative answers decrease in good times, but the positive answers do not increase. In one industry the conclusion is the reverse, i.e. positive answers increase, but negative answers do not decrese when demand is forecasted to grow. In one industry both the optimists and pessimists respond to forecasts, and in one industry no impact of forecasts on expectations was found. Also the effect of past realized output change varies somewhat from one industry to another, but in general there seems to be a significant adaptive element present in expectation formation.

Admittedly, the results do not say that without doubt forecasts influence expectations. Another interpretation of the evidence is that the forecasters and the firms use partly the same information set. However, one could still treat the macroeconomic forecasts as an approximation to the true, but unknown information set of the firms. In either case, macroeconomic forecasts that are available when expectations are formed, could be used as control variables in rationality tests of directly observed expectations.

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Output expectation	Information set	
	Macroeconomic forecasts	Previous realization
Expectation horizon 3 months		
DQ(3,t;6,t)	DZ(11,t-1;t)	DQ(3,t;3,t)
DQ(6,t;9,t)	DZ(5,t;t)	DQ(6,t;6,t)
DQ(9,t;12,t)	DZ(5,t;t)	DQ(9,t;9,t)
DQ(12,t;3,t+1)	DZ(11,t;t+1)	DQ(12,t;12,t)
Expectation horizon 6 months		
DQ(3,t;9,t)	DZ(11,t-1;t)	DQ(3,t;3,t)
DQ(6,t;12,t)	DZ(5,t;t)	DQ(6,t;6,t)
DQ(9,t;3,t+1)	DZ(5,t;t+1)	DQ(9,t;9,t)
DQ(12,t;6,t+1)	DZ(11,t;t+1)	DQ(12,t;12,t)

Note:

DQ(i,t;j,t+k) = expectation formed during month i of year t concerning the change in output in the three month period ending in month i of year t+k.
DQ(i,t;i,t) = realized change in output in the three month period ending in month i of year t.
DZ(h_i,t-n_i;t+k) = forecast made in month h_i of year t-n_i concerning percentage change in variable Z in the year t+k.
3 = March, 5 = May, 6 = June, 9 = September, 11 = November, 12 = December.

Table 1: The information set of the firms

Food, beverage and tobacco industries: Realizations

Realizations DZ(t):	$DQ^B(i,t;i,t)$				$DQ^+(i,t;i,t)$				$DQ^-(i,t;i,t)$			
GDP	5.07*** (2.74)				2.56** (2.52)				-2.51** (-2.44)			
Food etc. ind. production		4.06*** (3.58)				2.14*** (3.45)				-1.93*** (-2.98)		
Consumption			6.81** (2.26)				2.83* (1.70)				-3.98** (-2.44)	
Food etc. ind. exports				-0.14 (-0.65)				-0.03 (-0.22)				0.12 (0.97)
F	10.50***	11.70***	9.97***	8.90***	9.72***	10.91***	8.98***	8.37***	7.86***	8.38***	7.87***	6.99***
R^2	0.50	0.55	0.47	0.41	0.48	0.53	0.43	0.39	0.43	0.47	0.43	0.36
DW	1.61	1.60	1.45	1.37	1.65	1.73	1.47	1.46	1.73	1.66	1.68	1.53
s	24.53	23.24	25.18	26.64	13.44	12.69	13.99	14.48	13.65	13.22	13.64	14.47

Textiles, garment and leather industries: Realizations

Realizations DZ(t):	$DQ^B(i,t;i,t)$				$DQ^+(i,t;i,t)$				$DQ^-(i,t;i,t)$			
GDP	5.69*** (4.01)				3.56*** (3.58)				-2.12*** (-3.43)			
Text. etc. ind. production		3.03*** (5.28)				1.88*** (4.58)				-1.15*** (-4.49)		
Consumption			5.63*** (2.26)				3.43* (1.99)				-2.20** (-2.09)	
Text. etc. ind. exports				1.03*** (3.53)				0.66*** (3.26)				-0.37*** (-2.93)
F	0.52	0.63	0.42	0.48	0.41	0.47	0.34	0.39	0.51	0.59	0.44	0.48
R^2	0.28	0.40	0.11	0.23	0.23	0.33	0.09	0.20	0.22	0.32	0.09	0.17
DW	1.18	1.28	0.96	0.83	0.91	0.93	0.76	0.70	1.73	1.93	1.50	1.37
s	18.81	17.14	20.89	19.42	13.18	12.30	14.39	13.45	8.20	7.63	8.83	8.46

Forest industries: Realizations

Realizations DZ(t):	$DQ^B(i,t;i,t)$			$DQ^+(i,t;i,t)$			$DQ^-(i,t;i,t)$		
GDP	1.57 (0.77)			-0.36 (-0.29)			-1.93** (-2.03)		
Forest ind. production		3.14*** (7.65)			1.64*** (5.80)			-1.49*** (-7.42)	
Forest ind. exports			1.93*** (4.86)			1.25*** (5.49)			-0.69*** (-3.19)
F	0.60	1.51	0.95	0.76	1.44	1.37	0.45	0.98	0.51
R^2	0.01	0.58	0.36	0.002	0.44	0.42	0.09	0.57	0.19
DW	0.91	1.68	1.15	0.95	1.43	1.37	1.04	1.76	1.03
s	27.16	17.68	21.88	16.36	12.21	12.50	12.60	8.69	11.85

Chemical industries: Realizations

Realizations DZ(t):	$DQ^B(i,t;i,t)$				$DQ^+(i,t;i,t)$				$DQ^-(i,t;i,t)$			
GDP	5.23** (2.65)				2.41* (1.94)				-2.82** (-2.32)			
Industrial production		3.99*** (3.12)				2.00** (2.47)				-2.00** (-2.49)		
Chem. ind. production			3.51*** (3.56)				2.11*** (3.51)				-1.40** (-2.16)	
Chem. ind. exports				-0.03 (-0.13)				0.07 (0.49)				0.10 (0.71)
F	1.42	1.51	1.60	1.20	0.98	1.03	1.18	0.90	0.85	0.86	0.83	0.76
R^2	0.14	0.19	0.23	0.0004	0.08	0.13	0.23	0.01	0.11	0.13	0.10	0.01
DW	2.28	2.48	2.62	2.01	1.61	1.75	2.10	1.58	2.05	2.11	1.96	1.80
s	26.12	25.43	24.74	28.22	16.48	16.07	15.12	17.15	16.10	15.97	16.23	17.01

Metal and engineering industries: Realizations

Realizations DZ(t):	$DQ^B(i,t;i,t)$					$DQ^+(i,t;i,t)$					$DQ^-(i,t;i,t)$				
GDP	7.59*** (6.80)					4.29*** (5.91)					-3.30*** (-4.58)				
Industrial production		5.21*** (7.27)					3.15*** (7.24)					-2.06*** (-4.15)			
Metal etc. ind. production			3.08*** (6.47)					1.57*** (4.77)					-1.51*** (-5.33)		
Investment				2.21*** (4.36)					0.99*** (2.93)					-1.22*** (-4.47)	
Metal etc. ind. exports					-1.00 (-1.64)					-0.84** (-2.34)					0.16 (0.47)
F	7.04***	7.58***	6.68***	4.79***	3.44**	4.85***	6.00***	4.05**	3.12**	2.92**	4.38***	4.11**	4.93***	4.31***	2.87*
R^2	0.63	0.66	0.61	0.46	0.25	0.56	0.64	0.47	0.32	0.27	0.47	0.43	0.53	0.46	0.18
DW	0.93	0.89	0.92	0.65	0.44	0.96	1.10	0.79	0.53	0.48	0.81	0.72	0.94	0.91	0.58
s	14.78	14.24	15.18	17.92	21.15	9.61	8.64	10.51	11.98	12.39	9.56	9.87	9.02	9.64	11.82

Note:

- Constant term and coefficients of seasonal dummy variables not reported.
- t-values in parentheses.
- *** significant at 1% level, ** significant at 5% level, * significant at 10 % level.
- F = F(3,n-3) statistic for testing whether the coefficients of three seasonal dummy variables are zeros; when rejected at 5% level, the estimates shown are from a model with the dummies, otherwise from a model without them.
- n = 44
- DW = Durbin-Watson statistic.
- s = residual standard error.

Table 2: Survey realizations regressed on macroeconomic realizations

Food, beverage and tobacco industries: Expectation horizon 3 months

Forecasts $DZ(h_i,t-n_i;t+k)$:	$DQ^{B}(i,t;j,t+k)$			$DQ^{+}(i,t;j,t+k)$			$DQ^{-}(i,t;j;t+k)$		
GDP	1.38			1.95*			0.68		
	(0.80)			(1.74)			(0.76)		
Food etc. ind. production		1.88			1.09			-0.64	
		(1.18)			(1.05)			(-0.75)	
Consumption			3.47*			2.81**			-0.45
			(1.70)			(2.14)			(-0.41)
Realizations:									
$DQ^{B}(i,t;i,t)$	-0.23**	-0.23**	-0.24**						
	(-2.33)	(-2.41)	(-2.56)						
$DQ^{+}(i,t;i,t)$				-0.30**	-0.27**	-0.28**			
				(-2.60)	(-2.34)	(-2.55)			
$DQ^{-}(i,t;i,t)$							-0.07	-0.10	-0.09
							(-0.76)	(-1.08)	(-1.02)
F	30.61***	29.83***	32.53***	17.73***	16.62***	18.56***	36.21***	34.36***	35.85***
R^2	0.74	0.74	0.75	0.64	0.63	0.66	0.75	0.75	0.75
DW	1.80	1.79	1.88	2.22	2.12	2.28	1.86	1.86	1.88
s	15.53	15.53	15.09	9.89	10.16	9.70	8.24	8.35	8.28

Food, beverage and tobacco industries: Expectation horizon 6 months

Forecasts $DZ(h_i,t-n_i;t+k)$:	$DQ^{B}(i,t;j,t+k)$			$DQ^{+}(i,t;j,t+k)$			$DQ^{-}(i,t;j;t+k)$		
GDP	-0.67			0.43			0.79		
	(-0.30)			(0.29)			(0.65)		
Food etc. ind. production		-1.19			0.30			1.37	
		(-0.58)			(0.22)			(1.27)	
Consumption			-0.44			1.04			1.17
			(-0.16)			(0.57)			(0.78)
Realizations:									
$DQ^{B}(i,t;i,t)$	0.11	0.12	0.11						
	(1.03)	(1.07)	(0.99)						
$DQ^{+}(i,t;i,t)$				0.09	0.11	0.08			
				(0.64)	(0.81)	(0.62)			
$DQ^{-}(i,t;i,t)$							0.02	0.05	0.02
							(0.17)	(0.46)	(0.18)
F	20.99***	20.78***	20.78***	14.33***	14.07***	14.50***	13.51***	15.60***	13.27***
R^2	0.63	0.63	0.63	0.53	0.53	0.53	0.53	0.57	0.53
DW	2.83	2.83	2.82	2.55	2.65	2.55	2.32	2.43	2.34
s	17.74	17.91	17.76	11.72	11.69	11.68	9.85	9.49	9.82

Textiles, garment and leather industries: Expectation horizon 3 months

Forecasts $DZ(h_i,t-n_i;t+k)$:	$DQ^{B}(i,t;j,t+k)$				$DQ^{+}(i,t;j,t+k)$				$DQ^{-}(i,t;j,t+k)$			
GDP	3.82*				0.38				-3.59***			
	(2.00)				(0.32)				(-4.25)			
Text. etc. ind. production		2.05**				0.63				-1.52***		
		(2.54)				(1.29)				(-3.37)		
Consumption			1.98				-0.39				-2.68**	
			(0.87)				(-0.29)				(-2.33)	
Text. etc. ind. exports				1.61**				0.95*				-0.72*
				(2.16)				(2.11)				(-1.92)
Realizations:												
$DQ^{B}(i,t;i,t)$	0.43***	0.48***	0.52***	0.46*								
	(3.44)	(4.22)	(4.36)	(1.97)								
$DQ^{+}(i,t;i,t)$					0.47***	0.48***	0.49***	0.21				
					(4.10)	(4.78)	(4.65)	(0.99)				
$DQ^{-}(i,t;i,t)$									0.31**	0.36**	0.43**	0.77***
									(2.27)	(2.41)	(2.90)	(2.81)
F	2.24*	1.51	2.19	0.60	0.71	0.54	0.72	0.22	4.37***	2.63*	3.46**	1.24
R^2	0.40	0.47	0.35	0.46	0.35	0.44	0.35	0.33	0.56	0.39	0.43	0.51
DW	1.97	2.22	2.12	1.64	2.11	2.42	2.17	1.69	1.92	2.17	1.95	2.02
s	16.21	15.03	16.83	16.30	10.17	9.27	10.17	9.89	7.39	8.47	8.39	8.36

Textiles, garment and leather industries: Expectation horizon 6 months

Forecasts $DZ(h_i,t-n_i;t+k)$:	$DQ^{B}(i,t;j,t+k)$				$DQ^{+}(i,t;j,t+k)$				$DQ^{-}(i,t;j,t+k)$			
GDP	6.64***				1.82*				-5.16***			
	(3.96)				(1.86)				(-4.90)			
Text. etc. ind. production		1.67*				0.23				-1.66***		
		(1.85)				(0.47)				(-2.75)		
Consumption			4.33				0.25				-4.60***	
			(1.98)				(0.21)				(-3.14)	
Text. etc. ind. exports				0.89				0.25				-0.72
				(1.11)				(0.72)				(-1.23)
Realizations:												
$DQ^{B}(i,t;i,t)$	0.32***	0.43***	0.44***	0.44*								
	(3.31)	(3.99)	(4.26)	(2.11)								
$DQ^{+}(i,t;i,t)$					0.30***	0.36***	0.36***	0.18				
					(3.60)	(4.34)	(4.51)	(1.32)				
$DQ^{-}(i,t;i,t)$									0.22	0.31*	0.30*	0.52
									(1.49)	(1.82)	(1.82)	(1.43)
F	1.03	1.47	1.01	0.26	1.02	1.34	1.13	0.94	0.87	1.05	0.71	0.83
R^2	0.52	0.39	0.40	0.30	0.39	0.35	0.34	0.14	0.46	0.27	0.30	0.22
DW	1.92	1.60	1.78	1.65	1.81	1.80	1.87	1.17	1.98	1.34	1.59	1.69
s	12.82	14.64	14.41	15.65	7.48	7.83	7.79	6.91	8.37	9.79	9.47	11.42

Note: n = 44 (in the model where textile etc. industry exports forecast is included, n = 19).
For other explanations, see Table 2.

Table 3: Survey expectations regressed on macroeconomic forecasts and past survey realizations

Forest industries: Expectation horizon 3 months

Forecasts $DZ(h_i,t-n_i;t+k)$:	$DQ^{B}(i,t;j,t+k)$		$DQ^{+}(i,t;j,t+k)$		$DQ^{-}(i,t;j,t+k)$	
Forest ind. production	1.27		0.75		-0.43	
	(1.58)		(1.52)		(-1.02)	
Forest ind. exports		0.49		0.42		-0.14
		(0.86)		(1.17)		(-0.49)
Realizations:						
$DQ^{B}(i,t;i,t)$	0.29**	0.35***				
	(2.15)	(2.77)				
$DQ^{+}(i,t;i,t)$			0.13	0.16		
			(0.93)	(1.17)		
$DQ^{-}(i,t;i,t)$					0.58***	0.63***
					(4.08)	(4.70)
F	1.11	1.12	0.71	0.86	1.30	1.30
R^2	0.29	0.26	0.15	0.13	0.41	0.40
DW	1.74	1.75	1.89	1.91	1.85	1.86
s	19.02	19.42	11.70	11.83	10.65	10.75

Forest industries: Expectation horizon 6 months

Forecasts $DZ(h_i,t-n_i;t+k)$:	$DQ^{B}(i,t;j,t+k)$		$DQ^{+}(i,t;j,t+k)$		$DQ^{-}(i,t;j,t+k)$	
Forest ind. production	3.05***		1.86***		-1.17***	
	(3.96)		(3.35)		(-3.12)	
Forest ind. exports		2.42***		1.60***		-0.88***
		(4.30)		(4.05)		(-3.22)
Realizations:						
$DQ^{B}(i,t;i,t)$	-0.0001	0.02				
	(-0.001)	(0.15)				
$DQ^{+}(i,t;i,t)$			-0.03	-0.05		
			(-0.22)	(-0.33)		
$DQ^{-}(i,t;i,t)$					0.07	0.11
					(0.58)	(0.96)
F	2.86**	5.06***	2.37*	4.66***	2.12	3.06**
R^2	0.46	0.48	0.30	0.46	0.25	0.35
DW	1.84	2.04	1.89	1.91	1.90	1.69
s	17.96	17.51	12.25	11.10	9.77	9.44

Chemical industries: Expectation horizon 3 months

Forecasts $DZ(h_i,t-n_i;t+k)$:	$DQ^{B}(i,t;j,t+k)$			$DQ^{+}(i,t;j,t+k)$			$DQ^{-}(i,t;j,t+k)$		
GDP	2.09			-0.92			-1.82		
	(0.62)			(-0.45)			(-1.02)		
Industrial production		1.85			0.19			-1.11	
		(0.79)			(0.13)			(-0.88)	
Chem. ind. production			2.13			1.36			-0.12
			(1.40)			(1.38)			(-0.15)
Realizations:									
$DQ^{B}(i,t;i,t)$	-0.32*	-0.32*	-0.35**						
	(-1.86)	(-1.89)	(-2.07)						
$DQ^{+}(i,t;i,t)$				0.04	0.02	-0.08			
				(0.20)	(0.11)	(-0.44)			
$DQ^{-}(i,t;i,t)$							-0.23	-0.21	-0.15
							(-1.51)	(-1.42)	(-1.02)
F	1.68	1.74	2.40	1.97	1.92	2.42*	1.53	1.57	1.79
R^2	0.08	0.08	0.11	0.01	0.001	0.05	0.06	0.05	0.03
DW	2.35	2.37	2.47	2.23	2.19	2.21	2.42	2.43	2.51
s	29.83	29.75	29.29	18.95	19.00	18.68	15.72	15.77	15.96

Chemical industries: Expectation horizon 6 months

Forecasts $DZ(h_i,t-n_i;t+k)$:	$DQ^{B}(i,t;j,t+k)$			$DQ^{+}(i,t;j,t+k)$			$DQ^{-}(i,t;j,t+k)$		
GDP	-1.54			-2.51			-0.87		
	(-0.50)			(-1.36)			(-0.50)		
Industrial production		-1.03			-1.80			-0.73	
		(-0.46)			(-1.34)			(-0.57)	
Chem. ind. production			0.82			1.26			0.73
			(0.52)			(1.26)			(0.83)
Realizations:									
$DQ^{B}(i,t;i,t)$	0.09	0.08	0.06						
	(0.61)	(0.59)	(0.39)						
$DQ^{+}(i,t;i,t)$				0.28*	0.27*	0.20			
				(1.99)	(1.96)	(1.39)			
$DQ^{-}(i,t;i,t)$							0.05	0.05	0.09
							(0.36)	(0.36)	(0.66)
F	1.39	1.44	1.40	1.12	1.14	1.03	1.66	1.62	1.71
R^2	0.01	0.01	0.01	0.11	0.11	0.11	0.01	0.02	0.03
DW	2.77	2.77	2.86	2.26	2.29	2.40	2.41	2.42	2.37
s	25.00	25.00	25.24	15.43	15.44	15.65	14.10	14.09	14.18

Metal and engineering industries: Expectation horizon 3 months

	$DQ^{B}(i,t;j,t+k)$				$DQ^{+}(i,t;j,t+k)$				$DQ^{-}(i,t;j,t+k)$			
Forecasts $DZ(h_i,t-n_i;t+k)$:												
GDP	0.99 (0.82)				0.07 (0.10)				-1.20 (-1.46)			
Industrial production		1.47* (1.75)				0.32 (0.70)				-1.30** (-2.25)		
Metal etc. ind. production			1.01** (2.29)				0.09 (0.35)				-0.98*** (-3.35)	
Investment				0.46 (0.84)				-0.15 (-0.54)				-0.70** (-2.08)
Realizations:												
$DQ^{B}(i,t;i,t)$	0.76*** (9.11)	0.73*** (9.16)	0.71*** (8.75)	0.74*** (7.51)								
$DQ^{+}(i,t;i,t)$					0.70*** (9.39)	0.68*** (9.46)	0.69*** (9.58)	0.73*** (8.77)				
$DQ^{-}(i,t;i,t)$									0.75*** (7.17)	0.73*** (7.21)	0.67*** (6.79)	0.68*** (6.01)
F	51.52***	52.76***	53.69***	48.77***	45.86***	45.48***	45.65***	46.84***	27.51***	28.48***	30.75***	27.19***
R^2	0.84	0.85	0.85	0.84	0.83	0.84	0.83	0.84	0.74	0.76	0.79	0.75
DW	2.36	2.34	2.31	2.33	2.39	2.36	2.38	2.44	2.03	2.05	2.00	1.98
s	10.30	10.00	9.74	10.30	5.37	5.33	5.36	5.35	7.54	7.28	6.81	7.34

Metal and engineering industries: Expectation horizon 6 months

	$DQ^{B}(i,t;j,t+k)$				$DQ^{+}(i,t;j,t+k)$				$DQ^{-}(i,t;j,t+k)$			
Forecasts $DZ(h_i,t-n_i;t+k)$:												
GDP	-1.22 (-0.71)				-0.95 (-1.03)				-1.41 (-1.34)			
Industrial production		0.31 (0.24)				-0.10 (-0.15)				-1.65** (-2.23)		
Metal etc. ind. production			1.18* (1.80)				0.04 (0.11)				-1.25*** (-3.40)	
Investment				0.99 (1.33)				-0.02 (-0.04)				-1.16*** (-2.90)
Realizations:												
$DQ^{B}(i,t;i,t)$	0.68*** (7.11)	0.66*** (6.85)	0.51*** (4.64)	0.53*** (4.55)								
$DQ^{+}(i,t;i,t)$					0.27*** (2.92)	0.24** (2.53)	0.23** (2.30)	0.23** (2.25)				
$DQ^{-}(i,t;i,t)$									0.87*** (8.09)	0.86*** (8.25)	0.76*** (7.29)	0.79*** (7.41)
F	2.33*	2.73*	3.23**	3.13**	5.63***	5.73***	5.99***	5.51***	0.81	1.15	1.35	1.49
R^2	0.56	0.55	0.66	0.64	0.47	0.46	0.46	0.46	0.65	0.65	0.70	0.68
DW	1.30	1.36	1.06	1.10	1.47	1.45	1.44	1.44	1.12	1.27	1.22	1.41
s	14.07	14.14	12.91	13.15	7.01	7.10	7.11	7.11	8.81	8.50	7.95	8.20

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