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EXPERIENCES WITH A SHORT-TERM PRICE-INCOME POLICY MODEL*

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I. Introduction

The income settlements in Norway are strongly centralized and coordinated. Typically, bi-annual negotiations on wage rates between the organisations of the employers and the employees take place simultaneously with the negotiations between the Government and the organisations of the farmers and the fishermen on prices and subsidies.[1] A price-income model, called PRIM I, was presented as part of a report from an expert group who provided background material for the 1966 wage and income negotiations. The model has been used in connection with the income settlements in 1966, 1968 and 1970.

II. Main features of the model[2]

The model is primarily designed to bring the negotiating parties in a better position to anticipate the short-term consequences for prices and for the income distribution of alternative results of an income settlement. Therefore, wage rates, agricultural prices, and subsidies to agriculture and to fisheries are among the exogenous variables of the model, and the consumer price index, the nominal wage bill and profits (entrepreneurial incomes) are among the endogenous variables.

Reflecting the open-ness of the Norwegian economy an important distinction in the model is between sheltered and exposed industries. The sheltered industries are grouped into two broad sectors of production and the exposed industries into four, so that the model has altogether six sectors of production:

1. Agriculture	Sheltered industries
2. Other Sheltered Industries	
3. Import-Competing Industries	Exposed industries
4. Fisheries	
5. Shipping	
6. Other Export-Oriented Industries	

1) In Norway agriculture is heavily protected and subsidized.

2) The model is not discussed in any detail here. For a complete description of the model, including a formal presentation, see Odd Aukrust, "A Model of the Price and Income Distribution Mechanism of an Open Economy", Review of Income and Wealth, series 16 number 1, March 1970. See also Fritz Holte, "A Model for Estimating the Consequences of an Income Settlement", Economics of Planning, Vol. 8, No 1-2, 1968.

Different price hypoteses are postulated for each of these groups:

The exposed industries sell most of their products abroad, or on the domestic market under strong foreign competition (Import-Competing Industries). For the sectors Fisheries, Shipping and Other Export-Oriented Industries the model assumes prices of output to be determined in the world market; therefore, the prices of output from these industries are taken as exogenously given. For the sector Import-Competing Industries it is assumed that enterprises adjust their output prices in proportion to prices of comparable imported products; the import prices are taken to be exogenously given. It follows from the assumptions made about the price behaviour of the exposed industries that the profits (enterpreneurial incomes) in these sectors are determined as the difference between the value of output at exogenously given prices and the sum of all costs.

The sheltered industries, in contrast, operate largely in the home market. Hence, they can set output prices relatively independent of foreign competition. As already mentioned, the output price index of Agriculture is treated in PRIM I as an exogenous variable determined outside the model through negotiations between the farmers and the Government. Output prices of the sector Other Sheltered Industries are endogenous in the model. The model assumes enterprises in this group to adjust output prices to changes in costs in such a way that, for the group as a whole, the ratio of profits to factor income (= wages + profits) is left unaffected. This is a key assumption of the model. Its justification are annual data for the period 1952-1969, showing that the ratio of profits to factor income in Other Sheltered Industries has in fact remained remarkably stable in the past, apart from a rather weak trend due to an increase in the relative number of wage-earners in relation to self-employed.

The description of the price mechanism in Other Sheltered Industries shows that the model in this case is of the cost push type in that it explains the output price entirely in terms of costs with no reference to demand.

The price propagation process which follows from the fact that higher output prices of one sector means higher input prices, i.e. higher costs, in others, is studied in PRIM I through an input-output technique. The assumptions are that input-output (volume) coefficients are constant,

and that changes in input prices are always proportional for all deliveries from an industry irrespective of their uses.

Since PRIM I is designed for the study of prices and incomes rather than quantities, and for the sake of simplicity, the model ignores volume variables whenever possible. However, some volume variables have a direct bearing on prices and/or incomes and must accordingly be considered even in a simplified model (e.g. employment, labour productivity, and volume of depreciation by industries). All these variables are treated as exogenously given. It follows that the model recognices no feed-back effect from prices/incomes to quantities. For instance, the model contains no demand equations; instead it simply assumes that sufficient demand for the products of each industry (as determined by employment and productivity) will allways be forthcoming at the prices stipulated or determined by the model.[3] It also ignores the possibility that the exposed industries restrict production because of low profitability. Clearly, the assumptions made about volumes narrow the range of alternatives for wage rates which can be fruitfully studied by the model.

PRIM I may be looked upon as a mini-version of the price submodel of a more general model known as MODIS III. MODIS III was constructed by the Central Bureau of Statistics mainly for short-term national budgeting purposes. The core of this model is an input-output model of production combined with a set of consumption functions. The model contains volume, price and income variables.[4] The main difference between PRIM and the price sub-model of MODIS is that while, in the latter, industries are classified in about 150 sectors, there are, as earlier mentioned, only 6 sectors in PRIM. The hypotheses about prices in the two models are, however, very similar.

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3) The assumption of constant profit share of factor income in the sector Other Sheltered Industries depends on this condition.

4) For a description of the model, see Olav Bjerkholt, "A precise description of the equation system of the economic model MODIS III", Economics of planning, Vol. 8, no 1-2, 1968.

III. Some implications for price and income policy

If PRIM is accepted as a reasonably accurate description of the price and income distribution mechanism in the short run, there are certain interesting implications for an income policy. We shall note three of these.

First, as regards the goals of an income policy: The price level and the various income shares are shown to depend in a complex manner on a large number of variables that are exogenous to the model (e.g. labour productivities in individual industries, world market prices, and the outcomes of the income settlement). In general, it is not possible through the variables which are set in the income settlements, given the move in the other exogenous variables, to ensure at the same time a stable price level and a desired distribution of incomes.

Secondly, there is no assurance that a policy causing wages to rise in steps with average productivity will result automatically in stable prices: Such a policy will lead to a falling, stable or increasing national price level depending on what happens simutaneously to the other exogenous variables of the model.

Thirdly, as regards the way in which the conflict of interests in the struggle for income shares is described by the model: Farmers can increase their share of national income through demanding higher agricultural prices and more subsidies while wage-earners can increase their share of the national income through pushing up wage rates. The latter, however, according to the model, will cause a proportionate increase in the profits of enterprises in the Other Sheltered Industries via price adjustments. There remains the group of owners of enterprises in the exposed industries, which is the only group with a strong motive for opposing the price and wage claims of others. Thus, according to the model the struggle for income shares is not primarily a confrontation between farmers, wage-earners and employers, but a struggle between (i) the farmers, (ii) the wage-earners and the owners of enterprices in the sheltered industries outside agriculture, and (iii) the owners of enterprises in the exposed industries.

IV. The use of the model in connection with the income settlements

PRIM I was used for the first time in connection with the 1966 negotiations and it was used again before the subsequent negotiations in 1968 and 1970. Different sets of forcasts were made, each set relating to one particular possible combination of changes in the wage rates and the agricultural prices. These alternative forecasts were intended to bring the negotiating parties in a better position to anticipate the short-run consequences for prices and the income distribution of the possible outcomes of their negotiations in terms of changes in wage rates and agricultural prices.

In 1966 the forecasts were made by a group of independent Government appointed experts. In 1968 and 1970 the background material for the income settlements was provided by a committee with representatives from the labour unions, the farmers', the fishermen's and the employers' organisations and from the Government, together with non-partisan experts. This organisational change was done to let the negotiating parties have influence on the assumptions to be made about expected changes in the exogenous variables not directly determined by the income settlement (productivity, employment, world market prices, etc.) on which the model forecasts are heavily dependent. It was felt that, if the prognoses were to be accepted by the negotiating parties as reasonably good estimates of the short-term consequences for prices and the income distribution of alternative results of the income settlement, it was necessary that the parties would accept the assumptions on which the prognoses were based.

One of the reasons why PRIM I has been accepted by the parties as a useful tool is the pedagogical simplicity of the model. It would not have been a good strategy, when introducing mathematical models into the process of income negotiations, to start with a model which was so complicated as to look more or less like a "black box" to the representatives of the negotiating parties. The main ideas of PRIM I are easy to understand, and the model itself is of rather small size. Because of this, PRIM I is

more suitable at this stage of developement than MODIS III, which may be more theoretically satisfying since it covers a wider range of the economy, but which also is much more complicated and disaggreated.

V. The model forcasts and the actually observed changes

In table 1 the model forcasts[5] prepared in January 1966 and January 1968 for the main endogenous variables are compared with the actually observed changes[6] of the same variables. The discrepancies between the forecasts and the actual changes are decomposed in order to examine "the causes" of the discrepancies.[7] As mentioned earlier, a number of alternative forecasts were made before the negotiations were started, each relating to one possible outcome of the negotiations. The forecasts given in table 1 (row 2) show what the model forecasts would have been if the exact changes 1965-1967 and 1967-1969 in wage rates, agricultural prices and subsidies, and subsidies to the fisheries had been known in January 1966 and January 1968 respectively.[8] The estimates of the other exogenous variables and the data for the base years (1965 and 1967) are the same as those used by the forecasters in January 1966 and January 1968.

The discrepancies between the actual changes and the forecasts (row 3) can be ascribed to (i) weaknesses in the model itself (row 4), (ii) errors in prelininary data for the base year of the forecasts (row 5), (iii) errors in the predictions for the exogenously given variables (except those assumed to be directly determined through the income settlements) (row 6).

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5) The forecasts made in January 1966 and January 1968 were given both for 1 and 2 year periods. In table 1 results are given for the 2 year periods only.

6) The "observed changes" 1967-1969 are based upon preliminary national accounts and may be revised considerably.

7) The basic assumption in the model that there is no feed-back effect from prices/incomes to quantities (all volume variables are exogenously given) can not be tested by the method used here.

8) These changes are not, in fact, wholly due to the income settlements since changes in wage rates are heavily influenced by the wage drift. In Norway, the wage drift is rather steady and amounts to about 3-3,5 per cent per year. On the assumption of a full employment policy, estimates of the changes in wage rates can be given with fair accuracy, given the results of the income settlements.

Table 1. Forecasts made in Jan. 1966 and in Jan. 1968 of changes in prices and incomes compared with actual changes. Discrepancies between forecasts and actual changes decomposed "by causes".

	1965-1967						1967-1969					
		Changes in million kroner						Changes in million kroner				
	Consumers' price index Changes in pct.	Incomes in Agriculture and Fisheries	Profits in Other Sheltered Industries	Profits in Import Competing Industries	Profits in Shipping	Profits in Other Export Oriented Industries	Consumers' price index Changes in pct.	Incomes in Agriculture and Fisheries	Profits in Other Sheltered Industries	Profits in Import Competing Industries	Profits in Shipping	Profits in Other Export Oriented Industries
1. Actual change	8.35	205	1350	140	243	-222	7.08	182	1638	301	-591	509
2. Forecast	6.81	155	1609	-237	-1095	-515	6.25	12	1343	104	-645	249
3. Discrepancy[1]	1.54	50	-259	377	1338	293	0.83	170	295	197	54	260
Of which due to:												
4. The model	0.78	93	-16	428	13	34	0.94	42	104	352	-184	239
5. Errors in preliminary data for the base year of the forecasts	-0.38	1	36	-104	112	-144	0.12	-4	137	-14	-277	-33
6. Errors in the predictions for the exogenous variables[1]	1.20	-52	-275	56	1180	408	-0.26	139	45	-140	537	30
Of which due to predictions for:												
7. Subsidies and indirect taxes	0.62	-18	-	90	2	56	0.21	-8	-	103	-2	-6
8. Labour productivity and employment	0.50	286	-9	-128	335	111	-0.11	-89	146	72	-501	277
9. Volume of depreciation.	0.20	-44	-	-40	-259	107	0.03	64	-	41	687	-78
10. Export prices	-0.08	-205	-	-1	1252	113	0.19	163	-	-1	604	-132
11. Import prices	0.40	-20	-	128	-203	4	-0.44	36	-	-359	-234	-28
12. Changes in profit share of factor income in Other Sheltered Industries	-0.44	13	-266	7	4	10	-0.14	5	-100	3	1	4

1) The numbers in row 3, respectively in row 6, are not exactly the sum of the numbers in row 4 to 6, respectively in rows 7 to 12. This is due to some non-linearities in the model.

As shown in table 1, the forecasts given both in January 1966 and January 1968 gave a resonably correct picture of the consequences of the income settlements for most of the central endogenous variables. However, in both periods the actual rise in incomes in Agriculture and Fisheries, and profits in Shipping, Import-Competing Industries and Other Export-Oriented Industries, resulting from the income settlement, turned out somewhat higher than the negotiating parties had reason to expect on the basis of the model forecasts. At the same time, the rise in the consumers' price index came out higher, and therefore the rise in real wages lower, than forecasted. Profit in the sector Other Sheltered Industries came out higher than forecasted in the first period and lower in the second. For the period 1967-1969 the direction of the changes in the endogenous variables were correctly predicted in all cases, while there were two exceptions from this rule in the period 1965-1967 (profits in Import-Competing Industries, and profits in Shipping).

Table 1 shows that a considerable fraction of the discrepancies between forecasted and actual changes of the endogenous variables are due to weaknesses of the model. The figures (row 4) seem to indicate that the model tended to underestimate changes in the consumers' price index (0.78 per cent in the first period and 0,94 in the second) and changes in profits in Import-Competing Industries (428 mill.kr. in the first period and 352 mill.kr. in the second). The main reason for this can be traces back to an ability of the Import-Competing Industries to compensate for cost increases (in other words, the assumption of the model that enterprises in this sector adjust output prices completely in accordance with prices of comparable imported products is not fully realistic). PRIM will therefore underestimate the effects on prices of a rapidly rising national cost level, and overestimate the depressing effects which rising costs will have on profits in Import-Competing Industries. [9)]

Errors made in the predictions for the changes in the exogenously given volume variables (labour productivity, employment and volume of depriciation) have caused considerable errors in the forecasts for the endogenous variables (table 1, rows 8 and 9). In general, the assumptions made about changes in the volume variables have been too pessimistic and

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9) For a more comprehensive discussion of this point, see Odd Aukrust, op.cit.

has led to underestimates of profits in most industries in both periods. In Shipping, errors in the predictions of changes in production have been more or less automatically compensated for by corresponding errors in the opposite direction in the predictions for the volume of depreciation. Among the volume variables it is only those relating to Other Sheltered Industries which, according to the model, have an influence on the consumers' price index. For the period 1965-1967, wrong predictions for these variables led to a serious underestimate of the change in the consumers' price index, while errors made in the period 1967-1969 were much smaller.

Errors made in predicting export and import prices have also caused discrepancies between forecasted and actually observed changes of the endogenous variables. However, these errors do not seem to have been systematical. Errors made in predictions of changes in the profit share in the sector Other Sheltered Industries have caused overestimates in both periods of changes in the consumers' price index, and also of changes in the profits in Other Sheltered Industries (table 1, row 12).

VI. Implications of an alternative outcome of the income settlement 1968

An example may illustrate how the alternative model prognoses are presented to the negotiating parties.

Consider the following two alternatives concerning the changes in the wage rates in connection with the 1968 income settlement:

I. The actual change in wage rates 1967-1969 in all industries.[10)]

II. The actual change in wage rates 1967-1969 plus two per cent, in all industries.

The assumptions concerning changes in agricultural prices and subsidies to agriculture and fisheries are the same in both alternatives and correspond to the actual result of the negotiations.

Table 2 shows the forecasts generated by PRIM I for these two wage alternatives. The forecasts in col. 1 and 2 are based on the preliminary data for the base year (1967) and the same projections of the exogenous variables as those available in January 1968.[11)] The forecasts in col. 4

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10) On the average for all industries, the increase in wage rates 1967-1969 was about 14 pct.

11) The forecasts given in table 2, col. 1 are the same as those given in table 1, row 2.

Table 2. Estimated changes in prices and incomes 1967-1969 based on alternative changes in wage and salary rates

	1967-1969					
	Based on the Jan. 1968 predictions for the exogenous variables			Based on the actual changes in the exogenous variables		
	Alternatives for changes in the wage rates			Alternatives for changes in the wage rates		
	I	II	(II-I)	I	II	(II-I)
	Actual change	Actual change plus two pct.		Actual change	Actual change plus two pct.	
	1.	2.	3.	4.	5.	6.
ıanges in:						
ɔnsumers' price index. Pct.	6.25	7.30	1.05	6.14	7.18	1.04
ɜal wages per man-year. Pct.	7.20	8.30	1.10	6.96	8.07	1.11
ıcomes in Agriculture ıd Fisheries. Mill.kr.	12	-26	-38	140	103	-37
ɔofits in Other Sheltered ıdustries. Mill.kr.	1343	1549	206	1534	1757	223
ɔofits in Import-Competing ıdustries. Mill.kr.	104	-10	-114	-51	-161	-110
ɔofits in Shipping. Mill.kr.	-645	-712	-67	-407	-467	-60
ɔofits in Other Export- ɔiented Industries. Mill.kr.	249	159	-90	270	177	-93

ıd 5 are based on observations of the realized changes in the exogenous variables ıd the revised data for the base year.

Col. 3 in table 2 is the difference between col. 1 and 2. It shows what ıformation the negotiating parties could obtain from the model concerning the ffects on prices and incomes of two per cent increase in wage rates in ıdition to the actual change amounting to 14 per cent, on the average. Col. 3 ıdicates that such an extra increase would have resulted in a little more than 1 ɜr cent increase both in the consumers' price index and in real wages per man-year.

The profit in the sector Other Sheltered Industries would have increased by about 200 mill.kr. On the other hand, the profits in the exposed industries would have decreased by nearly 300 mill.kr.

Table 2 shows furthermore that wrong projections of the value of exogenous variables may have serious consequences for the predicted level of the endogenous variables (compare col. 1 and 4, or col. 2 and 5), but that such errors are of minor importance for the difference between alternative forecasts (compare col. 3 and 6). It may be inferred from this that even if the predictions of some of the exogenous variables are very uncertain and may easily be erroneous, the model forecasts may still give valuable information about the differences between the consequent developments in prices and incomes following upon alternative results of the negotiations.