

Statistics Norway
Research Department

Petter Jakob Bjerve

**The Influence of Ragnar Frisch
on Macroeconomic Planning
and Policy in Norway**

1. Introduction*

To understand why and how Ragnar Frisch influenced macroeconomic planning and policy, his basic political and professional views must be kept in mind.

He was very critical towards the free market system about which he expressed moral indignation.

Thus in 1932 he observed that "... it is an unworthy situation that people amidst a world of real abundance shall live in an economic system that with regular intervals creates suffering and anxiety for almost all groups of the population" (Frisch 1932a). In 1949 he made the observation that: "The mass unemployment prevailing in most countries in the 1930s, led to a monstrous situation.

Standards of living declined in the midst of plenty. Food and other consumption goods were deliberately destroyed while people hoped and prayed that something would turn up which would finally allow them to use their own labour for the satisfaction of their own wants" (Frisch 1949b).

Such situations had to be prevented by means of macroeconomic policy. Without a proper policy a "simultaneous realization of social justice and a high rate of economic growth is impossible" (Frisch 1963a).

Frisch was convinced that to make such a combination possible, economists could play a major role. Their role should be to clarify the state of the economy and to explore the means required to achieve the goals determined by policy makers. Economists should not impose their own preferences upon the politicians. He emphasized the moral importance of this distinction in many contexts. Already in one of his early courses at the University in Oslo, Frisch urged the students to distinguish sharply between scientific statements and value judgements. His presentation of this issue, influenced by Max Weber, made a strong impression on many of his students and was later published in a textbook (Frisch 1946a, pp. 7-10 and Frisch 1965a, pp. 5-8). It had an important impact as a moral guide for their advice on macroeconomic policy.

The main professional interest of Frisch was economic theory, and he preferred to spend his time on theoretical work. He used to illustrate his policy function in military terms: He should himself represent the "heavy artillery" and his pupils the "infantry", or "foot soldiers". His influence on policy should be exerted through his pupils. They should be armed with best possible tools for design

* Paper presented at *Symposium at the Centennial of Ragnar Frisch*, 3-5 March 1995, The Norwegian Academy of Science and Letters, Oslo. My sincere thanks to the many Norwegian economists who commented on a draft of this paper. I benefited from their experience in planning and policy, in particular, when reformulating the section on macroeconomic planning models. They also suggested a large number of improved formulations.

of appropriate policy. After the Second World War the theory of macroeconomic policy decisions became his major interest.

The policy influence of Frisch was exerted in several ways. One was the development of conceptual systems (section 2). Results of this activity were to a high degree utilized in preparing numerical national accounts and corresponding projections, designated national budget (section 3). Frisch followed up his conceptual work by constructing macroeconomic models, that may be regarded as prerequisites for the extensive system of models applied by the Norwegian government today (section 4). In addition, he exerted important personal policy influence by teaching and organization of research, by disseminating economic information and by advisory activities (section 5). Ragnar Frisch had extraordinary visions and ambitions. In conclusion (section 6) some of these are confronted with reality.

2. Conceptual systems

Almost 70 years ago Ragnar Frisch in his inaugural lecture as professor at the University in Oslo, predicted that "we shall develop an economic theory sufficiently complex to accommodate the concrete data observed and simultaneously we shall get observations planned and collected for the purpose of being fitted into this theoretical scheme" (Frisch 1932b, p.4). In accordance with this vision he worked on the establishment of three different systems of macroeconomic concepts.

The system published first, was presented in a lecture held in 1939 at a meeting of Nordic statisticians. The purpose of this system was to enable a numerical description of the economic structure. Three years later he published another system whose original purpose was to provide definitional relationships for macroeconomic theory. This was designated the Ecocirc-System (Economic circulation System). The third system, published in 1952, was intended to provide definitional relationships for analyses of monetary liquidity and was presented as an accounting system for the financial transactions between different sectors of the Norwegian economy.

Structural national accounts

In 1936 Frisch presented together with two colleagues a "Plan for a structural survey of the Norwegian economy". In a section of this plan, obviously written by Frisch, the purpose of national accounting was defined as "coordinating the most important data to be collected for the structural survey in such a manner that they appear as parts of a whole. The national accounts shall provide the same kind of survey for the entire country as the balance account and the profit and loss account of

the ordinary bookkeeping provide for the individual establishment. Thus, it is the economic viewpoint of the establishment that appears in the forefront" (Frisch, Keilhau and Wedervang 1936, p.29). This implied that the economic structure was to be described in great detail. Funds were granted and in 1937 work on structural national accounts began at the Institute of Economics, University in Oslo, under the supervision of Frisch. He had 2-4 assistants at his disposal, mainly for data work.

According to the report on the meeting in 1939 Frisch informed that the conceptual work was far advanced while empirical work had been limited mainly to an exploration of the data sources available (Frisch 1940, pp. 141-149, 152-156, 162-163)¹. The conceptual system arrived at was very ambitious. Three examples may illustrate this:

- 1) On valuation of the entries to be included in the national accounts, Frisch mentioned three principles which were of particular interest, viz. the use of actual costs, market prices and discounted value of prospective results. Basically the accounting would be made at actual costs, but a system of supplementary accounts would indicate income and wealth according to the two other principles of valuation.
- 2) Each establishment would be crossclassified by industry and form of its organization. As industry classification a standard developed by the League of Nations would be applied. The classification by organizational form was developed by the Institute. Each cell of the crossclassification was designated a structural sector, which again might be divided into so-called individual sectors. (For some sectors even a classification of establishments by size might be attempted).
- 3) For each sector, "large or small", data would be organized by a standard system of "business accounts". Two main characteristics of this system are mentioned in the report, viz. that it had separate accounts for real and for financial stocks and flows, and that production accounts would show value added as a balancing item. In total the system consisted of 127 accounts summarized into 14 main accounts. Data for the country as a whole would be obtained by adding up pyramidically the accounts for all structural sectors. These data would, inter alia, provide

¹ At this meeting Frisch presented quite an advanced definition of national accounting: «By national accounts we mean not only a survey of national income in a certain year and the national wealth at a given point of time, but a fairly complete survey of the entire economic activity in a year, presented in such a manner that the relationships in which we are particularly interested, show up by the necessity of bookkeeping. For instance, the change of wealth shall by bookkeeping necessity conform with the data on income, consumption and saving». Frisch 1940, pp. 141-142.

information for each of a large number of sectors on the national product broken down by consumption, internal net investment and net investment abroad. In addition, opening and closing balances should show data on both real and financial capital broken down by kind².

The system was never published in all detail, but typewritten presentations are available at the Institute of Economics at the University in Oslo. These presentations show that Frisch was ahead of his time in several respects, *inter alia*, by making the distinction between institutional (organizational) and functional (industrial) sectors, by distinguishing sharply between real and financial stocks and flows, and by introducing the concept «human capital» (Bjerve 1940, p. 84).

The attempt at establishing numerical accounts according to the structural system did not succeed. When the University was closed by the German occupation authorities in November 1943, such accounts were completed only for shipping and for government and half government banks. After the liberation of Norway this work was not continued.

The Ecocirc-System

In 1933 Ragnar Frisch recommended the establishment of national accounts "to get a basis for evaluating the real economic weight of the arguments that are being made in the economic debate" (Frisch 1933b, pp.7-9, 21-27, 36-37)³. Thus, the purpose of the accounts envisioned at that time, was macroeconomic analysis. With this in view he worked periodically during a period of about 25 years on macroeconomic concepts and the definitional relationships between them. He dealt with this in several series of lectures (during 1928-29, 1933-34, 1935 and 1940), in the introduction to his famous Cassel article (Frisch 1933a), in a seminar during the spring of 1942 with several university teachers participating, and afterwards in a number of meetings with some of them. Finally, in the fall of 1942 major conclusions were summarized in a mimeographed presentation (Frisch 1942). The conceptual system arrived at was the Ecocirc-System (Bjerve 1986).

A simplified version of the Ecocirc-System is exhibited in table 1, which shows a system of accounts, the column sums of which are definitional relationships⁴. The first of these accounts (from left)

² At the time when the numerical national accounting was initiated in accordance with the system described above, Frisch had developed a simple conceptual system which was presented in mimeographed form with the title: Et generelt monetært begrep- og symbolsystem. (A general monetary system of concepts and symbols). This system would have been suitable as a framework for calculating data for the purpose of macroeconomic analysis, but for the structural survey a much more detailed system was chosen.

³ Frisch coined the terms national accounts and national budget in respectively 1933 and 1940, as the first in Norway, if not in the world. He used the term «national accounts» in (Frisch 1933b), and he suggested the term «national budget» at a meeting on 29th January 1940, from which a record exists.

⁴ Frisch also exhibited these relationships by means of a graph (The Ecocirc-Graph).

indicates inputs into and gross output from production, the second the utilization of the gross output, the third the application of income and the fourth the increase of real capital and the export surplus achieved by means of saving. All entries in these accounts represent flows of real objects, i.e. objects which would exist even in an economy without ownership. The stock of such objects is designated real capital **K**.

Table 1. A simplified version of the Ecocirc-System for the real economy

Accounts Entries	Production		Utilization of resources		Application of income		Increase of capital	
	Debit	Credit	Debit	Credit	Debit	Credit	Debit	Credit
Gross product		A	A					
Input of commodities	H			H				
Value added	E					E		
Depreciation					D			D
Gross investment				J			J	
Consumption				C	C			
Real tax				T	T			
Net export surplus				A ^{ex}			A ^{ex}	
Saving					S			S
Sum	H+E = A		A = H + J + C + T + A ^{ex}		D + C + T + S = E		J + A ^{ex} = D + S	

Furthermore, in table 1, $E - D = \text{Netproduct } R$, $J - D = \text{Net investment}$ and $A^{\text{ex}} = \text{Exports } A^{\text{ex}+} - \text{Imports } A^{\text{ex}-}$.

Frisch also presented a system of concepts and definitional relationships for stocks and flows of financial objects, i.e. objects that would not exist in an economy without ownership. This system was designed analogously with the system of real concepts. The financial flows were symbolized by boldface letters, for instance **R** for net financial income. The stock of financial objects was designated financial capital **K**.

The most interesting definitional relationships including both real and financial concepts, are the following:

Real capital **K** + Financial capital **K** = Total capital

Net real product **R** + Net financial income **R** = Total income.

Net real investment I + Net financial investment I = Total investment.

Net real saving S + Net financial saving S = Total saving.

Total investment + Total capital gains + Total revaluation of capital = Increase of total capital.

In developing the Ecocirc-System Frisch emphasized the need for standardization "aiming at several things: the logical content of the concepts, the terminology, the mathematical presentation by means of letters and formulas, the presentation by an Ecocirc-Graph, and finally the bookkeeping by means of a system of accounts" (Frisch 1942). Such a standardization might facilitate comparison of the theories of different authors, and perhaps Frisch even hoped that his standardized concepts would be adopted by other theorists. Some comparisons were actually made (Bjerve 1944a and 1944b).

The Ecocirc-System presented in 1942 was designed so as to be applicable for any economic sector. It did not show intersectoral (from whom to whom) flows, for instance, flows between government and other sectors. This weakness was remedied in 1948 by a new version of the Ecocirc-System which had separate accounts for the private and the government sector (Aukrust, Bjerve and Frisch 1948). Consequently, this version also included transfer of income between the two sectors and the concept of disposable income. This change had been made already in 1946 by the Ministry of Finance.

The Ecocirc-System may be regarded as an aggregate form of the structural accounts previously described, implying far less data problems for calculation of numerical national accounts. But Frisch probably felt that a conceptual system of this kind, which he had developed quite far already in 1937, would not be suitable for structural analysis.

It may seem surprising that Frisch spent so much time and energy on developing a conceptual system which today may appear trivial. However, in the 1930s such systems were discussed at length also by other macroeconomic theorists, e.g. Carl Föhl, J.M. Keynes and Erik Lindahl. At the time of this discussion, before precise and fruitful concepts were arrived at, these problems were not at all trivial. In particular the relationship between investment and saving was often confused.

Intersectoral financial accounts

Ragnar Frisch dealt with conceptual systems for the accounting of financial stocks and flows both during the 1930s and after the war, in parallel with his work on structural accounts and the Ecocirc-System. Most of this work, in contrast to the two other systems, aimed at showing the flows between major sectors of the economy, calculated as net changes of the financial stocks.

At the end of 1932 he prepared a memorandum where he, inter alia, by means of two alternative tables demonstrated how the increase of deposits and the increase of loans for the banking system as a whole are related to each other and dependent upon the change of cash holdings of the public (Frisch 1951a, pp. 3, 11-19). One of his conclusions was that if the cash holdings were constant, an increase of the loans would create an equally large increase of deposits. If the increased lending resulted in greater productive activity, the cash holdings were likely to augment, and consequently the deposits would increase correspondingly less than the loans. In lectures later in the 1930s Frisch dealt with such relationships by applying a simple system for financial accounting, with separate accounts for government, Bank of Norway, other banks and a residual sector. The financial flows described, inter alia, the increases of loans, deposits and cash holdings. By means of this system he demonstrated not only that increased lending might create increased deposits, but also that a government deficit financed by internal loans, would not increase the net debt for the country as a whole.

After the war, systems of financial accounts were further developed, partly by Frisch and partly by the Central Bureau of Statistics (recently renamed Statistics Norway), the main purpose being to provide a basis for direct government control of credit. In the postwar years, as long as the economy was characterized by very high liquidity, such a control was considered desirable in order to reduce the pressure of demand for goods and services. Later when a gradual reduction of liquidity tended to increase interest rates, a direct control of lending was also desired to counteract this trend.

In the spring of 1946 Frisch was approached by the Ministry of Finance for advice on the development of financial accounts. The outcome was a dummy table where changes of financial assets and liabilities were crossclassified by type and major sectors of the economy. Calculation of these changes was also attempted, but without success. For such a purpose concepts and classifications of credit market statistics at that time differed too much for different groups of credit institutions, and even for some institutions within the same group.

In the early 1950s Frisch prepared a more advanced system of intersectoral financial accounts (Frisch 1952b). A simplified version is presented in table 2, where claims of each sector are indicated in the columns and debts indicated in the rows. The upper part of the table shows domestic, the lower part foreign claims and debts, and cash. In addition, he presented an identical crossclassification for the grants of credit so that for each sector, the sum of all kinds of grants could be added to the total net claims and cash. Subclassifications for the government sector, the banks and other sectors were also presented. (Data for 1948 were roughly calculated by one of his associates, Arne Amundsen, but he concluded that sufficiently reliable data could not be obtained until a coordination of the statistics on

claims and debts had been carried out.) This approach was later applied by the Central Bureau of Statistics for standardization of the credit market statistics so that numerical financial accounts could be prepared with a more detailed classification of financial objects and sectors.

Table 2. Changes of claims and debts by kind and by sector

Sectors Financialobjects	Govern- ment	Bank of Norway	Other banks	Other sectors ¹⁾	All sectors
Internal claims Government Bank of Norway Other banks Other sectors ¹⁾					
Total internal claims					
Net internal claims (sum of columns minus sum of rows) Norwegian claims on foreign countries - Foreign claims on Norway Notes (including gold and coins)					
Total net claims and cash					

¹⁾ Including government enterprises

3. Utilization of the conceptual systems

Numerical national accounts

The numerical work on structural national accounts was discontinued when the University was closed. When evaluating the results of the work done Frisch concluded: "It was never completed in the sense that it covered the entire economy, but for some sectors numerical accounts were prepared, and for the sector "official and semi-official banks" the results were particularly satisfactory" (Frisch 1948 a). In fact, a very small part of the economy was covered by data, mostly for one year, and a publication was issued only for shipping (Rossen 1942).

For a strange reason, calculations based on the Ecocirc-System could be initiated by the Central Bureau of Statistics in the fall of 1943. At that time the occupation authorities had requested that the Bureau provide data which after a German victory could justify claims on the Allies for war damage

in Norway. Thereby, the director of the Bureau, Gunnar Jahn (who was a top member of the secret resistance movement) felt authorized to initiate calculations of the annual national product by industry for 1935 and subsequent years and of the reduction of real capital from 1939 on caused by war damage and a large German use of Norwegian resources.

For this work a group of recently graduated economists was recruited. All of them had thorough knowledge of the Ecocirc-System, and two had even worked for Frisch both on structural accounting and the Ecocirc-System. This explains why in addition to the national product and the reduction of real capital, calculations were made of exports and imports, the German use of goods and services and the residual consumption (public and private) for the years 1940-1943. Thus, more comprehensive data than originally envisaged were calculated for both supply and demand for resources in this period (Statistisk Sentralbyrå 1946).

These data enabled the Ministry of Finance, after the war, to calculate ever more detailed numerical national accounts as a basis for its national budgeting. These calculations were made in consultation with the Central Bureau of Statistics, but the Bureau was largely relieved from this work in order to prepare new and more extensive and reliable national accounts.

These new national accounts were published in 1952 replacing the calculations of the ministry for 1946-1951. On this occasion Ragnar Frisch made the following comments:

"I believe that one can say that we now, after longlasting and burdensome work, have got a fairly usable conceptual system that describes the reality in the national economy. And this system is being used in the concrete statistics, inter alia, in the brilliant publication newly issued by the Central Bureau of Statistics on the national accounts, a work for which Aukrust first and foremost has been responsible" (Frisch 1953). This was justified not only by the fact that the new accounts were designed in conformity with the Ecocirc-System, but also because the input-output work of Wassily Leontief and the national accounts designed by Richard Stone were taken advantage of. For prospective planning it was particularly important that they included annual inter-industry tables prepared as an integral part of the national accounts (Bjerkholt 1995). These tables and a much more detailed table later prepared for 1954, were utilized for work on planning models, both by Frisch and by the research department of the Bureau. (The national accounts were extended from covering 34 production sectors for 1948 to 123 sectors for 1954.)

The national budget

The most important influence that Frisch exerted in Norway by the Ecocirc-System, was by its application for national accounting and for planning in the form of a national budget, i.e. a budget for the country as a whole projecting magnitudes of the national accounts.

In February 1946 the Ministry of Finance presented to the Parliament a White paper on the national budget (Finansdepartementet 1946). This budget included alternative projections of the national product and its major components for 1946 and for the period 1946-50. Its purpose was to provide a basis for the design of macroeconomic policy during the years of reconstruction.

Additional national budgets for 1947 and subsequent years were prepared in much greater detail and applied both for design of policy and for coordination of the many policy instruments that were used in the post war economy, and were presented to the Parliament as annual programs for macroeconomic policy.

The preparation of these budgets was to a large degree delegated to the various ministries in charge of the various policy instruments. They elaborated so-called subbudgets in conformity with the Ecocirc-System, and these were submitted as policy proposals to the Ministry of Finance. This ministry in turn adjusted them so as to fit into the national budget as a whole. The final decisions on these adjustments were made by the Cabinet in cooperation with the ministries concerned, after deliberations in a Cabinet Committee. This method of successive approximations towards the final national budget by means of decentralized administrative adjustments was applied in the elaboration of 14 annual national budgets and three so-called Long term programmes (which in fact were national budgets for periods of four years).

After this decentralization of national budgeting the Ecocirc-System contributed to making the various subbudgets consistent. In each ministry taking part in the budgeting process, economists with thorough knowledge of this system either carried out the budgeting themselves or were given sufficient logical control of this work. The concepts and definitions of the Ecocirc-System were in a sense a common language understood by all civil servants involved.

The credit budget

The new national accounts did not include data on the changes of financial assets and liabilities. Sufficiently reliable accounts on such changes required a coordination of the credit market statistics. Preparation for this began in the Central Bureau of Statistics in 1952. Standards were prepared for the

definition and classification of claims and debts by type, and of debtor and creditor sectors by kind of economy activity. These standards were made obligatory for all institutions which submitted data for credit market statistics. Thereby the different types of such statistics could be combined and coordinated within a comprehensive system of financial accounts, and quite reliable data could be obtained. Among the information provided, were data on the change of total loans issued by all credit institutions, broken down by groups of such institutions and by debtor sectors.

In a preface to the publication in which standardized credit market statistics were first published, the Bureau acknowledged: «The accounting framework is greatly influenced by the theoretical work of Professor Ragnar Frisch on the financial circulation analysis» (Statistisk Sentralbyrå 1957, p.6). In fact, the main difference compared with the system of Frisch was a more detailed classification of sectors and of claims and debts.

Due to the lack of coordinated credit market statistics many years passed before financial subbudgets could be included in the national budget. However, the coordination achieved in the early 1950s, enabled the Ministry of Finance to present, from the end of 1955, annual credit budgets as a part of the national budget. These budgets indicated the maximum increase of loans that the major groups of credit institutions were allowed to issue and were used as a basis for direct control of credit, as long as such a control was maintained. The introduction of quantitative credit control had previously been supported by Frisch, as further explained in section 5. Thus, he influenced macroeconomic policy both by this support and by assisting in the development of statistics required for credit control.

Evaluation

Even though Frisch did not succeed in establishing numerical national accounts, the logical framework of the Ecocirc-System promoted the work on both national accounts in the Central Bureau of Statistics and the national budget in the Ministry of Finance. Some of the classification systems developed for the structural national accounts, also benefited both institutions. Without this systems work the national budget could not have been prepared as early as it was, and the coordination of macroeconomic policy could not have become as effective.

Evaluating this influence one must be aware that Norwegian economists during the war did not receive information on the development of national accounts in Anglo-Saxon countries. Without the systems work of Frisch they would, at the end of the war, have been five years behind in this field. This work gave them the conceptual frame needed for macroeconomic planning and policy. The

scientific impact of the Ecocirc-System and its contribution to the international development of national accounting, is evaluated in (Aukrust 1994).

The Ecocirc-System also promoted consistency in macroeconomic thinking, not only among economists, but gradually also among politicians and others. In addition, it provided a necessary basis for the building of numerical macroeconomic models.

However, Frisch neither established the organization of national budgeting nor developed the method of successive administrative approximations. The national budgeting was initiated by Erik Brofoss, the finance minister of the first Labour government after the war. He was a pupil of Frisch and learned about the Ecocirc-System and the existing national accounts calculations after his return from London where he was a department chief in the Norwegian government administration in exile, and where he most likely got information on macroeconomic projections made by the British government (Bjerve 1991). He may have consulted Frisch on planning matters, but Frisch did not himself take part in establishing the national budgeting.

4. Macroeconomic models

Planning in the form of national budgets was for many years carried out entirely by means of the administrative method. During the 1950s inter-industry tables of the national accounts were utilized to improve some of the administrative calculations, though not to replace them. A replacement began in 1960 by means of model computations. From then on a gradual transition took place to the use of numerical models instead of the administrative method, although not entirely. Today, numerical macroeconomic models are used for the preparation of both annual and medium term projections and for more or less revising them as need arises. Long term and quarterly projections are also made by means of such models. Many of these analytical tools are so much connected that they can be regarded as a system of models.

The Frisch models

Frisch was clearly pleased with the national budgeting. In an address presented in the beginning of 1947, he said: "At present the national budget plays a very large role in the whole financial policy of our country". As a result of national accounting work "the foundation was laid and trained personnel available" at the time when the national budgeting "was launched on a large scale by our Ministry of Finance in 1945" (Frisch 1947). In addition, he mentioned that the Institute of Economics had begun work on a project to "find out what will happen when certain measures, such as fiscal measures or

definite wage policies or the like, are applied to the economic system". He further observed that the studies were "modelled over the burning economic problems of our Norwegian community to day" and that "most important, is the analysis of the structural relations that connect these various variables in the national budgeting system".

Important progress on this project was made during 1947 and 1948. At that time Frisch was a member of the United Nations Subcommission on Employment and Economic Stability⁵. At a meeting of this commission in the fall of 1947 he became dissatisfied with the discussion which, in his opinion, focused too much on "the evils of inflation". He felt that to improve the debate a macroeconomic model ought to be presented to the Subcommission (Bjerve 1989).

At the next UN meeting in the spring of 1948 Frisch presented a note on: A System of Concepts describing the Economic Circulation and Production Process (Aukrust, Bjerve, and Frisch, 1948). Probably as a justification for this note he later explained that the work at the Institute of Economics on conceptual systems "had all the time been inspired by the idea that this was only a stepping stone to a study of the structural relations (production relations, consumption relations etc.) of the economy» (Frisch 1948a).

At the end of 1948 Frisch published a first model, the main purpose of which was analysis of the effects of changed price subsidies, clarifying the "numerical relationships existing between price level, the sum of subsidies, income distribution etc" (Frisch 1948b, p.1). This model consisted of 20 variables between 13 independent definitional relations, i.e. the model had 7 degrees of freedom. At that time a change of the existing price subsidies in Norway was a major policy issue, and a committee had been appointed to clarify the problems implied by this policy (Aukrust, Haavelmo, and Hiorth, 1948). In a few months Frisch completed another and considerably extended model, later designated the Submodel (Frisch 1949a). A paper describing this model was presented to a meeting of the Subcommission in the spring of 1949, but the participants showed no enthusiasm about it.

Frisch did not attend subsequent UN meetings, and concentrated on model work. In the fall of 1949 he gave a brief progress report (Frisch 1949b). He admitted that the model system was simple and that the data used so far were in part only rough estimates, "yet the system does give valuable information of a kind hitherto not available""extensive tables have been computed which indicate

⁵ At the end of 1946, the government appointed Frisch as the Norwegian member of the UN Commission for Economy and Employment, of which he was elected as a chairman. This commission, at a meeting in the middle of 1947, established two subcommissions, one on Employment and Economic Stability. Frisch became a member of this subcommission, but was not elected as its chairman.

what effects are to be expected on various aspects of the Norwegian economy if a given system of price-wage-tax-subsidy measures is applied". At the same time Frisch also presented a very ambitious plan for the future work, indicating that the analysis ought to be elaborated in seven directions covering:

- 1) International aspects of the Norwegian economy,
- 2) investment problems,
- 3) breakdown of the national economy into major groups,
- 4) separation of government enterprises from private enterprises,
- 5) factors of the money market,
- 6) reaction of the enterprises on changes in prices, wages, taxes etc., and
- 7) social goals.

Shortly afterwards he came to the conclusion that the work according to this plan would be so comprehensive that a new organizational setup was required, and that a cooperation with the Central Bureau of Statistics would be desirable. In February 1950 he outlined an organization by projects such as indicated in table 3 (Frisch 1950a, p.3). The model aimed at was now designated Decision model which he later defined as «a theoretical model supported by empirical evidence and constructed with the specific object in mind of discussing the probable consequences of alternative courses of action» (Frisch 1955) or in other words «an analytical framework to achieve coordination and system in the many-sided discussions on basic goals of economic policy and the means (instruments) that can be used for realizing these goals» (Frisch 1957a).

Table 3. Projects for work on Decision models

Theory of the Decision model		1A. Mathematical-statistical computations on consumption and labor input
	1. The consumption economy	1B. Investigations by surveys on consumption and labor input
		2A. Investigations on the production elasticities in individual industries
	2. The production economy	2B. Inter-industry analysis
	3. The monetary economy	3A. Circulation of financial objects

Frisch informed that the Central Bureau of Statistics would cover projects 2B and 3A, in cooperation with the Institute of Economics⁶. This had already been discussed with the director of the Bureau, who was interested in such an arrangement. Frisch would himself be in charge of the theory of Decision models and the Institute would be responsible for the projects 1A, 1B and 2A.

The cooperation between the Institute of Economics and the Central Bureau of Statistics became quite close from the early 1950s onwards. Soon it was extended to the Ministry of Finance whose main role was to clarify how the models should be constructed in order to improve national budgeting. Frisch was instrumental in organizing this tripartite cooperation. He initiated the establishment of several committees for this purpose and a large number of meetings were held. Quite often Frisch himself took an active part in them. Thereby he received factual information from the two other parts, while they in return were informed about the work going on at the Institute and were stimulated by the contact with Frisch (Bjerkholt and Longva 1980, pp.12-14).

Frisch had a relatively large staff assisting him in model building during the 1950s and 1960s. Most assistants were doing numerical work (including collection of data) and elaborating classifications, but some were also doing more advanced analysis⁷. Three major numerical models were constructed, subsequent to the Submodel:

1. The Median model (Frisch 1956)
2. The Refi-model (Frisch 1959a)
3. The Channel Model (Frisch 1960)

These models had definitional relationships corresponding to those of the new national accounts and structural relationships for production estimated on the basis of the input-output data of these accounts. Model 1 in addition had consumption relationships for different groups of households. Model 2 was extended to including financial definitional relationships of the kind which Frisch had published in 1952 and structural relationships that enabled analyses of the financing of real investments, which had to be exogenously determined. Model 3 also had investment relationships required to determine real investments endogenously (Edvardsen 1970).

⁶ Frisch strongly supported the establishment of a research department in the CBS in 1950. Building of numerical planning models was from the beginning a major objective of this department, and development of statistics required for modelling became an important objective for the other departments.

⁷ In the middle of 1952 as many as six research associates were engaged in such work. In addition, a clerical staff carried out extensive computations for the purpose of model building.

From the mid 1950s onward Frisch became more and more interested in supplementing his models with macroeconomic preference functions instead of relying on target setting, which he felt was a primitive way of planning⁸. As a consequence he engaged himself heavily in programming techniques for solving the equation systems of such models, not only linear programming but also more advanced methods. This work remained academic and hardly influenced Norwegian planning, except that it clarified the concepts of "goals" and "targets".

None of the macroeconomic models constructed by Frisch were directly used in designing policy. For such a purpose their structural relationships were too roughly calibrated. To a large extent the data required were guessed. Frisch used to consult economists both at the Institute and in the government on such data, often about their probable upper and lower limits. Then he used the numbers which he felt most reasonable for his computations. Frequently, he used alternative sets of numbers in order to determine which of them would generate the most realistic results. Frisch was not interested in accuracy, but first and foremost in obtaining the data desired.

He also made attempts at statistical data collection. Thus the Institute conducted a household survey by means of interviewers, but returns were obtained from far fewer respondents than hoped for. Technical data collected from establishments and technicians were used for estimating production functions, and an investigation of private investment in real capital was made on the basis of the official manufacturing statistics (Sevaldson 1953). When inter-industry data became available, Frisch made extensive use of them. Nevertheless, the data which he applied for estimation of structural relationships, were to a large extent unreliable.

Separate production and consumption models

In the early 1950s the Central Bureau of Statistics invited Frisch to a meeting for discussing the model building at its Research department. He was informed that the department planned to develop first a production model based on inter-industry tables and later, hopefully, engage in the building of additional partial models. Frisch objected to such a step by step strategy. He was in favour of a more general approach, developing first a comprehensive model system and then estimating all its structural relations. This attitude was similar to that characterizing his prewar attempt at preparing numerical national accounts. In both cases he was overambitious. It reflected a difference of attitude between Frisch and the Bureau towards reliability of the data to be used. While Frisch, as just mentioned, did

⁸ According to (Johansen 1973) one reason for this change of interest was that Frisch «considered the problem of avoiding depressions as solved and raised the ambitions to a higher level; ...».

not care much about reliability, the Bureau, naturally, wanted to base its models on statistics of relatively high reliability.

In 1951 experimental model computations were made utilizing an inter-industry table for 1938 (Aukrust and Frisch 1951). Later, as soon as such a table for 1948 was completed and arranged in a nearly triangular form by the Central Bureau of Statistics, an inversion of it was carried out (Frisch 1952c). Frisch showed how the inverted matrix could be utilized in analysis and planning, by calculating input-output corrected data on production and imports resulting from given alternative changes of the data on consumption, investment and exports, respectively. Similarly the input-output corrected price consequences of alternative changes of cost components were computed. The results of these computations were presented in the form of tables which Per Sevaldson later designated: "Tables of effects". Such tables were frequently used by the Ministry of Finance to improve the reliability of national budget calculations. Towards the end of the 1950s input-output computations were made to check the consistency of such calculations.

An inversion of the 34-sector inter-industry table for 1948 was carried out by the Institute of Economics and the Central Bureau of Statistics in cooperation, each institution being responsible for about half of the computations. Two operators in each institution completed the operation in two weeks, using electric desk calculators. (Already at this time Frisch expressed great interest in the new electronic computers used in the USA.)

During most of the 1950s the Central Bureau of Statistics focused its model building on utilizing the inter-industry tables (Bjerve 1954). Comprehensive analyses were made in order to clarify the theoretical and empirical validity of the assumptions upon which the inter-industry analysis was based (Sevaldson 1960). The leader of this project was Per Sevaldson, who had worked for Frisch as a student. After years of preparations Sevaldson developed a comprehensive production model based on the inter-industry table for 1954. In 1954 the Bureau recruited Arne Amundsen, who for five years had worked under Frisch. He developed a model of private consumption based partly on household surveys carried out by the Bureau (for 1951-52 and 1958), and partly on national accounts' data utilizing a method developed by Frisch (Amundsen 1957). Both of these separate models were to some degree utilized for national budgeting in the late 1950s, in order to improve the estimates of some national budget entries, without changing the administrative method substantially.

It may also be of interest to mention that Atle Elsås of the Ministry of Finance, clearly inspired by Frisch, constructed a model which could be used to calculate the combined effects of tax policy and

monetary policy on private consumption, private real investment and imports. Its definitional relations were largely copied from the financial accounts designed by Frisch. This model was to some extent used in the national budgeting for 1959. Frisch himself presented the model in a separate memorandum (Frisch 1959b).

The MODIS-models

A breakthrough for the use of numerical models in macroeconomic planning and policy occurred in 1960, when Sevaldson and Amundsen together combined the production and consumption models into one, adding a few institutional relationships (Sevaldson 1962). The variables and the definitional relationships were the same as those of the national accounts. The model, designated MODIS (Model of DISaggregated type), could be used for computing most of the gross national product, total imports and most of private consumption at given magnitudes of exports, gross investment, government consumption, a minor part of private consumption and output which in some industries could be considered determined by capacity limits. These computations were made by means of an electronic computer (the English Electric Deuce), which the Central Bureau of Statistics had acquired in 1958. MODIS was completed early enough to be used for computing the former magnitudes of the national budget for 1961⁹. A prerequisite for this breakthrough was the pioneering model work of Frisch, aiming at a combination of corresponding models. He had explained that "it is of the greatest importance as soon as possible to integrate the demand side and the production side into a more comprehensive model" (Frisch 1953).

After 1960 extended versions of the MODIS-model were successively developed. In addition, a number of special purpose models were constructed by the Central Bureau of Statistics (Bjerve 1976). Some of them were integrated with the existing MODIS-version¹⁰. These extended MODIS-models were more and more extensively used instead of the administrative method for computing national budget magnitudes.

From 1968 onwards long term projections were made of production, employment and investment in different industries by means of a multisectoral growth model originally developed by Leif Johansen,

⁹ Administrative estimates were nevertheless made for checking purpose, and they corresponded well with the model estimates. For subsequent years the Ministry of Finance collected calculations of exogenous variables made by other ministries, and when the model computations had been made, the ministries concerned were asked to check if the results appeared reasonable.

¹⁰ The last version of MODIS, first used in 1974, contained flows of about 200 kinds of commodities and 150 industries. As many as about 2000 variables were considered exogenous, including those determined by the government. In 1988 this version was replaced by a more aggregated model, but even this one was large compared with models used in other countries.

who for many years was an associate of Frisch (Johansen 1960). By a cooperation between him and the Ministry of Finance the original model was made more suitable for planning purposes. This version was further developed by the Central Bureau of Statistics, and in 1973 coordinated with the last version of MODIS.

Evaluation

The construction and application of numerical models started at a relatively early date in Norway. This was to a high degree due to the influence of Ragnar Frisch. He convinced economists taking part in the national budgeting that the administrative method applied could be supplemented and to some extent substituted by model computations.

The model building in the Central Bureau of Statistics was to a high degree inspired by Frisch and promoted by the training that the model builders had got at the Institute of Economics. The cooperation in the early 1950s on inversions and the tripartite cooperation later organized by Frisch, contributed substantially to the model development and thereby to an improvement of macroeconomic analysis and planning.

Although the Frisch models were not directly applied for planning and policy purposes, they provided to some degree guidance for the building of planning models. Thus, the combination of the separate production and consumption models constructed by the Central Bureau of Statistics into the first MODIS-model, was clearly guided by the Median model. The possible guidance of the other Frisch models is less clear, but they may have shown what kind of variables and structural relationships should be included in successive MODIS-models. However, the extensive work of Frisch on programming and interviewing techniques, was not taken advantage of.

Undoubtedly, the model work of the Central Bureau of Statistics during the 1950s and the early 1960s was promoted by the contributions of Frisch, partly by his own model building and partly by his stimulus and guidance. Of course, this work was also facilitated by the model development in other countries, particularly by the inter industry models constructed by Wassily Leontief (Bjerkholt 1992). However, the system of numerical models applied in Norway today, could hardly have become as advanced as it is without the model work of Frisch. Thus, also by his model building Frisch exerted significant influence on Norwegian planning and policy.

5. Personal influence

Teaching and organization of research

The influence which Ragnar Frisch exerted through his pupils on planning and policy was, of course, first and foremost by teaching at the University in Oslo, where he was the dominating force. He also played a major role in reforming the study of economics and in establishing the Institute of Economics at this University, which were important prerequisites for his achievements in teaching and organization of economic research. These activities were inspired by his belief that economists in the future would be "an important factor in eliminating maladjustments between fundamental economic factors and assure a smooth and progressive utilization of resources" (Frisch 1946b, p.1), and that they could, and should play a decisive role in achieving these goals and in preventing the "monstrous situation" of the 1930s from being repeated.

Many of the economists studying in the 1930s were motivated by a concern for the high level of unemployment, by a desire to get a better knowledge of its causes, and perhaps even by a hope of becoming able to contribute to its prevention. Similarly, during the 1940s the serious postwar economic problems caused by the German occupation and the need for reconstruction, motivated the study of economics. Thus, during these two decades the students were particularly receptive to the teaching and training of Frisch.

Frisch was not always well prepared for his lectures. At times the students were more like observers in his study than listeners to a formal lecture. But in return they got the fascination and not the least, the inspiration of watching the genius at work. His research assistants might have to wait until the end of office hours before he turned up. Then he sometimes kept them busy in meetings until late at night. When they presented him a draft paper, he might return it full of comments on the first couple of pages, without having read the rest. However, the students who saw his face shining when he found fine formulations, and the research assistants who heard him laugh heartily when he got new ideas, would forgive him and never forget it. He was indeed inspiring both as a teacher and a research director. His professional enthusiasm was pervasive.

Before the last World War and until the University was closed by the occupation authorities, Frisch lectured almost exclusively on pure economic theory. During this period the competence of his pupils on macroeconomic policy was primarily developed by the study of Keynes' General Theory and of

publications by Danish and Swedish economists, such Kjeld Philip and Gunnar Myrdal. However, the conceptual frameworks presented by Frisch promoted their understanding of these publications.

Frisch played a leading role in reforming the study of economics at the University in Oslo. A new five years study adopted by the Parliament in 1935, required two more years than before and qualified for a Masters degree (cand.oecon.). It implied access to the civil service on equal terms to the study of law. This attracted a greater and perhaps more interested group of students at a time of increasing concern for economic and social problems.

At the same time the curriculum was extended and modernized with particular emphasis on economic and statistical theory. By several series of lectures Frisch gradually improved the curriculum substantially. By partly applying mathematics he also made the presentation substantially more precise than that of ordinary textbooks at the time (Frisch 1946c). Thereby, the students got Norwegian texts supplementing those in English. This greatly facilitated the study.

On the 1st of January 1932 the Institute of Economics was established with Ragnar Frisch and one of his colleagues, Ingvar Wedervang, as leaders. During the 1930s work under the direction of Frisch was, apart from the Structural Survey, focused on macrodynamic systems and on production and market analysis for special commodities. In a report on achievements of the Institute presented at the end of 1941, Frisch pointed out that it had made possible "a scientific recruitment and the creation of a scientific milieu in the field of economics which would have been inconceivable without this activity" (Frisch 1941, p.7). Most of the young economists engaged in scientific work at that time, had got training and stimulation at the Institute.

Shortly after the war Frisch presented a plan for economic research and teaching in Norway (Frisch 1945). In this he pointed out that both the government and the private sector now wanted to "use economists to a much larger extent than before. There is a need for people with a broad theoretical knowledge on a modern basis and with acquaintance of the characteristics of Norwegian economy and social structure". This view was followed up in 1953, when a revision of the curriculum was made, which allowed the students to choose between different subjects while a large basic group of subjects remained as common requirement. The idea behind this change was, according to Frisch, that economics had become such a wide field of subjects that "no single person can command it. A cooperation is needed between persons who, each of them commanding their specialities, at the same time have so much common ground that they can understand each others language" (Frisch 1958).

However, the revision was also a result of pressure from the students, who wanted a choice of subjects.

The plan included a proposal for reorganization of the Institute of Economics, mainly by establishing a new type of positions designated "associates". The purpose of these positions would be to enable young economists to carry out independent research after graduation, without or with negligible teaching responsibilities. They would as a rule stay in such a position for 2 years and alternatively for 5 years.

The teaching of Frisch during the post war years was to a high degree focused on macroeconomic planning and policy. His lectures were often recorded by one of his students and, after being corrected by himself, published as "Memoranda from the Institute of Economics", in mimeographed form¹¹. These were made available at low cost to the students, and contributed a great deal to their education in planning and policy.

Most of the economists graduating after the middle of the 1930s went into the civil service. Gradually they achieved such a competence that quite a few were appointed to high or the highest positions, to a large extent replacing retiring lawyers who previously had a virtual monopoly on such positions. In particular, this occurred in the Ministry of Finance, where a number of economists were appointed for national budgeting during the first post war decade. Gradually, economists were also appointed for fiscal budgeting and other positions. At the end of 1962 as many as four of seven top positions were occupied by economists (Lie, p. 350).

The scientific staff working full time at the Institute of Economics increased from 5 in 1947-48 to between 7 and 12 during the next 11 years. Among the 22 economists working at the Institute during the period 1947-48 through 1952-53, as many as 3 became administrative heads of a Ministry, 8 became professors and 2 assistant professors. Most of the remaining 9 also got high positions, mainly in the central government where they to a large extent dealt with macroeconomic planning and policy.

Some economists also got political positions, mostly for short periods. As many as 13 became members of the Cabinet, one even became Prime minister and seven ministers of finance. The insistence of Frisch on the need to distinguish between a scientific statement and a value judgement

¹¹ From May 1947 to November 1964 no less than 240 memoranda were issued, varying in size from 2 to 250 pages. Most of them were written by Frisch and some by him in cooperation with one of his associates.

did not imply that economists should abstain from political activity, but many of those who became policy advisors kept this distinction in mind.

Information activities

Both during the 1930s and after the war Frisch quite frequently used the mass media to promote better information on the functioning of the economy, to correct what he considered misunderstandings in the public debate and to some extent to make policy proposals. During the preceding years of his career he had been so occupied with theoretical work that he did not try to influence policy through such activities. The reason for his change of attitude was apparently "the unworthy situation" observed during the Great Depression.

His first contact with the mass media probably occurred in October 1931, when he gave an interview to the newspaper *Tidens Tegn* on the occasion of Norway leaving the gold standard. Shortly afterwards he published an article in the same newspaper advocating an expansionary policy to fight the depression. From then on Frisch published a large number of newspaper articles and some of them, dealing with related subjects, were reprinted in the form of pamphlets. He also published quite a few expository articles in weekly and monthly periodicals. In addition, he presented public lectures in the radio as well as to audiences at various places of the country. A large part of these interventions dealt with macroeconomic issues. Only a few of the most important are mentioned below.

In the spring of 1932 Frisch held radio lectures on business cycles (Frisch 1932a). After describing the length of such cycles and their synchrony in different countries, he made an attempt at explaining their causes, but conceded that these were not as yet "fully understood". Nevertheless, so much was known about "the construction of the machinery that it is possible to indicate certain rational economic policy measures which most likely would strongly dampen the oscillations". Furthermore, he mentioned that such measures might be organized on a national basis, but "when people awake and become aware of this situation, it is not impossible that in individual countries, perhaps even in several countries, a movement will arise enforcing measures to control the business cycles".

At the end of 1932 he presented confidentially a memorandum on "The Government's duty to circulation planning" to a number of distinguished politicians and bankers, describing "the injury and suffering" caused by the economic situation, sketching its causes and making proposals for action (Frisch 1951a, pp. 3, 11-19). He even invited some of them to private meetings on the memorandum. In this presentation Frisch recommended the creation of new purchasing power: "The logical rational

solution is that the central government acts to create this new purchasing power and makes use of it on the strategically decisive point: in the consumption." He also made several policy proposals, inter alia, on the use of treasury bills to finance budget deficits and the establishment of a directorate with the power to counteract business cycles independently of the government authorities. None of them were accepted.

The meetings were not successful. Frisch characterized them as «running the head against the wall». Nevertheless, during the beginning of 1933 he published in the newspaper Dagbladet a series of articles based on the memorandum¹².

Several newspaper articles published by Frisch in the 1930s, aimed at eliminating misunderstandings which he termed "fictions" or "fictitious thinking". One was the "saving fictions", i.e. the belief that an increase of savings deposits was equal to real saving and that the depression could be counteracted by increased real saving. As just mentioned, Frisch argued that for the latter purpose consumption should be increased. Another fiction was that the banks needed increased deposits to make increased lending possible. Frisch explained that the lending of banks created increased bank deposits. A third fiction was that internal government borrowing would impose burdens on future generations. Frisch showed by double accounting that such loans represent claims of the citizens equal to the debt of the government. He also fought other fictions, but these examples may suffice. The major reason why Frisch spent considerable time on this fight, was that he considered it a precondition for achieving a more rational macroeconomic policy.

After the war his information activities, like his teaching, dealt most frequently with macroeconomic issues. In October 1950 and February 1951 Frisch published two articles in the Labour Party periodical Kontakt, which are of great importance as expressions of his political efforts. Here he set out in some detail his views on macroeconomic policy and explained why it was necessary to disseminate information on the newest results of research in economics (Frisch 1952a). He again referred to the 1930s when "The standard of living declined at the same time as abundance of means of production and labour existed". This led to the "fundamental conclusion" that for the democratic system to survive "the democracy must prevent such paradoxical situations". This would "require thorough systematic analysis as a basis for the economic policy", and he once more stressed the need for distinguishing between scientific statements and policy judgements.

¹² The first article appeared on 14 January 1933.

Frisch went on to maintain that it was necessary for the continued existence of the Western democracies that they "wholly and fully understand the necessity of entering new ways in order to rapidly utilizing the results of intensive economic research". If this is done, one will have "got command of a powerful tool that can be applied on almost all economic-political questions....". Consequently, a continual contact and a thorough understanding must be established among "economic scientists, government administration, industrial organizations and trade unions, technicians, data providers, foremen and last but not least the man on the work place". Even the general public must make "real efforts to keep informed on the profound economic approaches".

He also pointed out that the national budget represented a first step towards an analytical basis for a rational economic policy, but a further "long and courageous step" had to be taken which must be more radical than the national budgeting. Economic models must be built to illuminate how current economic-political questions are related. The analysis by means of such models could be implemented only by the help of economists, but the decisions must be made by democratic, political bodies. In concluding the two articles Frisch stated that no important economic-political question ought to be decided on "before representatives of the political parties with their economic advisors get together for a round-table conference" utilizing an analytical model of the kind he had described. He maintained this rather unrealistic vision during the rest of his life (Frisch 1957b).

In the middle of the 1950s, Frisch turned to a growing discontent with Norwegian planning and policy, and in the early 1960s he disassociated himself from the Labour Party which he had supported since the early 1930s. Thus, in 1965 he published 12 articles in the Socialistic Left Party's newspaper where he criticized heavily, even furiously, a number of aspects of recent Labour Party policy. These articles were reprinted in a pamphlet where three of them, in the list of content, were presented under the title: "The socialism and the peace policy are being abandoned and the fall into decay is beginning" (Frisch 1965b, pp. 2, 22). Frisch complained, inter alia, about the return of the Party to "fiction economy" and "unenlightened plutocracy". The fictitious thinking today is, he explained, "that one by means of instruments which in all essentials are of a monetary and financial policy nature shall be able to ensure a high employment simultaneously with rapid economic growth and a stable price level".

Even more polemical was his fight against membership of the European Economic Community during the 1960s and early 1970s. In this debate he himself did not always distinguish sufficiently between scientific statements and value judgements (Frisch 1963b).

In his last radio performance, Frisch mentioned Decision models as means of improving political decisions, pointing out that particularly three factors were important in order to arrive at more advanced models in the long run, viz. 1) formalization of the preference function, 2) a better understanding of the investment process and 3) a deeper understanding of what he termed "infraproblems", so that in deciding on which investment project to select, it would be possible to decide the directions and speed of technological change (Bjerve and Frisch 1970). These factors were important elements of the models which he developed during the period 1954-1964.

Advisory activities

Ragnar Frisch never held a formal position as advisor to the government, such as the professors Tinbergen and Mahalanobis did in the Netherlands and India, respectively. But both in the 1930s and during the first post war decade he exerted advisory influence on macroeconomic planning and policy by personal contact and cooperation with policy makers of the Labour Party (Frisch never became a member of this party) and by serving as a member of government committees.

The contact with policy makers was triggered off by the Dagblad-articles previously mentioned. At first, Frisch got in contact with Ole Colbjørnsen (an influential Labour Party journalist and a major contributor to the formulation of expansionary economic proposals of the Labour movement) who in the spring of 1933 published critical comments on these articles. Frisch replied twice, and his arguments apparently impressed Colbjørnsen, who during the summer and fall of 1933 had contact with Frisch when writing a book presenting "A Norwegian 3-years Plan" (Colbjørnsen and Sømme 1933). In particular, chapters III (pp.25-32) and IV (pp.33-38) of this book appear to be influenced by Frisch. For instance, the views expressed on national accounts, saving, finance and organization are very similar to those presented in (Frisch 1933b).

In the fall of 1933 Frisch was invited by the Labour Party to participate in the preparation of a proposal for financing its expansionary Crisis Program of 1934. In December 1933 the two top parliamentary leaders of the party asked him to attend a conference on this proposal. Later Frisch together with some of the leading party members held further meetings which resulted in a draft signed by Colbjørnsen and Frisch on 1 January 1934. After some further modifications the final version was adopted. The bank and finance chapter of the Crisis Program was "undisputably Frisch's" (Andvig 1986, pp.366, 378-380). At the request of the Party leader Johan Nygaardsvold, Frisch even authored a Labour Party statement to The Parliamentary Committee of Finance on 5 May 1934.

The contact and cooperation described above took place without any initiative by Frisch. However, he took an initiative himself on 19 March 1934 by sending a public letter to the Parliament criticizing a report of The Monetary Committee¹³ (of which Frisch had not yet become a member) for arguments against "the employment and credit expansion which the Labour Party has proposed", which "appear to be built upon a faulty basis" (Frisch 1965b). According to Frisch one of the main arguments of the committee was that "an expansion of credit is dangerous and will lead to inflation unless it is based on a preceding increase of the saving in the society (increase of bank deposits etc.)"¹⁴ Frisch went on to criticize that the Committee "in support of this argument" had referred to J.M. Keynes, and pointed out that "Keynes is in fact a sharp opponent of the orthodox "passive" view which The Monetary Committee had expressed".

To prove this Frisch cited a letter which he on request had received from Keynes after having translated for him the relevant parts of "the Labour Party's Crisis Program and of the report of The Monetary Committee". Keynes stated in this letter that if the Committee had interpreted him as being of the opinion that increased saving is a precondition for increased real investment, his view was in fact the opposite. Not only that, he continued, "it may in my opinion be shown theoretically that the degree of employment has a tendency to continue growing until real income of the public has increased so strongly that a sum of saving is set aside which is just the same as that which is necessary for new investment in real capital" (Frisch 1965b, p.16).

The letter of Frisch, including the translated letter of Keynes, was read to the Parliament by its president, Mr. Johan Nygaardsvold, during the budget debate one day after its receipt (20 March 1934). A prominent Norwegian historian has commented on this episode as follows: "This must have given Nygaardsvold and his party fellows a proud happy confidence: They had not only a good election result and a broad popular movement behind themselves, but they were also in keeping with the most modern social science" (Bull 1979, p.238).

In March 1935 the Labour Party got into power and Johan Nygaardsvold became Prime Minister. Already the next month Frisch was appointed a member of The Monetary Committee, replacing one of the members belonging to the Labour Party who had become Minister of Finance. In an annex to a

¹³ Established by the Ministry of Finance 6 April 1932 «for reporting on matters concerning economic and monetary policy». Referred to as The Monetary Committee.

¹⁴ Already on March 21 the chairman of The Monetary Committee sent a public letter to Nygaardsvold denying «that the committee had argued that any desirable expansion of credit required an initial increase in the private saving.»... Frisch answered (March 22, 1934) that he was «happy this was the case» claiming that his first letter to the Parliament «was precisely written in order to clarify this point since the Monetary Committee's criticism had been interpreted that way in the conservative and liberal press» (Andvig 1986, p.388)

report of this committee Frisch published in November 1935 a presentation on Open market operations (Frisch 1935). This presentation, which clearly explained the effects of such operations, became a part of the curriculum for the new study of economics. It was partly based on a framework for financial accounting. The government later changed the law on Bank of Norway so as to allow open market operations.

After the Second World War Frisch maintained his contact with leading Labour Party members, among them Einar Gerhardsen who was Prime minister for nearly 20 years, and Erik Brofoss, who was Minister of finance until December 1947 and then became Minister of trade for almost seven years. Frisch was one of several economists taking part in the drafting of Brofoss' first budget speech in February 1946 (Brofoss 1946). Some of the statements in this speech, which lasted for three and a half hour, are very typical for Frisch, for instance "to the extent that a budget deficit of the central government is financed by internal loans, they have no direct consequence for the real national wealth. Whether such a deficit indirectly will result in an increase or decrease of this wealth, depends on how the government uses the borrowed money,".... "Therefore it is a misunderstanding when it sometimes is said that the raising of an internal government loan means imposing burdens on future generations"."However, the government debts have importance for the distribution of the real wealth and the real income in the society". These quotations are very similar to statements made by Frisch in two articles which he in January 1936 published in the newspaper Aftenposten.

Shortly after the war Frisch became a member of two important committees, viz. one to advice on the rate of foreign exchange to be adopted and the other to advice more permanently on monetary and financial policy.

The Foreign Exchange Committee was established in August 1945, and unanimously proposed a 20 per cent increase of the exchange rate towards Pound Sterling (Valutakomiteen av august 1945). Frisch was very active in the deliberations of this committee and wrote a substantial part of the premises for the proposal. The proposal, however, was not adopted by the Cabinet who decided to maintain the existing exchange rate. As a member of this committee he also demonstrated his extraordinary capacity of work. The next to the final meeting ended so late at night that the members had to walk home (taxis were not available). Frisch who lived quite far away, arrived so late at his home that he had to return to the final meeting without sleeping. But at this meeting which started at eight o'clock in the morning, he was the most active member, showing no signs of fatigue.

The so-called Monetary and Financial Council during 1946 discussed credit policy at several meetings chaired by the Minister of finance himself. Frisch supported the low interest policy declared by the Cabinet and agreed with the majority of the Council that this required a direct restriction on lending. Nevertheless, the Council only recommended qualitative guidelines for the lending of commercial and savings banks because a direct quantitative control would have required the availability of statistics on lending broken down by major groups of borrowers, which was lacking.

In the years 1947-1949 the Council did not meet, but in 1950 the Minister of Finance again asked for advice. At that time a liberalization of the economy had begun, which was followed by an increase of interest rates, and this led to, inter alia, difficulties of financing state banks at the desired interest rates on their bond issues. In addition, the lending of private banks increased too much in spite of the qualitative credit control attempted. In this situation the Council was asked to consider which monetary and financial measures could be introduced to ensure sufficient reserves of foreign exchange and to create a price- and cost structure which in the long run would enable the maintenance of a high growth of the national product and a balance in the foreign account. The Council unanimously made several proposals on credit policy, budget policy, quantitative regulations, some subsidy and tax measures, wage compensation and social policy. Frisch made some observations of his own on introduction of an income tax based on consumption units and on potential income rather than actual income, as well as on wage compensation (Frisch 1950b). Together with another member he criticized the relaxation of direct quantitative controls of imports and expressed some views on the tasks of the Council and the character of its recommendations, arguing, inter alia, that the Council should abstain from making value judgments and confine itself to scientifically based recommendations. One year later the Council submitted another report, mainly on wage compensation for price increase. Frisch agreed on most of the recommendations, but together with three other members advised against applying special benefits as a part of a wage agreement (Frisch 1951b).

In the beginning of 1952 the Council presented a third report, with recommendations on financing of the state banks, on means of restricting the investment volume and on interest policy. As a basis for this report the Central Bureau of Statistics, in cooperation with Frisch and Leif Johansen, made forecasts of bank liquidity by means of a model with definitional relationships of the financial accounts and with some roughly calibrated structural relationships (Bjerve 1956). The majority of the Council, to which Frisch belonged, recommended that credit rationing be introduced, that lending of the state banks be financed by loans from the Central government, and that the commercial and savings banks should be obliged to buy quotas of government bonds at a low rate of interest (Penge-

From 1952 onwards the Monetary and Financial Council held no meetings before being dissolved in 1955. Afterwards Frisch was not a member of any government committee. His role as advisor to the government had terminated. Later during the 1950s and in the early 1960s Frisch maintained contact with Brofoss and some other prominent Labour Party members, but now mainly to get advice from them on his model building.

Even though the direct credit controls recommended by the Council were introduced in 1955, several other aspects of the macroeconomic policy disappointed Frisch, for instance, that the interest level was allowed to increase further and that the quantitative restrictions on foreign trade and real investment were gradually abolished. The fact that the Labour Government and the economists administering planning did not apply his models may also partly explain his growing discontent. One indication of this is the fact that when a coalition cabinet of parties to the right of the Labour Party came into power during the short period 28 August to 25 September 1963, Frisch, two days before its term of office began, offered to become its advisor on macroeconomic policy. He expressly mentioned economic programming as one kind of possible advice (Lyng 1965, pp.197-198).

Evaluation

The significance of Ragnar Frisch as a stimulating teacher and an inspiring research director can hardly be overemphasised. He influenced the thinking of an entire generation of Norwegian economists. Many of them became «footsoldiers» in his fight for improved macroeconomic planning and policy, and Frisch to some degree even ensured that they were placed in strategic positions¹⁵. Thereby he exerted through his pupils an important indirect impact on planning and policy in the post war years (Bjerve 1989).

The information activities of Frisch lasted for almost four decades. They undoubtedly contributed to a better understanding of the functioning of the economy, and of current problems discussed among politicians as well as the general public. His fight against «fictions» seems to have been quite successful, though even today «fictitious thinking» may be identified, for instance, in the debates on budget policy. His proposals for new schemes and institutions were as a rule too complex and impractical to be accepted. For instance, in the early 1930s he even lectured on replacement of the

¹⁵ In a letter to Erik Brofoss dated 13 March 1950 Frisch expressed the view that the research department to be established in the Central Bureau of Statistics «must be a scientific centre», and then added: «... you will certainly not take me amiss that I currently keep an eye on the young economists who constitute the entire scientific milieu, and that I at any time try to explore the possibilities that are available to promote the scientific development for each of them, considering his special abilities and interests.»

free market by a moneyless barter system (Munthe 1992, pp.99-134). Nevertheless, Frisch also by his information activities contributed to improved planning and policy in Norway.

The influence that Frisch exerted by advisory activities was confined to a period of 20 years. In the 1930s his advice to individual policy makers, his contribution to the Crisis Program of 1934 and his intervention in the Parliamentary debate supported the Labour Party in its recommendations of an expansionary macroeconomic policy. However, the Labour government gaining power in 1935, only to a minor degree adopted such a policy. In 1945 the Labour Party formed a majority government which for several years conducted an expansionary policy, which Frisch supported, particularly by his participation in the Monetary and Financial Council (Det norske Arbeiderparti 1945). But from 1952 on his advisory activities had hardly any impact.

Ragnar Frisch undoubtedly exerted a greater personal influence on Norwegian macroeconomic planning and policy by his educational and information activities than by his policy advice. Through the influence on his pupils he contributed considerably to macroeconomic planning and policy during the first couple of post war decades. A condition for this influence was the conviction of the Labour party that this policy required an increasing assistance by economists. In particular Erik Brofoss repeatedly called attention to this need for economists. He also to a high degree ensured the recruitment of economists to important government positions. Brofoss, who may be considered as the chief architect of post-war policy in Norway, was also himself influenced by the macroeconomic thinking of Frisch.

6. Visions and ambitions versus reality

Ragnar Frisch was an economist with grand visions and extraordinary ambitions, as evidenced in the preceding sections. In conclusion, it may be of interest to confront some of his visions and ambitions with the reality.

His vision of being himself "the heavy artillery" and his pupils "the infantry" agreed well with reality. Frisch influenced policy to a high degree through his pupils. The vision of a complementary development of theory and the data observed, was also quite in harmony with the actual development, at any rate in macroeconomics. The national accounts, the national budget and the macroeconomic planning models used in Norway today, are well in conformity with this vision. The contribution of economics and economists to mankind has not become as great as Frisch envisioned. At any rate, the

economics and economists to mankind has not become as great as Frisch envisioned. At any rate, the vision of politicians and experts sitting together in a conference, computing an optimal policy by means of models, continues to be a dream. Obviously, his conception of party policy was too simple.

The political ambitions of Frisch increased over time, from keeping secret his contacts with the Labour Party in the early 1930s to offering advice even to a government to the right of this party in 1963. Frisch was very satisfied with the macroeconomic policy of the Labour Party during the first half of the 1930s, and he praised the reforms implemented during the second half, when the party was in power. In particular, he lauded prime minister Johan Nygaardsvold "by whose side" he had fought (Frisch 1965b). The most important reason for his growing discontent from the early 1950s on, seems to be the economic liberalization. Frisch was convinced that to achieve a combination of social justice and high rate of economic growth, many instruments of economic policy were required. This belief was based on "the general mathematical principle" ... that ... "if a function is maximized under certain restrictions (in this case that some instruments are not permitted) one will never be able to achieve a higher maximum than if these restrictions are removed (Frisch 1962, pp.1,3).

Frisch was an outstanding thinker, and a vast source of inspiration. He had an abundance of ideas, a remarkable ability to generalize, an extraordinary capacity for work, and an almost inexhaustible energy. But perhaps due to this greatness, his professional ambitions tended to exceed the possibilities. For instance, his macroeconomic concepts, terminology and symbols were not adopted as international standards, such as he perhaps hoped. The accounting system developed for the purpose of structural analysis, was too comprehensive and detailed to be numerically applied. Also in macroeconomic model building his ambitions carried him away from achieving direct, practical results. In particular, his efforts at constructing numerical welfare functions were far too ambitious, but even at the end of his career Frisch maintained that without models with welfare functions "there are so many things we shall be cut off from doing in advanced planning analyses, that we must engage on this task the sooner the better" (Bjerve and Frisch 1970).

References*:

Amundsen, A. (1957): Vekst og sammenhenger i den norske økonomi 1920-1955. (Growth and interdependence in the Norwegian economy). *Statsøkonomisk Tidsskrift*, **71**, 121-158.

Andvig, J.C. (1986): *Ragnar Frisch and the Great Depression*. Norsk Utenrikspolitisk Institutt, Oslo.

Aukrust, O., Bjerve, P.J., Frisch, Ragnar (1948): *A system of concepts describing the economic circulation and production process*. Memorandum from the Institute of Economics, 8 March 1948. Oslo, 56 pp.

Aukrust O., Haavelmo, T. and Hiorth, O. (1948): PM om stabiliseringspolitikken. (P.M. on the stabilization policy), 8 November 1948. Oslo, 38 pp. Mimeographed.

Aukrust, O. and Frisch, Ragnar (1951): *Prøverekning på numerisk løsning av kryssløpslikningene*. (Experimental computations on a numerical solution of the inter-industry equations). Memorandum from the Institute of Economics, 18 February 1951. Oslo, 16 pp.

Aukrust, O. (1994): «The Scandinavian contribution to national accounting» in *The Accounts of Nations* (Zoltan Kennesey, ed.) IOS Press 1994, 16-65.

Bjerkholt, O. and Longva, S. (1980): *MODIS IV. A model for economic analysis and national planning*. Samfunnsøkonomiske studier 43, Statistisk sentralbyrå. Oslo, 189 pp.

Bjerkholt, O. (1992): «Hvordan kryssløpsanalysen kom til Norge». (How the inter-industry analysis came to Norway) in *Mennesker og modeller. Livsløp og Kryssløp*. Samfunnsøkonomiske studier 78, Statistisk sentralbyrå. Oslo, 43-63.

Bjerkholt, O. (1995): When input-output analysis came to Norway. *Structural change and Economic Dynamics* 6, 319-330.

Bjerve, P.J. (1940): Utredning om regnskapet for struktursektoren Bankvirksomhet - Stat. (Explanation of the accounts for the structural sector Banking activity - Government). Oslo, 84 pp. Unpublished.

Bjerve, P.J. (1944a): Grafisk framstilling av sirkulasjonssystemet til Föhl (Graphical presentation of Föhl's circulation system). *Nordisk Tidsskrift for Teknisk økonomi*. Stockholm 1941, 101-103.

Bjerve, P.J. (1944b): Økosirkssystemet og realsirkulasjonen i "The General Theory of Employment, Interest and Money". (The Ecocirc-System and the real circulation in "The General Theory of Employment, Interest and Money"). *Statsøkonomisk Tidsskrift*, **58**, 1-25.

Bjerve, P.J. (1954): Kryssløpsforskning i Statistisk Sentralbyrå. (Inter-industry research in the Central Bureau of Statistics). *Statistisk Tidsskrift* nr. 1, Stockholm, 3-15.

Bjerve, P.J. (1956): Forecasting Bank Liquidity. *Income and Wealth*. Series VI. London, 52-77.

* Quotation from publications with a Norwegian title are translated into English by the author.

Bjerve, P.J. and Frisch, Ragnar (1970): Økonomisk teori og økonomisk politikk. (Economic theory and economic policy). Talk in the radio 5th July. Published in *Økonomi og politikk. 15 artikler*. Oslo 1971, 5-13.

Bjerve, P.J. (1976): *Trends in Norwegian planning 1945-1975*. Artikler fra Statistisk Sentralbyrå 84. Oslo, 41 pp.

Bjerve, P.J. (1986): Ragnar Frisch og Økosirkssystemet. (Ragnar Frisch and the Ecosirc-System). *Sosialøkonomen*, Oslo, no. 9, 17-23 and no. 10, 26-30.

Bjerve, P.J. (1989): *Økonomisk planlegging og politikk*. (Economic planning an policy). Oslo, 288 pp.

Bjerve, P.J. (1991): Korfor fekk vi nasjonalbudsjettet? (Why did we get the national budget?) *Norsk Økonomisk Tidsskrift* **105**, Oslo, 77-96.

Brofoss, E. (1946): *Norges økonomiske og finansielle stilling*. (The economic and financial position of Norway). Oslo, 64 pp.

Bull, E. (1988): *Klassekamp og fellesskap 1920-1945*. Norges historie, bind 13. Oslo, Gyldendal.

Colbjørnsen, O. and Sømme, A. (1933): *En norsk 3-årsplan. Veien fram til en sosialistisk planøkonomi*. (A Norwegian 3-years plan. The road towards a socialistic planned economy). Oslo.

Edvardsen, K. (1970): A survey of Ragnar Frisch's contribution to the science of economics. *De Economist*, nr. 118 nr. 2. 175-208.

Det norske Arbeiderparti (1945): *Arbeidsprogram* (Work program). Oslo, 18 pp.

Finansdepartementet (1946): *Nasjonalregnskapet og nasjonalbudsjettet. Særskilt vedlegg nr. 11 til statsbudsjettet*. (The Ministry of Finance: The national accounts and the national budget. Separate enclosure no. 11 to the central government's budget (1945-1946). Oslo, 38 pp.

Frisch, Ragnar (1932a): *Verdensøkonomien i etterkrigstiden. Konjunktorene*. (The world economy in the post war years. The business cycles). Universitetets radioforedrag, Oslo, 79-139.

Frisch, Ragnar (1932b): Nyorientering av den økonomiske teori. Økonomikken som eksperimentalvitenskap. (New orientation of the economic theory. Economics as an experimental science). *Statsøkonomisk Tidsskrift*, **46**, 1-5.

Frisch, Ragnar (1933a): «Propagation Problems and Impulse Problems in Dynamic Economics» in *Economic Essays in Honour of Gustav Cassel*, George Allen & Unwin Ltd, London, 171-205.

Frisch, Ragnar (1933b): *Sparing og sirkulasjonsregulering*. (Saving and circulation planning). Oslo: Fabritius og Sønners Forlag, 37 pp.

Frisch, Ragnar (1935): *Open Market Operations og deres virkninger på banksystemet*. Bilag 4 til Innstilling om Markedsoperasjoner avgitt av Komiteen til utredning av økonomiske og pengepolitiske spørsmål. (Open Market Operations and their influence on the banking system. Annex 4 to Report on Market operations submitted by The Monetary Committee). Oslo, 43-60.

Frisch, Ragnar, Keilhau, W. and Wedervang, I. (1936): *Plan til en økonomisk strukturundersøkelse for Norge*. (Plan for a structural survey of Norway). Oslo: Fabritius & Sønners boktrykkeri, 33 pp.

Frisch, Ragnar (1940): Nasjonalregnskapet. (National Accounts). Beretning om Det 3. nordiske statistikermøte i Oslo. (Report from the 3. Nordic Meeting of Statisticians in Oslo). 28 and 29 June 1939. Oslo.

Frisch, Ragnar (1941): P.M. om arbeidet ved Universitetets Økonomiske Institutt og ved Koordineringsavdelingen av den Økonomiske Strukturoversikt for Norge. (P.M. on the Work at the Institute of Economics, University of Oslo at the Coordination Section of the Structural Economic Survey of Norway). Oslo, 7 pp.

Frisch, Ragnar (1942): Noen innføringsmerknader om Økosirk-Systemet (Det økonomiske sirkulasjonssystem). (Some introductory remarks on the Ecocirc-System (The economic circulation system)). Oslo 37 pp. A shorter version was published in *Økonomisk Tidskrift*, **45**, 106-121.

Frisch, Ragnar (1945): Økonomisk forskning og undervisning i Norge. (Economic research and teaching in Norway). *Statsøkonomisk Tidsskrift*, **59**, 101-112.

Frisch, Ragnar (1946a): *Innledning til produksjonsteorien*. (Introduction to the theory of production). 7. ed. Oslo.

Frisch, Ragnar (1946b): The Responsibility of the Econometrician, *Econometrica*, **14**, 1-4.

Frisch, Ragnar (1946c): *Notater til økonomisk teori*. (Notes on economic theory). 3. issue, Oslo, 448 pp.

Frisch, Ragnar (1947): The Economist and the World Problems of the Day. Address to the International Economic Club. Lake Success, 3 February 1947, 1-3. (Also in Repercussion Studies at Oslo, *American Economic Review* **38**, 367-372).

Frisch, Ragnar (1948a): Work on National Accounting done at the University Institute of Economics, Oslo. University Institute of Economics. Stencil-memo, 22 December 1940, Oslo, 4 pp.

Frisch, Ragnar (1948b): *Subsidielikningssystemet*. (The System of subsidy equations). Memorandum from the Institute of Economics, 9 December 1948. Oslo, 16 pp.

Frisch, Ragnar (1949a): *Price-Wage-Tax-Policies as Instruments in Maintaining Optimal Employment*. Memorandum of 28 March 1949. Oslo, 58 pp. Also published as a United Nations document (E/CN1/Sub 2/13 1949) 18 April 1949. Later published in Frisch, Ragnar: The Mathematical Structure of a Decision Model: The Oslo Submodel, *Metroeconomica*, **7**, 111-136.

Frisch, Ragnar (1949b): Work done and work planned at the University Institute of Economics. *Stimulator*, **3** no. 5, 4-10.

Frisch, Ragnar (1950a): *Hovedsynspunkter for arbeidet med den økonomiske samgripingsanalyse (Decisjonsmodellen)*. (Main Views of the Work on the Economic Analysis of Interrelationships (The Decision Model)). Memorandum from the Institute of Economics, 3 February 1950. Oslo, 13 pp.

Frisch, Ragnar (1950b): *Særuttalelser i Penge- og Finansrådets innstilling 30. august*. (Special comments in the report of the Monetary and Financial Council). St.prop. nr. 129 (1950) Annex 10-11. Special comments together with Gunnar Bøe Annex 27-32. Oslo.

Frisch, Ragnar (1951a): *Statens plikt til sirkulasjonsregulering*. (Nedtegnet i hast 10.-12. desember 1932). (The Governments duty to circulation planning). Written in a hurry 10-12 December 1932). Memorandum from the Institute of Economics, 11 January 1951. Oslo, 35 pp.

Frisch, Ragnar (1951b): *Særuttalelse i Penge- og Finansrådets innstilling, 15. oktober 1951*. (Special comments in the report of the Monetary and Financial Council together with Bjerve, P.J., Jahn, G. and Getz Wold, K.). Oslo, 40-41.

Frisch, Ragnar (1952a): *Økonomisk demokrati*. (Economic Democracy). Memorandum from the Institute of Economics, 16 October 1952. Oslo, 20 pp.

Frisch, Ragnar (1952b), i samarbeid med associat Arne Amundsen: *Betalingsmiddelforskyvninger mellom sektorer i et lands næringsliv*. Innstilling fra Penge- og Finansrådet. (Frisch, Ragnar in cooperation with associate Arne Amundsen: Shifting of payments between sectors in the industry life of a country). Report from the Monetary and Financial Council, 13 January 1952. Oslo, 68-82.

Frisch, Ragnar (1952c): *Reperkusjonsanalytiske problemer som kan studeres på grunnlag av vare- og tjenestetilgangen oppdelt etter tiltrekningsandeler, hovedkategorier av goder og næringssektorer*. (Problems of repercussion analysis that can be studied on the basis of the supply of goods and services divided by estimation shares, major categories of goods and industrial sectors). Memorandum from the Institute of Economics, 6 November 1952. Oslo, 161 pp.

Frisch, Ragnar (1953): *Samfunnsmodell anvendt i en analyse av hvordan de økonomiske faktorer griper inn i hverandre*. (Model of the Society applied in an analysis of how the economic factors are interrelated). *Stimulator*, 6, No. 3, 5-19.

Frisch, Ragnar (1955): «From National Accounts to Macro-Economic Decision Models» in M. Gilbert and R. Stone (eds): *Income and Wealth*. Series IV. London: Bowes and Bowes Publishers Ltd., 1-26.

Frisch, Ragnar (1956): *Submodell, Medianmodell og Refi-modell*. (Submodel, Median model and Refi-model). Memorandum from the Institute of Economics. 2 January 1956. Oslo, 24 pp. (See also Memorandum of 21 October 1956, 5 February 1957, 4 June 1957).

Frisch, Ragnar (1957a): *Oslo Decision Models*. Memorandum from the Institute of Economics, 4 June 1957. Oslo, 47 pp.

Frisch, Ragnar (1957b): Om målsettingsformuleringen ved nasjonal planlegging. (On the formulation of objectives in national planning). *Nationaløkonomisk Tidsskrift*, 95, 125-130.

Frisch, Ragnar (1958): *Økonomikkens landevinninger i nyere tid*. (Recent progress in economics). *Statsøkonomisk Tidsskrift*, 72, 263-286.

Frisch, Ragnar (1959a): *Aggregat-Refi-Modeller*. (Aggregate Refi-Models). Memorandum from the Institute of Economics, 20 April 1959. Oslo, 92. (See also memoranda of 29 June 1959, 17 November 1959, 19 February 1960 and 27 June 1960.) Printed in Frisch, Ragnar: The Oslo Refi Interflow Table. *Bulletin de L'institut International de Statistique*, 33 session, Paris 1961, 1-11 and

«A Generalized Form of the Refi Interflow Table», *Problems of Economic Dynamics and Planning, Essays in Honour of Michal Kalecki*, (edited by T. Kowalik), 1964, 133-156.

Frisch, Ragnar (1959b): Elsås-modellen og dens utbygging for programmeringsformål. (The Elsås-model and its extension for programming purpose). Memorandum from the Institute of Economics, 15 March 1959. Oslo, 11 pp.

Frisch, Ragnar (1960): Synopsis of a Channel Model for Macroeconomic Programming. Memorandum from the Institute of Economics. 23 August 1960, 3 pp. (See also memoranda of 13 May 1961, 20 October 1961 and 3 October 1963). Printed as «Preface to the Oslo Channel Model» in *Europe's Future in Figures*. Amsterdam, 1962, 248-287.

Frisch, Ragnar (1962): Prinsipiell diskusjon om makroøkonomiske virkemidler. (A discussion on principles as regards macroeconomic instruments). Memorandum from the Institute of Economics, 7 December 1962. Oslo, 6 pp.

Frisch, Ragnar (1963a): An Implementation System for Optimal National Economic Planning without Detailed Quantity Fixation from a Central Authority. Proceedings of the 3rd International Conference on Operational Research. Oslo, 20 pp.

Frisch, Ragnar (1963b): *Hva saken gjelder*. (What the case concerns). Oslo, 10-64.

Frisch Ragnar (1965a): *Theory of Production*. Dordrecht - Holland: D. Reidel Publishing Company, 370 pp.

Frisch, Ragnar (1965b): *Politikk i pakt med fremtiden*. (Policy in keeping with the future). Oslo, 87 pp.

Johansen, L. (1960): *A Multi-Sectoral Study of Economic Growth*. North-Holland, Amsterdam. Second Enlarged Edition 1974, 274 pp.

Johansen, L. (1973): Ragnar Frisch (1895-1973). *Economics of Planning*, **11**, 1-3.

Lie, Einar (1995): *Ambisjon og tradisjon. Finansdepartementet 1945-1965*. (Ambition and tradition. The Ministry of Finance 1945-1965). Oslo, 493 pp.

Lyng, J. (1965): *Vaktskifte. Erindringer*. (Changing of the guard. Memories). Oslo.

Munthe, Preben (1992): *Norske økonomer*. (Norwegian Economists). Oslo, 190 pp.

Penge- og Finansrådet (1952): *Innstilling 13. januar*. (Report of the Monetary and Financial Council 13 January). Oslo, 1-63.

Rossen, S. (1942): Koordinerte regnskaper for skipsaksjeselskap. (Coordinated accounts for shipping). Published by Oslo kommunale statistiske kontor: *Statistisk månedsskrift*. Januar-mars 1952. Oslo, 23-147.

Sevaldson, P. (1953): Notat om Forskningsplanmøte. Sosialøkonomisk Institutt. (Note about a meeting on research planning at the Institute of Economics, 26 June). Unpublished.

Sevaldson, P. (1960): *Kryssløpsanalyse av produksjon og innsats i norske næringer*. (Input-output analysis of Norwegian Industries). 1954. Samfunnsøkonomiske studier 9, Statistisk Sentralbyrå. Oslo, 614 pp.

Sevaldson, P. (1962): En produksjons-konsum-kryssløpsmodell for økonomisk planlegging. (A production consumption input-output model for economic planning). Statsøkonomisk Tidsskrift, **76**, 69-98. Also published as «An inter-industry model of production and consumption for economic planning in Norway», in C. Clarc and G. Stuvell (eds.): *Income Redistribution and the Statistical Foundation of Economic Policy*. Income and Wealth, Series X, 23-50, Bowes and Bowes, London 1964.

Statistisk Sentralbyrå (1946): *Nasjonalinntekten i Norge*. (The Central Bureau of Statistics: The national income in Norway) 1935-1943. Oslo, 159 pp.

Statistisk Sentralbyrå (1957): *Kredittmarkedsstatistikk*. (Central Bureau of Statistics: Credit Market Statistics). NOS XI 281. Oslo.

Valutakomiteen av august 1945 (1945): *Innstilling*. (Foreign Exchange Committee of August 1945: Report). Oslo, 1-26 .

Issued in the series Documents

- | | |
|--|--|
| <p>94/1 <i>H. Vennemo (1994):</i> Welfare and the Environment. Implications of a Recent Tax Reform in Norway.</p> <p>94/2 <i>K.H. Alfsen (1994):</i> Natural Resource Accounting and Analysis in Norway.</p> <p>94/3 <i>O. Bjerkholt (1994):</i> Ragnar Frisch 1895-1995.</p> <p>95/1 <i>A.R. Swensen (1995):</i> Simple Examples on Smoothing Macroeconomic Time Series.</p> <p>95/2 <i>E.Gjelsvik, T. Johnsen, H.T. Mysen and A. Valdimarsson (1995):</i> Energy Demand in Iceland</p> <p>95/3 <i>C. Zhao, O. Bjerkholt, T. Halvorsen and Y. Zhu (1995):</i> The Flow of Funds Accounts in China</p> <p>95/4 <i>Nordic Indicator Group (1995):</i> Nordic Environmental Indicators. Draft document. English version with main points from comments received.</p> | <p>95/5 <i>H.A. Gravningsmyhr (1995):</i> Analysing Effects of Removing Survivors' Pensions, Using the Microsimulation Model LOTTE.</p> <p>95/6 <i>P. Boug (1995):</i> User's Guide. The SEEM-model Version 2.0.</p> <p>95/7 <i>E. Bowitz, N.Ø. Mæhle, V.S. Sasmitawidjaja and S.B. Widoyono (1995):</i> MEMLI – An Environmental model for Indonesia. Technical Documentation of data programs and procedures</p> <p>95/8 <i>K. H. Alfsen, T. Bye, S. Glomsrød and H. Wiig (1995):</i> Integrated Assessment of Soil Degradation and Economic Growth in Ghana</p> <p>95/9 <i>O. Bjerkholt (1995):</i> Ragnar Frisch and the Foundation of the Econometric Society and Econometrica</p> <p>95/10 <i>P.J. Bjerpe (1995):</i> The Influence of Ragnar Frisch on Macroeconomic Planning and Policy in Norway.</p> |
|--|--|

Statistics Norway
Research Department
P.O.B. 8131 Dep.
N-0033 Oslo

Tel.: + 47 - 22 86 45 00
Fax: + 47 - 22 11 12 38

ISSN 0805-9411



Statistics Norway
Research Department