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Haavelmo and Denmark

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Halvor Mehlum and Jon Vislie

Introduction

In December 2011 the Department of Economics, University of Oslo, hosted a symposium to commemorate Nobel Laureate Trygve Haavelmo, on the occasion of the centennial of his birth. The program was made up of eminent scholars giving presentations related to Trygve Haavelmo's contributions to econometrics and economic theory.

Trygve Haavelmo was awarded the Nobel memorial Prize in Economics in 1989 for his seminal contributions to the foundation of modern econometric theory. His numerous publications on econometrics from 1930-40's are well known to the international community. A selection of the symposium presentations on econometrics and econometric methodology will appear in a special issue of *Econometric Theory*. Beyond econometrics, Haavelmo made a lot of interesting contributions to economic theory. The present volume of *Nordic Journal of Political Economy* contains the symposium contribution related to these other contributions.

Well known to the profession is his book "A Study in the Theory of Economic Evolution", from 1954. This was a predecessor on neoclassical growth theory, rent seeking, international inequality and migration. Kalle Moene in his contribution to the present volume combines some of Haavelmo's ideas related to rent seeking and institutional quality, and their consequence for uneven development. In his other well-known book from 1960, "A Study in the Theory of Investment", Haavelmo builds a complete investment theory, from basic principles and distinguishing between flow and stock variables, incorporating not only demand for capital, but also the supply of investment goods. In this book he outlines some important consequences for the macroeconomy and macroeconomic modelling, inspired by both Wicksell and Keynes. In fact, macroeconomic theory caught Haavelmo's attention and thinking during all the years he was teaching at the University of Oslo. Some of these ideas are unfortunately not well known because they appeared in lecture notes in Norwegian. Therefore we decided to publish a translated version of a paper by Haavelmo, published in 1956 in a *Festschrift* in honor to Erik Lindahl, so as to give some flavour of Haavelmo's ideas. In the present volume some of the macro material of Haavelmo is further elaborated in one article by André K. Anundsen, Tord S. Krogh, Ragnar Nymoen and Jon Vislie, and one by Sheetal Chand. These papers are mainly discussing the interaction between monetary policy and the business cycle.

The year before Haavelmo went to USA, was spent in Århus, Denmark, in 1938-39. Niels Kærgård tells a story about the economic profession in Scandinavia at that time, and especially the influence Haavelmo had on macroeconomic thinking at the University of Århus, and perhaps vice versa.

Another issue occupying Haavelmo's mind for years, until his death in 1999, was the tension between population growth, economic progress and environmental quality. It is no exaggeration to say that Haavelmo was very pessimistic as to the future development. Rapid population growth and too high rate of growth in consumption per capita and energy consumption, would lead to environmental degradation and severe welfare loss. This issue is further discussed by Michael Hoel and Bjart Holtmark.

Halvor Mehlum
Managing Editor

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Niels Kærgård *

Haavelmo and Denmark

Abstract

Haavelmo's visit to Aarhus in 1938-39 did not have any influence on his famous econometric contributions. But if one considers Haavelmo's post-1945 research in the balanced budget multiplier and the investment theory, there seem to be indications of much more inspiration from the discussions that went on at Aarhus University. At least, this is the simplest explanation of a couple of 'independent' publications of closely parallel results.

Keywords: *Haavelmo, history of economic thought, Scandinavian economics, balanced budget multiplier, investment theory.*

JEL classification: B22, B31, E22

* Paper based on a presentation at The Trygve Haavelmo Centennial Symposium, Oslo, December 13-14, 2011.

1. Introduction

In studying the relationships between Scandinavian economists such as Ragnar Frisch and Trygve Haavelmo, who were working in the mid-twentieth century, and contemporary Danish economists, it is important to remember that the international research community at that time was quite different from what it is today. The most influential research institutions were not the same as those of today, for many reasons, and also the opportunities for and methods of communication were very different. It is also important to remember that different topics were in focus in the economic debate at that time.

In present-day views of the development of economics, Trygve Haavelmo is of course best known for his contributions to econometrics, through his 1943 and 1944 articles in *Econometrica*. But that was not the case in discussions among economic students at, for example, the University of Copenhagen in the 1960s and 1970s. Keynesian theories dominated completely at that time. Macroeconomics was viewed as consisting almost solely of demand driven multiplier models, and Haavelmo made two core contributions to these theories – contributions which every student at that time had to know long before he or she came on to more advanced topics like econometrics. These contributions by Haavelmo related to the balanced budget multiplier and the dimensions in the investment function. These two elements were included in even the most elementary courses in macroeconomics, and it was compulsory for students to know about them.

The balanced budget multiplier (at that time often called the Haavelmo theorem) came when it was first calculated as a complete surprise – thinking in terms of multiplier models was a new concept for the economists of that time, and the intuitive, ‘common-sense’ view was that a balanced budget must be neutral. Haavelmo published his results in *Econometrica* in 1945, and subsequently they were intensively debated both internationally and more locally in Scandinavia (Salant et al, 1975). For example, the Danish professor P. Nørregaard Rasmussen published one article with a discussion of the balanced multiplier in factor prices as opposed to market prices in a model with indirect taxes (Rasmussen, 1958), and another discussing the balanced budget multiplier in relation to foreign trade (Rasmussen, 1960). The balanced budget multiplier was at that time not a rather trivial case study in the textbooks but a relevant, new, interesting and surprising concept.

Haavelmo’s other remarkable contribution was related to the investment function. Today it is normal to see in textbooks an investment function where investments are a function of the interest rate. Following the publication of Haavelmo (1960), however, this was viewed in the 1960s and 1970s as a serious error. At that time, the distinction between stocks and flows was central in the macroeconomic debate. According to this discussion, the required stock of capital had to be dependent on variables such as the demand and the interest rate. This means that the optimal capital stock is constant if the demand and the interest rate are constant, and consequently the net investment is zero. This means that it is changes in interest rate which determine investment, not the level of the interest rate.

This argument was stressed in the textbooks of that time (see, for example, Andersen, 1969).

The main point of the present article is to argue that these two important macroeconomic contributions by Haavelmo could have had their basis in discussions at Aarhus University just before the war. Consequently Haavelmo's stay in Aarhus was more important than it was considered by, for example, Bjerkholt (2008) – not in relation to Haavelmo's econometric work in the years just after his stay in Aarhus, but in relation to his macroeconomic work in the post-war period.

However, to understand the relationships between the Scandinavian economists concerned, it seems necessary to give a description of the Scandinavian economic research environment. Consequently, the article begins with a description of this research environment as it was in Haavelmo's time, and the relationship of this environment to the international research environment. The next section discusses Haavelmo's relationship to Denmark; after that, Haavelmo's relations with the other Scandinavian countries are briefly described, especially with Sweden and Herman Wold. The last section is a short conclusion.

2. Scandinavian economic at the time of Haavelmo

At Haavelmo's time, the world and its institutions were quite different from those we know today. When Haavelmo was active, from the 1930s to the 1980s, e-mail did not exist. In the beginning of the period one could not meet with a person in the US or UK without making a long and expensive voyage by boat, and even in the 1950s and 1960s, transatlantic travelling was still much more difficult and expensive than it has become in recent decades.

Furthermore, a considerable proportion of economics publications were in local languages. The language of theses in economics at the University of Copenhagen can be used as an indication of the way this has changed over time (see Table 1). The movement away from Danish and to English is very clear. A similar trend is found in the other Scandinavian countries; see, for example, Sandelin and Ranki (1997) concerning Sweden. The same was the case for journal articles. The Danes mainly published in *Nationaløkonomisk Tidsskrift* (which did not normally accept English articles before 2003), while the Norwegians published in *Statsøkonomisk Tidsskrift*, the Swedes in *Ekonomisk Tidsskrift* (renamed *Swedish Journal of Economics* in 1965, and *Scandinavian Journal of Economics* in 1976) and the Finns in *Ekonomiska Samfundets Tidsskrift* – all in the local language.

This meant that it was necessary to be able to read Scandinavian languages in order to be able to evaluate Scandinavian candidates for a doctoral degree or a

Table 1: Language of economics at theses at the University of Copenhagen

Periods	English dr.polit. theses	Danish dr.polit. theses	Percentage in Danish	English Ph.D. theses	Danish Ph.D. theses	Percentage in Danish
1900-19	0	10	100%	-	-	-
1920-39	1	4	80%	-	-	-
1940-59	4	5	56%	-	-	-
1960-79	8	4	33%	1	9	90%
1980-84	1	0	-	3	10	77%
1985-89	2	2	-	5	10	67%
1990-94	0	1	-	14	7	33%
1995-99	0	0	-	21	6	22%
2000-04	0	0		49	0	0%

Note: Percentages are only calculated for groups with more than 5 theses in total.

professorship¹. Haavelmo, for example, was a member of the evaluation committees for a number of Danes.² It must be remembered that the evaluation of dissertations and of applications for professorships was considerably more troublesome at that time, when most of a candidate's academic production consisted of unevaluated book manuscripts in his or her national language, rather than, as now, a collection of refereed journal articles which can almost be evaluated by counting the number of articles and the ratings of the journals.

It is also worth remembering that the economics research environments of the world before the 1970s were very small. There were fewer than twenty researchers in economics in Denmark in 1950. At the University of Copenhagen, there were only four full time researchers and five part-time teachers in 1950; the new University of Aarhus, founded in 1928 but without an economics department until 1936, was even smaller, and Copenhagen Business School (founded in 1928) and the Agricultural University (founded in 1858) had only a couple of economists each at that time.

The small number of researchers in any one place was a strong argument for close contacts between economics departments throughout Scandinavia (see Kærgård, 1996). In the period 1863 to 1988, large-scale Nordic meetings for economists were held every third year, rotating among the countries and arranged by the national economics associations (in Denmark, Nationaløkonomisk Forening (Danish Economic Society)). However, these were rather broad meetings, dealing with many different political and economic issues, most of them only peripherally related to economics research. From the 1930s to the 1960s there were meetings especially for younger economists arranged by other

¹ Scandinavian citizens understand each other's language without translation.

² For example, the evaluation of Nørregaard Rasmussen's dissertation in 1956 and Erling Olsen's in 1971, as well as membership of the evaluation committees when Nørregaard Rasmussen became professor in 1956 and Mogens Boserup and Erling Olsen in 1970.

organisations (in Denmark, Socialøkonomisk Samfund (Danish Socioeconomics Association)).

The most relevant meetings for economics researchers were the ‘Marstrand Meetings’ (named after the small island of Marstrand in the archipelago of Gothenburg, where the meetings were normally held). When economics became more mathematical and statistical in focus (as signalled, for example, by the establishment of the Econometric Society in 1930, and the publication of *Econometrica* since 1933), a more technical and research-oriented Scandinavian forum seemed to be needed. So, in 1936, the Marstrand Meetings were started, with Ragnar Frisch, Erik Lindahl and Frederik Zeuthen among the main organisers. There were meetings in 1936-39, 1945-46, and 1948; and gradually it became a tradition that Scandinavian economics researchers met on the island of Marstrand in every year when there was no full-scale Nordic meeting. It also became a tradition that a few years after obtaining an appointment at an economics research department in Scandinavia, a researcher would present a paper at a Marstrand Meeting; and from then on he (and in very few cases she) would become known in Scandinavian economic circles. These meetings were rather informal, and featured very open discussion of scientific issues. They continued until 1978, when the island’s hotel was sold; then, after meetings in Kungälv in 1981, Mariehamn in 1982, in Hankø 1983 and Hirtshals in 1985, the meetings were dropped.

At that time, the Scandinavian economists met each other quite regularly, and were private friends – or enemies. They often strongly disagreed with each other; nevertheless, they had special relationships, and knew each other well. An indication of their close relations is that they contributed regularly to festschrifts published on the occasion of significant birthdays among the group. For example, Haavelmo contributed articles when Jørgen Pedersen (DK) turned 60 in 1951, Erik Lindahl (S) 65 in 1956, Frederik Zeuthen (DK) 70 in 1958, and Jørgen Gelting (DK) 70 in 1982.

All this gradually stopped in the final decades of the 20th century, when contributions to economics research came normally to be published in English in international journals, and many of the academic meetings became more and more specialised and less regional.

3. Scandinavian economics and the international environment

It is, however, important to stress that this Scandinavian economics research environment was far from isolated. It was an important part of the international research community. With the establishment of the Econometric Society in 1930, econometric and mathematical economics research became a dominating element of economics; and very soon the society’s journal *Econometrica*, first published in 1933, became one of the most well-respected among economics journals. The Scandinavians were very active in this

process. Ragnar Frisch was a leading figure in starting the society, and he was editor of *Econometrica* from 1933 to 1954. At that time the editor really did edit the journal; the peer review process was far from being as formal as today (see Bjerkholt (1995) for a discussion of Frisch and *Econometrica*). At the first European meeting of the Econometric Society in Lausanne in 1931 there were 19 presentations, and 3 of them were given by Frisch (who also gave the opening and closing addresses).

But many other Scandinavians were active in the new society. The numbers of members of the society in each country in 1950 per million inhabitants are shown in Table 2 for European countries with more than 1 million inhabitants and for the USA. Parallel figures for Fellows of the Econometric Society in 1960 are shown in Table 3. These two tables indicate that the Scandinavian countries were very active in the society, and that other Scandinavians beside Ragnar Frisch were influential in its development. Trygve Haavelmo became its president in 1957 and Herman Wold in 1960.

Without doubt, Sosialøkonomisk Institutt (Department of Socioeconomics) at the University of Oslo was the centre of Scandinavian economics at that time and an international centre of excellence throughout the 1950s and 1960s, with Ragnar Frisch, Trygve Haavelmo and Leif Johansen among its researchers. Very few other economics departments in the world, if any, were able to compete with it. Frisch was appointed as a professor at the University of Oslo in 1931, and he started Sosialøkonomisk Institutt in 1932. From there he worked on demand theory, confluence analysis, identification,

Table 2: Members of the Econometric Society per million inhabitants, 1950

Norway	9.59
USA	5.42
Switzerland	5.16
The Netherlands	3.98
Denmark	3.21
Sweden	2.73
France	1.68
UK	1.63
Belgium	1.55
Czechoslovakia	0.83
Ireland	0.68
Hungary	0.67
Austria	0.59
Italy	0.53
Finland	0.51
Spain	0.43

Source: *Econometrica*, 1950

Table 3: Fellows of the Econometric Society, 1960

	Fellows	Fellows per mill. inhabitants
Norway	3	0.83
Sweden	6	0.80
Switzerland	3	0.57
The Netherlands	5	0.43
USA	71	0.39
Ireland	71	0.36
France	14	0.31
UK	12	0.23
Finland	1	0.23
Denmark	1	0.22
Italy	8	0.16

Source: *Econometrica*, 1960

dynamics and many other key problems in the development of econometrics. He had a number of prominent assistants: Olav Reiersøl, Trygve Haavelmo, Leif Johansen and many others (Bjerkholt, 2005). The most prominent of these was undoubtedly Trygve Haavelmo (1911-1999)³. Haavelmo was already in contact with the most prominent econometric circles in the late 1930s. He was in the USA from 1939 to 1947 (with a Rockefeller fellowship 1939-42 and at the Cowles Commission 1946-47). In 1948 he became a professor at the University of Oslo.

It is a quality of the Oslo school that they tried to combine teaching, research and practical economic advisory work. Sosialøkonomisk Institutt was an important player in the Norwegian politico-economic debate, and Frisch's pupils dominated the central economic institutions (The Ministry of Finance, the Central Bureau of Statistics and the Bank of Norway); see Søylen (1998), Bjerkholt (1998) and Kærgård (2000). In this context it is important to mention Leif Johansen, too. His research area was not econometrics in the narrow sense, but his Multi Sectoral Growth Model from 1960 was the beginning of the Applied General Equilibrium Model tradition.

Even though Frisch, Haavelmo and Leif Johansen were very different people and worked on different topics, they nevertheless had views on methodology and the economic structure that coincided to such an extent that it is perhaps reasonable to talk about an 'Oslo School'. The separation of object and evaluation, the unification of

³ Scholars in the history of econometrics have had no hesitation in calling the introduction of probabilistic theory into econometrics 'Haavelmo's revolution'. Concerning Haavelmo's contribution to econometrics see, for example, Epstein (1987), Kærgård (1989), Morgan (1990) and Qin (1993).

theoretical and empirical work, and an interest in making results useful as tools for economic policy-makers were common to them all.

This situation meant that promising Danish economists who wanted to be trained outside Denmark did not go to the USA, as they do today, but to Oslo. Georg Rasch (professor in statistics at the University of Copenhagen 1962-71) was in Oslo in 1935; Poul Nørregaard Rasmussen (professor at the University of Copenhagen 1956-88) went there in 1947-48. Sven Danø (professor at the University of Copenhagen 1966-92) was in Oslo in 1950 and Ellen Andersen (professor at the University of Copenhagen 1975-99) in 1963.

4. Haavelmo in Denmark

Haavelmo had a very close relationship to Denmark. He was in the country for extended periods, in 1938-1939 and in 1971. He participated in a number of evaluation committees and was foreign member of the Danish Academy of Science and Letters. Haavelmo's visit to Aarhus University in 1938-39 occurred relatively shortly after the foundation of that institution.⁴ Aarhus University itself was actually founded in 1928, but no economics department was established there until 1936. The first head of the department was Jørgen Pedersen (1890-1973), who is best known for an article about Keynesian fiscal policy published in 1937 in German, independent of Keynes' General Theory, and for his 1944 book *Pengeteori og Pengepolitik* (Monetary Theory and Monetary Policy) (Brems, 1996). Eric Schneider (1900-1970, professor in Kiel after the war) and Thorkil Kristensen (1899-1989, later Minister of Finance and Secretary General of the OECD) were both professors in managerial economics. Jørgen Gelting (1912-1994) and Kjeld Philip (1912-1989), both of whom later became professors, worked there as teaching assistants. None of these people are known as econometricians; Gelting is best known as a macroeconomist, and Philip for his work on social and tax policy (both for his theoretical research and for his political work as a member of the Danish parliament and government in the 1950s and 1960s).⁵

There is little to indicate the existence of an inspiring econometric milieu in Aarhus at that time. However, there was a general interest in empirical work. The first publication from the newly-established department was an analysis by Jørgen Pedersen of the English butter market, in which Pedersen estimated a relation determining the price of Danish butter at the English market on the basis of the quantity of Danish and New Zealand butter supplied. Other noteworthy empirical publications from the department include a consumption function estimated on the basis of a sample of households in Aarhus published by Gelting in 1942, and a macroeconomic model constructed by

⁴ Haavelmo's visit to Aarhus is discussed in Andersen and Kærgård (1999), Kærgård (2000a and 2002), and Bjerkholt (2008).

⁵ See Topp (2003) for a discussion of Kjeld Philip's contributions.

Gelting and Børge Barfod (1909-1968) in 1945 (Andersen and Topp, 1982).⁶ Barfod himself published a number of papers with estimations of local multipliers for a large-scale industrial undertaking (Aarhus Oliemølle); one of these is now described as ‘epoch-making’ in the field of regional economics (see Eriksson, 1969 and Isard, 1962).

In 1938-39, research in economics at the University of Copenhagen was organised on a purely individual basis. The staff was composed almost entirely of full professors (Axel Nielsen, Jens Warming, Frederik Zeuthen, Carl Iversen), and they worked mostly at home. No common research milieu existed there at all. What Jørgen Pedersen created in Aarhus seems to have been in sharp contrast to this situation. Besides the three full professors, there were a number of young assistant teachers, and they appear to have worked on common themes, mainly empirical investigations related to the current economic depression and the agricultural crisis. Haavelmo joined this department in 1938 for an academic year as a substitute for Orla Strange Petersen, who normally taught statistics in Aarhus, but who was abroad for that year. Jørgen Pedersen and Ragnar Frisch were involved both in sending Orla Strange Petersen abroad and in finding a substitute (the relationship between Jørgen Pedersen and Frisch seems to have been better than the relationship between Jørgen Pedersen and Copenhagen).

The titles of the first eight studies produced at the department indicate this common interest in the current economic depression and the agricultural crisis:

1. *Jørgen Pedersen: En analyse af det engelske smormarked i perioden 1923-36 (An analysis of the English Butter Market, 1923-36), 1937.*
2. *Jørgen Pedersen: En Undersøgelse af Indtægtsvingningerne i Landbruget i perioden 1922-36. (An Investigation of Fluctuations in Income of Agriculture, 1922-36), 1938.*
3. *Kjeld Philip: En Fremstilling og Analyse af den danske Kriselovgivning 1931-38, (A Description and Analysis of the Danish Crisis Legislation 1931-38), 1939.*
4. *Trygve Haavelmo: A Dynamic Study of Pig Production in Denmark, 1939.*
5. *Trygve Haavelmo: Efterspørgslen efter flæsk i København (Demand for Pork in Copenhagen), 1939.*
6. *Jørgen Pedersen: Vekselkursernes Indflydelse på Leveomkostninger, Indtægt og Produktion (The Influence of the Exchange Rates on Cost of Living, Income and Production), 1940.*
7. *Kjeld Philip: Bidrag til læren om Forbindelsen mellem det offentlige Finanspolitik og den økonomiske Aktivitet (A Contribution to the Theory about the Relationship between Fiscal Policy and Economic Activity), 1942.*

⁶ After the war, Børge Barfod (1909-1968) was appointed to a post as professor in Aarhus, and later to a similar post in Åbo. In the period 1937-43 he was employed as an economist and statistician at Aarhus Oliemølle (Aarhus Oil Mill). The factory was neighbour to the Economics Department of the University; in fact, the Economics Department was located in buildings owned by the factory.

8. *Jørgen Gelting: En undersøgelse af Forbrugets Afhængighed af Indtægten og visse andre Forhold (An Investigation of how Consumption depends on Income and certain other Variables), 1942.*

It can be clearly seen how well Haavelmo's publications fitted into the common theme. Haavelmo seems in 1938 to have joined the most fruitful economics research milieu in Denmark at that time, even though contemporary academic circles in Copenhagen were strongly of the opposite opinion. Professor Axel Nielsen (the oldest of the economics professors at the University of Copenhagen) is quoted as saying 'OK, then you are leaving economic science' (Ja, så forlader De altså videnskaben) to Kjeld Philip when Philip told him that he had got a position in Aarhus (Andersen, 1994, p. 52).⁷

No doubt Haavelmo had more prominent international contacts at that time in relation to econometric theory than the staff at Aarhus University (see Bjerkholt, 2008). Bjerkholt's article about Haavelmo's stay in Aarhus concentrates on Haavelmo's contribution to econometrics, and at that time there were no specialists in that field in Denmark.⁸ However, there are, perhaps, other traces of Haavelmo's period of residence in Aarhus, mainly related to macroeconomics. His work on both the balanced budget and investment theory could have been inspired by discussions in Aarhus. Jørgen Gelting came to Aarhus in February 1939 at the age of 27, while Haavelmo was 28. It seems reasonable to assume that the two young macroeconomists had deep discussions on problems of common interest. At the outbreak of the war they were separated; Haavelmo went to the USA in 1939, Gelting to Copenhagen a couple of years later, and no further contact between them was possible. But there are common results in their publications in the subsequent years.

In 1941 Jørgen Gelting published his work on the multiplier of the balanced budget in Danish in an article in *Nationaløkonomisk Tidsskrift*. This article was translated into English and re-published in 1975 in *History of Political Economy* as being an independent forerunner for Haavelmo's 1945 *Econometrica* article (see Rasmussen, 1958a and Hansen, 1975). Rasmussen stressed the independence of the two publications, without mentioning Aarhus:

Needless to say, Haavelmo did not (because of the war) know of these Danish contributions when he wrote his article. Thus Haavelmo's contribution retains fully its originality. (Rasmussen, 1958a, p. 156)

⁷ Axel Nielsen' review of Jørgen Pedersen's *Pengeteori og pengepolitik* in *Nationaløkonomisk Tidsskrift* 1944 provides another example of this very critical attitude to the new University of Århus. There are indications of very strong conflicts in the Danish economic research milieu, conflicts which are perhaps part of the reason why some of the most talented Danish economists, e.g. Bent Hansen and Hans Brems, left Denmark in the 1950s.

⁸ The Danish econometrics pioneer Edvard P. Mackeprang had died in 1933; see Kærgård (1984).

The other Danish contribution to development of the theory of the balanced budget's multiplier mentioned by Rasmussen is a dissertation dating from 1942. The author of this 1942 book was none other than Kjeld Philip. In fact, the book is number 7 in the series of studies published by the Economics Department at the University of Aarhus, the series in which Haavelmo's publications are numbers 4 and 5. Rasmussen writes about Philip's book:

Philip arrives at the same conclusion as Gelting, but the analysis is carried one step farther, as the process is considered to be time-consuming. While Gelting's article from 1941 thus compares to Haavelmo's from 1945, Philip's contribution may to a certain extent be compared to the comments given by Haberler, Goodwin, Hagen and Haavelmo himself in the 1946 issues of *Econometrica*. (Rasmussen, 1958, p. 156)

There was a very similar situation in the case of investment theory. In Haavelmo (1960) it is argued that it is inconsistent to see investment as a function of the interest rate; it must be the optimal capital stock which is a function of the interest rate. Exactly the same ideas are to be found in Gelting's dissertation of 1948, as pointed out by Claus Vastrup (1994). Gelting writes in his book:

... the potential effect of a fall in the short-term interest rate on the businessmen's stock of inventories is a specific, one-time effect. If the adjustment of the inventories does not start a cumulative process, the effect of a fall in the interest rate will be over after the adjustment. In principle, exactly the same is the case for the effect on fixed capital of a permanent fall in the long-term interest rate. ... One can perhaps calculate the change in the optimal stock of dwellings, but it is not possible from this to conclude anything specific about the yearly growth in the building sector, because the growth in the stock of dwellings can be distributed over many or fewer years. (Translated from Gelting, 1948, pp. 121-22)

Vastrup describes this as an independent development of the same arguments as those of Haavelmo: 'It has not been possible to document any connections between the two other than a brief common relationship to the University of Aarhus in the spring of 1939' (Vastrup, 1994, p. 122, my translation).

This seems to attribute too little significance to their common time in Aarhus. The only problem with a theory of a common origin in Aarhus in 1939 would seem to be that Haavelmo's theories on the investment function appeared as late as 1960. But in fact Haavelmo worked on investment theory almost continually between 1939 and 1960. He published articles about theory of investments both in 1941 and 1949 (Haavelmo, 1941 and 1949), lectured on investment theory in Oslo 1953-54, and gave a couple of guest

lectures at University of Copenhagen in 1956 (where he was present for some days as an opponent at P. Nørregaard Rasmussen's dissertation defence). In the preface to his 1960 book Haavelmo indicated that it was a field he had worked in for many years: 'During the past ten years or so I have tried to speak and to write of the need for more axiomatic stringency in the field of investment theory' (Haavelmo, 1960, p. v). It seems highly probable that investment theory was intensively discussed in Aarhus in 1938-39. Further evidence for this is that Eric Schneider published a number of contributions to investment theory in the years following, among others the textbook *Investering og Rente* (Investment and interest rate) in 1944 – reviewed in *Erbvervsøkonomisk Tidsskrift* by another from the economic circles in Aarhus, Børge Barfod.

It thus seems very reasonable to assume that the seeds of the ideas about both the balanced budget and the investment theory were to be found in discussions in Aarhus in 1939.

Haavelmo's stay in Aarhus 1938-39 seems to have been more important than is normally assumed. Some of Haavelmo's important macroeconomic results, especially the balanced budget multiplier and the investment theory, seem to have had their roots in discussions among the staff at Aarhus University in 1939. At least, this seems the simplest explanation of a couple of 'independent' publications of closely parallel results.

Bjerkholt (2008) did not see any important effects of Haavelmo's visit to Århus, but this is perhaps because he concentrates on econometrics, and he is probably right in writing that Haavelmo's colleagues in Århus had no influence on his famous econometric contributions of 1943-44. But if one considers Haavelmo's post-1945 contributions in macroeconomics there seem to be indications of much more inspiration coming from discussions at Aarhus University.

Trygve Haavelmo's other extended stay in Denmark was in Copenhagen in the autumn of 1971, when he gave a PhD course on expectations and their role in economic theory. There were 13 participants on this course, six of whom later became full professors in Denmark. Haavelmo may have planned this visit mainly in order to be away from home when he turned 60. He seems to have used a considerable part of his time in Copenhagen to work on the more than 100 pages long memorandum 'Variasjoner over et tema av Gossen' (Variations on a theme by Gossen), where he argued for 'invading' a number of topics which have normally been viewed as non-economic, specifically in relation to the determination of people's preferences.

Another indication of both the way Trygve Haavelmo sought to avoid being the focus of celebrations and of the close relationship between Haavelmo and Denmark was an event that occurred in 1979. In that year, the University of Copenhagen celebrated its 500th anniversary, and a number of honorary doctorates were to be awarded on that occasion. The economics department was allowed to select two people to be honoured in this way, and naturally this was the cause of long discussions and negotiations between the different fields in economics. Finally it was decided to choose a somewhat neglected Dane (Ester Boserup) and a major international figure with many years of close cooperation

with the University of Copenhagen (Trygve Haavelmo). When Haavelmo was contacted just before the proposal has to be published he answered 'I usually say no to that sort of thing,' and so it ended.

5. Wold, Haavelmo and Denmark

The only Scandinavian econometrician outside Oslo of that period with an international reputation was Herman Wold.⁹ While the Oslo school was a central part of the mainstream international econometric tradition in the 1930s, 1940s, and 1950s, Wold was seen as a man with rather individual points of view. He made contributions to the mathematical theory of statistical time series in his dissertation *A Study in the Analysis of Stationary Time Series* of 1938, and his *Demand Analysis* (1952, with Lars Juréen) was a standard contribution to the field. But he is mainly known for his work on recursive models. This is a specifically Swedish tradition with roots dating back to the Stockholm School in the interwar period. This school worked in macroeconomics, and developed the *ex ante/ex post* analysis as an important concept in dynamic and disequilibrium models. A causal chain viewed as a sequence of single steps was a natural extension of these concepts. There are lags in the process. The income in one period determines the consumption in the following period, and perhaps the investment two periods ahead. The consumption, investment and income are determined in a process with different lags, and consequently there will normally be some sort of disequilibrium.

In this approach, Haavelmo's simultaneity bias disappears when the lags are carefully observed. This point of view was formulated by Wold and Ragnar Bentzel in 1946. Bent Hansen and Bentzel explain the attitude very clearly in the article 'On Recursiveness and Interdependency in Economic Models' in *Review of Economic Studies*, 1954. They explain how true economic models are recursive because of the lags, but because observed data relate to periods longer than the lags, e.g. annual data, and because of aggregation, etc., applied economic models can very often be simultaneous.

The casual structure of economic models was fiercely debated among the Scandinavian model builders in the 1950s. It was, for example, one of the main themes in the debate at the Econometric Society's European Meeting in Uppsala in 1954; Frisch, Haavelmo and Wold all participated in the debate there (Hansen, 1954). Were economic models simultaneous or recursive? The Danes joined in this debate on the Oslo side. Nørregaard Rasmussen had a feisty debate with Herman Wold about causality in *Økonomisk Tidsskrift* 1957, in which Rasmussen delivered the message from Oslo (Rasmussen, 1957). Without doubt, it was the Haavelmo point of view which came to dominate. Just as econometrics in the 1980s and 1990s was dominated by time-series models and cointegration, econometrics in the 1950s and 1960s was dominated by

⁹ Herman Wold (1908-1992) was a professor in statistics at the University of Uppsala from 1942 to 1970, and at the University of Gothenburg from 1970 to 1975; however, he was born in Norway.

simultaneous estimation. The starting point was Haavelmo's documentation of the simultaneity bias in 1943. A large number of estimation methods were developed to overcome this problem.¹⁰

The Oslo econometricians did not participate in this development, but Wold did. His fix-point method was an iterative approach based on the causal structure of the model. The endogenous variables were calculated from the estimated relationships, and the estimated values then used as right-hand variables for new estimations, which again gave new estimated endogenous variables; this iterative process was continued until it converged (Wold, 1965 and 1966; Lyttkens, 1973).

In relation to the present article about Haavelmo and Denmark, however, it is only relevant to observe that there was an intensive Scandinavian debate about simultaneity in the 1950s, and that Danes such as Nørregaard Rasmussen participated in this debate on the Oslo side.

6. Conclusion

In the period 1930-85, there were a number of world-famous Scandinavian economists and econometricians, and there was a great deal of Nordic contact between them. It seems natural to ask how important these verbal and informal contacts between the Scandinavian economists were.

Haavelmo's visit to Aarhus in 1938 can give some indication of what happened. Bjerkholt (2008) is obviously right that the colleagues in Aarhus did not have any influence on his famous econometric contributions. But if one considers Haavelmo's post-1945 research in macroeconomics, there seem to be indications of much more inspiration from the discussions that went on at Aarhus University. The visit was not relevant to his work in econometrics, but can perhaps be seen as a kind of beginning to his post-war research.

Another question related to Scandinavian economics of this period concerns the importance of the fact that the economists of that generation often used their mother tongue in the discussion of scientific problems. Does that mean that there was less contact with the international research community, and more contact with local decision-

¹⁰ Full Information Maximum Likelihood was developed by Koopmans et al (1950), Limited Information Maximum Likelihood by Anderson & Ruben (1949), and Two-Stage Least Squares by Theil (1953 and 1953a) and Basmann (1957). The models at that time were rather large (even though not as large as those of later decades), the samples very small (often only annual data for the post-war period), and there was very little computer power available. This made 2SLS the most popular estimation method, as it involved only two-step single-equation least squares estimations. The first step – construction of instrumental variables as estimated values of the dependent variables from estimation of the reduced system – was, however, not unproblematic, because the number of independent variables was often bigger than the sample size. This was known as the 'undersized sample problem'. This resulted in a considerable number of estimation methods being devised, e.g. using a number of principal components from the matrix of exogenous variables instead of all the exogenous variables in the first step (Kloek & Mennes, 1960).

makers? Haavelmo's change of research topic when he moved from the USA to Norway could be an indication of a positive answer to this question, but the issue is not a simple one to disentangle.

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