Essays on the inefficiency of Norwegian agricultural policy

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To Anne, Isak and Karin

Acknowledgements

After 15 years as a researcher at SNF, it was time to upgrade my skills and expand my horizon. In order to systemize this adult training, I enrolled in a PhD program at the University of Bergen in 2005. This set-up has served its purpose; most of the doctoral courses that I have attended have been both useful and stimulating, and I have got accustomed to writing journal articles.

Agricultural economics in Bergen was initiated by Rolf Jens Brunstad and Erling Vårdal in the mid 80s, and has since been an important field of research at SNF. I was fortunate to be included in this exciting research field, and have since benefited much from the close collaboration with Rolf and Erling, both professionally and socially. I am also indebted to Lars Mathiesen who patiently introduced me to general equilibrium modeling. My co-supervisor Sjur Didrik Flåm deserves thanks for his encouragement and support. In particular, however, I am grateful to Erling Vårdal, my main supervisor and good friend, who is always there.

My dissertation is a continuation of topics that have occupied me as a researcher at SNF, that means, use of numerical models to analyze efficiency aspects related to agricultural policy. The dissertation has been completed while working as a researcher at SNF (since I have not been holding any PhD scholarship). A half-year's work was funded by the SNF Foundation, for which I am grateful.

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Contents

Introduction

Self-sufficiency in main products and small-scale farming all over Norway have been long-standing objectives of the Norwegian agricultural policy. Since yields are low and land tends to be steep, substantial support is necessary to achieve these policy objectives. Total support fluctuates around NOK 20 billion per year, of which 60 per cent is budget support while the rest is market price support buttressed by import tariffs in the range of 170-430 per cent. About 60 per cent of the support is directly attached to the volume of production (market price support and output subsidies).[1] Consequently, self-sufficiency is obtained in main products like milk, meat and eggs. 12 per cent of the milk production is even exported at a loss. For climatic reason some grain is imported, as well as temperate products.

Obviously, the Norwegian agricultural policy contradicts with standard welfare theory which states that the role of public intervention in specific industries like agriculture should be to correct market failures, e.g., promote public goods, internalize externalities and facilitate competition, and not to support production of private goods like food. Prohibitive tariffs, export subsidies and production support - the backbone of the Norwegian agricultural policy - are also in conflict with major principles for international trade. The long term aim of the World Trade Organization (WTO), where Norway is one of 153 members, is to eliminate such obstacles to trade in order to promote world-wide economic growth and development.

The five papers that make up this thesis have the common feature that they, on the above background, employ *numerical models* to assess *efficiency aspects* related to *agricultural policy* in a small country like Norway. The papers are relevant to the ongoing multinational trade negotiations under the WTO. Research focus, main results and interconnections between the papers are briefly described below, followed by an abstract of each paper.

Research focus and main results

The sector model Jordmod is the workhorse in the three first papers. Jordmod is a price endogenous mathematical model of the type described in McCarl and Spreen (1980). It includes the most important commodities produced by the Norwegian agricultural sector. For given input costs, demand functions and support systems, the model computes market clearing prices and

[1] An overview of the level and composition of the Norwegian agricultural support is given in Gaasland, Garcia and Vårdal (2008) and OECD (2009).

quantities. It includes all major policy instruments and provides estimates of production, use of inputs, domestic consumption and prices, imports and exports, measures of support, and economic surplus measured as the sum of producers', importers' and consumers' surplus. A more comprehensive description of the model is provided in Appendix 2 of Paper III.

In the first paper, "Efficiency losses in milk marketing boards - the importance of exports", Jordmod is used to estimate the welfare costs of the Norwegian milk price equalization scheme (MPES). By law this scheme involves price discrimination and cross-subsidization between dairy products and markets. Especially, export of cheese and butter is subsidized by revenues from domestically sold drinking milk.

In the base year (1998) of the model analysis about 15 per cent of the Norwegian milk production was exported. The socio-economic cost of this export is estimated to NOK 1 billion. In addition to export costs, there are efficiency losses caused by Harberger distortions (Harberger, 1962) in the domestic markets that amount to about NOK 0.5 billion. As a total the efficiency loss due to the MPES amounts to 26 per cent of the milk production value. The costs are higher than for other countries that have similar arrangements. A main reason is that exports are a major ingredient of the Norwegian system. This transfers money not merely between domestic consumers but also from Norwegian to foreign consumers.

Export subsidies are a violation of basic WTO-principles. In the Uruguay Round of the General Agreement on Tariffs and Trade (GATT)[2], it was agreed that by the end of the year 2000 export subsidies and exported quantities should be reduced by 36 per cent and 21 per cent, respectively, as of the situation in 1992. Accordingly, compared to the base year of the analysis, the amount of exported cheese has been reduced by about 30 per cent. Nevertheless, export of dairy products still amounts to 12 per cent of the Norwegian milk production. In the ongoing Doha round of the WTO, it is proposed to abolish export subsidies with 2013 as a deadline which may eliminate the harm from arrangements such as the Norwegian MPES.

The core version of Jordmod follows the standard approach in partial equilibrium modelling of national agricultural policy which is to maximize the sum of producers', importers' and consumers' surplus for given demand and supply functions and policy instruments. The socio-economic costs of a given support regime then follows as Harberger triangles, i.e., deadweight losses in domestic production and consumption of food. This welfare measure ignores potential market failures attached to agricultural activity, e.g., neither the amenity value of the agricultural landscape nor costs from pollution are included in the objective function. Also,

[2] GATT was in 1994 succeeded by the WTO.

the agricultural support is assumed to cause no adverse effects on other industries in the economy.

It is, however, widely accepted that there are externalities related to agricultural activity that unregulated markets, per definition, are unable to take care of. Cited examples of positive externalities with the character of public goods include food security and the amenity value of the landscape (for a summary, see OECD, 2001). Emissions of nitrate, ammonia and greenhouse gases are examples of negative externalities. In an overall assessment of domestic agricultural policy, the value of these externalities should enter into the welfare function of the model. By comparing the estimated welfare of the present policy with the outcome of an optimal policy based on Pigouvian subsidies and taxes, the socio-economic costs of the present policy would be exposed.

As a step in this direction, Jordmod is in the second paper, "Multifunctionality of agriculture: an inquiry into the complementarity between landscape preservation and food security", modified to accommodate studies that involve public goods. A willingness to pay (WTP) function for cultural landscape, calibrated from available contingent valuation studies[3], is incorporated into the objective function of Jordmod. Furthermore, based on a given crisis menu and estimates of how much farm land, livestock and labour (i.e., agricultural skills) that must be available to produce this menu, a function for food security is implemented. The food security concept, which is in line with the early approach of Gulbrandsen and Lindbeck (1973), allows for adaptation in both consumption and production and differs notably from running self-sufficiency. In particular, the paper discusses an optimal policy when these public goods simultaneously are taken into account. Special emphasize is put on the degree of cost complementarity due to joint inputs like agricultural land and labour (see Boisvert, 2001).

The paper demonstrates that the current level of support is far out of proportions from a public goods perspective. Furthermore, the present support, stimulating high production levels, is badly targeted at the public goods in question. Since agricultural land is a major component of both food security and landscape preservation (as well as in production of food), thus giving rise to a high degree of cost complementarity, it would be more efficient to support land extensive production techniques, than production *per se*. With optimal policy

[3] Contingent valuation is a survey based method for valuation of non-market resources. See Diamond and Hausman (1994) for a general discussion of the method, and Drake (1992) for an application to valuation of cultural landscape.

instruments, the simulations suggest that at most 40 per cent of the current level of support can be defended by the public good argument.

While offering substantial welfare gains, the proposed policy will also bring the Norwegian agricultural policy closer to standards set by the WTO, where different kinds of production support are exposed to reduction commitments while so-called green support is accepted. The green support should be payments for incremental costs related to provision of public goods and environmental services, and not linked to production of food (Blandford and Josling, 2007).

The international pressure, fronted by the WTO, to shift away from import protection and production support to policy instruments that are targeted at environmental services, accentuates the need for appropriate indicators to measure the success of such a policy reform. The purpose of the third paper, "A better targeted policy on environmental services may lead to a larger relative PSE: a paradox illustrated by the case of Norway" is to study correlations between welfare effects and the so-called producer support estimate (PSE) published by the Organization of Economic Co-operation and Development (OECD). The PSE provides the only consistent and internationally comparable information on government support for agriculture.[4]

Even if the PSE was never intended to be an indicator of welfare impacts, but merely a measure of monetary transfers to farmers from consumers and taxpayers (Tangermann, 2006), the concept has widely been used in the international debate on agricultural policies as a yardstick of policy misconduct: the higher a country's relative (percentage) PSE, the more likely that it's agricultural policy will be criticized for being inefficient and trade distorting.

When considering conventional agricultural policy grounded on production subsidies, the relative PSE and inefficiencies are indeed highly correlated. High relative PSEs tend to be associated with high levels of market price support, which create distortions in both production and consumption. Consequently, reductions in support would result in a lower relative PSE and reduced distortions. However, in the paper we illustrate that this, somewhat paradoxically, is not necessarily the case if agricultural policy is targeted towards correcting externalities related to agricultural activity. While a welfare enhancing reform of agricultural policy from production subsidies to payments targeted towards externalities results in a lower absolute PSE and smaller trade distortions, we show that a rising relative PSE may well be the likely outcome.

[4] Legg (2003) gives an overview of the PSE measure.

A main characteristic of a partial equilibrium model like Jordmod is that prices on production factors that are purchased from the rest of the economy are assumed to be exogenously given and that other industries in general are unaffected by the agricultural policy. The underlying argument is that agriculture constitutes a too small share of the total economy to affect factor prices, real income and tax burdens to any significant degree. For example, the Norwegian agriculture accounts for less than 1 per cent of GDP and 3 per cent of total employment.

However, the agricultural support, which in Norway amounts to 70 per cent of the production value in agriculture, is disproportionate to the size of the sector. As argued by Alston and Hurd (1990) and Gylfason (1995), the deadweight losses connected to the financing of farm programs can be significant. To analyse repercussions of food policy programs on the rest of the economy we need a general equilibrium (GE) model. Such a model is introduced in the fourth paper, "Agriculture versus fish - Norway in WTO".

The model (FOOD.CGE.MOD04) includes highly disaggregated sectors for agriculture, fisheries, fish farming and food manufacturing, while the rest of the economy is on an aggregated form.[5] Major food policy instruments, including barriers to trade and subsidies, are implemented. General taxes like value added tax, excise taxes, import levies, pay roll tax and wage tax are included. The model is framed in order to perform food policy analyses, taking into account linkages within the food industries and to the rest of the economy. It reports figures like economic welfare, rents in fisheries and fish farming, resource allocation, production, trade and relative prices.

In the paper the model is applied to investigate the scope for domestic over-all welfare gains from an elimination of food trade restrictions, i.e., a complete elimination of subsidies and import tariffs on food is assumed. The paper also aims to explore the diverging trade interests between agriculture and fisheries in the WTO negotiations. Fisheries and fish farming, whose export value amounts to 7 per cent of the Norwegian export (exclusive of oil and gas), are hampered by barriers to trade. For these industries Norway promotes their offensive interest in trade talks. At the same time, however, Norway strongly resists a liberalisation of agricultural trade.

[5] GE models have been widely employed to study welfare and trade effects of farm liberalization, both globally and for different regions (see, e.g., Tyers and Anderson 1992; Hertel 1997; Anderson and Martin 2005). While agricultural sectors are on a quite aggregated form in most models, FOOD.CGE.MOD04 introduces more details with respect to technology, products, and interactions with factor markets and the processing industry. As such, it follows in the tradition of the special purpose GTAP-AGR version of the GTAP modelling framework (Hertel and Keeney, 2005).

The gain from a complete elimination of food subsidies and tariffs is for Norway estimated to be in the range of 1.2 - 2.7 per cent of GDP. Compared to the food sectors' low share of GDP (below 3 per cent), this result supports the view that deadweight losses connected to the financing of farm programs can be substantial. While one source of gain is that resources are redistributed from agriculture to other sectors in the economy, the most important stimulants to the economy are that demand increases since: 1) the reform opens for higher transfers to private households, or lower taxation (NOK 12 billion are saved in farm subsidies), 2) private households receive higher rents on fishing rights and fish farm licences (NOK 1.2 billion), and 3) food prices fall (up to 22 per cent).

Obviously, most of the gain stems from domestic farm sector liberalisation. The gain from free market access for seafood is estimated to 4.4 per cent of the seafood export value. Further growth in fish farming, e.g., made possible by trade liberalization, may elevate the gain to the seafood sector. The potential for market growth is especially high in emerging markets in Asia where the tariffs are substantial.

The last paper, "Modelling farmers' labor supply in agricultural models", deals with a phenomenon that can be observed in the farm sector, namely that farmers in spite of relative low return of their effort tend to stay at the farm (contrary to traditional neo-classical assumptions). In Norway, e.g., agricultural production has been kept up over the last decades with an on-farm wage that persistently has stayed 60 per cent below the alternative off-farm wage.[6] Strong preferences for farming or various social commitments to the farm have been proposed as explanations (Fall and Magnac, 2004).

When modelling agricultural policy it is crucial that preferences for farming are represented in a proper way. The substantial micro-based research on farm households' allocation of time is, however, rarely reflected in numerical models aimed at policy evaluation. In most agricultural models the on-farm wage either follows the ordinary wage in the economy or it is varies according to an assumption of sector specific farm labour. To overcome these restrictive model assumptions, a constant elasticity of transformation (CET) function can be adopted. This allows for the more realistic assumption that farm labour is partially sector specific, i.e., that the farm household, dependent on relative wage and preferences, allocates its working time between on-farm and off-farm work, respectively, and that the household's reallocation of labour as a response to change in relative wage, is sluggish.

[6] The persistent tendency of farm incomes to be lower than those in alternative occupations has been labelled as the farm problem (Gardner, 1992).

The CET approach to represent farm household preferences for on-farm work, or specific taste for farming, is in this paper demonstrated and interpreted. Using the Norwegian agricultural sector as an example, the paper shows clearly that the farmers' preferences for on-farm work are of vital importance as to how a liberalisation of farm policy affects farm output and farmers' income. The results depend on technology, i.e., to what degree costs can be reduced by replacing hired labour, capital and other factors with cheaper family labour. Technology is especially important when preferences for on-farm work are high, i.e., when farmers accept to work at their own farm even if the wage falls substantially.

Abstracts

Efficiency losses in milk marketing boards – the importance of exports
Co-authored with Rolf Jens Brunstad and Erling Vårdal.
Published in *Nordic Journal of Political Economy*.

A milk marketing board (MMB) is a well known instrument for regulating the markets for dairy products. MMBs are based on price discrimination, and receipts from sales are pooled so that the farmers receive a single price adjusted for composition and quality. Using a numerical model, we find that the economic welfare cost of the Norwegian MMB, is as much as 26.3% of the milk production value. This computed cost is far larger than for the other countries with MMBs. The main reasons are that exports are a major ingredient of the Norwegian system, and that production costs are very high.

Multifunctionality of agriculture: An inquiry into the complementarity between landscape preservation and food security
Co-authored with Rolf Jens Brunstad and Erling Vårdal.
Published in *European Review of Agricultural Economics*.

Without support, the levels of agricultural public goods like food security and landscape preservation would fall short of demand in high-cost countries. However, as demonstrated by Norway as a case study, the current level of support is disproportionate from a public goods perspective, and the policy instruments are badly targeted at the public goods in question. Because agricultural land is a major component of both food security and landscape preservation, giving rise to a high degree of cost complementarity between the public goods,

it would be more efficient to support land-extensive production techniques than production *per se*.

A better targeted policy on environmental services may lead to a larger relative PSE: a paradox illustrated by the case of Norway

Co-authored with David Blandford, Rolf Jens Brunstad and Erling Vårdal.

Revise and resubmit in *European Review of Agricultural Economics*.

The producer support estimate calculated by the OECD is widely used as an indicator of distortions created by agricultural policies. When considering conventional agricultural policy grounded on production subsidies, the relative (percentage) PSE and inefficiencies are highly correlated. However, we demonstrate that this is not necessarily the case if policy is targeted to correcting externalities associated with agricultural activity. In particular, a welfare enhancing reform involving a shift from production subsidies to payments for the supply of public goods may result in a lower absolute PSE and lower trade distortions but a higher relative PSE.

Agriculture versus fish – Norway in WTO

Published in *Food Policy*.

The Norwegian agriculture is highly protected and subsidised. The opposite is the case for fisheries and fish farming which suffer from foreign market restrictions. Using a computational general equilibrium model, the gain for Norway of a complete elimination of food subsidies and tariffs is estimated to be in the range of 1.2 - 2.7 per cent of GDP. Most of this gain stems from domestic farm sector liberalisation. The gain from free market access for seafood is estimated to 4.4 per cent of the seafood export value. Consequently, Norway has much to gain from offering other countries market access for agricultural products. By pursuing such a policy, Norway may also strengthen the case for fisheries and fish farming in trade talks.

Modelling farmers' labour supply in agricultural models

Micro-based research on farm households' allocation of time suggests that farm labour is partially sector-specific, i.e., that reallocation of farm labour as a response to change in the

relative wage between on-farm and off-farm work is sluggish. This evidence is rarely reflected in numerical models aimed at policy evaluation which most commonly assume either perfectly mobile or totally sector-specific farm labour. To overcome these restrictive model assumptions, a constant elasticity of transformation (CET) function can be adopted. The CET approach to represent farm household preferences for on-farm work, or specific taste for farming, is in this paper demonstrated and interpreted. Using the Norwegian agricultural sector as an example, the paper clearly shows that farmers' preferences for on-farm work are of vital importance as to how a liberalisation of farm policy affects farm output and farmers' income. The results depend on technology, i.e., to what degree costs can be reduced by replacing hired labour, capital and other factors with cheaper family labour.

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