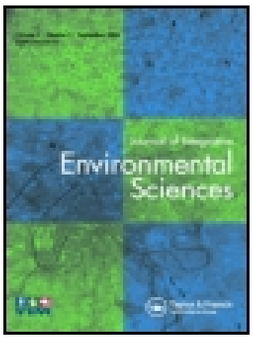

Environmental Sciences

ISSN: 1569-3430 (Print) 1744-4225 (Online) Journal homepage: www.tandfonline.com/journals/nens19

Agricultural subsidy reform and its implications for sustainable development: the New Zealand experience

Vangelis Vitalis

To cite this article: Vangelis Vitalis (2007) Agricultural subsidy reform and its implications for sustainable development: the New Zealand experience, Environmental Sciences, 4:1, 21-40, DOI: 10.1080/15693430601108086

To link to this article: https://doi.org/10.1080/15693430601108086

Published online: 20 Mar 2007.

Environmental Sciences
March 2007; 4(1): 21–40

Taylor & Francis
Taylor & Francis Group

RESEARCH ARTICLE

Agricultural subsidy reform and its implications for sustainable development: the New Zealand experience

VANGELIS VITALIS

Abstract
The elimination of agricultural subsidies in New Zealand in the mid 1980s has had a range of sustainable development-related effects. Drawing on a 'three pillar' (economic, environment and social) paradigm of sustainable development, this article assesses some of the impacts of this subsidy reform 20 years after it was launched. The economic and environmental effects are judged to have been broadly positive and the short-term negative social effects were relatively muted. The analysis suggests that linking the negative environmental effects of subsidies with their distortive economic effects may help provide further momentum for meaningful global subsidy reform. Finally, the key political economy lessons of the reform process are identified.

Keywords: *Sustainable development, subsidies, economic reform, agricultural reform, agricultural subsidies, New Zealand*

1. Introduction

The publication in 1987 of 'Our Common Future' provides the most commonly used definition of sustainable development as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs.' (World Commission on Environment and Development 1987) This formula has enormous human appeal. It also forms the core of many countries' approaches to the issue of sustainable development. New Zealand, for instance, uses this conceptualization as a means of ensuring that the inter-connectedness of many economic, social and environmental issues is reflected in both policy-making and assessment processes (Department of the Prime Minister and Cabinet 2003).

Sustainable development as an economic concept dates back to early attempts by environmental economists to use cost–benefit analyses to understand environmental problems and design policy instruments to deal with these (Opschoor & Coddington 1972). The relative failure of 'pure' cost–benefit analyses led to a fertile debate on how to make policy sense of the concept and this helped stimulate in turn the development of a range

Correspondence: Vangelis Vitalis, Deputy Director, Trade Negotiations Division, Ministry of Foreign Affairs and Trade, Wellington, New Zealand. E-mail: Vangelis.Vitalis@mfat.govt.nz
The views expressed in this paper are those of the author alone and do not necessarily reflect those of the New Zealand Ministry of Foreign Affairs and Trade.

ISSN 1569-3430 print/ISSN 1744-4225 online
DOI: 10.1080/15693430601108086

of different approaches. Many of these have helped inform and in some cases define national approaches to sustainable development (Vitalis 2004). In this context, sustainable development has generally come to be thought of in terms of *three pillars* (*economic*, *social* and *environmental*), all of which should be mutually supporting (World Summit on Sustainable Development 2002).

It is in this context that the European Commission (2001) has described the relationship between the three pillars as 'economic growth [that] supports social progress and respects the environment, social policy [that] underpins economic performance, and environmental policy [that] is cost-effective.' The goal is to set them in such a relationship that policy settings in any one field will not undermine future outcomes in any other and will enhance them (Vitalis 2001). The notion is therefore of a virtuous triangle of reinforcing policies that advance 'a society that is more prosperous and more just, and which promises a cleaner, safer, healthier environment' not just in the near term but the long term. New Zealand has adopted a broadly similar approach. It has argued, for instance, that at its heart sustainable development is about the cross-linkages between economic, social and environmental policies and their wider effects on society (Department of the Prime Minister and Cabinet 2003). In particular, the New Zealand Government has repeatedly asserted that it is taking a multi-objective approach. In this regard, policy makers have recalled that 'implicit in the quality of the growth we are seeking will be integration of the economic, environmental and social pillars of sustainable development . . .' (New Zealand Ministry of Economic Development 2001). The relationships among the 'pillars' are therefore highlighted, including the link between the natural environment and New Zealand's competitive advantage, as well as the complementarity between social and environmental factors and successful economic policy.

2. Subsidies and sustainable development

The link between subsidies and their adverse effects on sustainable development, specifically the environmental effects, has been recognized by the research community for many years. Economists have generally tended to regard subsidies as inefficient, expensive, socially inequitable and environmentally harmful, imposing a burden on government budgets and tax payers – all strong arguments for reform (OECD 2005a). Subsidies distort prices and resource allocation decisions, thereby altering the amount of goods and services produced and consumed in an economy. This type of assistance is proffered for a range of reasons, including to promote regional and rural development, support employment and incomes and to facilitate adjustment to changing economic, social or environmental conditions (OECD 2005a). Such support can, however, have negative effects that may be unforeseen or even ignored in the policy making process. Fuel tax rebates stimulate the use of fossil fuels, support for commercial fishing can lead to the overexploitation of fish stocks and agricultural support can lead to an overuse of pesticides and fertilizers. By the mid to late 1980s and thereafter, researchers were calling attention to the deleterious effects that subsidies were having on, for instance, energy demand (Kosmo 1987; Larson & Shaw 1992), the depletion of marine fish stocks (FAO 1992), and soil erosion, agricultural pollution and deforestation (Reichelderfer 1989; Tobey & Reinert 1991; Anderson 1992; Runge 1996).

There are no reliable estimates of the value of subsidies which have environmentally harmful effects (OECD 1998, 2001, 2005a). Typical impressionistic numbers range anywhere from $500 billion to $2000 billion a year. These take into account non-agricultural subsidies, like support for coal and fishing. Extrapolating data for environmentally harmful agricultural subsidies is difficult but not impossible. One reasonably reliable estimate is that for the late 1990s, OECD (Organisation for Economic Cooperation and Development) country subsidies

to agriculture that were environmentally harmful averaged in excess of $300 billion per annum (Van Beers & de Moor 2001).

In the context of the mounting evidence, it is perhaps not surprising that over the past two decades, there has been a growing acknowledgement by governments of the environmental harm that could arise from subsidies (Steenblik 2003). In part as a consequence, many countries have committed themselves to reform subsidies that may undermine sustainable development. These have included (non-binding) commitments to reform or eliminate subsidies that negatively affect biodiversity (Convention on Biodiversity 1992), encourage the consumption of fossil fuels (Kyoto Protocol, United Nations 1997), or stimulate over-fishing (FAO 2001). Similarly, the World Summit on Sustainable Development's (2002) Plan of Implementation calls in several places for the reform, phasing out or elimination of subsidies that have negative effects on the environment and are therefore incompatible with sustainable development. In subparagraph 32(i) of the Doha Ministerial Declaration, Ministers of Trade instructed the World Trade Organization's (WTO) Committee on Trade and Environment 'to give particular attention to: (i) . . . those situations in which the elimination or reduction of trade restrictions and distortions would benefit trade, the environment and development' (World Trade Organization 2001).

Given this extensive (and growing) range of international commitments to reduce subsidies which not only promote activities that harm the environment, but also reduce economic efficiency, one might reasonably expect to see countries implementing these commitments and even seeking to remove subsidies at a rapid rate. Unfortunately, however, progress internationally has been slow. Few countries have made good on their international commitments, let alone unilateral reform. This is perhaps not surprising. For sectoral economic as well as domestic political reasons, subsidies once in place are usually extremely hard to eliminate. Indeed, the international experience has underlined the difficulty of reforming subsidies (OECD 2005a).

One country which has not followed this trend of failing to reform its subsidy programmes is New Zealand. This article assesses New Zealand's reform of its agricultural subsidies in terms of its impact on sustainable development two decades after the reforms were first launched in 1984–1985. It begins by contextualizing the removal of subsidies to the agriculture sector within the wider reform process. Drawing on the three pillar paradigm of sustainable development explored above and against the background of a growing understanding of the environmentally harmful nature of many subsidies, it proceeds to describe and assess some of the economic and social impacts of this reform, with a specific emphasis on its environmental effects. The analysis concludes that the economic and environmental effects have been broadly positive and the short-term negative social effects relatively muted. In this context, it is suggested that linking the negative environmental effects of subsidies with their distortive economic effects may help provide further momentum for meaningful global reform of subsidies. Finally, the key political economy lessons which may be drawn from the New Zealand reform process are identified.

3. The New Zealand reforms in context

New Zealand's agricultural reforms of the mid 1980s were particularly significant for an economy which is dependent for its livelihood on the export of primary products and trades heavily on its 'clean green' image (OECD 2003a). The removal of agricultural subsidies had a profound, generally positive, impact on New Zealand's sustainable development prospects. That said, many of its favourable environmental effects were unintended. And the reforms themselves were not driven by a concern for the environment. Rather, it was a concern for the

economic unsustainability of the subsidy programmes themselves which provided the catalyst for the reform process (OECD 1985).

New Zealand's historical economic development was stimulated by the opportunity to sell primary products like wool, dairy products and meat to the UK and other industrialized countries. The growth of manufacturing and the very sharp trend upwards in population in those countries increased the demand for food and industrial raw materials. This demand was met in part by New Zealand which, in aggregate terms at least, focused its development (and macroeconomic policy) on its burgeoning commodity export sector (Lattimore & Rae 1990) At the same time, and like most liberal developed economies over the past 80 years, New Zealand has pursued broadly orthodox Keynesian economic policies with limited nationalization, social welfare and employment protection policies. Protection of the domestic market became standard practice, however, throughout much of the last century. Trade flows were narrow and focused on the UK, particularly over the first 60 years of the twentieth century. When the latter sought closer integration in the then European Economic Community, New Zealand's trade flows diversified, even if their composition did not. External crises, including the oil shocks and the changing nature of international economic trends, drove the demand for domestic trade liberalization, which culminated in the mid 1980s with far-reaching reforms which restructured both the domestic economy and fundamentally changed the country's trade policies. There was a marked shift away, for instance, from mercantilism to trade liberalization in general and almost overnight the removal of a range of support measures, including for the agriculture sector.

Arguably the single most important trade policy point to draw from the period since the UK signalled its intention to join the European Union is that New Zealand has *not* diversified out of the primary products sector. That is not to say that in aggregate terms there has not been diversification. There has. This diversification has, however, been narrowly focused on primary products and food processing. Figure 1 underlines the point. Indeed, New Zealand is unique in the OECD in maintaining over time such a level of concentration. Turkey, Mexico,

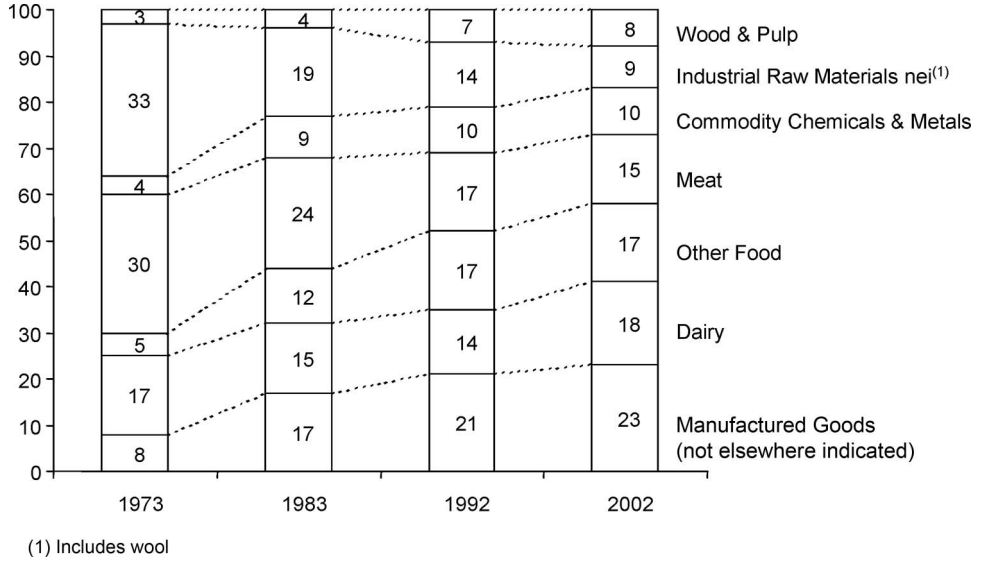

Figure 1. Composition of New Zealand exports of merchandise goods over time. *Source*: Boston Consulting Group (2004).

Poland and Slovakia, for instance, all have seen their export sectors diversify more rapidly in the past 10 years than New Zealand's (OECD 2003a).

This limited level of diversification over time underlines the obvious point that New Zealand's comparative advantage remains primarily with agricultural products – including processed foods. These form the enduring core of New Zealand's ongoing trading relationship with the world. It is in this context that the reforms of the agriculture sector in the mid 1980s, specifically the elimination or reduction of over 95% of subsidies, had such a significant impact on the country's sustainable development.

By 1983–1984, New Zealand's general macroeconomic situation had deteriorated markedly. More specifically, some of the country's key economic indicators were signalling a serious problem, including (Wallace 1990):

- an unemployment rate which had reached 7% by 1983 compared with less than 1% a decade before;
- inflation tracking rapidly upwards with the consumer price index (CPI) reaching the 20% mark before the imposition of price controls in 1982;
- real GDP per capita growth averaging barely 1% per annum between 1976 and 1984;
- a ballooning fiscal deficit which by 1983 had increased to 9% of GDP;
- a chronic current external deficit which was placing serious pressure on the effective management of the government's overseas debt management with attendant negative implications for the exchange rate;
- Government net debt had risen from less than 10% in 1976 to 41% of GDP by the mid 1980s, resulting in a looming public debt crisis; and
- accelerating monetary growth as a consequence of the Government's micro-management of interest rates.

In the agriculture sector the economic situation had become similarly difficult (Tyler & Lattimore 1990). The two decades to 1984 had seen a gradual acceleration in production grants and subsidies to the agriculture sector. In the 1960s agricultural support amounted to just 3% of farm income, by 1983 it was nearly 40% in the sheep sector alone. Taken together, this was equivalent to 4% of New Zealand's GDP. Initially relatively narrowly focused, the programmes rapidly expanded to include a range of production-related measures such as concessionary livestock valuation schemes, fertilizer subsidies, loans to farmers at below-market rates, generous tax rebates, and lucrative incentives for land development. At its height there were some 30 different forms of assistance to farmers. This was further boosted by a deficiency payment scheme (Supplementary Minimum Prices). By 1983, New Zealand's Producer Subsidy Equivalent (PSE) had peaked at 34% and the Effective Rate of Assistance surged to 123% (Figure 2).[1] These export subsidy support levels were made considerably worse because they were combined with even higher rates of import protection and a general regulatory structure which in many cases was more akin to those extant in OECD countries in the mid 1950s and before.

While still moderate by world standards, the support levels were high for New Zealand. All of this had ominous implications for the sustainability of the agriculture sector and indeed the wider economy. Successive OECD Economic Surveys in the early to mid 1980s reported that the support being provided to the agriculture sector was no longer financially sustainable (OECD 1983). In particular, the 1984–1985 OECD Survey indicated serious problems with the supplementary minimum prices programme and a range of other production-related subsidies, noting that these were an effective brake on economic development (OECD 1985).

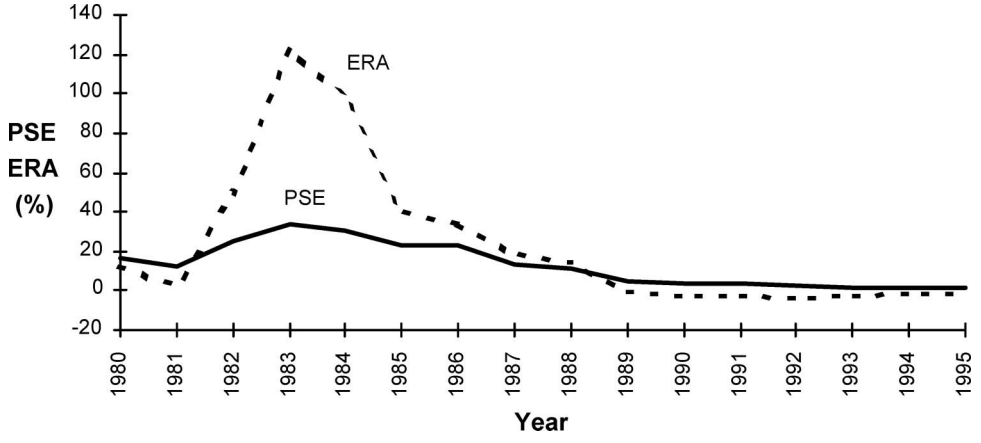

Figure 2. Percentage assistance to New Zealand pastoral agriculture before and after the removal of subsidies. Assistance figures are calculated with stabilization payments spread over the years in which losses actually occurred, and not when settled. *Source*: New Zealand Ministry of Agriculture (1996a). ERA, Effective Rate of Assistance; PSE, Producer Subsidy Equivalent.

In fact, by 1984–1985, the economic situation in the agriculture sector was precisely the way economic theory would describe the distortionary effects of subsidization:

- *Supply and demand bore no relationship to one another.* Production had soared, but there were no buyers. In 1970, the national flock comprised 55 million sheep, by the mid 1980s there were 70 million, with the Government funding the slaughter of sheep that could not be on-sold. In 1983, for instance, 6000 tonnes of surplus sheep meat was turned into fertilizer, as there was no market for it and no room left in cold storage plants.
- *Prices were inflated and bore no relationship to market values.* Land prices were a case in point. These were inflated as subsidies were capitalized into land values. The increases in values exceeded 200% between the late 1970s and mid 1980s.
- *Decision-making was distorted.* Subsidies encouraged farmers to bring large areas of marginal land into production and by 1984, in excess of two million hectares of marginal land was being farmed solely because subsidies made this profitable. All of this helped ensure that farmers derived the maximum economic benefit from this financial assistance – but at significant cost to the environment and in terms of long-term economic development.

Taken together, it was not surprising that by 1984–1955, increased output from the agricultural sector was generally worth less than the actual costs of production and processing. And the agriculture sector was not the only part of the economy that was experiencing a downturn. Government spending sharply increased. High domestic inflation and a collapse in the terms of trade were rapidly reducing New Zealand's international competitiveness. Accumulating budget deficits financed in part by off-shore borrowing and in part by literally printing money drove official overseas debt and inflation into double digits. As time wore on New Zealand's balance of payments deficit became chronic and its credit rating collapsed, making borrowing increasingly expensive. It was this worsening economic situation which provoked a far-reaching and substantive economic reform programme.

The agriculture sector and specifically subsidies to farmers were not immune, indeed in many respects the sector was the primary target for reform. The Government moved quickly by abolishing minimum price schemes for wool, beef, sheep meat, and dairy products.

In addition, tax concessions for farmers were withdrawn. Free government services for farmers were also eliminated. Producer Boards had their access to concessionary Reserve Bank funding withdrawn. Land development loans, fertilizer and irrigation subsidies, and subsidized credit were also reduced and then phased out from 1987, as were assistance for flood control, soil conservation, and drainage schemes (Tyler & Lattimore 1990). The scale of the change is underlined in Figure 2 above. This shows the continuing decline from an average PSE of 24% in 1979–1986 to 3% from 1989 onwards (OECD 2005b). The Effective Rate of Assistance (ERA) shows even more clearly the decline in real assistance.

4. The economic pillar

The concept of sustainability encompasses three inter-related 'pillars' and it was the economic pillar which drove the reform process in New Zealand. Over the medium to long term there is little doubt that this core element of sustainable development was substantively strengthened as a consequence.

In general terms, the economic indicators for the sector have improved across the board since subsidies were eliminated (New Zealand Ministry of Agriculture and Fisheries 1996). It is important, however, not to overdraw the causal relationship between the removal of subsidies and the improvement in economic indicators (and indeed in the environmental measures discussed in the latter section of the paper). The removal of subsidies alone was not the sole contributing factor for the upturn in economic fortunes of the sector. Their elimination needs to be seen against the background of wider reforms taken across the economy (including the floating of the dollar, phased tariff liberalization which lowered input prices and so on). Nevertheless, it is clear that the removal of subsidies was an important contributing factor (if not the only one) to the changed and improved circumstances of the sector following the reforms of the mid 1980s.

Perhaps the most dramatic change triggered by the reforms was to the sheep sector. Table I shows the changes that took place in the sheep and dairy sectors in particular, as well as the development of the deer (venison) industry. The national sheep flock was sharply reduced from 70 million in 1983–1984 to 40 million in 2004–2005. There are now 31% fewer sheep and beef farms. There has been a shift in focus from quantity to quality; lambing percentages, for instance, have actually increased by 25% compared with the 1984–1985 levels. Average carcass weights have also increased by a quarter. General agricultural productivity growth is three times greater than in the economy as a whole and some of the most spectacular gains have been in sheep breeding. In 2002, for instance, the export revenues from a sharply reduced flock exceed those generated by the 70 million strong flock extant in the early 1980s (Sherwin 2004).

Table I. Changes in sheep, dairy and deer numbers before and after the reforms.

	Pre-reform (1983–1984)	Post-reform (2004–2005)
Sheep	70 million	40 million
Dairy herds	16 000	13 000
Dairy cattle	2.3 million	5.3 million
Deer	–	2 million

Source: Statistics New Zealand (1984, 2003, 2004, 2005).

As a direct result of the reduction in stock numbers, many processing companies were forced to close in the mid 1980s. Processing plants in New Zealand are now smaller on average, closer to the sheep farming areas and much more modern and sophisticated than they were before the reforms benchmarked relative to their international competitors. They have also managed to smooth processing across the year to a considerable extent. Particularly important perhaps is the point that processing companies have focused on adding value. In 1982, carcasses accounted for 82% of New Zealand's global lamb exports. Now 90% of sheep meat exports are cut and pre-packed before they leave New Zealand. New Zealand has also diversified its markets and many New Zealand companies have processing facilities in overseas markets to better supply supermarket chains with specific cuts on request and on a 'just-in-time' basis. In 1980, the UK and the wider European Union absorbed some 80% of New Zealand's agricultural exports. The EU now takes less than half that figure.

While the decline of the sheep sector was one striking economic outcome of the reform, the change in dairying was no less profound. The number of dairy herds fell 17% from nearly 16 000 in 1983–1984 to around 13 000 in 2004–2005. Significantly, however, the national herd actually increased from 2.3 million to 5.3 million (see Table I). Moreover, the average herd size has increased from 150 to 270 and there has been a 75% increase in the volume of dairy production. In 1984, New Zealand did not have a deer industry and there were no venison exports. Two decades later, the national deer population is around 2 million (Table I) and export earnings exceed US$100 million.

Before the reforms were launched, New Zealand's horticultural industry was small and largely domestically focused. It exported relatively little, not least because subsidies to meat, wool and dairy production dwarfed assistance to horticulture, with farmers responding to these signals by focusing production where the subsidies were provided, including those supporting exports. In this context, it is not surprising to see that the horticultural industry has been one of the primary beneficiaries of the removal of subsidies. Table II shows the expansion in the export of horticultural products and wine. In 1983–1984, New Zealand exported US$42 million kiwi fruit and US$140 million worth of horticultural products in total. In 2004–2005, it exported more than US$400 million worth of kiwi fruit alone and nearly US$850 million worth of horticultural products more generally. Wine has also been a growth industry; exports were worth less than US$10 million in 1984–1985 and $125 million in 2004–2005.

Underlining the distortionary nature of Government subsidization and its capitalization into farmland values, the nominal value of farmland prices fell by some 50% in real terms by 1988 as a direct consequence of the removal of subsidies to the sector. Less than a decade later in 1995, however, farmland values had recovered to around 86% of their 1982 value, in real terms and currently stand at more than 100% of the 1982 figure.

One of the spill-overs from the subsidy reform programme had been the expectation that farm sizes would change. A decade after the reforms it was clear that the elimination of subsidies had only a limited effect on farm size, a point which remains true today. In effect,

Table II. Changes in the export of horticultural products and wine before and after the reforms.

	Pre-reform (1983–1984)	Post-reform (2004–2005)
Exports of kiwi fruit (US$)	42 million	405 million
Exports of all horticultural products (US$)	140 million	827 million
Wine (US$)	<10 million	125 million

Source: Statistics New Zealand (1984, 2003, 2004, 2005).

there was some consolidation and an increase in the size of some holdings (e.g. dairy herds expanded), although this has been primarily a consequence of a drive towards greater efficiencies of scale. That said, the elimination of land development subsidies has meant the withdrawal of a small area of marginal land (i.e. land not suited for pastoral agriculture) from production. Much of this land has also been re-forested. Moreover, farm distribution has become increasingly bi-focated – more and larger farms (dairy, sheep and arable) and more smaller farms (viticulture, horticulture, venison). Not surprisingly therefore, overall numbers of employment on-farm have not fallen, not least because the horticultural sector is more labour intensive.

In summary, while on one level, the sheep sector was particularly hard hit by the reforms and has shrunk over the past two decades it has become more efficient and profitable and produces more sheep meat. Moreover, other sectors have benefited significantly from the elimination of subsidies. The dairy and horticultural sectors have been major beneficiaries of agricultural resource mobilization. Perhaps the most important change in aggregate has been the enhanced flexibility of a sector that had been renowned in New Zealand for its inability to respond to change. Specifically, the removal of subsidies helped increase the sector's incentives to respond more effectively and efficiently to price signals by switching to new or different types of production. Significantly, there were no incentives or subsidies to assist these land-use changes. They were business decisions that no government would ever had had sufficient information to make. Risks have been diversified – and responsibility for commercial viability squarely accepted by farmers themselves.

5. The social pillar

As with any such rapid reform process, there were social costs for the New Zealand agricultural sector as well. What is perhaps surprising is that the impact on what is known as the 'social pillar' of sustainability was not as great or as long lasting as had been widely predicted at the time.

While rural incomes experienced a general decline during the 1980s, it is important not to exaggerate the rate of decline and also to underline the point that this fall did not result solely from the removal of government support (Chamberlain 1996). A combination of high inflation and interest rates, an appreciating New Zealand dollar and lower than expected prices for dairy and meat products in world markets all played their roles. Moreover, throughout the 1970s and the early 1980s, negative real interest rates had stimulated over-borrowing on a significant scale and this meant that many farms suffered losses on the eventual return in the mid 1980s and onwards to positive real interest rates. Moreover, these low world prices were a direct result of the subsidization programmes extant in the USA and the European Community, which continue to have effects beyond their own economies. In addition, the Government's failure to implement the deregulation process across all sectors of the economy led to unnecessary hardship. The planned tariff liberalization process, for instance, proceeded a great deal more slowly than planned and certainly at a much slower pace than the subsidy elimination programme. This meant that on a range of inputs for farming, the rural sector was paying a premium as a consequence of high tariff rates. Nevertheless, by 1988 – 1989, farm prices began to rise. Improving world markets for pastoral products combined with falling input prices (a consequence of a belated and in some areas half hearted tariff liberalization process) and lower processing costs cumulatively improved farmer incomes.

The decline in discretionary expenditure by farmers including on all non-essential repairs and maintenance, new land development, fertilizer applications, and capital expenditure on

new plant and equipment did have wider social effects. Many small rural firms went out of business and a large number of farm labourers became unemployed as farmers did more of their own work. Operating expenses, as a percentage of gross farm income, fell from a peak of 80% in 1984 to below 60% by 1993 (Walker & Bell 1994).

In the end there were only 800 forced sales out of 80 000 farms. Around 1% of farmers left the industry. This was considerably less than the projected 16% that had been widely touted. Nevertheless, the social costs while relatively isolated were high. There were some suicides and some farmers were forced to draw on social welfare assistance for a time. Many small rural towns experienced reductions in population in the mid 1980s as farmers stopped spending and people left in search of jobs elsewhere. Public services like schools and small hospitals contracted in the wake of this rural downsizing. Notwithstanding this, the rural collapse predicted by some never eventuated. In fact, New Zealand's rural population actually rose slightly between the 1981 census and the 2001 census despite the removal of subsidies (Statistics New Zealand 2002a).

Transitional assistance to groups affected by reform is increasingly seen as a standard economic tool designed to smooth the reform process (OECD 2005c). In New Zealand's case, what is striking is that such measures were sparingly used. This was in part the consequence of the speed and pace of the reforms which meant that flanking measures were not conceived and implemented in time. The primary reason, however, for the relatively limited assistance provided the sector remains the Government's straitened financial circumstances. Nevertheless, the Government did provide some transition assistance to farmers through debt rescheduling in 1986–1987 and provided a modest exit package for farmers who still remained in debt (Sherwin 2004). The Government also provided some assistance with some farm debt restructuring. The government-owned Rural Bank, for instance, wrote off some farm debt and the Government encouraged private lenders to do the same. Many farmers received assistance to develop business plans and help them through credit mediation, involving experts in finance, law, and farm management. In the end, about 20% of the total rural debt was written off and about 6% of farms were sold (mostly to other farmers), considerably fewer than had been predicted (Walker & Bell 1994; Chamberlain 1996). Moreover, one important benefit of the reform has been to place the rural sector on a more sustainable footing in terms of income. This has been because the elimination of subsidies directed the sector into activities which could be economically viable. This included a move into rural and eco-tourism and, as discussed already, a greater preparedness to consider horticulture, viticulture and deer farming.

Politically, the removal of subsidies was initially unpopular in rural New Zealand. The reforms culminated in a rural sector protest march on Parliament in early 1986. It was the largest such protest in New Zealand's history. Notwithstanding this level of anger, Federated Farmers, the main farmers' organization, strongly supported the wider reform process. It considered that reform across the board would ease the pressure on farmers by, *inter alia*, lowering the costs of production (Federated Farmers of New Zealand 1995). In 1987, the reforming Labour Government was returned to power assisted in no small part by votes in the rural sector. The Government actually increased its majority, including winning a largely rural farming electorate (Manawatu) that had once been an opposition stronghold.

6. The environmental pillar

While the environmentally harmful aspects of subsidies are increasingly well known, in 1984–1985 when the Fourth Labour Government launched its reform programme, this was not the case. This is perhaps understandable given that the Brundtland report was a work in progress

and the Rio Conference was still 8 years away. Not surprisingly therefore, preserving the environment was not a factor driving the reform process – although it was a significant if unintended beneficiary.

The impact of subsidies on the environment is generally understood to be primarily indirect, but important (although the direct effects should not be underestimated). These second-order effects are what Gerritse (1990) once described as 'externalities that we did not bargain for' and it is these that have come under sustained (if relatively recent) attack by economists and environmentalists, not least because of an increased understanding that the removal of subsidies can have positive environmental effects. The New Zealand reforms provide support for this view (Sinner et al. 1995). As noted earlier in the context of the economic changes wrought by subsidy reform, it is important when detailing the changed environmental conditions not to over-state the causality of the relationship between the subsidies being removed and the improvement in environmental indicators. This is compounded in the case of New Zealand since reliable data and time-series-based evidence on many of the measures cited below is relatively incomplete in parts and unreliable in others. Nevertheless, bearing these caveats in mind, it is possible to make the case that while the causal relationship may be less direct, the removal of support was an important factor in the improvement of some of the environmental issues considered below. Against that background, the following provides a 'before and after snapshot' of the environmental effects of the removal of subsidies in New Zealand (New Zealand Ministry of Agriculture 1993).

6.1. Land use

Table III shows the shift over time away from the use of land for pasturing/grazing to forestry. In particular, the removal of subsidies for the development of marginal land into pasture for sheep grazing has meant that farmers have had less incentive to convert indigenous bush and other marginal land to other uses. Total area in various forms of pasture has declined from 14.1 million hectares in 1983–1984 to 13.5 million hectares in 1995 and 12.1 million in 2004–2005. Concomitantly, the area of planted forest has increased from 1.0 million in 1983–1984 to over 1.8 million hectares in 2003–2004, a 50% increase, over the same period. This occurred despite the removal of forestry establishment grants in 1984 (New Zealand Ministry of Agriculture 1993). More particularly, reduced government intervention has had environmental benefits since there is now a growing appreciation that sustainable land management is enhanced through diversification. Moreover, there is also a better understanding of the complementary nature of diversified land use to mitigate soil erosion, enhance general amenity values as well as producing a valuable crop.

The elimination of subsidies has also highlighted the fact that some land uses (e.g. forestry) are a more appropriate and sustainable use for much marginal land (New Zealand Ministry of

Table III. Changes in the land use before and after the reforms.

	Pre-reform (1983–1984)	Post-reform (2004–2005)
Pasture (ha)	14.1 million	12.1 million
Planted forests (ha)	1 million	1.8 million

Source: Statistics New Zealand (1984, 2003, 2004, 2005).

Agriculture 1993). Subsidies for land development and for increasing livestock numbers throughout the late 1970s and early 1980s encouraged farmers to clear indigenous bush, forest and other woody vegetation to increase pasture area for stock. With the decline in subsidies and in prices for pastoral products, it has become less economic to bring new land into production. Amendments to the Forests Act have also assisted in this process, including a requirement that any native trees that are to be milled into timber must come from sustainably managed forests. As a consequence, the felling of regenerating and established native forest for agricultural development has declined substantially with positive implications for sustainable development.

6.2. Fertilizer use

The environmentally harmful effects of fertilizers relate primarily to the possible impact on water quality. The removal of subsidies has caused reductions in the leaching of phosphates from hill country pasture catchments, where phosphate is the dominant nutrient applied. Fertilizer purchases by farmers have been positively related to farm incomes and output prices. Subsidies were a primary input into incomes over the period and this helps explain a rise in fertilizer usage by between 10% and 25% during the 1970s and early 1980s (Jones 1990). The removal of both subsidies in general and specific fertilizer-related support led to a concomitant decline in fertilizer use. Unfortunately, as a consequence of the Government's decision to give advance notice of and a transition period for the elimination of fertilizer subsidies, application of superphosphates rose sharply in 1984 and 1985 and declined just as dramatically thereafter. Total gross tonnage is currently below the high points of the two years between 1978 and 1980.[2] If New Zealand had not removed its agricultural subsidies in the mid 1980s, it is reasonable to assume that the pattern extant during the period of subsidization would have continued, i.e. that input use would have been higher during the 1985–1993 period, and certainly higher than it is today.

6.3. Pesticide use

Pesticide use in New Zealand was never subsidized directly in the way fertilizers were. Like fertilizers, however, government support as an input to farm incomes has been correlated with the increased use of pesticides. With the decline in rural incomes as a consequence of the elimination of subsidies and a shift in production, sales of pesticides declined after 1984, although less spectacularly than fertilizer use.

6.4. Livestock (numbers and composition)

As noted earlier, the most dramatic change wrought by the reforms was the decline in the sheep sector and the increase in dairying. These changes have had differing environmental effects. The fall in the national sheep flock has yielded positive environmental benefits, including for instance reductions in erosion and a decline in the presence in rural waterways of sediment, nutrients and faecal matter. This has been a consequence of the reduced pressure from grazing numbers. The removal of subsidies had a further positive impact on the environment since production-related assistance, for sheep in particular, masked the impact of market signals. Their removal forced farmers to respond directly to market forces meaning that adjustment has proceeded more quickly than might otherwise have been expected. In contrast to the sheep flock, the numbers of dairy cattle and deer, however, have increased.

The dairy sector in particular while operating at a lower level of intensity than its European equivalents continues to make use of nitrogenous fertilizer. In some cases this has led to high levels of run-off into surface or groundwater supplies. A range of industry and farmer-led voluntary initiatives have been implemented to address such problems.

6.5. Greenhouse gas emissions

Closely related to stock numbers is the issue of methane emissions. New Zealand's greenhouse gas emission intensity is higher than all but a few OECD countries. This is largely the consequence of significant numbers of ruminant farm animals (sheep, beef and dairy cows). Taken together, methane emissions and nitrous oxide (from agricultural land/soils) accounted for almost 50% of total (gross) GHG emissions in 1990, although transport-related emissions are also substantial (41% of energy emissions).[3] Total emissions rose 5% between 1990 and 2001 (OECD 2004). Methane emissions, however, increased by nearly 35%. This rise is not related to subsidies or indeed to the agriculture sector generally where overall GHG emissions have increased somewhat. On the positive side, New Zealand's ability to adapt to the consequences of climate change has been improved through a combination of rural/farmer and Government investment in technological innovation designed to help provide the requisite adaptation tools.

6.6. Water use

Irrigation for farming in New Zealand accounts for nearly 60% of all withdrawals (compared with 65% in 1983–1984). Subsidies for irrigation were proportionately higher than for other types of agricultural development and were removed relatively late (1988). While it is difficult to assess the causality of the removal of a wide range of subsidies which existed for irrigation and the improvement in water use because of the absence of time series data, it is generally agreed that while the land area now under irrigation has increased (not least as a consequence of the move into horticulture) water abstractions for agriculture have not risen at the same rate as when subsidies were available for irrigation purposes.

6.7. Water quality

The quality of New Zealand water has been generally high, both before and after subsidy reform. While there was a small dip in quality during the zenith of subsidization as a consequence of fertilizer and general production-related support, this was never a particularly significant problem. More recently, however, the expansion of dairy farming in the late 1980s has affected water quality through contamination by effluent (Statistics New Zealand 2002b). The level of campylobacter infections, for instance, is now well above other OECD countries with some 31.6 cases per million people in New Zealand compared with 7.8 in Australia and 6.6 in Germany (OECD 2004). That said, the removal of subsidies is clearly not the cause of the changes in water quality. The increase in infection rates is a consequence of the increased size of the dairy herd, which in itself is a response to the increasingly favourable international market conditions for dairy products. Indeed, the retention of subsidies would have made matters worse, not least by distorting market signals as to the profitability of dairying with the likely consequence of an ever-growing sheep flock leading to greater pressure on rural waterways as a consequence of waste and faecal run-off (OECD 2004, figure 41).

6.8. Disaster relief

Subsidies for disaster relief can encourage environmental degradation if these remove the incentive for farmers to plan for such contingencies. Livestock farmers may, for instance, need to reduce stock numbers when drought becomes a real possibility, and may also need to keep grazing pressure down to a level that will better enable hill country pasture to sustain heavy rainfall. The removal of most disaster relief-related support in the late 1980s ensured that sheep and beef farmers in particular adopted stocking policies that are better adapted to climatic risks and are quicker to respond to early signs of drought (New Zealand Ministry of Agriculture and Forestry 1996). This reduces the likelihood that pasture will be overgrazed and made more vulnerable to erosion. Subsidies to disaster relief had effectively shielded New Zealand farmers from having to consider such issues. Central government support is still available, within tight criteria, when an adverse event is beyond the ability of the local community to deal with. In such cases, support is provided in a manner that does not reduce individual responsibility for managing risk. A case in point was the assistance provided to the sector following the extensive damage caused by the flooding which occurred in the central North Island in New Zealand in early 2004.

6.9. Industry-led initiatives

There are several industry-led initiatives designed to improve the sustainability of the agriculture sector in New Zealand.[4] These include a range of voluntary codes of practice utilized by, *inter alia*, the pork industry, the logging industry, sustainable wind production and an agrichemical education trust initiated by leaders in the horticulture industry. Guidelines for responsible fertilizer use have been developed by the fertilizer industry, and grazing guidelines have been implemented (OECD 1996). In many of these cases, farmers and rural industry are motivated not just by the desire to consider sustainability issues or the possibility of regulatory pressure if problems are not addressed, but also by market considerations. The wider agricultural sector is aware that consumers in New Zealand and in overseas markets are increasingly interested in how a product is produced, in addition to traditional quality concerns. They are therefore supporting efforts to establish systems to ensure that their production systems are sustainable and that this can be demonstrated to consumers. Thus, in a variety of ways, the environmental costs and benefits of sustainable agriculture are being internalized to the production process.

Despite these far-reaching changes, environmental challenges remain. A number of agri-environmental measures require ongoing careful monitoring. The removal of subsidies was a necessary measure, but not sufficient in and of itself for addressing the environmental impacts of agriculture. This is now well understood in policy terms (Fraser et al. 2005). In 1993, nearly a decade after the launch of agricultural reforms which removed many environmentally harmful subsidies, the New Zealand Ministry of Agriculture released a position paper on sustainable agriculture. This formed one element in the Government's wider strategy on sustainable land management which is embodied in the Resource Management Act of 1991 (RMA). Under the RMA, regional and district councils were charged with developing policies, in consultation with their communities, to address soil conservation issues, water quality monitoring and control, among other agri-environmental issues. Importantly, too the 1993 position paper defines sustainable agriculture in terms drawn from both the Bruntland Commission's 1987 report and the Rio Declaration of 1992. Specifically, the concept is taken to mean the use of farming practices that maintain or improve the natural resource base, and can help ensure that any parts of the environment influenced by

agriculture are financially viable, and allow people and communities to provide for their economic well-being.

Underpinning the New Zealand reforms was the judgement that removing distortive price signals and addressing environmental and economic 'bads' was a first step before considering whether agriculture provides environmental 'goods' that require government funding and assistance. The logic of the argument was that to do otherwise, i.e. to compensate farmers for perceived environmental 'goods' without addressing the 'bads', risked entrenching systems that were having a negative impact on the overall sustainability of the sector and was just another way to subsidize farmers. It is also worth underlining that there is little evidence of market failure in the provision of environmental 'goods' by New Zealand agriculture. While agriculture does provide landscape amenities and *in situ* preservation of biodiversity, these 'goods' are by-products of agricultural systems and will continue to be provided regardless of payments from governments. If anything, the New Zealand experience suggests that government assistance to agriculture has had a negative effect on the supply of these goods, and the first step should be the elimination of such distortions.

7. Political economy lessons

A feature of New Zealand's uniqueness is its geographic isolation and its small size. Certainly, relative to other OECD members these factors, particularly the one related to distance, make New Zealand something of a special case. The small population base relative to the land mass and its separation by considerable distance from a range of biological invaders and the usual trans-boundary pollutants has, for instance, helped ensure a relatively muted impact on the domestic environment. Notwithstanding the benefits of relative isolation, it is also important to acknowledge that, in part at least, the presence of a large agricultural sector means that New Zealand does stand out in sustainability terms when compared with OECD members. All of this does have a bearing on sustainability and, in particular, on the kinds of lessons that may be drawn from the New Zealand experience such that they have a wider application. Against this background, and in the context of the linkage between the reforms and the sustainable development of the wider agricultural sector, there are perhaps seven key political economy lessons to draw from the New Zealand experience.

First, ongoing political support is critical to the success of reform. This was a significant and salient feature of the reform process both in agriculture and in the wider economy with reforms being undertaken by a two-term Labour Government and then deepened and broadened by a National Government between 1990 and 1996.

Second, reform gathers its own momentum and indeed inevitability if there is a crisis. New Zealand was forced into the reform process by a clear sense of impending economic catastrophe. Simply put, it had to eliminate subsidies because it could no longer afford them. While 'big bang' reform can work best under crisis conditions, such circumstances do not necessarily lend themselves to the best kind of planning for transitional assistance. The message therefore is that rather than wait for the crisis to hit, countries should already begin preparing for the inevitable and this forward planning will ease and speed up the transitional process.

Third, reforms are generally easier to implement when the Government implementing the reforms does not depend on the recipients of the subsidies for political support. The reforms in New Zealand were undertaken by a left-wing government that had a thin rural constituency at best. It did not expect to lose political support, since there was only limited support extant for the Government in the rural sector in any case.

Fourth, the elimination of subsidies must be implemented according to an agreed and transparent timetable. Certainty of reform and its pace is essential for its success.

New Zealand farmers were given clear signals about the pace, breadth and depth of the reform. This was vital to their overall success. A policy that is too gradual, like the planned next phase of CAP reform in 2012 for instance, is likely to fall prey to conflicting signals and vulnerable to capture by special interest groups (Johnston 2000). Notwithstanding this, transitional measures should be designed in sequence with the reforms. These must, however, be measures that assist the change, not delay it.

Fifth, sequencing is crucial. A holistic strategic overview of the reform process is required. Tackling a single sector in isolation may lead to increased suffering in that sector if other parts of the economy are not addressed simultaneously. In the case of New Zealand there were widespread reinforcing reforms in overall macro-economic management and micro-economic regulation, including measures which lowered input prices, etc. Nevertheless, there were imperfections. The lowering of tariffs on inputs to farms did not proceed as quickly as the elimination of subsidies to the agriculture sector and this caused unnecessary hardship in terms of loss of income. In short, deregulation needs to be multi-sectoral and effectively sequenced. New Zealand did not do this particularly well and prolonged the adjustment as a consequence.

Sixth, while quantitative work suggests that deregulation works best when countries deregulate multilaterally, the New Zealand experience strongly supports the view that unilateral reform and elimination of subsidies delivers substantive and worthwhile economic and environmental benefits.

Seventh, there is now a potent, if not particularly new, weapon in the war against subsidies – their environmentally harmful effects. The New Zealand experience demonstrates that subsidies had a negative effect on the environment and that their removal has improved this situation. Analyses which outline these effects are not new and have been the feature of work undertaken by economists and by environmental scientists for some time now. The impact of subsidies for fishing activity and the parlous state of global fish stocks, for instance, has resulted in the identification by Members of the World Trade Organization of such subsidies as a specific issue for negotiation in the Doha Round. The aim of the negotiations in this area is to tighten the disciplines on these measures. Most recently, the work of the Geneva-based Global Subsidies Initiative (2006) has revealed the impact on sustainable development of the subsidization of, *inter alia*, the biofuels industry in the USA, with further reports due on such support in a range of other countries including Australia, Brazil, Canada, the European Union and Switzerland. It is this kind of high quality and rigorous analysis which links the mounting concern for the environment with the arguably better known economic downside of subsidies into a powerful combination that draws the attention of economic reformers in general and trade negotiators in particular to the issue of reform for sustainable development.

This underlines the point that there is real scope for a 'connecting of the dots' process whereby the trade and economic concerns about subsidies are linked to the environmentally harmful effects of subsidies, such that a collectively more powerful argument can be mounted for meaningful reform through the multilateral process.[5] Moreover, it is also worth noting that the negative environmental effects of subsidies experienced in New Zealand do have wider applicability. They are also common problems that exist in the USA, Japan, Korea and in Europe, as well as in developing countries. Paying people to produce things the market is not demanding inevitably leads to wasteful use of scarce economic and environmental resources. This is not to suggest that the elimination of subsidies is the 'silver bullet' and that there will be no environmental problems caused by agriculture in the absence of subsidies – there will. Environmental regulations will therefore still be needed to protect common water and soil values, for instance, but subsidy reform offers an important way of beginning the process of improving environmental outcomes. An important starting point in this process would be to improve policy coherence at home, ensuring for instance, that officials working on

environment and agriculture issues are alerting trade negotiators to such problems thereby ensuring that the 'dots' between the environmental and economic effects are being connected.

8. Conclusion

Two decades ago, New Zealand Government intervention in the economy, including agriculture, had led to severe misallocation of resources and high levels of assistance that could no longer be maintained. In 1984, New Zealand implemented wide-ranging economic reforms, and government assistance to agriculture was virtually eliminated, in some cases almost overnight. The elimination of agricultural subsidies in New Zealand had a range of sustainable development-related effects. The economic and environmental effects were broadly positive and even those short-term negative social effects were relatively muted. The removal of subsidies triggered a sharp reduction in the national sheep flock with attendant benefits for erosion control, water quality and methane emissions. These were in part offset by the increase in other sectors, including the dairy and deer sectors. The net effect, however, has been broadly positive across a range of indicators. Moreover, the removal of subsidies also ensured that the development of marginal lands virtually ceased, forestry plantings increased, and the use of fertilizers and other agricultural chemicals and pesticides stabilized. These changes have lessened the likelihood of the sector further degrading land and causing off-site contamination of water resources. Perhaps most importantly, the reforms have become self-reinforcing (International Monetary Fund 2004). Government assistance to New Zealand agriculture today is the lowest in the OECD – about €208 million, almost all of which is related to core public regulatory functions (€114). This contrasts with the situation at the start of the reforms where such relatively non-distortive assistance accounted for less than 20% of the overall sum (OECD 2005c).

Taken in aggregate the reform process undertaken by New Zealand more widely has been critical to New Zealand's ongoing growth. Improvements in human capital development, increased international exposure (not least in trading terms), sharp reductions in the volatility of inflation and actual inflation and reductions in the size of the government administration have all been beneficial for New Zealand's per capita GDP growth. This has also improved the economy's resilience to economic shocks ensuring that, for instance, during and after the Asian crisis, New Zealand's growth pattern was hardly affected (OECD 2003a; New Zealand Treasury 2004).

One other important outcome of the subsidy elimination process has been the understanding that the achievement of sustained environmental benefits requires agricultural policies to be coordinated with other policies affecting macroeconomic conditions. The New Zealand experience has confirmed that the removal of agricultural subsidies is a critical step towards sustainability, but specific environmental policies designed in the context of social and economic policies continue to be necessary to address secure the sustainability not only of the agriculture sector, but of the wider economy of New Zealand.

Finally, seven political economy lessons have been identified as having been critical to the removal of agricultural subsidies in New Zealand. The environmentally harmful effects of subsidies, perhaps the least important issue for policy makers at the time of the reforms, has been identified as having the potential to grow in importance. 'Connecting the dots' between the environmentally harmful effects of subsidies and their social and economic effects is likely to become an increasingly powerful way of opening up a series of 'new' fronts in the wider international effort to restrict and eliminate the use of such distortive measures. In this way, the global prospects for positive economic, social and environmental conditions are more likely to be achieved.

Acknowledgements

Vangelis Vitalis works in the Trade Negotiations Division of the New Zealand Ministry of Foreign Affairs and Trade. The views expressed in this paper are his own and do not necessarily reflect those of the New Zealand Ministry of Foreign Affairs and Trade. The author wishes to express his thanks to Dr Ralph Lattimore, Meredith Stokdijk, Neil Fraser and two anonymous referees for their helpful comments on earlier drafts of this paper. All errors and omissions are the author's alone.

Notes

1. The total PSE aggregates the value of all agricultural assistance measures; the percentage PSE is the total PSE divided by the sum of the value of agricultural production at local (supported) prices and direct payments from government. The Effective Rate of Assistance (ERA) is the net value of assistance (i.e. less costs imposed by protection of sectors providing inputs) divided by value of production at world market prices at the border.
2. Note, however, that the nutrient value of much of the fertilizer applied has increased.
3. See in particular: http://www.environment.govt.nz/indicators/climate/emissions/emissions-table.html
4. Project FARMER, for instance, was established in the late 1980s to assist farmers in the use of computer-based decision support systems, including better monitoring and analysis of environmental and farm performance data. In cooperation with the regional council and another research institute, dairy farmers have developed an operational definition of sustainable dairy farming, compiled a list of sustainable management practices, and designed subjective indicator scales to monitor their performance. The New Zealand Meat Research and Development Council (also industry-owned) uses 21 privately-owned farms to monitor and demonstrate to sheep and beef farmers how farm business planning and monitoring can improve performance and the environment.
5. In this context the Global Subsidies Initiative marks a critically important step forward in mobilizing for the reform of subsidies by highlighting their pernicious effects on sustainable development, both globally and domestically. For more details on this important initiative and recent reports see www.globalsubsidies.org.

References

Anderson K. 1992. Effects on the environment and welfare of liberalising world trade: The cases of coal and food. In: Anderson K, Blackhurst R (eds). The greening of world trade issues. Michigan: University of Michigan Press, pp 47–61.

Chamberlain B. 1996. Farming and subsidies: Debunking the myths. Wellington: Government Print.

Boston Consulting Group. 2004. Export development and promotion. Wellington: New Zealand Ministry of Economic Development.

Convention on Biodiversity. 1992. Conference of the parties of the convention on biodiversity. Geneva: United Nations Environment Programme.

Department of the Prime Minister and Cabinet. 2003. Sustainable development for New Zealand: Programme of action. Wellington: New Zealand Ministry of Economic Development, New Zealand Ministry for the Environment.

European Commission. 2001. Communication from the Commission: a sustainable Europe for a better world: A European Union strategy for sustainable development. Brussels: European Commission.

Federated Farmers of New Zealand. 1995. Life after subsidies: the New Zealand farming experience. Wellington: Federated Farmers of New Zealand.

FAO. 1992. Marine fisheries and the Law of the Sea: A decade of change. Fisheries Circular No. 853 FID/C853. Rome: Food and Agriculture Organisation.
FAO. 2001. International plan of action to prevent, deter and eliminate illegal, unreported and unregulated fishing. Rome: Food and Agriculture Organisation.
Fraser N, King G, Knight L. 2005. Policy measures addressing environmental issues in New Zealand agriculture. New Zealand Ministry of Agriculture and Forestry Technical Paper No. 2005/05. Wellington: New Zealand Ministry of Agriculture and Forestry.
Gerritse R. 1990. Producer subsidies: Issues and arguments. In: Gerritse R (ed). Producer subsidies. London: Pinter Publishers, pp 134–153.
Global Subsidies Initiative. 2006. Biofuels – at what cost? Government support for ethanol and biodiesel in the United States. Geneva: Global Subsidies Initiative International Institute for Sustainable Development.
International Monetary Fund. 2004. New Zealand: selected issues, country report. Number 4/127. Washington: International Monetary Fund.
Johnston RWM. 2000. Reforming EU farm policy: Lessons from New Zealand. Occasional Paper 112. London: Institute of Economic Affairs.
Jones D. 1990. Determinants of fertiliser demand: a preliminary analysis. Paper presented at the 15th Annual Conference of the New Zealand Branch of the Australian Agricultural Economics Society, Blenheim.
Kosmo M. 1987. Money to burn? The high costs of energy subsidies. Washington, DC: World Resources Institute.
Larsen B, Shaw A. 1992. World fossil fuel subsidies and global carbon emissions. Policy Research Working Paper Series, No. 1002. Washington DC: World Bank.
Lattimore R, Rae A. 1990. Agricultural trade. In: Sandrey R, Reynolds R (eds). *Farming without subsidies: New Zealand's recent experience*. Wellington: Government Print Books and Ministry of Agriculture, pp 25–39.
New Zealand Ministry of Agriculture. 1993. Impacts on the environment of reduced agricultural subsidies: a case study of New Zealand. Technical Paper 93/12. Wellington: New Zealand: Ministry of Agriculture.
New Zealand Ministry of Agriculture. 1996a. Situation and outlook for New Zealand agriculture. Wellington: New Zealand Ministry of Agriculture.
New Zealand Ministry of Agriculture. 1996b. The New Zealand Reforms. Paris: OECD.
New Zealand Ministry of Economic Development. 2001. Growing an innovative New Zealand. Wellington: Ministry of Economic Development.
New Zealand Treasury. 2004. New Zealand's economic growth: An analysis of performance and policy. Wellington: New Zealand Treasury.
Opschoor H, Coddington A. 1972. Some limitations of benefit–cost analysis in respect of programmes of environmental economics. In: Pearce DW (ed). Problems of environmental economics. Paris: OECD.
OECD. 1983. New Zealand, OECD Economic Surveys. Paris: OECD.
OECD. 1985. New Zealand, OECD Economic Surveys. Paris: OECD.
OECD. 1996. Voluntary, cooperative approaches to sustainable agriculture. Paris: OECD.
OECD. 1998. Improving the environment through reducing subsidies. Paris: OECD.
OECD. 2001. Environmental effects of liberalising fossil fuels trade: Results from the OECD green model. Paris: OECD.
OECD. 2003a. New Zealand Economic Surveys. Paris: OECD.
OECD. 2003b. The sources of growth. Paris: OECD.
OECD. 2004. OECD economic surveys: New Zealand. Paris: OECD.
OECD. 2005a. Environmentally harmful subsidies. Paris: OECD.
OECD. 2005b. Agricultural policies in OECD countries: Monitoring, evaluation 2005 part 1 – main policy developments and evaluation. Paris: OECD.
OECD. 2005c. Trade and structural adjustment. Paris: OECD.
Reichelderfer K. 1989. Environmental protection and agricultural support: are trade-offs necessary? National Center for Food and Agricultural Policy Discussion Paper Series FAP89-03. Washington, DC: Resources for the Future.
Runge CF. 1996. Environmental impacts of agriculture and forestry subsidies. In: OECD, subsidies and the environment: Exploring the linkages. Paris: OECD, pp 139–161.
Sherwin M. 2004. Promoting structural adjustment in APEC economies: Deregulation and structural adjustment in the context of wider macroeconomic reform processes – The New Zealand agriculture experience. Paper delivered to APEC High Level Conference on Structural Reform, 8–9 September, Tokyo.
Sinner J, Cairns IJ, Storey M, Warmington B. 1995. Agri-environmental programmes in New Zealand: A report to the OECD. MAF Policy Technical Paper 95/3. Wellington: Ministry of Agriculture.
Statistics New Zealand. 1984. The New Zealand official yearbook. Wellington: Statistics New Zealand.
Statistics New Zealand. 2002a. The New Zealand official yearbook 2001. Wellington: Statistics New Zealand.

Statistics New Zealand. 2002b. Monitoring progress towards a sustainable New Zealand. Wellington: David Bateman Publications.
Statistics New Zealand. 2003. The New Zealand official yearbook 2002. Wellington: David Bateman Publications.
Statistics New Zealand. 2004. The New Zealand official yearbook 2003. Wellington: David Bateman Publications.
Statistics New Zealand. 2005. The New Zealand official yearbook 2004. Wellington: David Bateman Publications.
Steenblik RP. 2003. Subsidy measurement and classification: Developing a common framework. In: Environmentally harmful subsidies: Policy issues and challenges. Paris: OECD, pp 101 – 141.
Tobey J, Reinert K. 1991. The effects of domestic agricultural policy reform on environmental quality. J Agric Econ Res 43:20 – 28.
Tyler L, Lattimore R. 1990. Assistance to agriculture. In: Sandrey R, Reynolds R (eds). Farming without subsidies: New Zealand's recent experience. Wellington: Government Print Books and Ministry of Agriculture and Fisheries, pp 60 – 79.
United Nations. 1997. The Kyoto Protocol, Article 2.1.a. Bonn: United Nations.
Van Beers C, de Moor A. 2001. Public subsidies and policy failures: How subsidies distort the natural environment, equity and trade and how to reform them. Cheltenham: Edward Elgar.
Vitalis V. 2001. Measuring what?. Paris: OECD.
Vitalis V. 2004. Science, economics and sustainable development, making measurement meaningful. Environ Sci 1:201 – 230.
Walker A, Bell B. 1994. Aspects of New Zealand's experience in agricultural reform since 1984. Ministry of Agriculture and Fisheries Policy Technical Paper 94/5. Wellington: Ministry of Agriculture and Fisheries.
Wallace R. 1990. The macroeconomic environment. In: Sandrey R, Reynolds R (eds). Farming without subsidies: New Zealand's recent experience. Wellington: Government Print Books and Ministry of Agriculture and Fisheries.
World Commission on Environment and Development. 1987. Our common future. Oxford: Oxford University Press.
World Summit on Sustainable Development (WSSD). 2002. The plan of implementation. New York: United Nations. Also available at http://www.johannesburgsummit.org/html/documents/summit_docs/2309_planfinal.htm
World Trade Organization. 2001. Doha ministerial declaration. Geneva: World Trade Organisation.