Simulating a market for milk quota under policy reforms: an Irish study

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Abstract

In the wake of policy reforms such as the MTR of the CAP and WTO arrangements, many policy analysts are questioning the value of retaining the EU milk quota system in its current form and one policy reform option that has been discussed in advance of the 2008 "Health Check" of the CAP is the international transfer of quota rights between member states. A methodology for simulating a "free market" for milk quota is outlined in this paper with a view to extending the work to other member states to determine which member states would supply and demand milk quota if an international market for quotas was established. The analysis, conducted for Ireland, uses National Farm Survey data from 491 dairy farms to estimate the aggregate demand for and supply of milk quota. A profit maximization model is used to simulate the production decisions of farmers and aggregation techniques are applied to arrive at national and regional demand and supply curves. Two policy scenarios are analysed; one assumes that there is no WTO reform and that the policies agreed under the MTR of the CAP in 2003 continue indefinitely, the second scenario assumes that a WTO agreement is reached and that export subsidies are phased out. The analysis also considers the effect of the Single Farm Payment on the market for milk quota and a sensitivity analysis is conducted on the lifespan of the milk quota. The methodologies developed in this paper, offer policy makers in Ireland a useful tool to analyse the effect of imposing different constraints on the milk quota market, be they regional, volume based or some other measures. The analysis also offer some insight into the capitalisation of policy measures into asset values; this is evident from the substantially lower market equilibrium price for quotas in a scenario where there is no export subsidies relative to a continuation of these policies and also from the effect of re-investment of the Single Farm Payment on quota values. The approach adopted is sufficiently general to be applied to FADN data for the major dairy producing countries in Europe to determine where milk production may move to if there was an international free market for quota rights.

Introduction

The European agricultural policy agreements of the last number of years, such as Agenda 2000 and the Mid Term Review (MTR) of the Common Agricultural Policy in 2003, have resulted in a downward trend in European milk prices. Although the World Trade Organisation talks have been adjourned, the inevitable resumption of these talks will most likely result in an agreement that will accelerate the downward trend in European milk prices. Against a backdrop of declining milk prices, the MTR made provisions for a review of the milk quota regime in 2008. Given the recent price pressures in the sector, it seems increasingly likely that a significant reform, of the dairy policy regime is imminent.

In preparation for the impending reform of the dairy policy regime the Department of Agriculture in Ireland has changed the domestic policy on the transfer of milk quota. Milk quota transfer policy has been changed from a highly restricted scheme to a more market based exchange system. The objective of this paper is to develop methodologies that would provide estimates of the economic value of milk quota. The motivation for the analysis is two fold. First, estimates of the economic value of milk quota are produced to provide some insight into the prices at which milk quota might trade under the new milk quota exchange scheme in Ireland. Second, the economic values of milk quotas across the EU are a leading indicator of which member states would increase milk production at a lower milk price and a more liberal milk quota policy and are therefore the first stage of any analysis of milk quota abolition. The analysis presented in this paper is conducted on Irish FADN data only, however the methodology is sufficiently general to be extended for the analysis of other member states.

Background

EU Dairy Policy

A "Health Check" of the Common Agricultural Policy is scheduled for 2008. While the Health Check was initially planned to be a minor review of policies, it is looking increasingly likely that it may result in another significant reform of the CAP. While the precise details of this Health Check remain unknown, it has been widely hinted by the EU Agriculture and Rural Development Commissioner Mariann Fischer Boël that the dairy sector, in particular the milk quota regime, will be at the centre of this review. The European Commission has already strongly indicated that it cannot envisage the continuation of milk quotas beyond 2015 and therefore the practicalities of a transition from a quota regime to a no quota system now need to be addressed. The Commission also indicated that there will not be an overnight abolition of quotas but that they will consider a number of phasing out options with a view to providing dairy farmers with a "soft landing", (Hennessy 2007). The "phasing out" policy options that have been mentioned include;

1. A gradual increase in the EU milk quota in line with the increasing world demand for milk products.
2. The gradual erosion of national super levies; this would overtime erode the current disincentive to increase production and result in a gradual increase in production and reduction in price.
3. Rebalancing of milk quotas and the application of the super levy at EU level. This would mean that if a particular member state over supplies its quota that they might not incur a levy if the EU25 quota is not exceeded.

4. International trading of milk quotas, under this option milk quota would move to the highest bidders internationally.
5. The final, and more traditional option, is to reduce milk prices slowly until quotas are no longer binding.

An analysis of any of these five options presents the policy analyst with a considerable challenge. The lack of historical data on supply elasticities, because of the imposition of the quota, makes the use of the commonly used partial equilibrium models complex. To gain some insight into how producers may respond to a change in quota policy it is important to have reliable estimates of quota rent, as the larger the milk quota rent is, the greater the scope for market expansion when quotas are abolished, (INRA, 2002).

Transfer of Milk Quota Rights in Ireland

Up until the beginning of 2007 the transfer of milk quota in Ireland was operated through an administered system and for the most part there was no private market for the sale, purchase or lease of milk quota rights. All producers exiting the industry were obligated to sell their milk quota to the central restructuring pool at an administratively determined price which was set by the Minister for Agriculture. Prices since the scheme began in 1998 are presented in Table 1.

Table 1: Restructured Quota Price Euro per Litre

Year	1998	1999	2000	2001	2002	2003	2004
Price € per Litre	0.44	0.43	0.38	0.34	0.30	0.31	0.31

Source: DAFRD (2004)

Under the restructuring scheme, milk quota was re-sold at the administratively determined price. However, access to restructured quota was restrictive; the resale of quota was governed by priority groupings which were inversely related to current milk quota size, where smaller farmers had the first choice to purchase quota. The re-sale of quota was also spatially ring-fenced within the dairy processor's region.

In January 2007 the Irish Department of Agriculture announced that the transfer system for milk quota would be changed to a more market based mechanism. In the new exchange system, the trade price of milk quota is determined by farmers' bids for the purchase and sale of quota. The transfer of quota is still ring-fenced within the dairy processor's region. In order to eliminate the effect of "uneconomical bids" on the equilibrium price of milk quota, the Department of

Agriculture decided to implement some dampening measures. These included eliminating the highest 30% of offers to buy as well as siphoning off a proportion of quota being sold for re-sale at a lower price for force majeur cases. In advance of the move to the new quota exchange based scheme, the Department of Agriculture and Food commissioned this research to ascertain what milk quota price might prevail under the new exchange system. The research is carried out with a methodological approach described in the following section, to first estimate the economic value of milk quota and then to determine possible quota movements within Irish regions.

Methodological approach

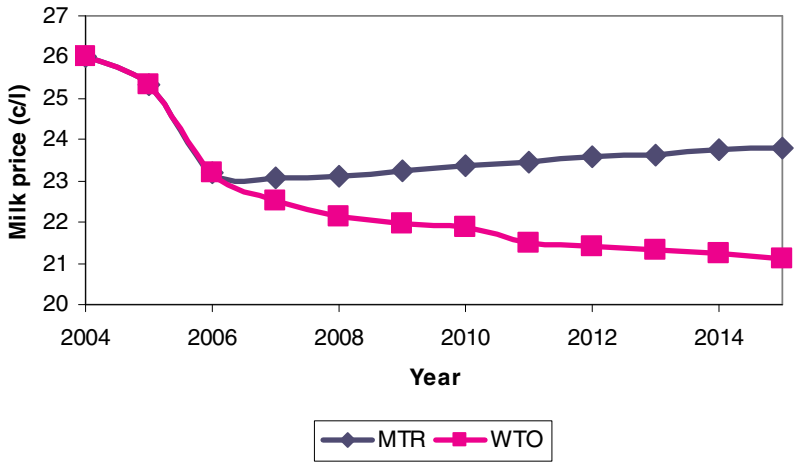
The methodology is based on a profit maximization model which simulates the production decisions of farmers and estimates normative supply and demand curves for milk quota. The model considers four major factors to arrive to an estimated quota value, they are; (i) the outlook for milk prices, (ii) costs of production, (iii) the number of years that the quota will produce a profit, and (iv) the cost of producing the additional milk. These four factors determine the value of quota and therefore should guide any farmer's calculation on what to pay for quota if expanding production and what to accept for quota if exiting production. By using the outlook for prices and costs of different producers and assuming various years for which the quota will last it is possible to determine (i) the minimum breakeven price that a farmer should accept if selling quota and (ii) the maximum affordable price a farmer can bid if expanding production. By aggregating these estimates it is possible to produce estimates of the regional or national supply of and demand for milk quota. It is very important to note however that these estimates assume that farmers are profit maximisers and that they will only bid and accept prices that are economical. It should therefore be noted that this analysis will provide estimates of the value of quota rather than the actual price at which it may be traded. The value of quota can be measured economically but the price that will prevail in the market will vary depending on the willingness of farmers to buy quota at uneconomical prices either for reasons of utility or lack of knowledge of the true value of quota for their own situation.

Estimating a sale price of quota

The major determinant of quota values is the future stream of profit, which in itself is a function of the future milk price as well as costs of production. The outlook for milk price is somewhat uncertain due to a stalemate of the Hong Kong round of the World Trade Organisation talk in July 2006. To allow for this uncertainty in the analysis, two policy scenarios are considered; a baseline scenario and a WTO scenario. The baseline scenario assumes that no WTO agreement is reached and that the EU dairy policy agreed under the MTR reform of 2004 stays in place up until

2015. The MTR agreement entailed the reduction in intervention prices of butter, cheese and skimmed milk powder in conjunction with the decoupling of the associated compensation. Under the WTO scenario, export subsidy expenditure is assumed to be reduced to zero by 2015, leading to sharp reductions in cheese, butter and whole milk powder exports from the EU and Ireland to non-EU markets. It is also assumed that tariffs are reduced leading to imports of cheeses from third country markets into the EU. In this analysis the FAPRI-Ireland milk price projections for these two policy scenarios are used to estimate the value of milk quota.

Figure 1: Projections of Milk Prices MTR and WTO Scenarios



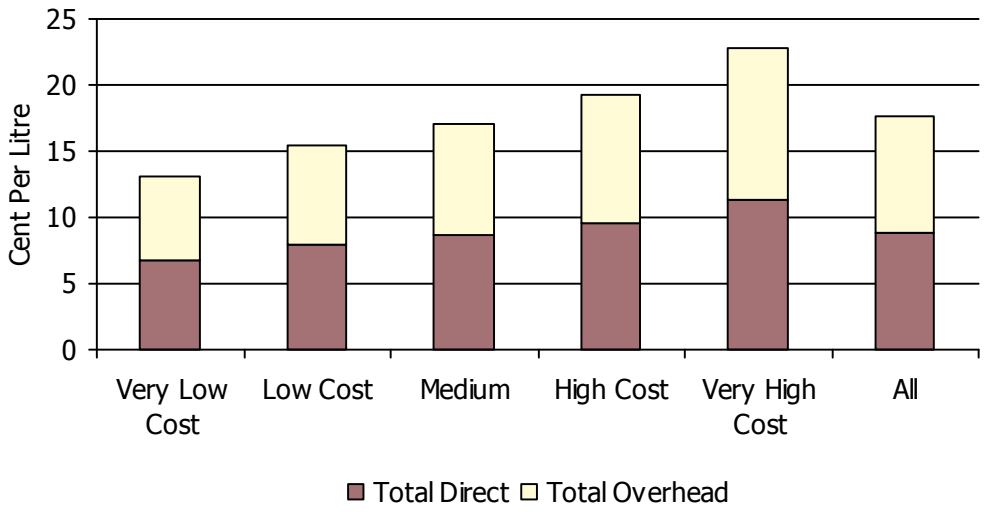
As shown in Figure 1, the projected figures suggest that the Irish farm level milk price will decline by approximately 10 percent under the MTR and by almost 20 percent under the WTO scenario from 2004 to 2015 (Binfield et al 2006). These price projections are net of compensation which is decoupled.[1] The substantial difference in milk prices between the baseline and WTO scenarios is likely to have a significant impact on the value of milk quota.

The second major determinant of quota values is the cost of producing the milk. The cost of production depends on the efficiency of a dairy farm hence would be different for different farms. In Ireland, there is a large variation in production costs across the across dairy farms (Fingleton, 2004). Figure 2 shows the variation in costs of production in 2004, the farm sample is divided into quintiles on the basis of production costs. The difference in costs of production between the best 20 percent of farms and the poorest 20 percent was 9 cent per litre (CPL) in 2004 that is a cost difference of almost €23,000 for the average quota size of 250,000 litres. This variation in

[1] This study does not consider the decoupled dairy compensation to be a profit accruing to the dairy enterprise. As it is decoupled from production it can be argued that this compensation is payable regardless of the farmer's production or investment decisions.

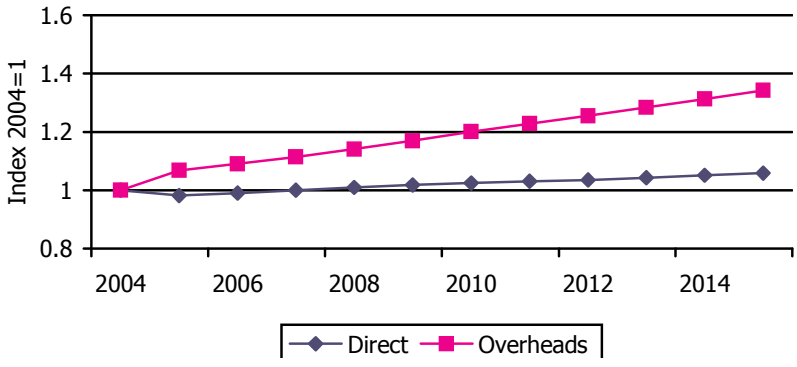
costs means that the maximum affordable quota price and the minimum profitable sale price will vary significantly across the sample of farms.

Figure 2: Total Production Costs on Specialist Dairy Farm by Quintile 2004



Looking forward some costs of production are likely to increase, such as energy prices and hired labour costs, while other costs of production may decline such as feed prices as recent policy agreements have led to a reduction in crop prices. For the purposes of this analysis we estimate future production costs by applying FAPRI-Ireland projections to the costs incurred on dairy farms as recorded by the NFS. FAPRI-Ireland produce projections of a number of elements of farmers' costs such as feed costs and fertiliser costs, while the ESRI produce macroeconomic projections of changes in inflation, labour costs and so forth (ESRI, 2006). By combining these price projections we estimate a composite projection for changes in the farm level costs of production (Figure 3). The figure shows direct costs are projected to increase only slightly over the projection period, by approximately 6 percent between 2004 and 2015. This modest increase is mostly due to the assumption that purchased feed costs remain more or less static because of falling cereal prices. Overhead costs however, are projected to increase more rapidly by approximately 34 percent between 2004 and 2015; this is mainly due to rising fuel and labour costs.

Figure 3: Projections of Direct and Overhead Costs



The third main determinant of quota value is the life span of milk quota. The value of quota is calculated by aggregating the profit accruing to the quota in every year that the quota remains binding. Under the MTR of the CAP in 2004 it was agreed that milk quotas would be in place until 2015. However, under the MTR it was also agreed that milk quota policy would be reviewed in 2008 and it seems increasingly likely that a major review of the milk quota system may take place in 2008. Recent studies of the impact of a WTO agreement show that there may be no benefit to retaining the milk quota system beyond 2012 given the falling milk price (Hennessy and Thorne 2006). Furthermore, studies in other EU member states also question the advantages of retaining the milk quota system until 2015 (Van Berkum 2006). Recent announcements from the EU Commission also allude to the fact that the milk quota may not remain binding until 2015. As there is still no certainty about the longevity of milk quotas, a sensitivity analysis is carried out with different quota end date; 2010, 2012 and 2015.

Estimating a purchase price of quota

For farmers considering expanding milk production, the maximum price they can afford to pay for milk quota depends on the cost of producing the additional milk which in itself is dependent on (i) the farmer's capacity to expand milk production within owned resources and (ii) the cost of acquiring additional resources. If farmers can achieve small increases in milk production at very low costs, i.e. by increasing deliveries per cow, then it follows that farmers can pay high prices for small amounts of quota but where substantial expansion is achieved it is likely that investment is required and therefore the ability to pay for quota in this scenario is reduced. It is therefore expected that there will be an incremental type demand process for milk quota at the farm level, where farmers pay high prices for the first stage of expansion and lower prices for subsequent stages of expansion. To allow for this, we estimate the costs of producing additional milk under different expansion stages as per Shalloo and Dillon (2006). The stages we consider are; Stage 1: Increase deliveries per cow through longer lactation and better feeding/management, and Stage 2: Replace beef livestock with dairy and increase the specialisation in milk production. No capital investment is required at stage 1, as cow numbers remain unchanged. We assume that deliveries per cow increase by 10 percent which is composed

of a 6 to 7 percent increase through longer lactations and a 3 to 4 percent increase through better feeding/management. The variable costs of production (mainly feed costs) increase in line with increased milk production. Stage 2 expansion involves removing beef animals from the farm and increasing the dairy herd. The plausibility of this option depends on whether the beef animals are in fact grazing land near the milking parlour. In Irish context, the Irish National Farm Survey (NFS), on which our work is based, does not record any information on land fragmentation and so it is not possible to establish whether Stage-2 expansion is possible on all Irish dairy farms. Instead, we assume in this study that 50 percent of beef animals on all farms could be replaced with dairy cows. The costs associated with Stage-2 expansion are; the cost of acquiring additional cows, the cost of additional labour, upgrading of the milk bulk tank, conversion of beef housing to dairy housing and the profit foregone on the beef animals. In this study, cows are purchased at individual farm replacement prices based on the NFS data, labour is costed at €12.44 per hour and it is assumed that replacing a livestock unit (lU) of beef with a lU of dairy results in a net increase in labour of 23 hours per cow. The bulk tank cost is estimated at €406 per cow and the foregone profit on the beef animals is estimated individually for each farm based on their NFS records and on the outlook for beef prices. Finally it is assumed that the capital for all expansion costs is borrowed and paid off over a period of ten years at an interest rate of 6 percent each year. In this analysis we assume that all interest charges are repaid over the life-time of the milk quota only, so in the scenario where milk quotas have no value in 2010 the full interest charge over the ten year period is costed into the investment in 2007. However, additional model run is considered where farms use Single Farm Payment as a source of investment for expansion and hence do not incur interest charges. The amount of milk that can be supplied under each stage of expansion is estimated as are the costs of expansion for every dairy farm in the NFS. The costs of expansion are added to the production costs to estimate the profit accruing to each additional litre of milk produced. These profits are converted to real terms, by discounting the profits by 3 percent each year, and aggregated to estimate the value of the additional quota.

Simulation of quota movement

The quota movement within a well defined area such as at regional, national or international level is simulated by using a linear programming (LP) model. Linear programming operates by maximising or minimising an objective function subject to a number of constraints. In this case, farm gross margin (z) for a region with f farms was maximised within the constraint of the limiting resources R_f. The general form of the model is;

$$\text{Max } z = \Sigma (p_f * x_f) - (c_f * x_f)$$

$$\text{s.t.} \quad A_f * x_f \leq R_f$$
$$x_f \geq 0$$

where, x_f is the farm activities for farm type f, p_f is a measure of the returns and c_f are the costs procured for x_f activity, A_f is an input – output coefficient for activity x_f, while R_f is a limiting resource such as milk quota, land and labour. However, transfer of milk quota is possible between farms within a region depending upon the profitability such as;

$$\sum_{f=1}^{n} \text{bquota}(f,y) \leq \sum_{ff=1}^{n} \text{squota}(ff,y); \forall\ y$$

where, bquota is bought quota; squota is sold quota; f is the n number of farm types; y is the number of years, and ff is an alias of f such that ff C f but ff ≠ f. For equilibrium, total bought quota is made equal to total sold quota in a region;

$$\sum \text{bquota}(f,y) = \sum \text{squota}(f,y)\ \forall\ f, y$$

For this study, a farm level dynamic linear programming model, Teagasc_mod, is developed to determine the quota movement at the regional level in Ireland. The model was written in the mathematical programming software, GAMS® and was solved using Xpress® solver. Individual farm profit is maximised for each farm in a region subject to the total land and milk quota available in the region. For a full description of the model structure see Shrestha and Hennessy (2005).

Results

Estimating milk quota supply

The model provides a range of estimates of breakeven minimum sale prices for milk quota for Irish dairy farms. By applying the NFS weighting factors to each farm and aggregating these prices, a national aggregate supply curve for milk quota can be estimated for the baseline and WTO scenarios. Figure 4 shows the amount of the national milk quota that would be supplied at

various prices in the MTR scenario. In the MTR scenario, the maximum prices at which the whole national milk quota of 5.5 billion litres would be supplied is 50 CPL, 72CPL and 92CPL for the various termination years.[2] In other words these are the maximum breakeven prices. At a milk quota price of 40 CPL 3 billion litres of milk quota would be sold assuming quotas last until 2015, 3.5 billion litres would be sold if milk quotas last to 2012 and over 5 billion litres of milk quota would be sold if quotas expired in 2010.

Figure 4: Estimates of Supply Curve for Milk Quota - MTR

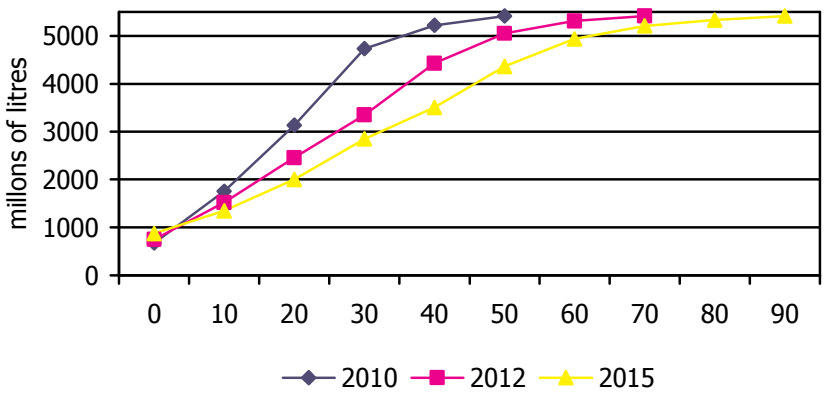
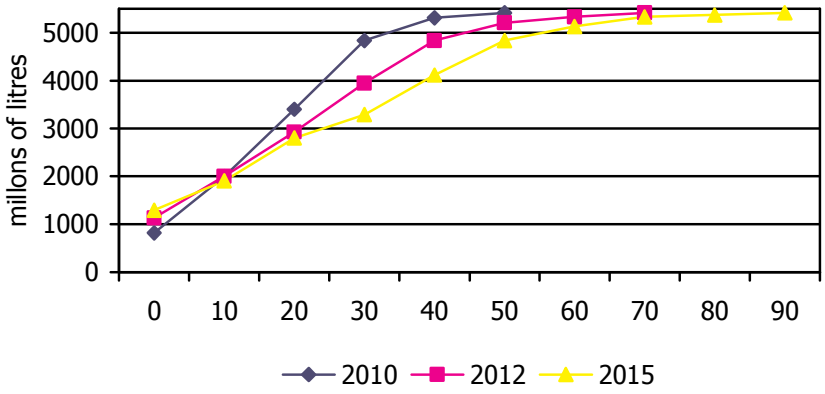


Figure 5 shows the supply curve in a WTO scenario. At a milk price of 40 CPL the amount of quota being supplied is higher than in the MTR scenario because the value of quota is less due to the lower milk price. At 40 CPL 3.5 billion, 4.5 billion and almost 5.5 billion litres of quota would be supplied for the various termination dates.

Figure 5: Estimates of Supply Curve for Milk Quota - WTO

[2] The national milk quota is arrived at by weighting the milk quota of each farm in the National Farm Survey and therefore it may not be the equivalent to the actual national milk quota.



Estimating Milk Quota Demand

The model also provides a range of maximum breakeven purchase price for milk quota for each dairy farm in the sample. By applying the NFS weighting factors to each farm and aggregating the maximum breakeven purchases prices and the quantity that can be purchased at that price a national aggregate demand curve for milk quota can be estimated for the MTR and WTO scenarios (Figures 6 and 7 respectively). These demand curves represent stage 1 and stage 2 expansion only and so there is only demand for 2 billion litres of milk. The demand for milk quota falls to zero at approximately 40 CPL quota price when quota is projected to terminate in 2010, this increases to 60 cent and 80 cent when quotas are terminated in 2012 and 2015 respectively. In other words, if quotas are expected to last to 2015 in a MTR scenario and quota price is set at 80 cent then there will be zero demand if however quota prices are set at 30 cent 1 billion litres will be demanded.

Figure 6: Estimates of Demand Curve for Milk Quota - MTR

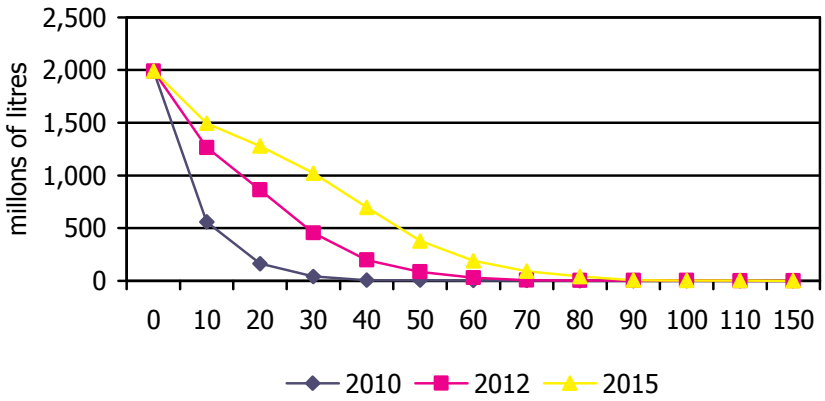
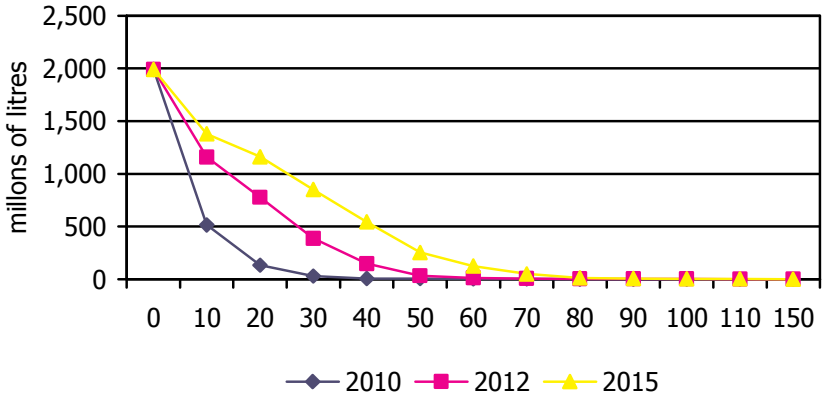


Figure 7 shows that the demand for milk quota is lower at a given price under the WTO scenario this is due to the lower milk price projection. At 30 CPL, the demand is 0.4 million litres and 0.8 million litres when quota is assumed to terminate in 2012 and 2015 respectively, compared to 1 billion for the 2015 scenario in the MTR scenario. The demand for milk quota also ceases much sooner under the WTO scenario compared to the MTR scenario.

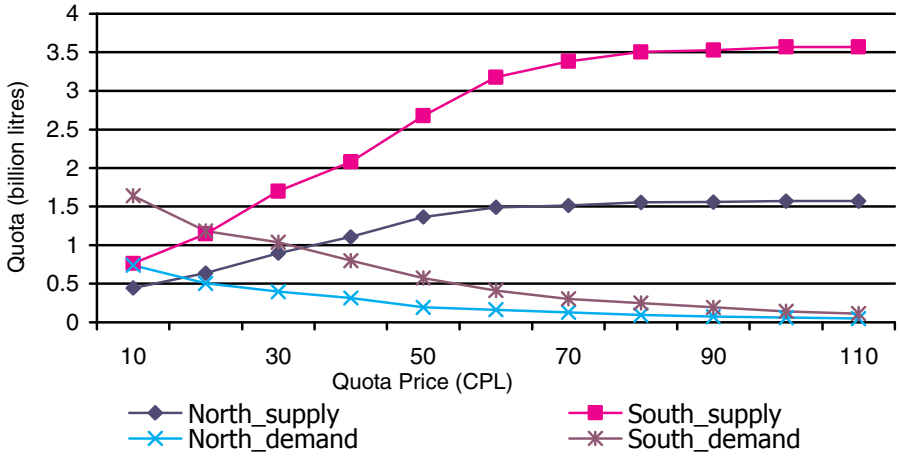
Figure 7: Estimates of Demand Curve for Milk Quota - WTO



Estimating equilibrium price for two regions in Ireland

The normative demand and supply curves as shown above can be used to determine an equilibrium price where demand for quota is met by supply of quota. This practice is especially useful to determine quota equilibrium prices between two different areas. For example in our study, we divide Ireland into two regions; north and south based on the level of milk production. The south region consisting of three NUTS III regions produces more than 60% of total milk production in the country whereas south region consists of remaining four NUTS III regions. Figure 8 shows equilibrium prices for these two regions combining supply and demand curves under the MTR scenario with quota ending date set at 2015. The figure shows that the equilibrium price in the south region is 20 CPL whereas this price is 18 CPL in the north region.

Figure 8: Estimate of equilibrium price of quota in north and south Irish regions - MTR



The scenario where SFP is considered to be invested in dairy expansion shows that there are only 33% of total sampled dairy farms which receive sufficient SFP to add at least one dairy animal on farm. On average these farms can afford up to 25 CPL to purchase quota for expansion under the MTR and quota ending on 2015 scenario. However, this quota purchasing price decreases up to 18 CPL under the WTO scenario.

As stated earlier, this work uses an LP model, Teagasc_mod, to determine possible quota movement within a region. The results suggest that in all Irish regions, quota will move from less efficient to more profitable dairy farms under the MTR scenario (Shrestha et al., 2006). There is an increase in dairy animal numbers in such farms to produce more milk. For example, large specialist dairy farms in the South East region are able to increase milk production by almost 30% by acquiring milk quota from smaller farms in the region.

Conclusions

The results of the model facilitate the estimation of supply and demand curves of milk quota under different policy scenarios at Irish regional and national levels. Regional estimates provide an indication of where dairy production would be concentrated geographically if a free market for milk quota was implemented. The methodologies developed in this paper, offer policy makers in Ireland a useful tool to analyse the effect of imposing different constraints on the milk quota market, be they regional, volume based or some other measure. The results of the analysis also offer some insight into the capitalisation of policy measures into asset values; this is evident from the substantially lower market equilibrium price for quotas in a scenario where there is no export

subsidies relative to a continuation of these policies and also from the effect of re-investment of the Single Farm Payment on quota values. The approach adopted is also sufficiently general to be applied to FADN data for the major dairy producing countries in Europe to determine where milk production may move to if there was an international free market for quota rights.

References

Binlfield, J., Donnellan, T., Hanrahan, K., and Westhoff, P. (2006). World Agriculture Trade Reform and the WTO Doha Round: Analysis of the Impact on EU and Irish Agriculture. Rural Economy Research Centre, Teagasc, Galway.

ESRI (2006) Quarterly Economic Commentary, Summer 2006. Published by the Economic and Social Research Institute, Dublin 4.

Fingleton, W.A. (2004). Comparative costs and returns for milk production in Ireland. Paper presented at the Annual Conference of the Rural Economy Research Centre, Dublin.

Hennessy, T. and Thorne, F. (2006) The Impact of WTO ~Doha Development Round on Farming in Ireland. Teagasc, Rural Economy Research Centre, Galway.

Hennessy, T (2007). What Future for Milk Quotas? Today's Farm – January Issue 2007. Vol. 18 No 1. Published by Teagasc, Oak Park, Carlow, Ireland.

INRA (2002). Study on the inpacct of future options for the Milk Quota system and the common market organisation for milk and milk products: summary report. Available at http://ec.europa.eu/agriculture/publi/reports/milkquota/inrawag_en.pdf

Shallo, L. and Dillon, P. (2006). Is Quota Worthless? Paper presented at the Teagasc Annual Dairy Conference, Limerick, November 2006.

Shrestha, S. and Hennessy, T. (2005). Description of TEAGASC-MOD: A linear programming model of Irish agriculture. Working paper prepared for the GENEDEC partnership. www.grignon.inra.fr/economie-publique/genedec/eng/home.htm

Shrestha, S., Hennessy, T. and Hynes, S. (2006) The Effect of Decoupling on Farming in Ireland: A Regional Analysis. *Rural Economy Working Paper Series, 06WPRE11*. www.tnet.teagasc.ie/rerc/workingpapers.htm

VAN BERKUM, S. and HELMING, J. (2006) European dairy policy in the years to come: impact of quota abolition on the dairy sector. LEI-Wageningen UR, The Hague, The Netherlands.