# MEASURING AND INTERPRETING INTERVENTION IN AGRICULTURE*

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## SUMMARY

Intervention includes all form of protection or taxation in agriculture irrespective of the source, and includes for example price support, income support, export tax, regulations whether marketing or technical, non-tariff barriers and exchange rate distortions. In fact, all factors which cause the domestic price to differ from the world price when measured at the same point in the marketing chain. This paper surveys recent studies which illustrate measures of measuring intervention and their welfare effects. Problems of interpreting these measurements are discussed and suggestions are made for future analysis.

## INTRODUCTION

Intervention in agriculture is often described as protection but since agriculture is also taxed in many countries a more general word is preferable. Intervention may be due to general economic policy as well as to agricultural policy and includes the effect of marketing regulation and non - tariff barriers. Other

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factors both technical and economic which cause the domestic price to be different from the world price and which cannot be explained by explicit policy measures are included as a residual effect which helps to explain the difference between the domestic price and the world price for any commodity.

Neoclassic economic analysis emphasises that free trade stimulates competition and encourages economic grow. On the other hand the argument in favour of protection includes self-sufficiency, economic independence and encouragement of local industrialisation[2]. In agriculture protection is defended by the desire to increase self- sufficiency on basic agricultural products, to maintain the stable domestic food prices and to ensure a fair standard of living for farmers^. However in many countries market distortions may not relate to policy objectives and many commodities are both taxed and subsidised in a situation where the new effect is not known or even considered.

CONSUMER SURPLUS

The measurement of the effects of protection depends on the concept of economic or consumer surplus which is the difference between the price paid for any good and the price the consumer would be willing to pay. Satisfaction generally exceeds commodity cost and this difference is defined as consumer surplus[4]. Marshall also introduced the concept of producers surplus to describe the difference between what the seller receives for a good and the price at which he would be prepared to supply to the market. Some writers, for example Mishan, use the concept of rent to describe producers' surplus.

The welfare effects of price policy involve three assumptions[5].

1. The demand price for a good measures its value to the consumer.

2. The supply price of a good measures its value to the supplier.

Consumer surplus is therefore measured by the triangle $P_0$ AB and the producers surplus by the triangle $P_0$ AC in figure 1 below.

The equilibrium price is $p_D$ and the quantity traded is $Q_0$. The highest value put by the consumer on the good is OB. As more of the good becomes available its demand price reduces because new buyers value the good less whereas additional units generate less additional satisfaction to consumers. In a compe-

titive market there is only one price and the last unit bought has a value to the consumer equal to the market price while previous units have higher values above the market price.
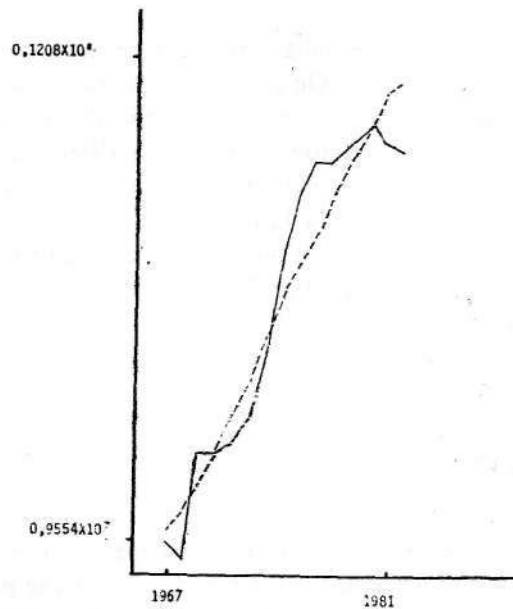


Figure 1

A similar interpretation applies to producer surplus where the cost of producing $Q_0$ is area $COQ_0A$ whereas the revenue is $OP_0AQ_0$ exceeding the cost by the producers surplus, amount $P_0AC$.

3. The third assumption is that consumer or producers surpluses with the addition of administrative costs can be aggregated to show the overall effects of government policy on national welfare.

The main theoretical criticism regarding the practical application of the concept is related to the difficulty associated with aggregating utility functions connected with welfare gains and losses for individuals or countries[6]. However Bergson[7] says that «despite theoretical criticism, practitioners have continued to apply surplus analysis through the years...that must say something about the usefulness of such analysis» and Willing[8] demonstrated that consunmer surplus is a good estimate of appropriate welfare measures. The approach has been ex-

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tensively used, particularly in recent years   as the following review of literature will show, and it is currently accepted and used in practice by the World Bank[9].

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## OBJECTIVES  OF  INTERVENTION  IN  AGRICULTURE

Distortion of domestic agricultural prices due to intervention and regulation of the  market  as  well  as  to  the  effect of non - tariff barriers are many and varied  and  include  the  following :

1. Export  taxes  in  agriculture  provide  government  revenue,  particularly  in newly  developing  countries,  and  may  help  keep  domestic  prices  down.

2. Price  support  attempts  to  maintain  or  increase  farm  incomes  in  line  with the   concept  of  parity  income  between  agriculture  and  non - agriculture  initiated in  the  United  States  between  the  wars  and  pursued  in  most  rich   developed  countries  since.  This   policy  tends  to  be  ineffective  in  the  sense  that  it  leads  to  surpluses.  At  the  same   time  it  tends  to  be  inefficient  in  maintaining  the  incomes  of the  low  income  sector  of  agriculture  since  price  supports  go  to  large  farmers  who account  for  a  large  proportion  of  output.  These  surpluses  in  turn  have  to  be  subsidised  to  pay  for  storage  and  eventual  distribution.

3. Agricultural  inputs  are  often  subsidised  in  both  rich  and  poor  countries. This  tends  to  contribute  to  more  capital  intensive   technology  than  might  otherwise be  optimum,  to  displace  labour  from  agriculture  at  a  more  rapid  rate  than  would otherwise   occur,  and  to  reduce  the  employment  potential  in  agriculture.

4. Particular  developing  countries  have  price  policies  designed  to  keep  down the  price  of  domestie  food  which  tends  to  be  reinforced  by  exchange  rate  policies which  effectively  subsidise  imports.  This  is  associated  with  the  idea  that  development dependent  on  the  non - agricultural  and  service  sector  is  facilitated  by  low  food prices  and  low   wage  rates.  Brown[10]  listed  the  assumptions  behind  price  policies  in  developing  countries  as  follows :

a) Agricultural  production  is  price  inelastic.

b) Large  farmers  benefit  most  from  higher  prices.

c) High  food  prices  affect  low  income  consumers  most.

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d) Growth depends on large transfers of profits and foreign exchange from agriculture to manufacturing.

5. In periods of rapid economic growth in particular in the non - agricultural sector it is considered important to the agricultural sector provide surplus food and also labour for growing industries. This has been relevant in Europe and UK after the  second World War and also in the United States. It is difficult to avoid the impression,  however, that agricultural price policy has been designed at times of rapid economic  growth and is particularly irrelevant during a recession and in conditions of high unemployment particularly in view of the capacity in agriculture for labour intensive production.

Generally speaking, poor countries tax poor farmers in order to subsidise relatively  rich consumers of food while in rich countries, relatively poor consumers are taxed in order to subsidise relatively rich farmers.

In many underdeveloped countries farm gate prices are particularly low compared with  world prices[11].

Unfavourable prices tend to reduce agricultural output and cause food shortages which mays reduce agricultural as well as overall economic growth[12].

Extensive market intervention by governments in LDCs discriminates against agriculture affecting efficiency and income distribution[13].

Considerable evidence demonstrates that agricultural production, income distribution and economic growth benefit from elimination of distortions that reduce agricultural domestic terms of trade[14].

Generally, in developed countries, agricultural production is heavily protected, that is, subsidised. This results in overproduction and surpluses and under - consumption of agricultural output, possibly acceptable in a post-war period of food shortage. However,  the producer and consumer prices for agricultural products in rich countries are generally much above world level. Until recently, however, the welfare cost of protection,  which takes into  account both the degree of protection and its effect on production and  consumption of protected goods, has been given litle attention.

# THE MEASUREMENT OF PRICE DISTORTION

Intervention causes a difference between domestic prices and opportunity costs measured at international prices. There is no alternative to the international or border price as a means of estimating distortion of the domestic price. Border prices measure the value of tradeable goods and services at international prices rather than distorted local prices[15]. This is justified as follows:

a) No other common observable system of market value exists for comparing with domestic price.

b) Border prices in the case of a small country where price represents marginal revenue do represent true opportunity costs.

c) Most intervention is very complex and the only way to measure its extent is to compare the domestic price with the world price.

The limitations in this approach are as follows :

1) It is difficult to identify world price since there is no unique homogenous international market.

2) For some products world prices are unstable so that moving averages may have to be used[16].

3) In large countries comparisons with world prices may be difficult because the world price is affected by the domestic policy.

4) Agricultural commodities with low price elasticities of demand may poor indicators since they fail to measure the reduced marginal return from expanding production[17].

Border prices can be used in comparison with domestic prices as follows[18] :

1) The ratio of border price to domestic price can be used to assess the pattern of specialisation of a country.

2) Border prices adjusted to an equivalent marketing point and compared with domestic prices at the same point give a comparative measure of the level of protection afforded to individual products.

3) Consumer prices and border prices at an equivalent point can help to show low the pattern of consumption is effected by intervention.

4) The deviation between domestic and international price for individual commodities of sectors can be used to measure differential levels of protection.

Turning to method, the difference between domestic and border price may be estimated by measuring the equivalent tariff raised on a good. Individual commodity tariff rates on output and inputs can be used to measure a gross tariff rate for the sector. This method does not explain the difference between domestic and border prices which are due to factors other than tariffs and a distinction needs to be made between nominal rates of protection and effective rates of protection.

## THE NOMINAL RATE OF PROTECTION

The nominal rate of protection is the percentage by which the domestic price exceeds the border price as a result of both explicit and implicit intervention :

$$NRP = \frac{P_d - P_w}{P_w} \times 100^2$$

Where NRP is the Nominal Rate of Protection $P_d$ is the Domestic Price and $P_w$ is the Border Price, i.e. the foreign price times the official exchange rate.

If a tarrif is the only source of intervention then the tariff rate is equivalent to the NRP. Where other distortions exist, the difference between border and domestic price is regarded as an equivalent tariff rate and non - tarrif measures are thus included[19]. NRP therefore includes the net effect of producer price supports, tariffs, quotas, export taxes, distorted exchange rates and other non - tariff effects.

The edvantages of NRP according to Lutz and Scandizzo[20] are

1) Simplicity

2) Interpretation of distortion measures as equivalent to tariffs or subsidies

3) The relationship between these measures and the shadow of exchange rate can be assessed.

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Indeed the ratio of domestic and international price in appropriate currencies represents the equivalent exchange rate for that particular good. Consequently the NRP measures tariff (subsidy) levied against a good as a result of over (under) evaluation. Further, Balassa[21] measured the net nominal rate of protection (NNRP) by using the shadow instead of the nominal exchange rate.

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## EFFECTIVE RATE OF PROTECTION

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The effective rate of protection (ERP) shows the percentage increase in value added per unit in any activity which is made possible by tariff structure compared with what would obtain in the absence of tariffs but with the same exchange rate. Consequently it takes account of tariffs which apply to inputs used in the production of an output. Generally tariff is used to apply subsidies as well as taxes.[22]

A further concept has been used mainly in manufacturing. It is increasingly applied in agriculture, for example in the work of Wipf, Motha and Plunkett, Sampson and Yeats and Strak. This is the comparison of value added with and without protection. Value added is defined as the value of output at any point of production - distribution process in any period less the value of purchased inputs, less depreciation in the same period.[23] Purchased inputs can be both traded and non - traded, the evaluation of the latter involving some complexity. Two methods exist for the measurement of value added.

First the Corden method, which treats non - trade inputs in the same way as primary factor inputs, i.e. they are included;

Secondly the Balassa method which treats non - tradeable inputs in the same way as traded inputs which have a zero level of nominal protection; in other words, they are excluded from value added. It is assumed that non - traded inputs are in infinitely elastic supply and therefore can be treated like traded inputs.[24] These

two methods can give different effective ERP measures although the ranking of comparable commodities may not be much affected.

Third the Scott method assumes that non-trade inputs are subject to a uniform level of tariff, namely that which occurs for non - tradeables as a result be the imposition of a protective structure.[25] This method shows the additional incom due to protection and is particularly suitable in agriculture where non - tradeable inputs such as electricity are often heavily subsidised.

Corden[26] treats the whole of depreciation as a cost like a traded input whereas Balassa[27] excludes depreciation of the buildings, machinery and equipment. This involves the difficulty of deducting the domestic value of depreciation from the domestic value - added, whereas the world market value of depreciation has to be deducted from the world market figure. This demands knowledge of tariffs or taxes and subsidies and capital grants and overhead items which is not usually available, and of course the existence of joint costs of products in agriculture raises a difficulty of allocating such overheads, not to mention the problem of distinguishing current from historical costs.

Since ERPs measure protection on input as well as output, overall protection enjoyed by different commodities or industries can be compared. This gives a measure of the relative pull of industries on available resources. Production shifts from low to highly protective activities involving misallocation of resources influencing pattern of consumption and the terms of trade. Eruen and Evans[28] emphasised that while ERP is relevant for measuring the production effect of protection, measurement of consumption effect demands the use of NRP. Earlier approaches for the measurement of the effect of tariffs on output and trade inputs only show that ERP measures the protection afforded by the tariff structure alone. A more approach includes the effect of non - tariff measures assuming that all other effects on agricultural prices are equivalent to tariffs and that their equivalent tariff rate can be calculated.[2] This latter method measures the total protection given to a commodity or sector or industry, irrespective of source, as opposed to the explicit protection provided by direct tariff measures.

The effective rate of protection used as a static partial equilibrium concept relies on the following assumptions :

a) Physical input - output coefficients are fixed.

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b) Elasticities of inputs and outputs are infinite, i.e. industries do not affect prices and purchases and sales.

c) The difference between internal and international prices are measured by the tariff, subsidies, etc.

d) Factors of production are mobile nationally but immobile internationally fixed in total supply with less infinite elasticity for a particular industry.

e) Domestic fiscal and monetary policies maintain full employment.

ERP then shows the relative pull of the protective structure on inputs. The concept says nothing directly about the distribution of protection between factors of production or levels of employment or output. It is a descriptive concept with no clearly normative implications, and is considered to be of limited use when considering ajustment[30]. Nevertheless, Balassa[31] classifies ERP measures into positive and normative as follows :

Positive
1) ERP provides additional information compared with NRP for countries or industries
2) ERP measures can be used in tariff negotiations.
3) ERP can be used to assess protection by rich against poor country imports and to explore the tariff preferences.
4) Import response due to tariff reductions may be estimated if relevant elasticities are known.
5) Measures of relative protection for comparable industries may be useful.

Normative applications involve

1) Estimating the costs of protection.
2) The establishment of policy norms, for example, the World Bank has been known to use ERP for policy guidelines in developing countries.

Two important concepts relate ERP to the more modern project evaluation criteria DRC (Domestic Resource Costs) and NSP (Net Social Profitability)[32]. The DRC/NFE ratio used to show either the amound of domestic activity created by given investment of funds borrowed overseas, or alternatively, the foreign ex-

change which can be earned as a contribution to the balance of payments by given investment of domestic resource costs and in a particular project.

The net social profitability of projects involves measuring all inputs and outputs at their social opportunity cost and taking into account also the social effect of external factors such as foreign exchange rate.[33] Pearson[34] shows that the effective rate of protection on value added is algebraically identical to the domestic resource cost if all importable inputs are actually imported, or are zero, and ERP + 1 is multiplied by the shadow price of foreign exchange.

## MEASURING DISTORTIONS IN AGRICULTURE

The basic model for measuring distortions in agriculture is illustrated in World Bank studies[35] in the following formulas which apply to a small country. In the case of a large country, world prices should be replaced by marginal revenues

a) Net social loss in production (NSL$_P$)

$$= i \ (Q_W - Q) \ (P_W - P_P) = i \ t_P^2 \ V$$

b) Net social loss in consumption (NSL$_c$)

$$= i \ (C - C_W) \ (P_C - P_W) = i \ t_c^2 n_d W$$

c) Total net social loss (NSL)
$$= NSL_P + NSL_c$$

d) Welfare gain of producers (G$_P$)
$$= Q(P_P - P_W) - NSL_P$$

e) Welfare gain of consumers (G$_c$)
$$= C \ (P_W - P_c) - NSL_c$$

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f) Change in foreign exhange earnings
$$= -P_W(Q_W - Q + C - C_W)$$

g) Change in government revenue
$$= Q(P_W - P_P) - C(P_W - P_c)$$

Where :

$Q_W$ = production at world prices

$Q$ = production at domestic prices

$P_W$ = border prices

$P_P$ = price faced by domestic producers

$P_c$ = price faced by domestic consumers

$t_c, t_p$ = proportion of tariff in domestic price at the consumer ($t_c$) or the producer ($t_p$) level

$n_s$ = elasticity of domestic suppiy

$n_d$ = elasticity of domestic demand

$V$ = value of production at $p$

$W$ = value of consumption at $p_c$

$C_W$ = consumption at world prices

$C$ = consumption at domestic prices

Only static partial equilibrium analysis has been used in agriculture as can be seen in reviewing the list of studies by Lutz and Scandizzo.[35].

## REVIEW OF EMPIRICAL STUDIES

There are four categories of study.

First, models are used to evaluate government domestic programmes for agriculture. See Wallace[37] who estimated the social costs for two alternative agricul-

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tural programmes in the United States, end expressed these as a percentage of the value of farm output, which ranged from 0.03 to 6.5. A similar analysis was used by Johnson[38] to assess the tobaco programme involving the high price support and acreage control. Hushak[39] showed that the netwelfare costs of the feed grain programme in the United States in 1961 - 66 were small but the income transfers were substantial. Darbis and Dennisson[140] showed that deficiency payments were less costly than tariff protection. Dardis[41] estimated the welfare cost of grain protection in the UK for the year 1959 - 60 showing that cost as a percentage of income redistributed to the grain sector, which relates the cost of a given agricultural policy to its results, was significant. Cost arises from increased production in response to high prices and employment of excessive resources in grain which might be used more profitably elsewhere. Bale and Green shields[42] assessed the welfare implications of current and future Japanese agricultural trade and production policies which they showed to have a total cost equivalent to less than two per cent of Japan's GNP.

Second, studies in developing countries show the effect of intervention, in this case taxation rather than subsidy, is important. Valdes[43] found that in Chile negative rates of protection averaged—0.38 for wheat,—0.35 for beef,—0.30 for lamb and—0.45 for wool. Production was below levels which would otherwise have obtained by 3 to 10 per cent for wheat, 4.5 to 14.5 for beef, 6.8 to 23 percent for wool. Without taxation Chile's agricultural trade deficit could have been reduced by 76 percent between 1951 - 55 and almost completely during 1956 - 1960. Wong[44] showed that taxation of rice exports from Thailand involved substantial transfer of income from farmers and reduced production and technical invovation.

Prices received by farmers in LDCs have been lower than prices in the developed countries. Taxing of agriculture in LDCs reduces agricultural output and causes food shortages.

In constrast rich country agricultural policy involves overproduction, underconsumption and food surplusses. Peterson*[5] surveyed fifty - three countries showing that real farm prices are higher in developed countries than in LDCs. Had farmers in LDCs enjoyed similar prices to those in rich countries, there would be no world food shortage. Bale and Lutz[46] and Lutz and Scandizzo[47] estimated the effects of price distortions in agriculture using the nominal protection coefficient measuring the difference between domestic and border prices. In nine countries, including four LDCs (Thailand, Egypt, Argentine and Pakistan) where heavy taxation of agricultural exports limits production, and four developed coun-

tries (Japan, West Germany, France and Great Britain) the immediate consequence of price support were food surpluses.

Lutz and Scandizzo used a similar approach to estimate the effect of government intervention in agricultural commodity markets, as follows :

Argentina - wheat, maize and beef

Egypt - rice, cotton, wheat

Kenya - maize, coffee, beef

Pakistan-wheat, cotton, rice

Portugal - wheat, olive oil, maize, beef, rice

Thailand - sugar cane, rubber

Yugoslavia-wheat, maize, beef, pork.

Except maize in Portugal and pork in Yugoslavia, sugar cane rubber in Thailand, all products were taxed, discouraging agricultural production while consumption is subsidised. The increased government revenue from taxation is counter - balanced by an equal loss of foreign exchange earnings.

A third approach compares the relative protection for different producers in the agricultural sector. Wipf[48] used effective protection concept for the first time in agriculture, concluding that.

1) The nominal protection of protection rates for an industry are often very different.

2) Effective protection rates vary greatly from one agricultural sector to another.

3) Non - tariff distortions cause very high effective protection in some agricultural sectors, while in other sectors tariff and non - tariff measures on input may have contrary effects.

Motha and Plunkett used the ERP consept to study wheat, sheep and eggs in Australia, emphasising the limitation of the fixed input - output relationship assumption and associated cost allocation problems, especially in multi - product farm enterprices with a multiplicity of types of intervention.

Strak[50] estimated effective protection for livestock production - activities in the UK showing how relative support levels change over time.

Hamilton[51] shows in Sweden over the period 1970-80 that the seventy percent ad valorem tariff equivalent in 1970 - 72 rose to about eighty percent in 1970-80. Dairy products and beef were highly protected, but both nominal and effective rates of protection were lower in Sweden than in the EEC. He found that Sweden produces more food than can be justified for self- sufficiency in a crisis.

In a fourth area, protection due to trade policies in developed countries have been examined as it is a barrier to low cost producers of food in Canada, the United States, Australia and New Zealand. The main stimulus was the restrictive trade policy of the CAP. CAP reduces the world demand for agricultural imports[52] and the restrictive effect of levies imposed by CAP more than double that of current MFN tariffs on certain items.[53] Valdes and Zietz[54] estimated the effect of a fifty percent reduction tariff in trade barriers for 99 commodities in 17 developed OECD countries, suggesting that this could increase world trade by $ 8.5 billion per annum at 1977 prices, but thirty - six per cent of this expansion would accrue to certain LDCs, twenty percent to OECD exporters and fortyfour percent to the remaining countries.

## SUMMARY

Measurement of agricultural intervention has been concentrated as follows :

1) The welfare implications associated with particular policies for agriculture and general economic policy

2) On relative levels of support for individual products

3) On the measurement of social costs of price distortions in both developed and developing countries

4) On the trade effects of agricultural protection.

Very few studies seem to have been carried out on the effect of production on the structure of domestic agriculture as a whole. Intervention certainly will effect the domestic pattern of output and in turn the distribution of the level of income within agriculture. Cenerally, in the studies reviewed here, each commodity is considered separately and the prices and quantities of all other commodities

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are regarded as being unaffected, so that only part of the production structure and constraints is considered which makes the significance of the studies much more limited.

Some of the major questions which require further investigation are as follows :

1. How is net tax or subsidy on a project divided between the effect of direct policy instruments and other uncontrollable effects including non - tariff barriers?

2. Does the effect of agricultural policy intervention reinforce or contradict the influence of general economic policy on agriculture, for example as exerted through controlled exchange rates?

3. How far is agricultural intervention, either tax or subsidy to be justified as a counteraction to the adverse (or favourable) affects of macro-economic policy, or alternatively to what extent are the combined effects unknown and coincidental?

4. To what extent does tax and subsidy in agriculture have regressive effects on the distribution of income? Tax on agriculture in poor countries clearly transfers income from poor farmers to relatively well off consumers. In the same way subsidies in rich countries tax relatively poor consumers in order to distribute the benefits mainly to rich farmers while doing very little to support the incomes of the poor farmer.

5) How is the structure of agriculture with or without the effects of protection, both tariff and non - tariff, affected and what are the associated patterns of output, income and employment, in the face of intervention compared with non - intervention?

6) The current pattern in rich countries and in general in Europe is to subsidise the producers of grain and dairy products and to encourage surpluses and the introduction of technology which favours large farmers and reduces the employment potential of agriculture. High grade prices for example, in countries adjusting to the CAP such as Portugal, Spain and Greece tend to reduce the production of commodities such as wine, fruit, olive oil, etc., in which they have a comparative advantage at international

prices in favour of the production of grain, and to a lesser extent dairy products, in which there is an accepted surplus.

At the same time taxation of agriculture in poor countries increases the problem of food shortage.

Taken as a whole the influence in agriculture in rich and poor countries appears to involve enormous costs and very dubious benefits in a situation of less than full unemployment and low industrial growth.

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