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Impact of the US–EC price war on major wheat exporters' shares of the Chinese market

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Abstract

China is both the world's largest producer and consumer of wheat. In an attempt to gain a larger slice of the important Chinese market, both the European Community and the United States have offered China subsidised wheat. In addition, other exporters have offered attractive credit arrangements to China. The objective of this paper is to measure the overall impact of these policies on each exporter's share of the Chinese market. To that end, an improved version of the constant market shares model is applied to data on Chinese wheat imports in the 1980's. The results indicate that the United States has been outperforming the other exporters since subsidised US wheat sales were authorised for China in 1987. The implications of the analysis for the smaller exporters and international wheat trade are discussed.

1. Introduction

Since the 1950's, China has primarily been a net importer of grain. Large imports of wheat have been partially offset by exports of rice and, more recently, maize and soybeans. Garnaut and Ma (1992) estimate that Chinese grain demand will be between 550 and 590 million metric tonnes (t) in the year 2000. Of this figure, 50 to 90 million t is expected to be imported.

China's wheat imports have been historically determined by imbalances between domestic production and consumption. In 1980, China imported 14 million t of wheat, which represented approximately 15% of total world wheat imports. Import levels fell in the mid-1980's but have since risen to a high of almost 16 million tonnes (16% of world imports) in 1988 (International Wheat Council, 1991 and various issues). Most of China's wheat imports come from Canada, Australia and the United States. However, both the European Community and Argentina export small quantities of wheat to China. It is predicted that Chinese wheat imports will continue to be significant because of continued population growth, the loss of arable land due to soil erosion, and the use of available land for more profitable crops than wheat (USDA, 1990). Halbrendt and Gempesaw (1990) suggest that planners are increasing the role of consumer preferences in trade, rather than concentrating purely on foreign exchange accumulation to enhance industrialisation. This also implies that China will participate more in international wheat trade.

While the Chinese Government is seemingly

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committed to the objective of self-sufficiency, participation in international grain trade has been necessary to stabilise food supply, to conserve foreign exchange and to reduce domestic transportation costs (Lardy, 1992). Foreign exchange loss is minimised because the price of rice on international markets is greater than the price of wheat. Furthermore, the importation of wheat to the wheat-consuming northern cities of China minimises the costs associated with transporting wheat across China (Garnaut and Ma, 1992).

On the export side, the European Community has been able to marginally increase its share of the Chinese market since the late 1970's primarily through the use of export subsidies. In the United States, the position of the grains industry worsened in the early 1980's as the US loan rate increased, stockpiles grew and the US share of world grain exports continued to fall. This can be partly explained by the appreciation of the US dollar and the subsidisation practices of the European Community (Roberts et al., 1989). In response, the United States introduced a new farm program in 1985 called the Export Enhancement Program (EEP), whose specific goal was to win back market share lost to countries using 'unfair' trading practices. The major commodity sold under the EEP was wheat (Seitzinger and Paarlberg, 1989). EEP wheat sales to China, however, were not authorised until 1987. In recent times, there has been much debate about the actual benefits of the EEP (see Roberts and Love, 1989; Brooks et al., 1990; Seitzinger and Paarlberg, 1990; Anania et al., 1992).

While it is widely accepted that market power exists on the exporter side of the international wheat market (see, for example, McCalla, 1966; Alaouze et al., 1978; Paarlberg and Abbott, 1986), there is an increasing body of evidence indicating that large importers of wheat may also be able to exert a certain degree of market power. Pick and Park (1991), for example, have shown that both the former Soviet Union and China have been able to exert such oligopsonistic power to obtain lower prices. This suggests that the international wheat market is not perfectly competitive and that the offer of cheap wheat to targeted countries by the United States and the European Community may be part of a continuing dynamic game. Analysis of grains trade and pricing in a dynamic framework has been well developed (see, for example, Karp and McCalla, 1983; Ahmadi-Esfahani and Carter, 1987).

Table 1
Average export volume and share of the five major exporters to the Chinese wheat market over the two sub-periods 1980-86 and 1987-90

Exporting Country	1980-86		1987-90	
	Volume (1000 t)	Share (%)	Volume (1000 t)	Share (%)
USA	3951	38	5879	40
Canada	3292	32	5201	35
Australia	1862	18	1574	11
EC	495	5	891	6
Argentina	786	8	700	5

Table 1 shows that the United States, Canada and the European Community have all increased their share of the Chinese market since 1987. Both the United States and the European Community may have been able to increase their market shares through export subsidies while Canada's market share increased because of a number of long-term agreements with China. The shares of the Chinese market held by both Australia and Argentina, on the other hand, have fallen since 1987 possibly because of the intensification of the US-EC price war in 1987. It is of significant importance, therefore, to examine the factors underlying the changes in market shares for each of the major wheat exporters to China.

This study seeks to measure the net effect of distortionary export policies on the value of wheat exported to China by each country. To that end, some theoretical background is provided below. Then, an improved version of the Constant Market Shares (CMS) model is applied to data on Chinese wheat imports in the 1980's. The results are discussed prior to conclusions.

2. Theoretical model

The difficulties associated with explaining the cause of differences in export performance among countries have provided a long-standing problem for policy-makers and applied researchers. Despite these perplexities, a number of notable attempts have been made. For instance, Tyszinski (1951) attempted to quantify the impact that industrialisation has had on the export performance of nations that specialised in exports of textiles. Tyszinski's analysis postulated that if a country's competitiveness with respect to a certain export good stayed at the same level, its market share had to be constant as well. Therefore, any difference between the actual change in exports of the focus country and the sum of its market competitors (which is called the 'standard') had to be caused by either changes in export composition or competitiveness. This proposition forms the cornerstone of what is now known as the CMS model.

The theory underlying CMS analysis has since been further developed and applied to trade of both agricultural and manufactured commodities (see, for example, Narvekar, 1960; Leamer and Stern, 1970; Richardson, 1971a,b; Jepma, 1986, 1989; Tiwari, 1986; Fagerberg and Sollie, 1987; Merkies and Van der Meer, 1988; Roy, 1991; Kapur, 1991). A number of these studies refer to problems associated with the application of the traditional CMS model. Some of these problems and the corresponding approaches to overcome them are examined below.

The traditional CMS model is derived from Tyszinski's original assumptions. In its more basic form, the CMS model assumes that:

$$S = q/Q \tag{1}$$

where q repesents the focus country's exports, Q the exports of the standard, and S the focus country's share of the market. Accordingly, $q = SQ$. Differentiating with respect to time yields:

$$\Delta q = \underbrace{S\ \Delta Q}_{\text{structural effect}} + \underbrace{Q\ \Delta S}_{\text{residual}} \tag{2}$$

Eq. (2) indicates that a country's total export growth (Δq) can be divided into a structural ($S\ \Delta Q$) and a residual ($Q\ \Delta S$), where Δ refers to the change per period in the variable. The structural effect indicates what the country's export growth would have been if it had maintained its export share, and the residual represents any additional growth due to changes in the country's competitiveness. It is normally assumed that competitiveness is sensitive to pricing policies, financial arrangements and bilateral trade agreements, while trade policies could be used to improve the country's export structure.

This simple model allows for the proposition that changes in a country's export structure may affect its export growth even if the competitiveness of the country vis-a-vis the rest of the world remains unchanged. There are two reasons for this to happen: first, a country may be concentrating on exporting commodities for which world demand is growing relatively slowly, and second, a country may be concentrating on exports to markets that are relatively stagnated.

Eq. (2) only holds for an unmeasurable short time period. Where the decomposition is applied at discrete intervals, the equation can be written in various ways utilising beginning and end of period variables. For example,

$$\Delta q = S_0\ \Delta Q + \Delta S Q_1$$
$$\Delta q = S_1\ \Delta Q + \Delta S Q_0$$
$$\Delta q = S_0\ \Delta Q + \Delta S Q_0 + \Delta S\ \Delta Q \tag{3}$$

where subscripts 0 and 1 represent the beginning and the end of the discrete period, respectively, so that $S_1 = S_0 + \Delta S$. In Eq. (3), a third component known as the second-order effect is established. The second-order effect is a dynamic component capturing the interaction of changes in market share with changes in demand. In past applications, the second-order effect has been incorporated into either of the first two components (see Leamer and Stern, 1970; Rigaux, 1971; Sprott, 1972).

A new approach developed by Jepma (1986) measures each of the two effects in Eq. (2) from a higher level of disaggregation. To deal with the index problem of choosing the base year, as identified by Richardson (1971a,b), Jepma (1986) suggests reconsidering it regularly. This can be done by shifting the weights of the elements in Eq. (3). That is, the decomposition is carried out yearly so that the end of the period in one decomposition becomes the beginning of the period in the next. Using this method, the year chosen as the beginning of the overall period does not dominate the results.

Jepma's decomposition introduces a number of new components which help explain changes in trade-flows. It also solves the order problem, which is another problem noted by Richardson (1971a,b). The order problem concerns the choice of measurement for the commodity and market effects. This is a concern because the order of specification of the commodity and market effects influences their size and measuring the market and commodity effects using different methods can yield vastly different results. Jepma's final decomposition is:

$$\begin{aligned}\Delta q = {} & \underbrace{S_0\,\Delta Q}_{\text{growth effect}} + \underbrace{\left(\sum_i\sum_j S_{ij0}\,\Delta Q_{ij} - \sum_i S_{i0}\,\Delta Q_i\right)}_{\text{market effect}} \\ & + \underbrace{\left(\sum_i\sum_j S_{ij0}\,\Delta Q_{ij} - \sum_j S_{j0}\,\Delta Q_j\right)}_{\text{commodity effect}} \\ & + \underbrace{\left[\left(\sum_i S_{i0}\,\Delta Q_i - S_0\,\Delta Q\right) - \left(\sum_i\sum_j S_{ij0}\,\Delta Q_{ij} - \sum_j S_{j0}\,\Delta Q_j\right)\right]}_{\text{structural interaction effect}} \\ & + \underbrace{\Delta SQ}_{\text{pure residual}} \\ & + \underbrace{\left(\sum_i\sum_j \Delta S_{ij} Q_{ij0} - \Delta SQ\right)}_{\text{static structural residual}} + \underbrace{(Q_1/Q_0 - 1)\sum_i\sum_j \Delta S_{ij} Q_{ij0}}_{\text{pure second-order effect}} \\ & + \underbrace{\left[\sum_i\sum_j \Delta S_{ij}\,\Delta Q_{ij} - (Q_1/Q_0 - 1)\sum_i\sum_j \Delta S_{ij} Q_{ij0}\right]}_{\text{dynamic structural residual}} \qquad (4)\end{aligned}$$

where the subscripts 'i' and 'j' indicate the group of exports considered and the export destination, respectively.

In Eq. (4), the first term is known as the 'growth effect' and measures the part of the export growth of the focus country that is attributed to the general increase in world exports. The second term is called the 'market effect' and it will be positive if the focus country has concentrated its exports in markets that are experiencing a relatively rapid growth. It would be negative if exports are concentrated in relatively stagnated regions. The third term is known as the 'commodity effect' and it indicates the extent to which the exports of the focus country are concentrated in commodities (or commodity groups) with growth rates higher or lower than the world averages. Accordingly, the commodity effect may be positive or negative. The fourth term is the structural interaction effect which indicates the extent to which the actual market distribution of the commodities influences the size of the commodity effect. Therefore, this effect indicates whether an exporter sells a good in markets where demand is increasing relatively quickly. The residual is split into pure and static structural components. Given that the focus country's export structure is unchanged, the pure residual measures the increase in the focus country's exports attributable to a general increase in competitiveness. On the other hand, the static structural residual reflects the impact of changes in the focus country's export structure on export performance.

In order to express the interaction of changes in the focus country's export structure with changes in the structure of world imports, the second-order effect is also split into two different components: the pure second-order effect and the dynamic structural residual. The pure second-order effect measures the impact of changes in the size of world demand on the focus country's exports given that the structure of world demand is unchanged. The dynamic structural residual explains the interaction of the focus country's market share with changes in the structure of world demand. If this effect is positive, world demand is growing rapidly for those commodities whose share of the focus country's exports is increasing.

Apart from solving the order and index problems, the major advantage of the improved CMS model is that the extended decomposition has the capacity to provide insightful and specific information pertaining to export performance in the presence of distortions. As noted earlier, wheat trade is distorted on both the exporter and importer sides. Thus, the question of relative performance of each wheat exporter is related to the dynamic nature of international wheat trade. However, while not directly modeling the game structure of wheat trade, the CMS approach is consistent with this structure as it captures the net impact of all interacting strategic, structural and competitive policies of various players in the international wheat market and disaggregates them into various effects. As such, the CMS approach appears to be a useful framework for the analysis of wheat trade-flows.

Table 2
The average results of the yearly CMS decomposition of the change in export value for the five major exporters to the Chinese wheat market over the two sub-periods 1980–86 and 1987–90

	US (US$1000)		Canada (US$1000)		Australia (US$1000)		EC (US$1000)		Argentina (US$1000)	
	1980–1986	1987–1990	1980–1986	1987–1990	1980–1986	1987–1990	1980–1986	1987–1990	1980–1986	1987–1990
Change in export value	−260162	291150	−22319	98167	17751	−62110	−4421	27420	5554	15240
The CMS decomposition										
Structural effect	67485	−61829	−131673	556940	−36589	211911	−9762	15594	−19215	20974
Residual	−216260	309178	140212	−97826	85174	−126065	2781	27732	26546	11569
Second-order effect	−111387	43801	−30858	−360947	−30834	−147956	2560	−15906	−1777	−17303
Growth effect	12730	3840	−79788	159940	−36377	86114	−43161	22190	−18597	13718
Market effect	54755	−65669	−51885	397000	−212	125797	33399	−6596	−618	7256
Pure residual	−69679	31673	21459	−101439	14875	−24710	12305	117947	3896	21054
Static structural residual	−146581	277505	118753	3613	70299	−101355	−9524	−90215	22650	−9485
Pure second-order effect	10623	55731	−14011	−91175	−16846	−40041	−6031	11867	−6770	−1649
Dynamic structural residual	−122010	−11930	−16847	−269772	−13988	−107915	8591	−27773	4993	−15654

3. Empirical models, data and procedures

A market disaggregated version of Jepma's decomposition is applied to the change in wheat exports to China of the five major wheat exporters over the two sub-periods 1980–1986 and 1987–1990. A separate series of decompositions is carried out for each exporter, on the yearly change in exports to China in each of the sub-periods. The decomposition is based on the existence of a hypothetical standard whose change in exports represents the change that would occur for any country whose competitiveness remained unchanged over the period.

Due to the fact that this study is only concerned with one commodity (wheat) in one market (China), there is no commodity or structural interaction effect in the empirical model. Two decompositions were carried out as follows:

$$\Delta q = \underbrace{S_{j0}\,\Delta Q_j}_{\text{structural effect}} + \underbrace{\Delta S_j Q_{j0}}_{\text{residual}} + \underbrace{\Delta S_j\,\Delta Q_j}_{\text{second-order effect}} \tag{5}$$

and

$$\begin{aligned}\Delta q = {} & \underbrace{S_0\,\Delta Q_j}_{\text{growth effect}} + \underbrace{\left(S_{j0}\,\Delta Q_j - S_0\,\Delta Q_j\right)}_{\text{market effect}} + \underbrace{\Delta S Q_{j0}}_{\text{pure residual}} \\ & + \underbrace{\left(\Delta S_j Q_{j0} - \Delta S Q_{j0}\right)}_{\text{static structural residual}} + \underbrace{\left(Q_1/Q_0 - 1\right)\Delta S_j Q_{j0}}_{\text{pure second-order effect}} \\ & + \underbrace{\left[\Delta S_j\,\Delta Q_j - \left(Q_1/Q_0 - 1\right)\Delta S_j Q_{j0}\right]}_{\text{dynamic structural residual}}\end{aligned} \tag{6}$$

Wheat price and quantity data were collected from World Grain Statistics and World Wheat Statistics (International Wheat Council, 1991 and various issues). One set of f.o.b. prices was used in the data set: US No. 2 Hard Winter Ordinary (Pacific Ports), Canadian Western Red Spring (Pacific Ports), Australian Standard White, EC standard wheat (Basle), and Argentine Trigo Pan. The prices for EC standard wheat f.o.b. Basle and US Hard Winter Ordinary f.o.b. Pacific Ports were estimated for the years 1986 to 1989.

The above levels of decomposition were carried out for each crop year and each exporter, totaling nine breakdowns for each of the wheat exporters. A comparison of the average of the yearly effects for each of the exporters over the period provides a useful approach to examining which of the factors had the most influence on the change in market share in China for each of the major exporters.

4. Discussion of results

The results of the disaggregation are presented in Tables 2 and 3. Table 2 presents the average of each CMS effect for the two levels of decomposition for the major wheat exporters to China in the two sub-periods 1980–86 and 1987–90. The sub-periods were divided up in this manner in order to capture the impact of the sale of subsidised US wheat to China, which was autho-

Table 3
The difference of the average change in export value for the five major exporters to the Chinese wheat market between the periods 1980–86 and 1987–90

	USA (US\$1000)	Canada (US\$1000)	Australia (US\$1000)	EC (US\$1000)	Argentina (US\$1000)
Change in export value	551312	120486	−79861	31841	9686
The CMS decomposition					
Structural effect	−129314	688613	248500	25356	40189
Residual	525438	−238038	−211239	24951	−14977
Second-order effect	155188	−330089	−117122	−18466	−15526
Growth effect	−8890	239728	122491	65351	32315
Market effect	−120424	448885	126009	−39995	7874
Pure residual	101352	−122898	−39585	105642	17158
Static structural residual	424086	−115140	−171654	−80691	−32135
Pure second-order effect	45108	−77164	−23195	17898	5121
Dynamic structural residual	110080	−252925	−93927	−36364	−20647

rised in 1987. Table 3 presents the difference between each CMS effect in the two sub-periods in Table 2. All of the results in Table 3 are therefore contained in Table 2. The purpose of presenting Table 3 is to highlight the change in each of the CMS effects between the periods more clearly.

According to Table 2, the change in export value was negative for the United States, Canada and the European Community in the 1980–86 period. However, all three of these countries recorded a positive change in export value in the 1987–90 period. Canada's ability to increase the value of its exports to China may in part be explained by a number of long-term agreements that China has signed with Canada. In the 1987–90 period, Australia experienced a negative change in export value which means that the value of Australia's wheat exports to China fell dramatically after the introduction of EEP. This may indicate that the subsidisation practices of the United States and the European Community have prevented Australia from increasing the value of its exports to China. Argentina's change in export value was positive but small relative to the other exporters, which reflects the small and relatively stable nature of Argentina's wheat exports to China.

At the first-level decomposition in Table 2, the structural effect represents the change in exports expected given initial market shares in the world market and China. For Canada, Australia, Argentina and the European Community, the structural effect in the 1987–90 period was positive. This may simply reflect the fact that the US share of the Chinese market was high in the 1980–86 period and that the Chinese wanted to diversify the source of supply. The residual represents the portion of the change in exports that can be attributed to the change in competitiveness that occurred over the period. It appears that only the United States and the European Community have been able to increase their competitiveness in the post-1986 period, which is not surprising considering the high level of subsidisation offered by both exporters. The second-order effect represents the interaction of the changes in market shares with changes in demand. All of the exporters except the United States recorded a negative second-order effect in the 1987–90 period. The first-level decomposition measures the general impact of structural, residual and second-order effects on the change in export value. The best interpretation of these three effects, however, can be obtained by analysing the second-level decomposition.

At the second-level decomposition in Table 2, the following observations can be made. First, the growth effect is the hypothetical change in exports that would have occurred if an exporter's share in the world market had remained constant over the period. For each of the exporters except the United States, the growth effect in the 1987–90 period was positive, indicating that the impact of the growth of world wheat exports was greater for the majority of exporters in the post-1986 period than that in the 1980–86 period. The fall in the US growth effect since the introduction of EEP may simply indicate that any increase in US wheat exports since 1987 is more attributable to aggressive US export policies than the overall growth in world wheat trade.

Secondly, the market effect is the additional change in expected exports if an exporter's initial share of the Chinese market remained constant over the period. For Canada, Australia and Argentina, the market effect in the 1987–90 period was positive. This indicates that these countries have tended to concentrate their exports in markets growing faster than the Chinese market. The United States and the European Community, however, both recorded negative market effects in the 1987–90 period. The decomposition of the structural effect into growth and market components highlights one of the major analytical advantages of the improved CMS model. For example, if only the total structural effect in Table 2 had been considered, it would have been concluded that the EC structural effect had increased. This is only partly correct. In net terms, the structural effect has increased in the 1987–90 period but the reason for this is that the increase in the growth effect has more than offset the fall in the market effect. This means that the increase in export value attributable to the growth of world exports since 1987 has more than offset the

EC desire to concentrate their exports in markets growing slower than the Chinese market. To illustrate this result, consider the results in Table 3, which represent the difference between each of the CMS effects in the different sub-periods. For the European Community, the growth effect was large and positive while the market effect was smaller in magnitude and negative. This results in a positive structural effect. If only the traditional CMS decomposition had been utilised, the positive structural effect result would have masked the fact that the European Community was facing a negative market effect. Therefore, the improved CMS model provides additional insight into the causes of changes in the value of a country's exports.

Thirdly, the pure residual measures that part of the change in exports that can be attributed to changes in general competitiveness. The United States, the European Community and Argentina all experienced a positive change in the pure residual after 1986. Despite the high US loan rate at times in the 1980's, it was still expected a priori that the competitiveness of the United States would increase after EEP wheat sales were authorised to China. After all, the major goal of the EEP was to win back market share lost to the European Community. Both Canada and Australia experienced a negative pure residual in the post-1986 period which reflects the generally negative impact that the intensification of the US–EC price war has had on the smaller exporters.

Fourthly, the static structural residual measures that part of the change in exports that can be attributed to changes in competitiveness specific to the Chinese market. Table 2 shows that only the United States was able to increase its static structural residual in the post-1986 period. Once again, this indicates that the EEP has had benefits for the United States, in particular in improving the US competitiveness in the Chinese market. This observation may not have been made if only the traditional CMS model had been analysed. The decomposition of the original CMS model also provides additional information concerning the competitiveness of the European Community. For example, if only the total residual of the traditional model had been considered it would have been concluded that the European Community was able to increase its competitiveness significantly in the 1987–90 period. While this is partly true, it disguises the fact that the EC competitiveness in the Chinese wheat market, as measured by the static structural residual, has actually fallen in the 1987–90 period. This tradeoff between the pure and static structural residuals can be more easily seen in Table 3.

Fifthly, the pure second-order effect measures the interaction of an exporter's change in market share of China with the change in the level of world demand. Table 2 indicates that this effect is only positive for the United States and the European Community in the 1987–90 period, indicating that both of these exporters may have gained from the shifts in overall world demand for subsidised wheats.

Sixthly and finally, the dynamic structural residual, which measures the interaction of an exporter's change in market share in China with the change in Chinese demand, was negative for all of the exporters in the 1987–90 period. Argentina and the European Community are the only exporters to report a positive dynamic structural residual in the 1980–86 period.

To examine the impact of the price war on the performance of the suppliers of the Chinese wheat market, consider Table 3. It appears that the change in value of wheat exported to China since 1987 has been greatest for the United States. Of the other exporters, Canada, the European Community and Argentina all increased the value of wheat exports to China while Australia's export value fell. This information is quite useful on its own, although one of the benefits of the CMS approach is that it enables us to identify the causes of the respective changes in export value. More to the point, it can help determine whether EEP has been a useful strategy in increasing US market share in China.

The second-level decomposition in Table 3 shows that the primary causes of the increase in US export value are the increases in the pure, static structural and dynamic structural residuals. It appears that the United States has increased its general competitiveness and its competitiveness in the Chinese market. Factors such as the growth effect and market effects negatively impacted the change in export value. The most plausible explanation of the increase in the US competitiveness since 1987 is the introduction of EEP. The European Community's competitiveness in the Chinese market appears to have fallen; however, this has been counteracted by competitive increases in other markets. As a result, the export value of EC wheat to China has increased. Thus, the European Community may seemingly be willing to tolerate loss of competitiveness in specific markets as long as its world competitiveness continues to improve.

Table 3 indicates that while experiencing a significant fall in its competitiveness, Canada has still been able to increase the value of its wheat exports to China. This is largely due to the positive growth and market effects. In a similar fashion, Argentina experienced a fall in competitiveness in the Chinese market which was offset by increases in the growth effect. Unlike Canada and Argentina, however, Australia's fall in competitiveness has more than offset the positive impact of the structural effect, resulting in a negative change in export value. It is highly likely that this has been caused by the aggressive export policies of the European Community and the United States implying that the US–EC price war has negatively impacted the smaller exporters to a varying degree.

5. Conclusions

The analysis tends to lend support for the observation that EEP wheat sales have enabled the United States to outperform the other exporters in the Chinese market. The United States exhibited the largest change in export value and strong growth in the residual and second-order effects. The high structural and low residual effects for Canada, Australia and Argentina suggest that they have been adversely affected by the introduction of the EEP. While the European Community's total residual has increased since 1986, its competitiveness specific to the Chinese market appears to have fallen. The apparent success of the US EEP in acquiring market share in China implies that strategic trade policies such as targeted export subsidies may have emerged as a more important force than the laws of comparative advantage.

There are several implications for the smaller exporters such as Australia, Argentina and, to a lesser extent, Canada. For Australia and Argentina, the outlook appears to be grim. If the price war continues to deepen, Australia and Argentina may not find it viable to compete in strategically important markets such as China. The sale of subsidised US wheat to nontraditional markets may indicate that the EEP is simply a glorified subsidy package and not a retaliatory response as claimed by the United States. In other words, the EEP may have been used to mask the US intention to offer across-the-board subsidies in a manner similar to the European Community. Accordingly, the US–EC price war may be argued to constitute a by-product of domestic structural-surplus problems in the United States and the European Community. It appears, then, that international cooperation has been further undermined and a world of beggar-thy-neighbour wheat trade policies has become a reality.

The economic pressure of the US–EC price war on smaller wheat exporters has also resulted in a major commitment by these countries to negotiate trade reforms via the General Agreement on Tariffs and Trade (GATT). However, given the impotence of the GATT and the failure of the Uruguay Round of negotiations, a number of new countering policy packages have emerged which are indicative of the escalation of protectionism in the affected countries.

One is the recent introduction of two new multi-billion dollar farm support programs, the Gross Revenue Insurance Plan and the Net Income Stabilisation Account, whose aims are to stabilise farm incomes in Canada. Both of these schemes, in effect, provide an implicit export subsidy for Canadian wheat producers. The other is the initiative by the Australian Government to maintain and enhance the Australian Wheat Board as the most potent vehicle for countering the US–EC price war and an extension of the Government's guarantee of borrowings until 1999.

The single-desk selling capacities of the Canadian and Australian Wheat Boards together with their ability to sign and fulfil long-term agreements and the high quality of Canadian and Australian wheats may enable these exporters to withstand the onslaught of US and EC subsidisation schemes for some time. However, in the absence of a more effective international wheat trading system and successful GATT reforms, the current trends of global protectionism are bound to persist and to further damage the welfare of the smaller wheat exporting nations.

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7. References

Ahmadi-Esfahani, F.Z. and Carter, C.A. (1987) A dynamic analysis of US export wheat pricing and market shares. Aust. J. Agric. Econ., 31: 191-203.

Alaouze, C.M., Watson, A.S. and Sturgess, N.H. (1978) Oligopoly pricing in the world wheat market. Am. J. Agric. Econ., 60: 173-185.

Anania, G., Bohman, M. and Carter, C. (1992) U.S. export subsidies in wheat: Strategic trade policy or expensive beggar-thy-neighbour tactic? Am. J. Agric. Econ., 74: 534-45.

Brooks, H.G., Devadoss, S. and Meyers, W.H. (1990) The impact of the US wheat export enhancement program on the world wheat market. Can. J. Agric. Econ., 38: 253-277.

Fagerberg, J. and Sollie, G. (1987) The method of constant market shares analysis reconsidered. Appl. Econ., 19: 1571-83.

Garnaut, R. and Ma, G. (1992) Grain in China. Department of Foreign Affairs and Trade, Australian Government Publishing Service, Canberra, 154 pp.

Halbrendt, C. and Gempesaw, C. (1990) A policy analysis of China's wheat economy. Am. J. Agric. Econ., 72: 268-278.

International Wheat Council (1991) World Grain Statistics, London, 41 pp.

International Wheat Council (various issues) World Wheat Statistics, London.

Jepma, C.J. (1986) Extensions and Application Possibilities of the Constant Market Shares Analysis: The Case of the Developing Countries' Exports. Univ. Press Groningen, The Netherlands, 257 pp.

Jepma, C.J. (1989) Extensions of the CMS analysis with an application to long-term export data of developing countries. In: J.G. Williamson and V.R. Panchamukhi (Editors), The Balance between Industry and Agriculture in Economic Development. Proc. 8th World Congr. International Economic Association, New Delhi, pp. 129-143.

Kapur, S.N. (1991) The structure and competitiveness of India's exports. Indian Econ. Rev., 26: 221-37.

Karp, L.S. and McCalla, A.F. (1983) Dynamic games and international trade: an application to the world corn market. Am. J. Agric. Econ., 65: 641-650.

Lardy, N. (1992) Foreign Trade and Economic Reform in China: 1978-1990. Cambridge Univ. Press, MA, 197 pp.

Leamer, E.E. and Stern, R.M. (1970) Quantitative International Economics. Allyn and Bacon, Boston, MA, 209 pp.

McCalla, A.F. (1966) A duopoly model of world wheat pricing. J. Farm Econ., 48: 711-727.

Merkies, A.H.Q.M. and Van der Meer, T. (1988) A theoretical foundation for CMS analysis. Emp. Econ., 13: 65-80.

Narvekar, P.R. (1960) The role of competitiveness in Japan's export performance 1954-58. International Monetary Fund Staff Paper, 7: 86-99.

Paarlberg, P.L. and Abbott, P.C. (1986) Oligopolistic behaviour by public agencies in international trade: the world wheat market. Am. J. Agric. Econ., 68: 528-542.

Pick, D.H. and Park, T.A. (1991) The competitive structure of US agricultural exports. Am. J. Agric. Econ., 73: 133-141.

Richardson, J.D. (1971a) Constant market shares analysis of export growth. J. Int. Econ., 1: 227-239.

Richardson, J.D. (1971b) Some sensitivity tests for a constant market shares analysis of export growth. Rev. Econ. Stat., 53: 300-304.

Rigaux, L.R. (1971) Market share analysis applied to Canadian wheat exports. Can. J. Agric. Econ., 19: 22-34.

Roberts, I. and Love, G. (1989) Some international effects of the US export enhancement program. Agric. Resour. Q., 1: 170-181.

Roberts, I., Love, G., Field, H. and Klijn, N. (1989) US grain policies and the world market. Aust. Bur. Agric. Econ. Policy Monogr. 4, Australian Government Publishing Service, Canberra, 286 pp.

Roy, D.K. (1991) Export performance of Bangladesh: a constant market share analysis. Bangladesh Dev. Stud., 19: 63-81.

Seitzinger, A.H. and Paarlberg, P.L. (1989) The export enhancement program: How has it affected wheat exports? Agric. Inf. Bull. 575, U.S. Department of Agriculture, Washington, DC, 9 pp.

Seitzinger, A.H. and Paarlberg, P.L. (1990) A simulation model of the US export enhancement program for wheat. Am. J. Agric. Econ., 72: 95-103.

Sprott, D.C. (1972) Market share analysis of Australian wheat exports between 1950-51 to 1969-70. In: The Wheat Situation. Bureau of Agricultural Economics, Canberra, pp. 11-16.

Tiwari, R.S. (1986) Constant market share analysis of export growth: the Indian case. Indian Econ. J., 33: 70-80.

Tyszinski, H. (1951) World trade in manufactured commodities, 1899-1950. Manchester Sch., 19: 272-304.

USDA (1990) Export markets for US grain and products. Foreign Agricultural Service, U.S. Department of Agriculture, Washington, DC, 25 pp.