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# FARM INCOME STABILIZATION: A CENTRAL GOAL FOR AMERICAN AND EUROPEAN POLICIES[1]

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## Abstract

The central thesis developed in this paper is that snapshot views of the global measures of agricultural support mask what is really happening in U.S. and E.U. agricultural policies. We demonstrate that American and European farmers are effectively protected from market risk by these policies. The level of PSE is largely determined by the level of world price. Most economists do not pay much attention to the role of agricultural policies in income stability. Yet farm income stability is clearly a prime objective of government policy both in the E.U. and the U.S. and probably elsewhere. We need to turn out attention to this objective if we are to produce policy analysis relevant to real world policy decisions.


**Keywords**: agricultural policy, market risks, agricultural income, U.S., E.U. *JEL* classification: Agricultural and natural resource economics.

Farm income in Europe as in the United States depends a lot on agricultural policies. That dependence functions in two ways. First, in the form of guaranteed prices or direct aid, government support represents an important portion of farm income. Second, agricultural policies protect farmers from world price fluctuations.

The 2003 Organization for Economic Co-operation and Development (OECD) review of agricultural policies concludes that general support levels in member countries, notably the United States and the European Union, as measured by percent PSE are essentially unchanged over the past decade.[2] In fact, the percent PSE level for OECD countries in 2002 is the same as it was in 1989 (31%). According to this report (OCDE, 2003; Tangermann, 2003), the policy reforms have mainly changed from support through market interventions and guaranteed prices to more direct aid less and less linked to the nature and the volume of production i.e., more and more decoupled. However, the absolute level of support has remained about the same.

The political debate also seems to concentrate on the global level of support and on the question of the decoupling, both in the World Trade Organization (WTO) negotiations and in the preparation of the terms and conditions for future European Common Agricultural Policy (CAP). Thus, both in the current reformulation of the objectives of the CAP and in the international debate concerning the necessary reduction of the government's intervention, the important role of agricultural policies on farm income stabilization seem to be forgotten.

This role of income stabilization is nevertheless an essential aspect of the American and European policies, and we believe it is an important government objective, even if not often discussed today.

In this paper, we examine the role of policy mechanisms in achieving income stability and the results clearly demonstrate this link. American and European policies are both very efficient in this stabilization effort, even though they accomplish the task using different policy instruments. Thus, in the first section, we describe the mechanisms used by each policy to maintain producer revenue. Then, in the second section, we analyze the efficiency of these policies in income stabilization in two ways:

- First, by comparing the revenue variability with what this variability would be without the governmental intervention, and
- Second, by measuring the correlation between the global level of producer's support and the world price.

For the calculations, we will focus on one commodity, wheat, but the same principles apply for other commodities as well.

# Income stabilization in American and European Agricultural Policies: Mechanisms and impacts

## 1. Mechanisms of intervention in the U.S. with the 2002 Farm Bill[3]

Commodity program support for U.S. farmers and the agricultural sector under the 2002 Farm Bill comes in three different forms of payments: [4]

- Loan Deficiency Payments (LDP).
- Direct Payments (DP).
- Counter-Cyclical Payments (CCP).

The Loan Deficiency Payments and the Direct Payments appeared before 2002. However, the Counter-Cyclical Payments were created in 2002, and institutionalized the "emergency payments" given every year from 1998 to 2001. The total budget for these support programs to products in this new Farm Bill is slightly larger than the one for the period 1999-2001 if we include the expenses for the emergency payments.

For the last couple of years, the Direct Payments have been declared to the WTO as green box (decoupled), while the emergency payments were declared as orange box (coupled). LDPs also are coupled as they are linked to both production and market price. However, some defend the idea that CCPs are only partially coupled as these payments are based on the current market prices but not linked to current production. Indeed, the payments are effectively linked to the market prices but are based on historical production.

### *Loan Deficiency Payments*

The loan rate has been for many years a major mechanism of American agricultural policy. It has served both as a means of providing operating capital and a form of support price. In the past, the government would acquire and store production when the world price fell below the loan rate. The loan rate program was substantially changed in 1986 for rice and cotton, in 1991 for oilseed products, and in 1993 for the other crops. Since then, the farmer can get a marketing loan and repay it on the basis of the market price if it is lower than the loan rate. Instead of opting for the marketing loan, farmers can also (this is the most common practice today) choose to receive a deficiency payment equal to the difference between the market price and the loan rate (therefore the name Loan Deficiency Payment). The 1996 Fair Act and the 2002 Farm Bill have maintained this mechanism.

Loan Deficiency Payments are made when the market price is lower than the loan rate (the loan rate is fixed at the county level). To receive the LDP, a farmer must declare his production/harvest and declare that he wants the payment on a given day. The LDP received by the farmer is equal to the total production multiplied by the difference between the county loan rate and county posted price for that day.

The national loan rate was $95 per ton of wheat for the 1996 Farm Bill and for the 2002 Farm Bill it was fixed at $103/ton for the period 2002-2003 and $101/ton for the period 2004-2007.

### *Direct Payments*

Direct Payments were introduced for the first time in 1996 as a form of decoupled income support. These payments are calculated from the historic area of the crop in production and historic yields. Farmers receive the payments regardless of what is planted on the land in the current year[5]. The direct payments are considered decoupled, since they, in principle, have no direct influence on production.

For these Direct Payments, the yields of reference were calculated based on the yields for the period 1981-1985 (the lowest and highest yields being excluded). The reference for the area was the period 1991-1995 (Bearden, 1996). However, the 2002 legislation gave the farmer the opportunity to update the yields and the areas used to calculate the direct payments, based on the data for the period 1998-2001.

The direct payment rate for wheat increases in the 2002 Farm Bill from $16.90/ton to $19.11/ton. The payment made to the farmer is equal to the direct payment rate multiplied by the yield of reference, by the base area and by the coefficient 0.85.

*Counter-Cyclical Payments*

This third payment, created in 2002, is based upon a target price and in that sense is reminiscent of the pre-1996 programs. But, contrary to the old Deficiency Payments, the Counter-Cyclical Payments are not tied to current volume of production but to historic production, calculated similarly to Direct Payments. Here also, the historic references can be updated.

The Counter-Cyclical Payments are received only when the average market price is lower than the target price. The target price for wheat was $141.83/ton for 2002-2003 and is $144/ton for 2004-2007 in the 2002 legislation.

The CCP payment rate is equal to the difference between the target price and the market price (or the loan rate if the market price is lower than the loan rate) minus the Direct Payment ($19.11/ton in 2002). This base is then multiplied by the base area and by the coefficient 0.85.

Table 1 shows the payments under alternative market price conditions for wheat. The total payment per ton, illustrated in Table 1, is the sum of the three types of payments (LDP, DP, CCP). The LDP is equal to the difference between the market price and the loan rate, for the first scenario where the market price is lower than the loan rate. The LDP is 0 when the market price is higher than the loan rate. The values for DP and LDP used in the calculation are the ones in parenthesis. The base values for DP and CCP were multiplied by 0.85 (reduction rate decided by the legislation) and by the coefficient 0.99. This 0.99 coefficient is used to estimate the values received per ton of wheat currently produced, since the payments are made based on historic yields. This 0.99 coefficient corresponds to the ratio of historic yields/real yields in Kansas (this rate in fact varies by farm).

We can already note on this table that these 2002 Farm Bill payments effectively protect the farmer from market price downturns. When the price goes from 120 to 95 $/ton, farmer revenue decreases by less than $3/ton. In addition, the farmer receives Direct Payments and Counter-Cyclical Payments even in the absence of production.

Table 1. Government Payments for Different Wheat Market Prices (in U.S. $ per ton)

| | | | |
|---|---|---|---|
| Target price | 141.83 | 141.83 | 141.83 |
| Loan rate | 102.88 | 102.88 | 102.88 |
| Market price | 95.00 | 120.00 | 145.00 |
| LDP | 7.88 | 0 | 0 |
| DP<br>Adjusted | 19.11<br>(16.05) | 19.11<br>(16.05) | 19.11<br>(16.05) |
| CCP<br>Adjusted | 19.84<br>(16.67) | 2.72<br>(2.28) | 0 |
| Total payment | 40.60 | 18.33 | 16.05 |
| Market + Payments | 135.60 | 138.33 | 161.05 |

Source: our calculations based on USDA, 2004.

## 2. Support Programs' Impact on Revenue Stabilization: Simulation with a Representative Farming Operation in Kansas

*Description of the representative farming operation*

In this section, we will study the impact of the 2002 Farm Bill on a typical farm - a fairly farm in the South-West of Kansas. This area is part of the hard red winter wheat region. The data were gathered by the extension service of Kansas State University, and the characteristics are defined by experts based on data collected from real farms. The operation grows wheat and sorghum, but our analysis focuses only on wheat:

- the average yield is 2.72 tons/hectare,
- the base yield for the calculation of the direct and counter-cyclical payments is 2.22 tons/hectare, which corresponds to the average yield of the farm for the period 1980-84.

This farm chose not to update base area and yield. The update if done must apply to both area and yield. Even if yield has increased during these last 20 years, the wheat area has decreased; and the increase in yield did not compensate for the decrease in area in the payment calculations.

The loan rate used here is the national rate for 2002. The DP and CCP per unit are the values for the period 2002-2003 in the Farm Bill. The total wheat cost of production for this operation is $296/ha. This cost includes the variable costs (including the farmer's remuneration) and the fixed cost (including depreciation). Land is the only cost not taken into account. Table 2 summarizes the relevant information for the representative farming operation.

Table 2. Characteristics of the Typical Kansas Wheat Farm

| Variable | | Kansas Wheat Farm |
|---|---|---|
| Location | | Sumner County, Kansas |
| Loan Rate | $/t | 102.88 |
| Direct Payment (DP) | $/t | 19.11 |
| Yield for DP | t/ha | 2.22 |
| Target Price for CCP | $/t | 141.83 |
| Yield for CCP | t/ha | 2.22 |
| Expected Yield | t/ha | 2.72 |
| Cost of Production | $/ha | 296.05 |

Source: Fogleman and Kilgore, 2002.

*Methodology*

Spreadsheet simulations were conducted to measure the role of the payments in revenue and net income stability for different price levels. The analysis varies the farm gate price for wheat from 85 percent of the loan rate to 163 percent of the loan rate i.e., from $87.45 to $166.67/ton. This price range is comparable to the price ranges observed for the period 1980 to 2001 (USDA).

For the typical farm, the amount per hectare for the different governmental payments was calculated with the data included in Table 2 and the following formula:

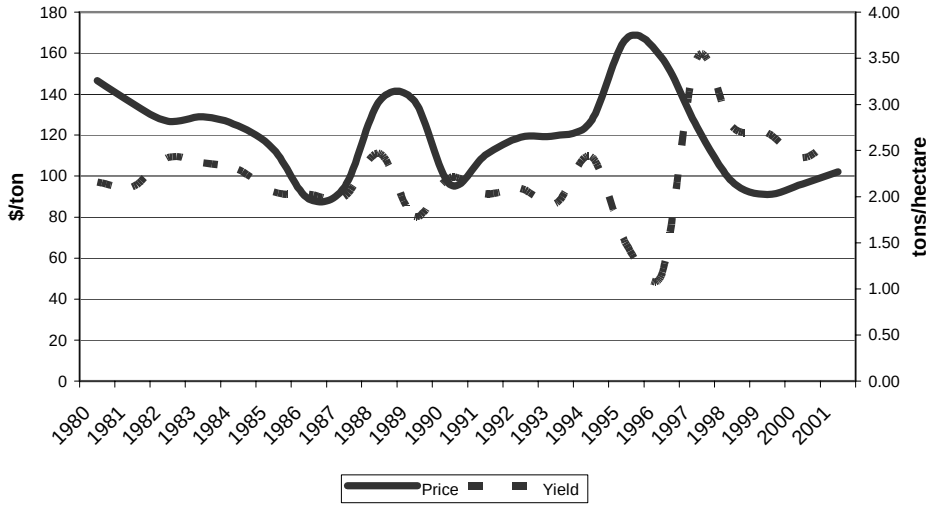
- Direct Payments (DP)
    - Direct Payments = DP/ton x base area x DP yield x 0.85
- Counter-Cyclical Payments (CCP)
    - CCP/ton = target price – DP/ton – loan rate or market price
    - Counter-Cyclical Payments = CCP/ton x base area x CCP yield x 0.85
- Loan Deficiency Payments (LDP)
    - LDP = (county loan rate – county posted price) x current production

Furthermore, it seems reasonable to include a correlation between yields and prices. Indeed, in the United States, we observe a large correlation between the average yield and the market price received by the farmers, as we can see in Figure 1. To capture the relationship between yield and price, a log-log regression equation was estimated (yields for Sumner County/average national market price). The yield reported in Table 3 is the one based on this equation.

*Results*

Table 3 summarizes the results for the wheat farm:

- The first column gives the different market price levels for wheat, and the second column is the corresponding yield from the regression equation;
- The Revenue column represents the product of the price and yield;
- The column Total revenue is the revenue the farm receives from both the government and the market. The costs of production (not including land) are subtracted resulting in net income.




Source: USDA, 2004

Figure 1. National Price and Average Yield for Wheat in Kansas

Figure 2 illustrates the combined effect of all three government payments and revenue from the market, for different price levels:

- The solid area in the graph is the revenue from the market place while the hatched areas represent the three government payments.
- The horizontal hatched area represents the direct payments. These remain constant regardless of the market price level.
- The diagonal hatched area represents the counter-cyclical payments. Once the price falls below the $123.46 per metric ton level, CCP payments start being made. On a per hectare basis the total revenue for the farm actually begins to rise. This is because the CCP payments are fixed to fully compensate the price decrease. However, we hypothesize an increase in yield linked with a decrease in price.
- The vertical hatched area represents the marketing loan payments. They appear when the price is below $102.8/ton. At that time, CCP payments are at their maximum. CCP payments stay constant since they are calculated based on the difference between the target price and the loan rate. The loan payments and the CCP therefore clearly protect the farmer from a decrease in price. For the same reason as before, the revenue per hectare increases despite falling market prices.

Table 3. Results of the Analysis for the Representative Wheat Farm

| Market Price | Yield | Revenue | Direct Payments | Marketing Loan Payments | CCP Payments | Total Government Payments | Total Revenue | Cost of Production | Net Income |
|---|---|---|---|---|---|---|---|---|---|
| 87.45 | 3.11 | 271.82 | 36.03 | 47.97 | 37.41 | 121.41 | 393.23 | 296.05 | 97.18 |
| 94.65 | 2.99 | 283.12 | 36.03 | 24.62 | 37.41 | 98.06 | 381.18 | 296.05 | 85.12 |
| 101.85 | 2.89 | 294.08 | 36.03 | 2.97 | 37.41 | 76.41 | 370.49 | 296.05 | 74.44 |
| 109.06 | 2.79 | 304.75 | 36.03 | 0.00 | 25.77 | 61.80 | 366.55 | 296.05 | 70.50 |
| 116.26 | 2.71 | 315.16 | 36.03 | 0.00 | 12.19 | 48.22 | 363.38 | 296.05 | 67.33 |
| 123.46 | 2.64 | 325.33 | 36.03 | 0.00 | 0.00 | 36.03 | 361.35 | 296.05 | 65.30 |
| 130.66 | 2.57 | 335.28 | 36.03 | 0.00 | 0.00 | 36.03 | 371.30 | 296.05 | 75.25 |
| 137.86 | 2.50 | 345.03 | 36.03 | 0.00 | 0.00 | 36.03 | 381.06 | 296.05 | 85.00 |
| 145.06 | 2.44 | 354.60 | 36.03 | 0.00 | 0.00 | 36.03 | 390.63 | 296.05 | 94.57 |
| 152.27 | 2.39 | 364.00 | 36.03 | 0.00 | 0.00 | 36.03 | 400.03 | 296.05 | 103.98 |
| 159.47 | 2.34 | 373.25 | 36.03 | 0.00 | 0.00 | 36.03 | 409.28 | 296.05 | 113.22 |
| 166.67 | 2.29 | 382.35 | 36.03 | 0.00 | 0.00 | 36.03 | 418.38 | 296.05 | 122.33 |

Source: Our calculations

As market prices decline, government payments become an increasing proportion of the farm's revenue and net income above land costs. Direct payments represent as much as 55 percent of farm net income per hectare for a market price of $123/ton. For even lower prices, counter-cyclical payments and loan rate are added to the direct payments. At very low prices total government payments represent 125 percent of the farm's net income per hectare.

This result suggests that without government payments, wheat production in this prominent American wheat production area would not regularly be able to cover production costs, let alone land costs. Government payments exceed 100 percent of net income when market prices fall below $101 per metric ton in this analysis (which is about the same as the loan rate established for wheat in the 2002 Farm Bill).

The analysis of a typical farm at the microeconomic level illustrates the contribution of government payments to revenue and the impact on revenue stability. One of the least expected results is that the loan payments more than compensate the producer for losses as prices decline. Indeed, loan payments give producers the opportunity to generate higher revenues for very low prices than for average prices.

While the loan payments are a tool coupled to production, the counter-cyclical payments are considered semi-coupled (being decoupled from current production) but still have a compensatory effect for important price declines.

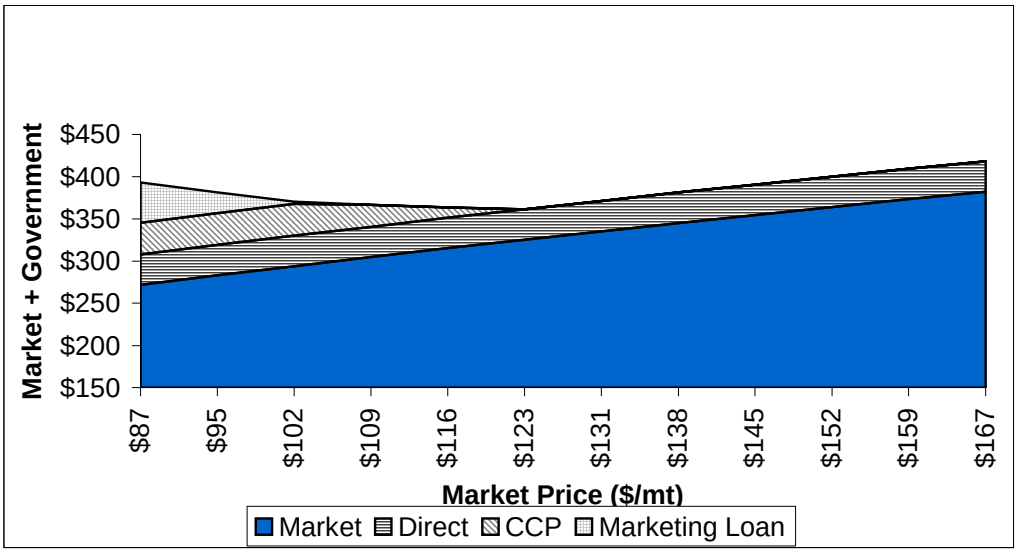



Figure 2. Typical Farm in Kansas: Components of Final Revenue per Hectare of Wheat

## 3. Mechanisms of Intervention in the European Union: the CMO Cereals since the "Agenda 2000"

The 2003 Cereals Common Market Organization (CMO) has similar mechanisms as the ones created in 1992. At that time, the main aspect of the reform was to replace the high level of guaranteed prices with lower intervention prices. The 1999 reform, "Agenda 2000" maintained the mechanisms and decreased intervention prices further while increasing the compensatory direct payments.

Currently, the Common Agricultural Policy intervenes in determining the level of cereal producer's income through six different instruments:

- intervention price,
- border protection,
- export restitution,
- export taxes,
- compulsory land set-aside,
- direct aid.

Four of the instruments intervene directly in the market price: the intervention price, and the three border mechanisms (border protection, export restitution, and export taxes). Compulsory land set-aside influences total supply, and thereby impacts prices. Finally, the direct aid augments producers' incomes.

### *Intervention Price*

The intervention price for cereals is the price at which the European Union agrees to purchase the commodity when the market price is lower than the intervention price. It is thus the price to which the private storage organizations have the obligation to buy cereals offered by producers. The time for which cereals can benefit from the intervention price varies according to the country. In France, it runs from November 1 to May 31.

This intervention price has fallen at the time of each of the two reforms: -25% in 1992; -15% in 1999 (with the decline spread out over a three-year period). It has decreased[6] from €119.90/ton to €110.25/ton in 2000 and was then fixed at €101.31/ton for the period 2001-2006.

### *Compensatory Direct Aid*

This aid was introduced for the first time with the 1992 reform to compensate farmers for the decrease in revenue caused by the decline of the intervention price. Direct aid has been maintained since then and progressively increased as the intervention price has declined. Paid per hectare according to the area in production for each farmer, it does not depend on the volume of production per hectare, and as such is considered semi-decoupled, and at present is classified as "blue box[7]." The amount of aid for oilseeds has been progressively aligned with the aid available for cereals.

The base payment is paid for all the E.U. in Euros per ton (Table 4). The payments per hectare are calculated based on the base payment, multiplied by the base yield. The base yield is defined by procedures specific to each country.

The compensatory payments can be subject to an annual abatement if the area cultivated surpasses that authorized for each member state. For example, for France in 2002, the area exceeded the maximum by 2.7% for dryland cereals and by 3.94% for dryland corn. Coefficients of abatement of 0.974 and 0.962 respectively, consequently, apply to the payments for these crops.

*Compulsory Land Set-aside*

In order to be eligible to receive compensatory direct payments, farmers must agree to set-aside a certain percentage of their cropland. This set-aside must be equal to the rate fixed by the European Union multiplied by the total area in cereals, oilseeds, and set-aside. This set-aside area also receives a payment per hectare equal to the assistance fixed for cereals.

Table 4. Direct Compensation

| In €/ton | 1999 | 2000 | 2001 | 2002/2006 |
|---|---|---|---|---|
| Cereals | 54.34 | 58.67 | 63 | 63 |
| Oilseeds | 94.24 | 81.74 | 72.37 | 63 |
| Protein crops | 78.49 | 72.5 | 72.5 | 72.5 |

Source: European Union, 2004

Since 1999, the set-aside rate has been maintained at 10%. It was 5% in 1997 and 1998. The compensatory direct payments for the set-aside area are equal to the payment for dryland cereals (base cereal payment multiplied by the base yield for dryland cereals). On the set-aside land, the only authorized crops are nonfood crops.

*Border Protection*

The variable levy system of imports, which existed until 1995, was removed starting with the marketing year 1995-96 following the GATT agreement and was replaced by a border tariff rate that can change every two weeks. This tariff is calculated every fifteen days and is equal to the difference between 155% of the intervention price and the world reference price adjusted for port charges and trans-Atlantic shipping. The world reference price is an average of various types of wheat on the Chicago Mercantile Exchange.

In 2001 and 2002, this system engendered significant wheat imports from Russia and Ukraine, export wheat prices in these countries (FOB Black Sea) being, on average, 40 Euros per ton lower than the wheat prices in the FOB U.S. Gulf of Mexico. Consequently, the import system was reformed in January 2003 for wheat of average and poor quality (which constitutes most of the transactions). A system with annual quotas was established. For 2003, the quota is 2.981 million tons with a reduced border specific tariff of €12/ton. Any imports beyond the 2,981 million tons are subject to a tariff of 95 €/t.

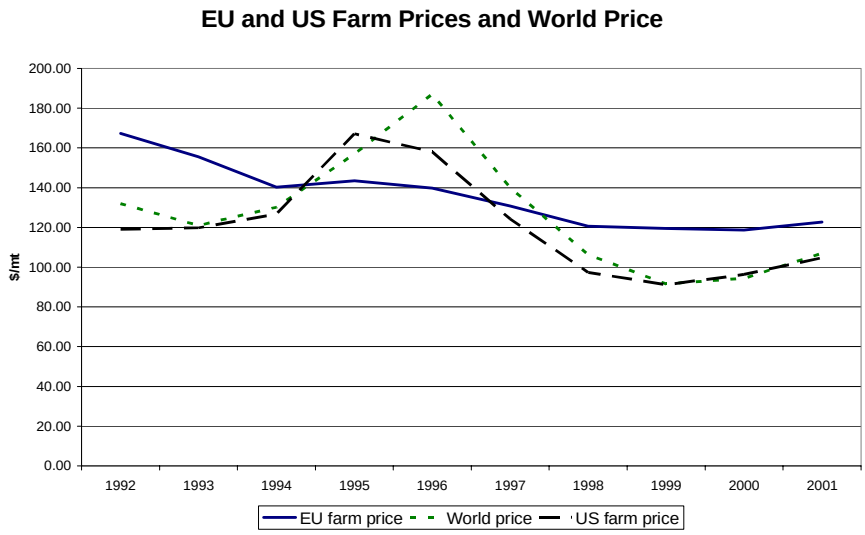
*Export Restitution and Export Taxes*

Export restitution aiming at covering the difference between the world price and the Community price, can be allotted to exporters by the European Union. Requests are allotted by a procedure of adjudication. When the community price is higher than the world price, export taxes can be applied. This was the case in 1996 and 1997. This policy protects the internal market from increase in world prices.

Thus, the price paid to the European producers is the result of the different intervention mechanisms presented above. The intervention prices, compulsory land set-aside, border mechanisms (border protection and export restitution) all protect the internal market from variability on the down-side.

From Figure 3, one can easily detect that the European Union internal price is definitely more stable than the U.S. price. Generally, the European price is also higher than the world price[8] except in the high world price years of the mid-1990s. The revenue stabilization obtained in the U.S. mainly

through the direct payments is primarily obtained in the European Union through the mechanisms of price stabilization.




Source: OECD, http://www.sourceoecd.org

Figure 3. E.U. and U.S. Farm Prices and World Prices

## 4. Impacts of Support Mechanisms on Revenue Stabilization: Simulation with a typical farm in the "Cher" department (France)

*Description of the Typical Farm*

The representative farm chosen for this analysis was obtained from the French network for the monitoring of agricultural production systems (Réseau d'Observation des Systèmes Agricoles du Centre (ROSACE)) put into place by the regional "Chambre d'Agriculture de la Région Centre." This network, as the one used for the United States, creates typical cases based on real data and references collected by experts. The ROSACE network regularly observes 200 farming operations in the central region of France. Each typical case is built based on four to seven homogeneous farming operations.[9]

The chosen farm is located in the "Cher" department, in the heart of the wheat production region of the European Union. This farm is characteristic of crop farms specialized in wheat with average agronomic potential (according to the ROSACE network, there are 1060 farms quite similar to this one in the central region). This farm has 153 hectares and one farm worker. It is a dryland farm with a rotation of rapeseed, followed by wheat, followed by wheat, barley or sunflower.

For wheat, the direct payments are equal to the base rate (€63/t for the period 2000-2001) multiplied by the base yield for dryland cereals for the "Cher" department and multiplied in 2000-2001 by an abatement of 0.977 for surpassing the authorized area. The base yield is calculated according to the following formula: $0.5 * Y_f + 0.5 * Y_d$ [10](with $Y_f$ = French average yield for 1986-90 and $Y_d$ = average department yield for 1986-90) which gives a base yield of 5.67 for the "Cher" in 1998-2003.

For oilseed products (rapeseed, sunflower), the aid is €73.37/t for the whole region multiplied by a fixed yield (base yield for cereals) of 5.9 t/ha.

The compulsory land set-aside of 10% of the area in 2000-2001 was used on this farm to produce industrial rape for non-food use. We therefore did not take into account the impact of the set-aside requirement for wheat revenue.

Table 7. Gross Margin per Hectare for Crops Produced on the Typical Wheat Producing Farm in South-central France

| | Area | Yield | Price | Aid | Variable Costs | Gross Margin |
|---|---|---|---|---|---|---|
| | ha | t/ha | €/t | €/ha | €/ha | €/ha |
| Wheat | 73 | 6.8 | 110 | 349 | 299 | 798 |
| Rape | 51 | 3.4 | 220 | 427 | 308 | 872 |
| Sunflower | 13 | 2.3 | 280 | 427 | 165 | 906 |
| Industrial rape | 16 | 3.4 | 190 | 349 | 308 | 689 |

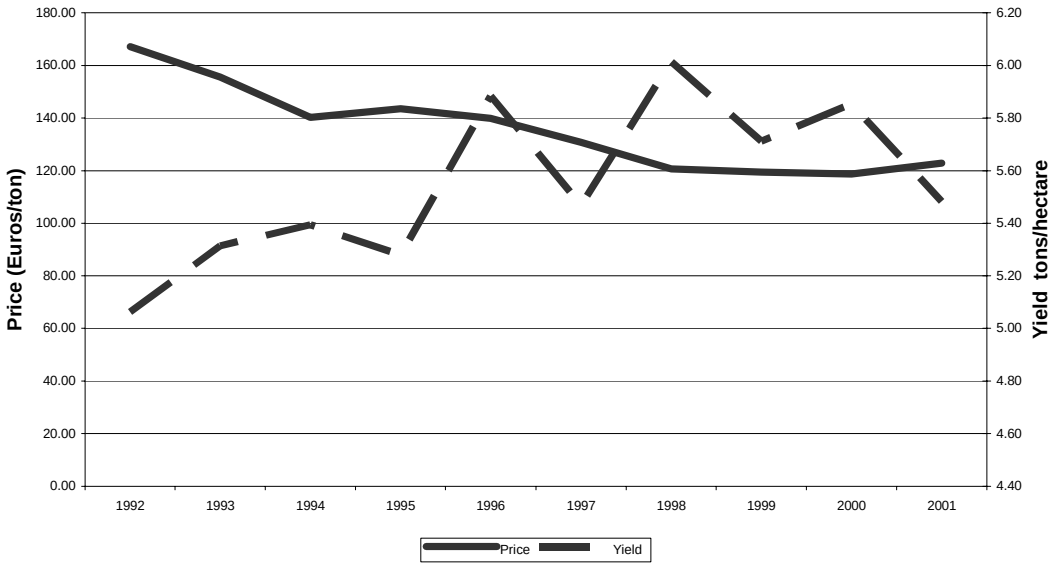
Source: Chambre d'agriculture région Centre, 2002.

*Methodology*

Since 1992, the price received by farmers has decreased regularly, following the decrease of the intervention price. This trend is compensated by the progressive increase in direct aid and by the increase in yields per hectare. Thus, the revenue for wheat producers has not varied a lot.

Annual price fluctuation is much lower than in the U.S. and is not linked to the yield variability. Thus, producers can benefit, as in 1996, from high prices (however, lower than the world price) and simultaneously from good yields and direct aid (Figure 4).

The simulations used for the United States cannot be exactly reproduced for the European Union. For the United States, the hypothesis we made was that the market prices received by producers were independent of the government intervention and were just based on yield, this being probably not entirely true. For the European Union, this is even less true, since revenue stabilization is mainly based on price stabilization. The observed prices on the internal market reflect, on the one hand, the impacts of the policy mechanisms, and, on the other hand, the markets' state. We don't have any model to link internal and international prices. Therefore, we analyzed the role of the European Union policies in revenue stability by considering the prices and yields observed from the year 1992 to the year 2001.




Sources: For yield, FAO, http://www.fao.org; for producer prices, http://www.sourceoecd.org.

Figure 4. Wheat Producer Price and Yield Level for the E.U.

The yields taken into account in our calculation for the typical farm account for the annual variability observed in average yields in the "Cher" department (in 2001 the department yield was at

6.5 t/ha compared to 6.8 for the typical farm). The reported price is calculated based on the price received by the typical farm in 2001 and the average price received by farmers in the European Union for each of the other years reported (OECD, 2004). Furthermore, we hypothesize a constant cost of production based on that for 2001. The cost of production of €858/ha represents all the production costs; i.e., €299 of variable costs and €559 of fixed costs (not including land costs). Direct aid payment calculations vary with the rules in effect each year (modulation included).

*Results*

The results are reported in Table 6:

- the first column indicates the average price received by the European Union producer.
- the column "Sales" is the yield multiplied by the price (in the first column), while the column "Total Revenue" is the sum of Sales and direct payments.

The variable costs and the production costs give us the opportunity to calculate the gross margin and net income (cost of land not being deducted).

The changes in the contribution of direct payments to the total revenue are the result of the changes in the agricultural policy. While, in 1993, direct aid represented 13% of the total revenue, it represented 32% in 2001. The changes in agricultural policy in these last ten years have led to the direct payment becoming a larger fraction of producers' revenue. These direct payments are made per hectare regardless of the characteristics of the market.

Table 6. Simulation Results for the Typical Farm in the Cher Department of France (in Euros per hectare of wheat)

| | Market price €/ton | Yield t/ha | Sales €/ha | Direct payments €/ha | Total Revenue €/ha | Variable Costs €/ha | Gross Margin/ha | Production Costs €/ha | Net Income €/ha |
|---|---|---|---|---|---|---|---|---|---|
| 1992 | 149.82 | 6.38 | 955.85 | | 955.85 | 299.00 | 656.85 | 858.00 | 97.85 |
| 1993 | 139.28 | 6.80 | 947.10 | 136.12 | 1,083.22 | 299.00 | 784.22 | 858.00 | 225.22 |
| 1994 | 125.62 | 6.70 | 841.65 | 190.56 | 1,032.21 | 299.00 | 733.21 | 858.00 | 174.21 |
| 1995 | 128.59 | 6.70 | 861.55 | 245.01 | 1,106.56 | 299.00 | 807.56 | 858.00 | 248.56 |
| 1996 | 125.28 | 6.70 | 839.38 | 295.86 | 1,135.24 | 299.00 | 836.24 | 858.00 | 277.24 |
| 1997 | 117.22 | 6.59 | 772.48 | 295.86 | 1,068.34 | 299.00 | 769.34 | 858.00 | 210.34 |
| 1998 | 108.09 | 7.64 | 825.81 | 301.18 | 1,126.99 | 299.00 | 827.99 | 858.00 | 268.99 |
| 1999 | 107.01 | 7.01 | 750.14 | 301.18 | 1,051.32 | 299.00 | 752.32 | 858.00 | 193.22 |
| 2000 | 106.37 | 7.43 | 790.33 | 325.17 | 1,115.50 | 299.00 | 816.50 | 858.00 | 257.50 |
| 2001 | 110.00 | 6.80 | 748.00 | 349.17 | 1,097.17 | 299.00 | 798.17 | 858.00 | 239.17 |

Source: Our calculations

However, contrary to the U.S., in the European Union, other mechanisms are still playing an important role in revenue stabilization. The price variability for European producers is half that for world price.

Direct aid now represents an essential contribution to the farm income. In 2001, it represented 146% of the net income per hectare of wheat for the farm studied.

In our simulation, the farm in the Cher, with production costs for wheat of €125/t (compared to $112/t for the farm in Kansas) received for the period considered a more stable but lower average price, but larger payments than the farmer in Kansas. Thus, the farm in the Cher had on average a net income of €32/t for the period; i.e., about the same as the one for the farmer in Kansas ($33/t on average for the simulation 1992-2001).

Thus, direct aid plays in the European Union a larger role than in the U.S. to maintain revenue at an acceptable level. However, the intervention price continues to have a major role in revenue stabilization in the E.U., whereas other mechanisms with less impact on market price are used in the U.S. Despite the differences in the mechanisms, the results of these different interventions are that in the U.S. as in the E.U., agricultural income has remained stable.

Our results are consistent with those of Debar who, in a recent study (Debar, 2002) compares crop producers' revenues in the U.S. and in France. He shows that French producers receive much more aid than the American producers when prices are high (in 1996), but when prices are low (in 2000), the payments received by American wheat producers are higher and contribute more to income.

## Policy Efficiency in Producer Income Stabilization

The analysis above clearly shows that the functioning of historical income support policies, in the United States and in the European Union, have the effect of stabilizing producer incomes. It is interesting to measure this effect. A first approximation consists of comparing the actual variability of producers' revenues with the variability that would exist in the absence of agricultural policy interventions.

### 1. Comparison of the Variability of Revenue for Wheat Producers with and without Government Intervention

Figure 5 shows the contribution of the market and the contribution of government payments to gross income per hectare for the studied farm in Kansas. The information is reported for the different prices of the period 1992-2001, assuming the 2002 Farm Bill was enforced throughout the entire period. The prices reported on the x axis correspond to the national average prices each year from 1992 to 2001.

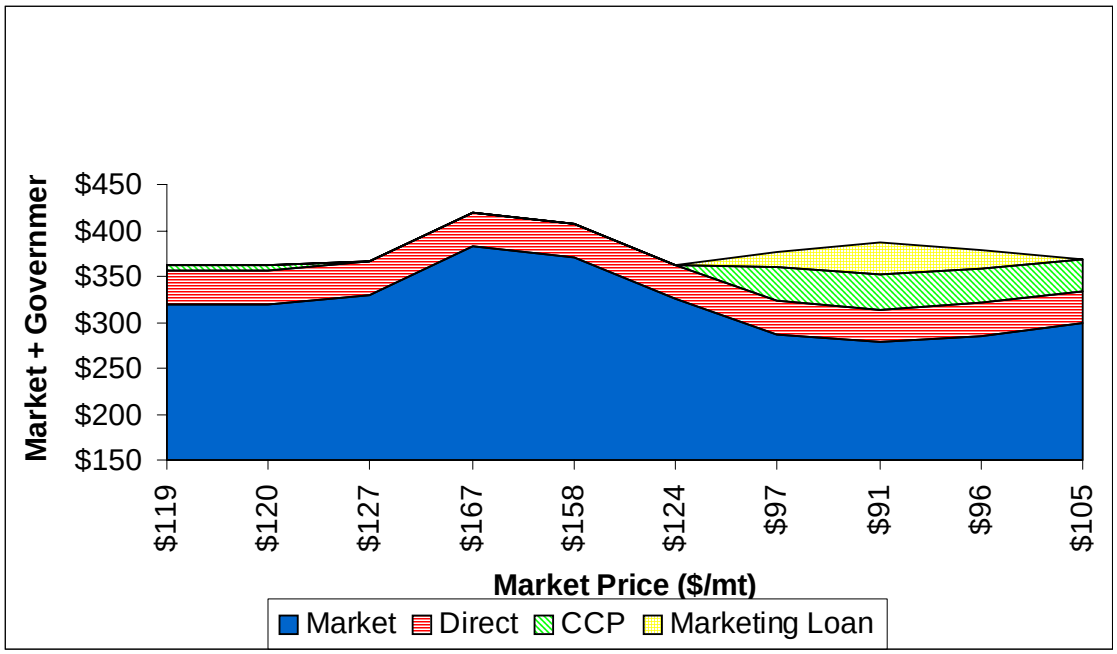



Figure 5. Typical Kansas Farm. Contribution of Government Payments to Wheat Revenue per Hectare (1992-2001).

From 1992 to 2001, the market price received by American producers clearly has the same pattern as the world price. Starting at a price of $119 per ton in 1992, the price slightly increases the following two years, before jumping in 1995 and 1996. During the last five years of the analysis (until 2001) the prices are low, around $100 per ton. In a scenario of price evolution such as this, one can clearly observe in Figure 5 the stabilizing role of government payments. The decoupled direct payments (DP) remain constant regardless of the market price level. However, the CCP and loan payments largely offset the decline in market price. In 1995 and 1996, the American producers fully benefit from the increase of the world prices and continue to receive the decoupled direct payments.

Based on the simulation data for the typical farm in Kansas, we calculated the coefficients of variation for the economic results: gross income (total revenue including government payments) and net income, with and without government support. Table 7 reports the results and clearly shows the effects of government programs on revenue stability. The variability of gross income with government intervention is half that without the interventions. The variability of net income without government intervention is six times larger than with intervention. The revenue supports also obviously have an effect on the absolute result. The gross income is on average $379/ha with intervention and would be $320 without intervention; i.e., a difference of 18%. This difference in the gross income affects the net income which is, with the support programs 3.5 times higher than without government intervention. But the most interesting effect is the reduction of the variability. Without the government payments, the farming operation would have a net loss three years out of ten. Thanks to the government intervention, the net income is positive each year of the considered period.

Table 7. Typical Kansas Farm. Variability of the Economic Results for a Ten-Year Period (1992-2001)

| With government intervention | Gross income | Net income |
|---|---|---|
| Average $/ha | 378.95 | 82.89 |
| Standard error value | 20.05 | 20.05 |
| Coefficient of variation | 0.05 | 0.24 |
| Without government intervention | | |
| Average $/ha | 319.88 | 23.83 |
| Standard error value | 35.38 | 35.38 |
| Coefficient of variation | 0.11 | 1.48 |

Concerning the European Union, Figure 6 shows the gross income per hectare for the studied farm. The results are reported for the different price levels of the period 1992-2001.

One can observe that the fluctuations of revenue from year to year are very low. On this graph, the major part of gross income comes from the market, but this market price is fixed by the intervention policy, and its stability contributes to income stability. One can particularly note that, contrary to the U.S., the European producer did not benefit much from the world price increase in 1995 and 1996. Indeed, the intervention policies stabilize the internal price on the down-side as on the up-side.

We calculated what the gross income per hectare of wheat would be if the E.U. producer price were the world price[11] (at the farm level). We then compared the variability of gross[12] and net incomes with the ones calculated with the internal price and the direct payments.

One can see from the data in Table 8 that government intervention reduced income variability considerably. For gross income, the variability with government intervention is four times less than without intervention. Moreover, the difference is huge for net income. Indeed, the variability when the producer sells at the world price is over 100 times larger than with government intervention. The effect on income is amplified in absolute terms by the elimination of state support, which lowers

considerably average income. Without government support, net income is negative six years out of ten.

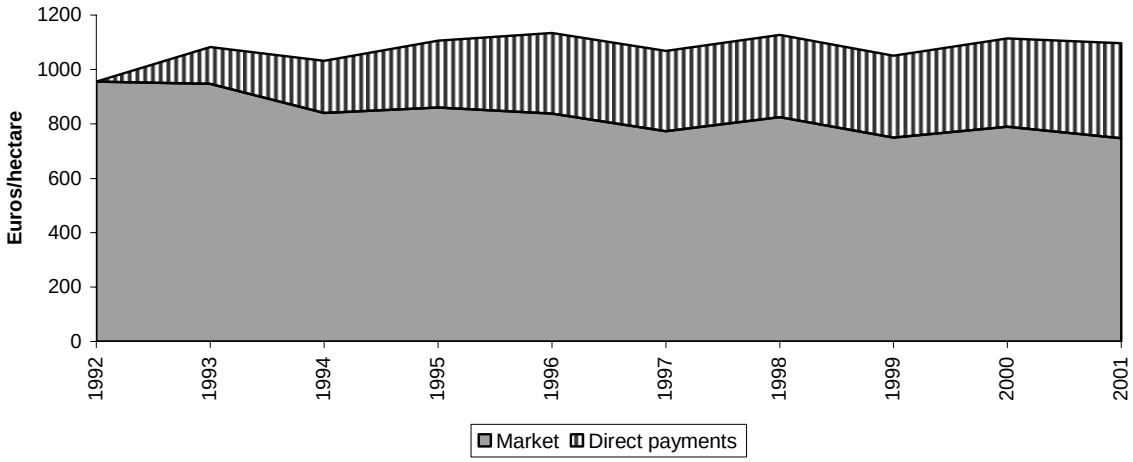



Figure 6. Typical Farm of the Central Region in France. Contribution of the Direct Aid in the Gross Income – Wheat (1992-2001).

Table 8. Typical Farm in the Cher. Variability of Economic Results for the Ten-Year Period (1992-2001)

| With government intervention | Gross income | Net income |
|---|---|---|
| Average $/ha | 1,077.24 | 219.24 |
| Standard error value | 53.86 | 53.86 |
| Coefficient of variation | 0.05 | 0.25 |
| Without government intervention | | |
| Average $/ha | 864.69 | 6.69 |
| Standard error value | 179.24 | 179.24 |
| Coefficient of variation | 0.21 | 26.79 |

Comparison of the E.U. and U.S. results demonstrates the large similarities concerning the efficiency of the policies in obtaining revenue stability. The variability of the gross income per hectare with government intervention is the same (0.05 in both cases) as the case for the net income (0.24 and 0.25). Without government intervention, revenue variability considerably increases in the U.S. (1.48) and much more in the E.U. (26.8).

## 2. Producers' Support and World Prices

If the reasoning based on typical U.S. and E.U. farms has permitted us to demonstrate the functioning of policy mechanisms at the farm level, it seems it would be useful also to complete this analysis with a more synthetic approach.

One of the differences between the American and European policies is the support through the internal price in the European policy. Furthermore, Debar shows that in 2000, the PSE as a percent of the producer's revenue is larger in the E.U. than in the U.S.

Therefore, we decided it would be useful to study global support and its evolution relative to the world price. The study of the correlation of the PSE with the world price will help measure the importance of the goal of revenue stabilization in agricultural policies. A low correlation would mean that revenue stability is not the central point of the producer support policies. But, if the correlation is large, the conclusion will be that revenue stability is a main goal of the policies.

The data used in this section is based on the policies for the period 1992-2001. However, the similarities between the former and current policies make it possible to use these data to explain the functioning of the current policies.

Estimates of protection and domestic support are at the heart of international trade negotiations. To facilitate comparisons, analysts have agreed on some standard measures and terminology. The most commonly used measures are the Producer Support Estimate[13] (PSE), which can be expressed in absolute value or in percent, and the Producer Nominal Assistance Coefficient (NAC).

The PSE gives the annual monetary value of gross transfers (from consumers and taxpayers) to support agricultural producers, arising from policy measures, regardless of their nature, objectives or impacts on farm production or income. The Percentage PSE (PSE%) measures the ratio of the PSE to the value of total gross farm receipts (including budgetary support).

The NAC, an indicator of the nominal rate of assistance to producers, measures the ratio between the total value of farm receipts including government support and the value of gross farm receipts valued at world market prices minus the support to producers. The NAC is another way of expressing the PSE. We will use these measures calculated by the OECD.[14] In algebraic terms:

PSE = Q.(Pd-Pm) + PP
PSE% = PSE.100/(Q.Pd + PP)
NAC = (Q.Pd+PP)/Q.Pm
Thus, PSE% = (1-1/NAC).100
With:
Q the volume of production
Pm the world price (at the farm gate)
Pd the internal price (at the farm gate)
PP direct payments to producers

## 3. United States

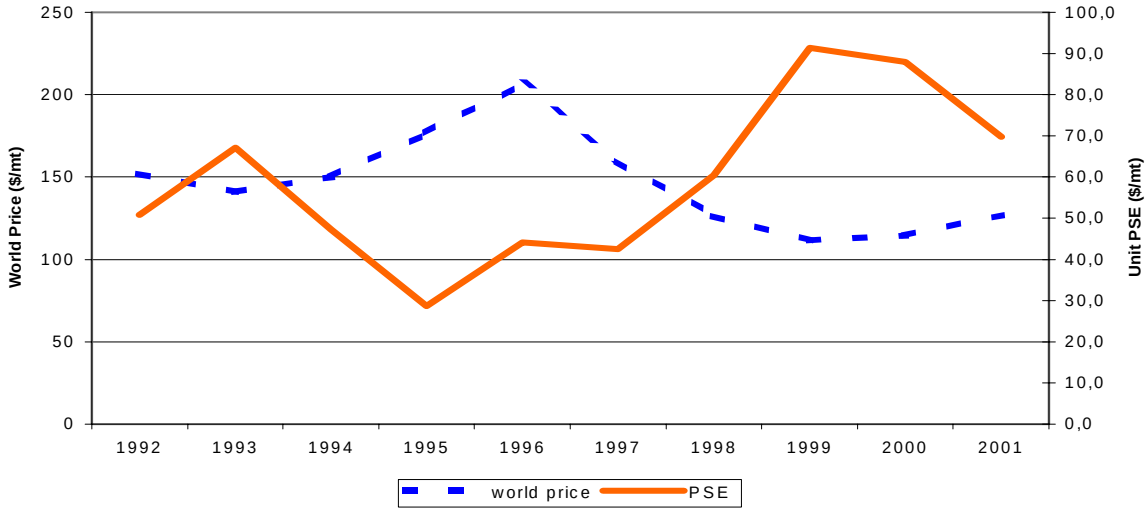
For wheat, the U.S. PSE percentages have ranged from 15 to 50 percent over these last ten years. The U.S. NAC for wheat has therefore ranged from 1.17 to 2.00.

The interesting fact here, beyond the absolute level of support, is the link between the absolute level of support and the world price. In Figure 7, one can see the inverse correlation between the subsidy level and the international price.[15] The government support is higher when prices are low and vice versa. A measure of this correlation between the world price and the subsidy level can be obtained by a regression. A log-log regression between the world price and the PSE (expressed here in $/t) gives the following results:

Log PSE = 11.97 - 1.71 * log world price

$R^2$ = .76, F = 25.8, both being highly significant.

The coefficient on the log of the world price can be viewed as an elasticity. The coefficient is 1.71 which indicates that a 10 percent decrease in world price leads to a 17 percent increase in unit PSE.[16]




Source : http://www.sourceoecd.org

Figure 7. U.S. PSE and World Wheat Prices

## 4. European Union

The results for the European Union do not differ much as can be seen in Figure 8. The PSE% is on average higher for the E.U. than for the U.S. It varies from 30 to 55% which represents a nominal support coefficient from 1.4 to 2.1. As for the U.S., there is an inverse correlation between the level of support per ton of wheat and the world price.

Furthermore, the log regression gives the following results:

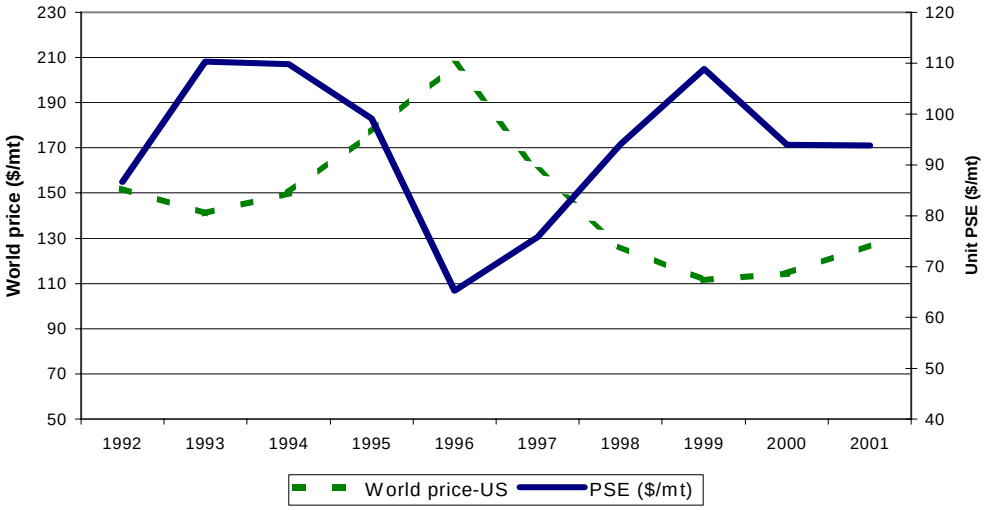
Log PSE = 7.20 - 0.68 * log world price

$R^2$ = .47, F = 8.9, both being highly significant

Therefore, a 10% decrease in the world price leads to a 6.8% increase in unit PSE.

The equations used for the E.U. and U.S. are not exactly comparable since in the U.S. the farm gate price and the world price are highly correlated, which is not the case for the E.U.. The efficiency of the European policy in achieving stability is for the most part based on price stabilization at the farm gate. The U.S. FOB Gulf price is only an approximation of the world price for the E.U.. In the E.U. case, the PSE was less "responsive" statistically to changes in world price, which could be because of the fact that average PSE is higher in the E.U. than in the U.S. Furthermore, during the studied period, the correlation between the farm gate in the E.U. and the world price was low ($r^2$=0.33), because of the high increase of the world price in the mid-1990s. This increase was not transmitted to European producers because of the E.U. policies.

Nonetheless, the graphs and the regression results both clearly show that the global amount of support, expressed by the PSE, is in the U.S. as in the E.U. highly correlated to the world price.




Source : http://www.sourceoecd.org

Figure 8. E.U. Wheat PSE and World Price

## Conclusion

From this analysis, the bottom line is that American and European farmers are highly protected from the risk of revenue variability. The agricultural policies are designed to do that, and they do it well. In the case of the European Union, the stabilization of the internal price received by farmers plays the main role in this stability, while in the U.S., it is the market support, through marketing loans and counter-cyclical payments. However, regardless of the differences in mechanisms, the results with respect to stability are very similar. And despite the 2003 E.U. reforms, the intervention price is still an important component of E.U. policy, and that is the main E.U. policy instrument delivering stability. In the U.S., the counter cyclical and loan deficiency payments are providing that stability.

The global support level measured with the PSE is highly correlated with world price. The support is high when the price is low, and the support is low when price is high, and this has not changed with the increased decoupled characteristic of the overall support.

Thus, producer revenue stabilization is still a central goal of the American and European policies, even if it is not widely discussed. Public debates focus on the absolute level of support. In fact, this revenue stability goal is accepted by the WTO, under the condition that it is achieved through specific tools, meeting green box criteria in the GATT agreement. This is the approach used by Canada with the creation of the Canadian Program for Stabilization of Agricultural Income (Government of Canada, 2004). But for now, the main mechanisms used by the E.U. and the U.S. in their stabilization policies do not conform to the philosophy of the GATT agreement nor to the Doha Round (Petit, 2002).

Most economists who analyze what is at stake with the reform alternatives being debated for the Doha round are mainly interested in the average level of support and the importance of the decoupling. They do not pay much attention to the policies' role in income stability (Beghin *et al.*, 2002; Young *et al.*, 2000; Tangermann, 2003). Yet farm income stability is clearly a prime objective of government policy both in the E.U. and the U.S. and probably elsewhere. We need to turn out attention to this objective if we are to produce policy analysis relevant to real world policy decisions.

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[1] This paper is a somewhat modified English version of a paper that originally appeared in French in *Economie Rurale* (Jacquet, Tyner, and Gray, 2004). The authors are grateful to Maud Roucan for her help with the translation.

[2] Two papers report essentially the same data and analysis: *Agricultural Policies in OECD Countries, Monitoring and Evaluation 2003 Highlights*, www.oecd.org, June 2003; and Stefan Tangermann, "Agricultural Policies in OECD Countries 10 Years After the Uruguay Round: How Much Progress?," paper presented at a conference in Capri, Italy, June 2003.

[3] This section is based on Tyner (2002) and Gray (2002).

[4] Even though these tools are the main elements of the agricultural policy in the U.S. for crops, it is important to note the existence of programs such as yield insurance (for many years) and revenue insurance (since 1995).

[5] With the exception of fruits and vegetables.

[6] Common price for cereals: common wheat, durum wheat, corn, rye, barley, sorghum.

[7] According to the agreement of Luxembourg in June 2003, 75% of the direct payments for cereals will be classified in the coming years (starting in 2006) as « green box ».

[8] The "world price" used here is the average price of wheat FOB US Gulf of Mexico from which was subtracted $20/ton to represent transport cost, to obtain an equivalent of the world price received by the producer.

[9] ROSACE is not a statistical network as the RICA, but the available data by farming operation are used to create functional segments. It was easier for us to use this network to chose an operation "similar" to the American one, the latter representing a typical farm with average agronomic potentials in a region specialized in wheat.

[10] 0.33 Yf + 0.66 Yd, from 1993 to 1998.

[11] Based on the world price data reported in Figure 2.

[12] Total revenue including government aid.

[13] Called Producer Subsidy Equivalent until 1999.

[14] For a detailed definition, refer to OECD, 2003.

[15] The world price considered here is the wheat price HRW FOB US Gulf of Mexico.

[16] The regression was performed for both world and farm gate price and with both unit PSE and percentage PSE. The results were essentially the same results in all cases.