NORTH AMERICAN FARM PROGRAMS AND THE WTO

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Introduction

Since the Uruguay Round, North American countries have fully implemented less distorting farm programs. The United States adopted the FAIR Act in 1996, which provides for declining, direct payments (Production Flexibility Contracts or PFC) for farmers and the elimination of the deficiency payments program. Since 1994, the U.S. has also begun to restructure and expand crop and revenue insurance programs, which are partially subsidized. Canada initiated its farm policy reforms beginning in 1991, with the introduction of subsidized revenue insurance programs, including the National Income Stabilization Accounts (NISA), and the gradual elimination by 1995 of its grain freight subsidies. Mexico introduced the mostly decoupled PROCAMPO direct payments program in 1993, eliminating its guaranteed price supports and reducing its other farm subsidies. The U.S. and Mexican direct payments programs are reported to the WTO as "green box" compliant. Because U.S. and Canadian insurance programs do not meet all the criteria outlined in Annex 2 of the Agreement on Agriculture, they are reported to the WTO as "amber box" programs that are subject to reduction commitments.

The growing experience with less distorting farm programs has led some to argue that they may not be sufficiently non-distorting of agricultural production and trade, (e.g. Tielu and Roberts, Rude). Recent research has identified several channels through which these programs can affect output, through their effects on farm wealth and risk aversion (Pope and Chavez; Hennessy; Young and Westcott), labor migration (Burfisher, Robinson, Thierfelder, 1994), and the economy-wide distortions related to raising the funds for such programs (Moschini and Sckokai).

In this paper, we provide a brief summary of research on the links between less distorting programs and production. Then, we use North American agriculture as a setting to explore the potential for one type of less distorting programs - direct payments - to affect output through its effects on risk aversion. To do this, we model risk in a stylized way in a computable general equilibrium (CGE) model of the U.S., Canada, and Mexico, and account for the effects of increased direct payments in reducing the risk premium, a discount that producers apply to returns from production activities that are characterized by risk. We also account for the economy-wide distortions from direct payments.

Literature on Less Distorting Programs and Production Responses

Much of the recent literature on less distorting farm programs identifies risk as an important link between farm programs and supply, building on the theoretical framework developed by Sandmo. Sandmo showed that when producers are risk averse, their optimal output is below that of risk neutral producers. Building on the assumption that decision makers= risk aversion will decline as their wealth increases, he also derived what have later been termed the "wealth effect" and the "insurance effect" on supply. Hennessy extended the Sandmo framework in the context of farm programs, deriving a wealth effect and an insurance effect, in addition to the direct "coupling" effect of subsidies that provide incentives to increase supply. Higher wealth shifts the producer to a less risk averse region of his utility function, and can have a positive effect on supply of products characterized by risk. Insurance reduces the variance in returns, motivating the producer to increase output of crops for which the expansion is associated with increased risk.

Chavez and Holt provided the first empirical evidence from agriculture to support the Sandmo assumption that risk aversion declines as wealth increases. In an analysis of U.S. corn and soybean farmers, Chavez and Holt found that risk (measured as variance in price) and wealth (measured as farm value of proprietor equity) have significant effects on acreage decisions. Under some conditions, the wealth effect was even more important than the direct price effect on acreage planted. Recent research describing the risk averse preferences of farmers is summarized in House; Knight and Coble; and USDA.

In theory, Ramaswami showed that the supply of crops characterized by yield risk may not increase when insurance reduces this risk, since there is substantial evidence of moral hazard in agricultural production. Farmers tend to cut back on the use of fertilizers, pesticides and other risk-reducing inputs (moral hazard) when their crop is insured. However, recent evidence suggests that the positive effect of insurance on increased acreage dominates the moral hazard effects, resulting in a net supply increase (Wu).

Other important channels through which direct payments and insurance programs can affect output is through their effects on capital and labor markets. Programs that reduce income variability can increase farm investment by lowering the risk of loan default and thereby increasing rural credit availability.[1] Burfisher, Robinson, Thierfelder (1994) analyzed the effects of Mexico=s PROCAMPO decoupled payments on reducing rural-urban migration by raising relative wages in farming. Finally, subsidized insurance programs and transfer payments must be funded through taxation. In an economy-wide framework, Moschini and Sckokai showed that even in

[1]On the other hand, lower income variability can also lead to increased farm household consumption and lower savings and farm investment. Research has shown that farm households have a higher propensity to consume from stable sources of income, such as a predictable stream of government transfer payments (Carriker, et al.). Furthermore, expectations of stable transfer payments may increase expected lifetime income, tending to increase consumption relative to savings and investment.

the case of non-distorting, lump sum transfer payments, there are likely to be welfare-reducing, distortionary costs from raising funds to finance them.

A CGE Analysis of Less Distorting Policies

The core CGE model consists of three country models of the U.S., Mexico, and Canada, linked to each other and the rest of the world through trade flows. (NAFTA-CGE is described more fully in Burfisher, Robinson, and Thierfelder (forthcoming)). We incorporate risk into the CGE model in a highly stylized way, by quantifying variance in returns and farmers= subjective risk averse preferences as a risk premium. Risk premiums behave like taxes that reduce the optimal output of risk averse producers below that of risk neutral farmers. In this framework, farmers are assumed to respond to risk in returns only through their production decision. There are actually many other channels through which farmers can reduce risk, such as crop diversification, hedging or off-farm employment (USDA). The results of our stylized approach might be interpreted as the pressures for adjustment, only some of which actually occur through production changes. We use an economy-wide, multi-country model because we might expect variance in returns to differ by crop, and farmers= risk preferences to vary by level of development. We also account for the effects of transfer payments on raising household income and consumption, and taxes.

Measuring Risk To measure risk, we follow the approach of Paris and House to estimate sectoral risk premiums of NAFTA farmers, using data on actual producer decisions, historical yields and market prices. All production activities in the model are assumed to entail risk in the underlying model equilibrium, but we explicitly measure, and analyze changes in, risk in returns for four crops: corn, wheat, feedgrains, and oilseeds.

Paris defines absolute risk aversion (•) as:

$$\alpha = t\,(x' V x)^{-1/2}$$

where t is the normal distribution parameter for an assumed level of risk tolerance, x is an array of current acreage in production of the four crops, and V is the variance-covariance matrix of time series of real returns per acre, inclusive of subsidies and net of insurance indemnities. Transfer payments are also included in crop returns, allocated proportionately according to each crops= share in total farm returns from the four crops. Transfer payments are assumed to raise returns above market levels, but do not distort relative crop returns. In the U.S. and Mexico, all direct payments from PFC and PROCAMPO are incorporated into returns from these four crops. In the U.S., PFC payments are paid to wheat, corn and feedgrains, but are considered here as a nondistorting payment across all four crops because of the potential for substitution among these crops in production. In Mexico, PROCAMPO payments are provided based on historical production of nine crops. Three of these crops B beans, cotton, and rice B are not among the risk-related crops analyzed here, and so the transfer payments may be overstated. In Canada, we include only the share of NISA expenditures that corresponds to the share of these four crops in Canadian agricultural production.

The t parameter allows us to assume higher risk tolerance levels for the U.S. and Canada, compared to Mexico, where there is subsistence agriculture. For the U.S. and Canada, we assume that farmers tolerate loss in one of five years, while in Mexico, farmers are assumed to tolerate loss in one of ten years. Our calculated absolute risk aversion coefficients are 2.0 for the

U.S., 1.3 for Canada, and 1.0 for Mexico. While our assumptions of risk tolerance are relatively ad hoc, we can compare our estimated absolute risk coefficients with coefficients assumed or calculated by others. According to USDA, most researchers agree on a coefficient of 2, or Arather risk averse.” House finds a coefficient for the U.S. of 3.41 given the subjective risk tolerance level assumed here. Following Newbery and Stiglitz, we then calculate the sectoral risk premium as:

$$risk\ premium_i = \frac{\alpha\ y\ (CV_i)^2}{2}$$

The risk premium is a function of • , real farm income (y), and the coefficient of variation (CV_i) of real returns per acre for each crop. Farm income is inclusive of subsidies and transfer payments, minus insurance premiums. We include only returns from the four crops in calculating the farm income used in this equation. We use time series data from 1979 to 1995, a time period for which data on prices, yields, area, and OECD producer and consumer subsidies are available. U.S. data are from NASS. Canadian data are from the FAO. We use unpublished Mexican data from SAGAR. Subsidy data are from the 1998 OECD PSE data base. We deflate prices, detrend yields and incorporate deflated farm program benefits to calculate real returns per acre.

Model Scenarios Farmers' decisions are shaped in part by their expectations, which in turn are shaped by historical experience. Hazell, Bassoco, and Arcia simulated alternative crop yield insurance programs by revising the historical time series of prices and yields to include insured yields, deriving a new variance-covariance matrix of crop returns, and calculating a new risk premium. In a similar approach, we calculate how the risk premiums change when benefits from a direct payments program are increased. When we simulate changes in program benefits, we change the historical time series of crop revenues that are used to calculate risk premiums, as if enabling a farmer to overlay the benefits of the new programs onto historical market prices and yields, and derive new expectations about crop returns.

We first update the base model to 1997 farm programs, the most recent year for which OECD subsidy data are available. We use the observed data for 1979-1995 on real prices and yields for each crop. We introduce the 1997 farm programs of each country by assuming farmers received the real, 1997 level of subsidies and payments throughout the time period, instead of the observed program benefits. Risk premiums under 1997 farm programs are reported in table 1. Except for oilseeds, Mexico=s risk premiums are higher than in Canada and the U.S. This is mostly a result of the greater variability in crop returns in Mexico, as well as the assumed lower subjective risk tolerance of Mexican farmers. In the U.S., the risk premium for oilseeds is lower than that for corn, consistent with U.S. farmers' use of soybeans to offset risk in corn production.

Table 1 -- Risk premiums for U.S., Canada, and Mexico, 1997 farm programs

	U.S.	Canada	Mexico
Wheat	9.4	10.6	12.4
Corn	9.7	7.5	13.7
Feedgrains	7.8	5.4	20.0
Oilseeds	8.2	7.2	3.8

We then simulate the expansion of direct transfer payments. This scenario is stylized, and is not intended to exactly simulate actual programs in North America. In particular, the NISA payments are linked to farm savings and revenue insurance. The scenario is intended to analyze the potential for transfer payments to producers to affect supply through their effects on increasing returns and lowering risk aversion in the context of North American agriculture. In the model scenario, we increase direct payments from 1997 levels of real expenditure on PROCAMPO, NISA, and PFC=s in five steps of 10 percent, with the final step representing a 50 percent increase in 1997 payments expenditures. All other 1997 programs remain in place.

Direct payments are assumed to raise household income and consumption, and entail a fiscal cost that must be financed through higher taxation. They affect production through their effect on risk premiums. We allow increased transfer payments to proportionately increase historical returns above market levels for all crops, in the case of Canada, and the four risk-related crops in the case of Mexico and the U.S. The effects of increasing transfer payments on supply are shown in figures 1-3. The variances in market returns of the four crops are unchanged. From equation 2, as the ratio of the variance in returns to average returns (coefficient of variation) for each crop declines, the risk premiums also decline in each of the five steps of this experiment. The effects of increasing direct payments on risk premiums are shown in table 2.

Table 2 -- Risk premiums for U.S., Canada, and Mexico, 50% increase in transfer payments from 1997 levels.

	U.S.	Canada	Mexico
Wheat	8.7	10.5	11.8
Corn	8.9	7.4	13.2
Feedgrains	7.3	5.3	19.3
Oilseeds	6.6	7.1	3.7

Through the mechanism of risk premium reduction, the effects of up to a 50 percent increase in transfer payments are relatively small in all three countries, and impacts vary by country and by commodity. Increased direct payments increase output of all four crops in the U.S., by up to 1.1 percent in the case of oilseeds and one-half percent in the case of wheat. In Mexico, the risk-reduction effects of direct payments are similar in range to those in the U.S., with 0.7 percent increases in wheat and feedgrains. Output of oilseeds, a crop characterized by a relatively low risk premium, declines 0.3 percent as resources shift into crops characterized by higher risk in returns. It might be expected that increased transfer payments would have a greater effect on Mexican output compared to the impacts in the U.S., given the greater assumed risk aversion of Mexican producers. The reason this does not occur is because, comparatively, Mexican market returns are highly variable, and this variability in market returns is not reduced by direct payments. Output effects in Canada are smallest, partly reflecting the low share of 1997 NISA payments in total returns in agriculture in the model base date: 2.3 percent compared to 7.4 percent in the U.S., and 6.8 percent in Mexico. The effects of increased payments on corn and feedgrains in Canada are close to zero.

Conclusion

The Uruguay Round of negotiations achieved important points of global consensus on farm policy. Among these was the agreement that not all agricultural policies need to be disciplined. Programs that are mostly delinked from farmers' current or future production decisions were considered to be minimally distorting. These were placed in a “green box” and were exempted from reduction commitments. The growing experience with less distorting farm programs such as direct payments and insurance programs has led some to argue that they may not be sufficiently non-distorting of agricultural production and trade. Several potential links between these programs and agricultural supply have been identified. We use a multi-country CGE model of the United States, Mexico and Canada, to analyze one program—direct payments—and one linkage - the effects of increased transfer payments on risk premiums, the discount that farmers attach to crop returns characterized by risk. We find that the effects of increased transfer payments on production vary by country and commodity, mostly depending on differences among crops in variability of returns. We also find that, through this mechanism, the effects of increases in direct payments on output are relatively small.

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Fig. 1 - U.S. Supply

(% change from 1997 base quantity)

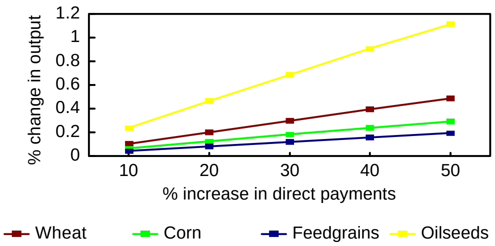

Fig. 2 - Canadian Supply

(% change from 1997 base quantity)

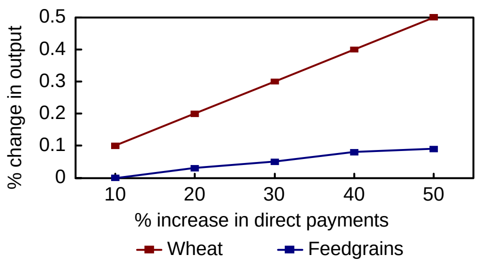

Fig. 3 - Mexican Supply

(% change from 1997 base quantity)