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Developing Financial Weather Derivatives for Prairie Farmers

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Crop insurance programs have traditionally been used to protect farmers in western Canada from the vagaries of weather, but such programs are characterized by adverse selection and moral hazard. Adverse selection occurs when the costs of insurance for some farmers exceed their expected benefits, so they do not voluntarily participate in crop insurance because they are able to cope with adverse weather. Only farmers who are likely to claim benefits would participate. Requiring all farmers to participate eliminates this problem, but at a cost to society. However, no crop insurance program can eliminate moral hazard, which occurs because, once farmers participate in crop insurance, they take no steps to reduce their exposure to adverse weather; the farmer's decisions are contrary to the desires of the insurer – farmers take on risks they would otherwise avoid.

Financial weather derivatives eliminate problems of adverse selection and moral hazard since neither the behavior of farmers nor participation rates can influence weather outcomes. The only drawback relates to basis risk – the risk that payoffs do not correspond to the underlying exposures (e.g., the farmer is exposed to adverse weather but the instrument used to indicate exposure indicates otherwise). The problem is to design appropriate weather derivatives acceptable to farmers. To do this, we examine two potential financial weather products – growing degree days (number of days when temperature exceed 5 °C) and excessive heat days (days temperature is above 38.5 °C).

To determine the potential of these financial weather derivatives for protecting farmers, we employ a 40-year (1970-2000) simulation model that utilizes a 10-year moving average of Saskatchewan RM-level crop yields, realized yields and prices, and realized weather information for the growing season. We begin by postulating that farmers can purchase options to sell growing degree days and/or excessive heat days over-the-counter or in a futures market. We then determine the extent to which these financial options can stabilize a farmer's income, protecting her in particular from downside yield risk.