

Taking a new look at hedging strategies in Quebec hog industry under public farm income insurance program



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Background and research questions

- ❑ Quebec hog industry is a significant contributor to the economy of the province, with 31,000 employees and about 3.6 billion of added value per year. More than 70% of the production is exported and is therefore sensitive to international price fluctuations¹.
- ❑ The industry also faces high production costs that reduce profitability, especially for small farms. This makes the subsidized farm income stabilization program (ASRA) a critical risk management tool for small hog farms.
- ❑ ASRA's reference price is designed to minimize downside risk implying truncation of cash price received by hog farms (**figure 1**). The producers' payoff under the program introduces a nonlinearity in the profit function, raising the need for producers to search for additional risk management tools.
- ❑ We consider the price risk management decision-making problem of a typical Quebec hog farm and analyze the use of derivatives products both on output and inputs markets. Specifically, the study addresses the following questions:
 - (i) What proportions of output and inputs (corn and soya) can producers hedge using futures and/or options to maximize their expected utility of profits under ASRA?
 - (ii) How do optimal hedging ratios vary in a worldwide crisis context, such as the 2008 food crisis or the COVID-19 pandemic?

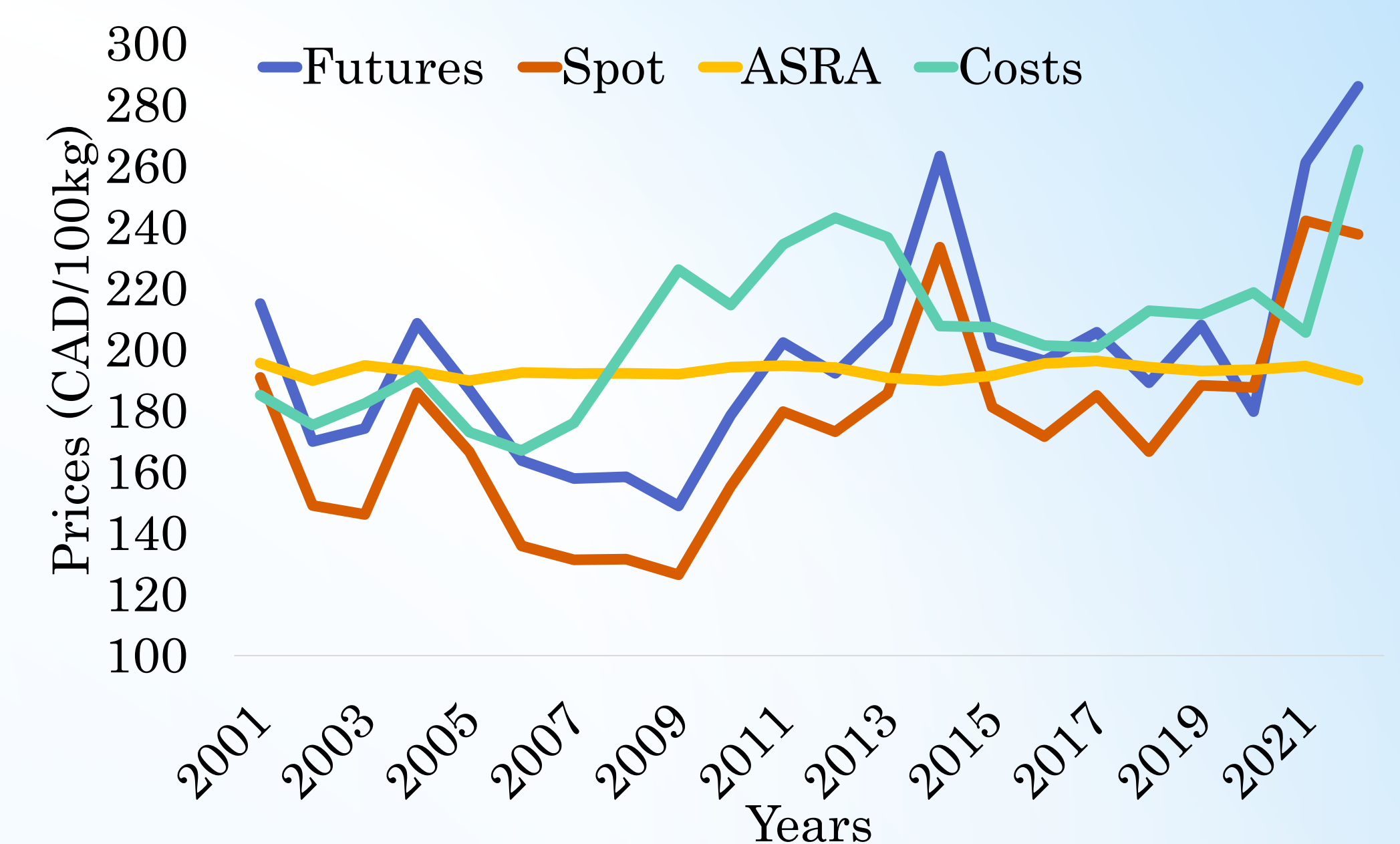


Figure 1: Hog prices trends 2001-2022

Data source

- ❑ We use 30 years (1992-2022) monthly data from various sources.
- ❑ Spot prices of hog, corn, and soya and slaughtered hog volumes in Quebec were collected from Statistics Canada and the hog producers' union of Quebec.
- ❑ Futures contracts data were extracted from hog lean contracts published by the Chicago Mercantile Exchange (CME).

Empirical strategy

- ❑ We assume a Constant Relative Risk Aversion (CRRA) utility function and a multivariate normal distribution for random futures and spot prices.
- ❑ We build a linear forecast model to predict cash and futures prices and use a Monte Carlo simulation to maximize the expected utility of profits over the choice of futures contracts intensity (output and inputs) and put/call options^{2,3,4}.
- ❑ Finally, we check for heterogeneity in world crisis contexts by computing hedging ratios for 2008-2009 and 2020-2021.

Conclusions and policy implications

- ❑ Hedging is beneficial to Quebec Hog producers, even in the presence of ASRA. It contributes to a significant reduction of producers' exposure to price volatility.
- ❑ Producers are better off when hedging simultaneously on the output and inputs markets.
- ❑ The one-size-fits-all solution does not apply to optimal hedging ratios. The producer's degree of risk aversion and a good price shock prediction determine the best hedging position.
- ❑ Using derivatives would reduce producers' dependence on ASRA. Since ASRA's subsidy is a transfer from taxpayers to hog producers, a decrease in producers' dependence on ASRA would improve total welfare.

Preliminary results

- ❑ Optimal hedging ratios (OHR) on futures contracts vary with producers' degree of risk aversion, from 0.31-0.94 on the hog output and from 0.23-0.47 on the inputs (**figure 2**).
- ❑ Put/call options required for optimal hedging positions are always lower than the futures (**figure 2**).
- ❑ The OHRs are sensitive to worldwide crises. OHRs were larger during the global food price shock of 2008 than during COVID-19 (**figure 3**).
- ❑ Simultaneous hedging on both output and inputs offers the largest certainty equivalence, regardless of the risk aversion degree of producers and market conditions (**figure 4**).

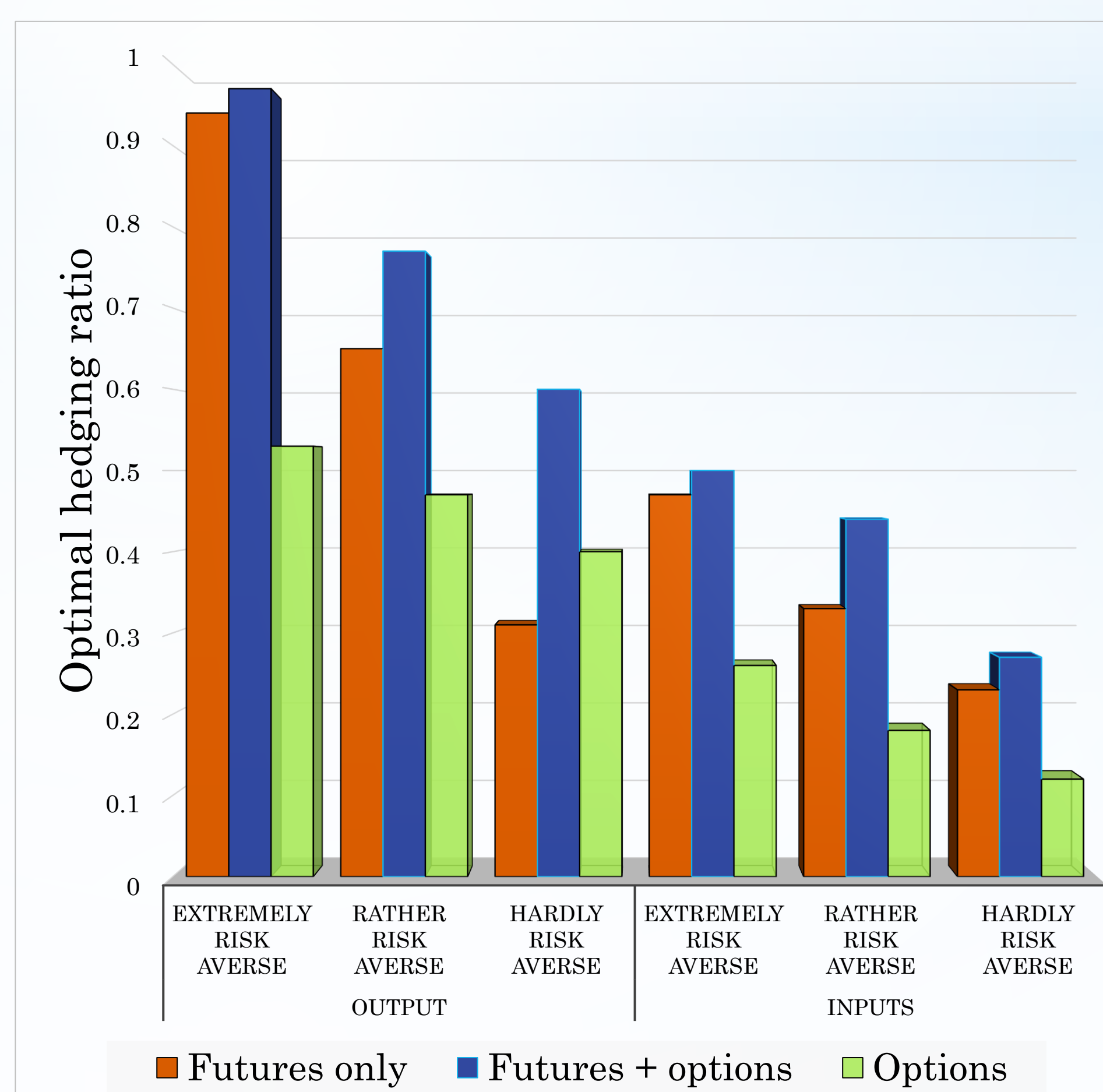


Figure 2: Optimal hedging ratios (OHR) with ASRA

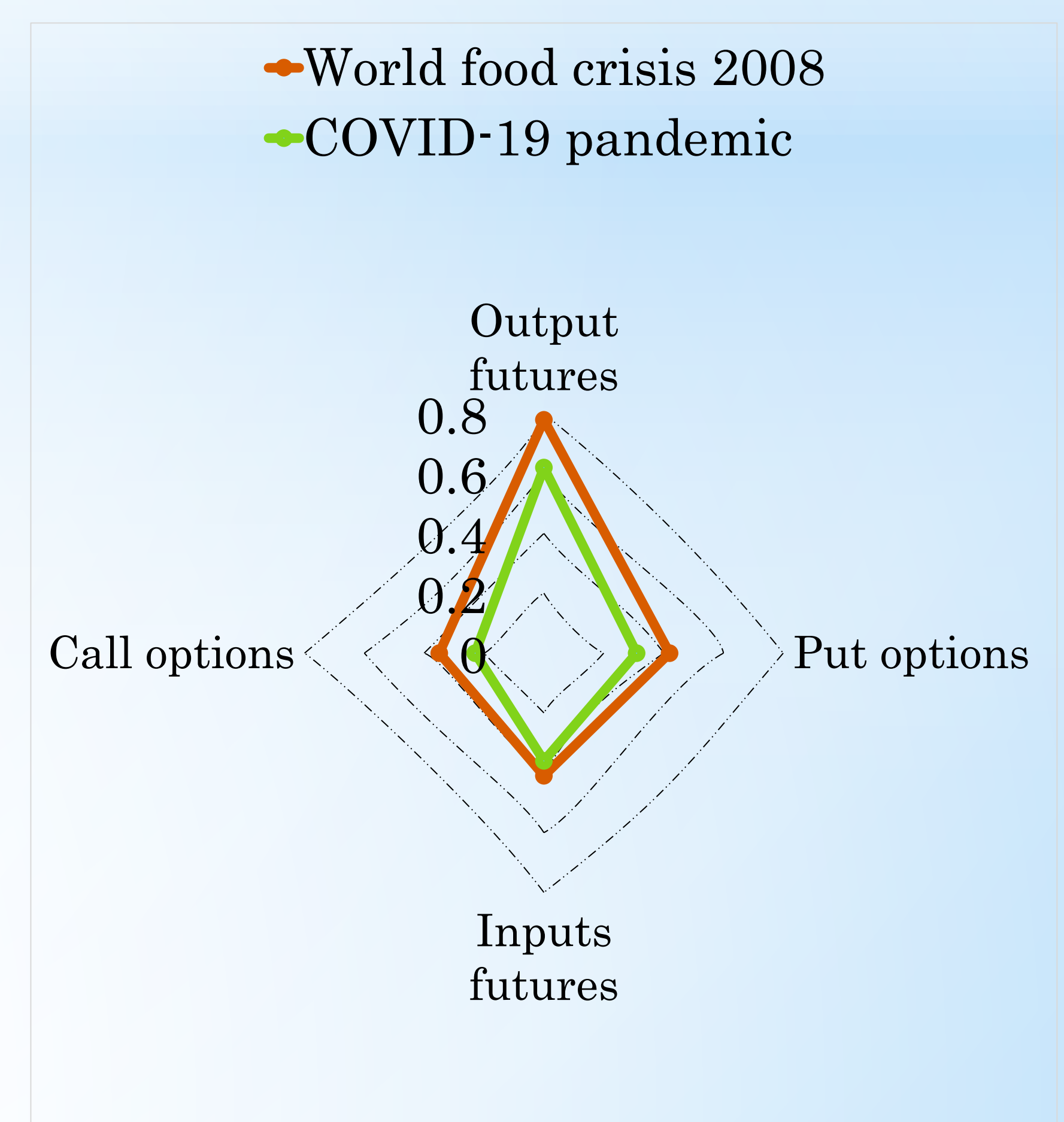


Figure 3: OHR heterogeneity for a rather risk-averse with ASRA

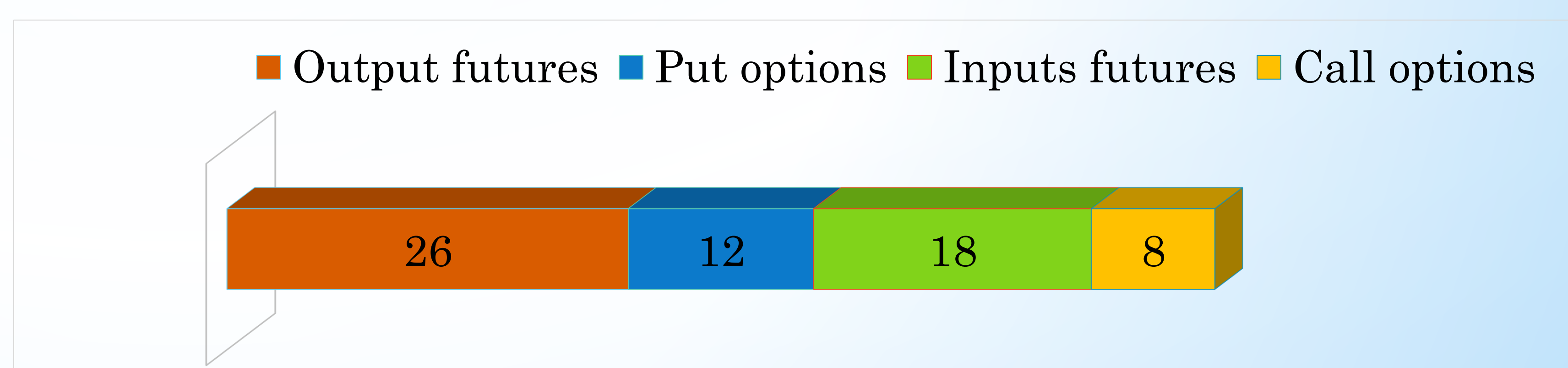


Figure 4: Cumulative certainty equivalence (CAD/100 kg) for a rather risk-averse with ASRA

References

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