The Impact of Agricultural Subsidies on the Corn Market with Farm Heterogeneity and Endogenous Entry and Exit

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Objectives
• Develop a model with farm-level heterogeneity in productivity and endogenous entry and exit
• Analytically show how both coupled and decoupled subsidies affect input use, output supply, prices, number of farms, industry productivity, and farm operating decisions
• Calibrate the model to the US corn market and quantify through simulation the effects of coupled and decoupled subsidies

Background
• Following the Uruguay Round Agreement on Agriculture (URAA), there was a major policy shift in the US and EU from coupled to decoupled subsidies
• Coupled subsidies are tied to production (e.g., price supports) and distort production decisions at the intensive margin
• Decoupled subsidies are independent of production (e.g., income supports) and are similar to lump-sum transfers
• There was a shift from coupled to decoupled subsidies because decoupled subsidies were thought to be less distortive
• We reconsider the distortive effects of these two types of subsidies by also considering the extensive margin—farms’ decisions to enter and exit the industry

Analytical Results
• Assuming standard functional forms, the model has an analytical solution
• The model provides microeconomic foundations for an industry supply curve that takes the form
  \[ Y(p) = \left(1 + \sigma_y p\right)^{\alpha_1} \left(f_o - \sigma_d p\right)^{\alpha_2} \]
• By shifting the supply curve, the subsidies have the same qualitative effect on output price and quantity
• The following figure illustrates the qualitative effect of implementing a coupled subsidy, which moves the equilibrium from A to B

Key difference between the two subsidies
• The decoupled subsidy affects the productivity cutoff for operating, while the coupled subsidy does not:
  \[ \frac{\partial \bar{z}}{\partial \sigma_y} = 0 \quad \frac{\partial \bar{z}}{\partial \sigma_d} < 0 \]
• With coupled subsidies, changes in prices exactly offset changes in the subsidy level to leave profits unchanged
• Decoupled subsidies lower industry TFP, while coupled subsidies do not

Calibration
• We calibrate the model to match data on the US corn industry from 2003-2007 from Foreman (2014)
• Key data we match:
  • Corn price of $2.74/bushel
  • Corn quantity of 11.33 billion bushels
  • Farm expenditure shares for capital (21%), labor (5%), intermediates (50%), and land (24%)
  • Most productive 25% of farms account for 39% of output
  • Levels of corn subsidies through price supports and direct payments
• Elasticities are taken from the literature

Quantitative Results
• Removal of direct payments:
  • Number of farms falls by 6.67%
  • Productivity rises by 1.87%
  • Output declines by 4.35%
• Removal of price supports:
  • Number of farms falls by 1.35%
  • Productivity remains unchanged
  • Output declines by 3%
• Our findings indicate that decoupled payments are more distortive than price supports in terms of production, prices, and welfare

Conclusions
• When analyzing the effects of subsidies, it is important to take into account the extensive margins of farm entry and exit
• Decoupled subsidies can be more distortive than coupled subsidies
• Coupled subsidies do not change the productivity cutoff for operating or industry TFP, while decoupled subsidies do

Model
• We compare the distortive effects of coupled and decoupled subsidies in a model with
  • perfect competition
  • farms that are heterogeneous in productivity
  • fixed costs of entry and operating
  • endogenous entry and exit
• Each entering farm receives a productivity draw from probability distribution \(G(z)\)
• A farm with draw \(z\) has profits
  \[ \pi(z) = (1 + \sigma_y p)z^{1-\gamma} - w(x(z) - f_o + \sigma_d) \]
• Because of the fixed cost of operating, there is an endogenous productivity cutoff for operating, \(\bar{z}\), that satisfies
  \[ \pi(\bar{z}) = 0 \]
• Farms enter until the expected profit from doing so equals the cost of entry
• Prices adjust so that markets clear

The green area is the cost of the subsidy

Key difference between the two subsidies
• The decoupled subsidy affects the productivity cutoff for operating, while the coupled subsidy does not:

Conclusions