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

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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

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

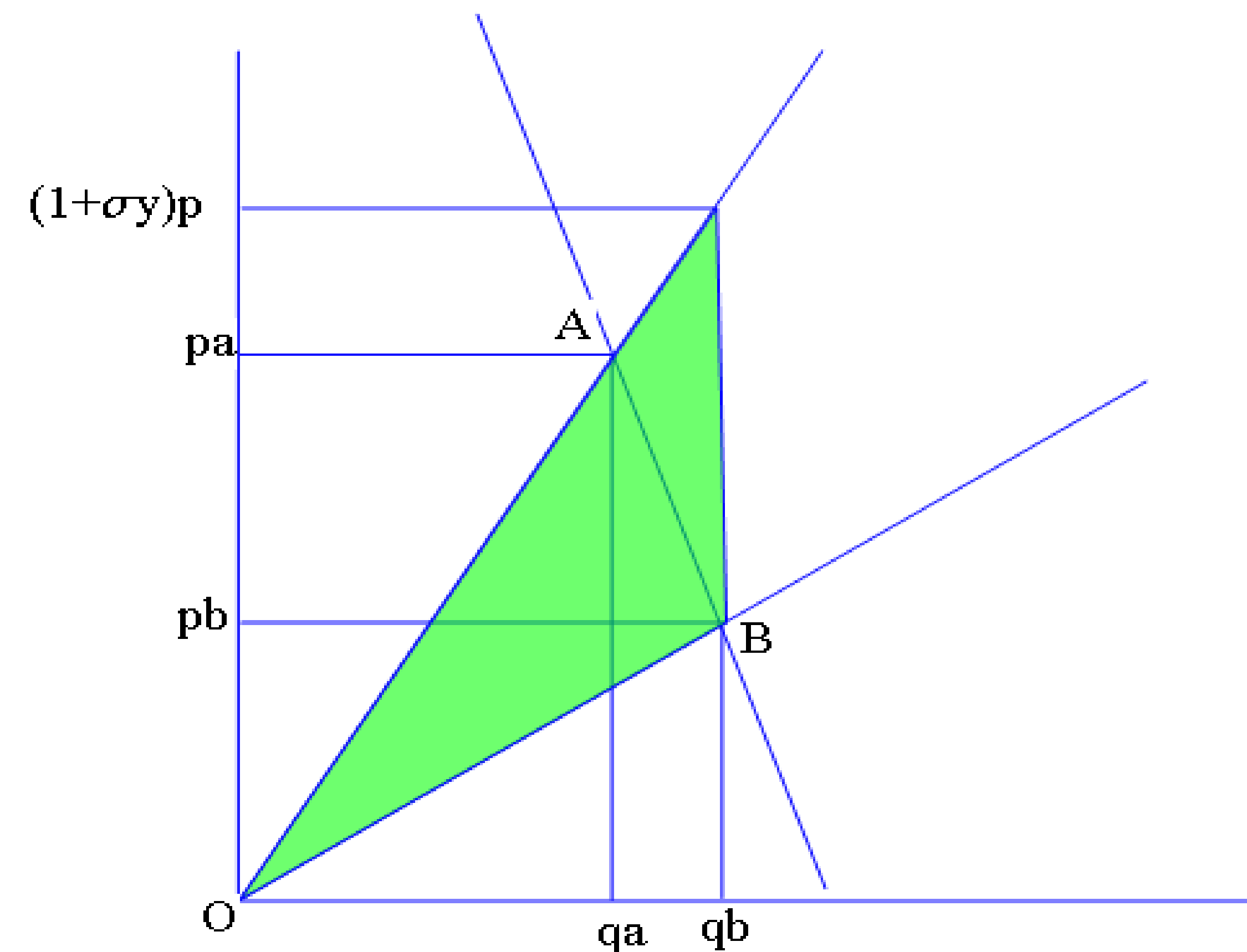
$$\pi(z) = (1 + \sigma_y)pz^{1-\nu}x(z)^\nu - wx(z) - f_o + \sigma_d$$
- Because of the fixed cost of operating, there is an endogenous productivity cutoff for operating, \bar{z} , that satisfies

$$\pi(\bar{z}) = 0$$
- Farms enter until the expected profit from doing so equals the cost of entry
- Prices adjust so that markets clear

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

$$Y(p) = \left((1 + \sigma_y)p \right)^{A_1} (f_o - \sigma_d)^{-A_2} A_3$$
- 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



- 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:

$$\frac{\partial \bar{z}}{\partial \sigma_y} = 0 \quad \frac{\partial \bar{z}}{\partial \sigma_d} < 0$$
- 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
 - 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