Recent ERS Work on Farm-Level Productivity

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I'll Discuss Three Projects

- US-EU dairy structure
  - Comparisons, changes, and policy
- Antibiotic use on US livestock operations
  - Practices, productivity, & costs
- Changing structure in US field crops
  - Measurement, technology, policy

US-EU Dairy Comparisons

- Richard Nehring and Charles Hallahan, ERS
- Jeffrey Gillespie, Louisiana State University, US
- Johannes Sauer, University of Manchester, UK
  - Sauer handles EU data collection and analysis
- I’m going to talk about some initial data collection and results

Goals and Methodology

- Investigate structural change in the US and EU dairy industries
  - Size & production technologies
  - Basic technical and financial trends
- Assess impacts of technology and size on:
  - scale economies and technical efficiency
    - Using a transformation function and stochastic production frontier estimation

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Recent Trends in Farm Structure

	Number of farms with cows		Cows per farm		Milk/cow (kilos)	
	2000	2007	2000	2007	2000	2007
USA	105,170	69,890	88	133	8,257	9,193
Denmark	9,767	4,940	68	107	6,930	8,919
Germany	136,000	101,000	35	41	6,122	6,944
France	116,647	97,368	36	38	5,623	6,381
Ireland	29,425	23,511	40	45	4,289	4,846
Italy	97,000	48,487	35	41	4,894	5,998
Netherlands	34,354	23,677	48	62	7,417	7,879
UK	25,944	15,385	90	130	6,155	7,155



Comments on Structure Data

- Size distributions are skewed, and it matters
  - Mean US herd size is 133
    - But 18,000 farms had less then 20
  - Median, from cow's point of view, is 570
- Will EU policy changes lead to structure shifts?

Methods

- Use a transformation function,
- A multi-output production function
  - $Y_1=G(Y_{-1}, X, T)$
  - Y_1 is primary output, is vector of other outputs, X is vector of inputs, T is vector of shift variables

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Data

- US: annual ARMS records
  - Farm level, but primarily financial
  - Revenues and expenses, with deflators, to get to quantity estimates
  - 5,000 US farms, 1999-2008, NE and Midwest
- EU: farm-level records, 1999-2007,
  - Denmark (3,744), France (12,180), Germany (15,524), Italy (13,272), Spain (11,315), and UK (5,970)

Returns to Scale Estimates, by Country and Herd Size

($\partial \ln Y_1 / \partial \ln X$; 1.0 is constant, >1.0 is increasing returns)

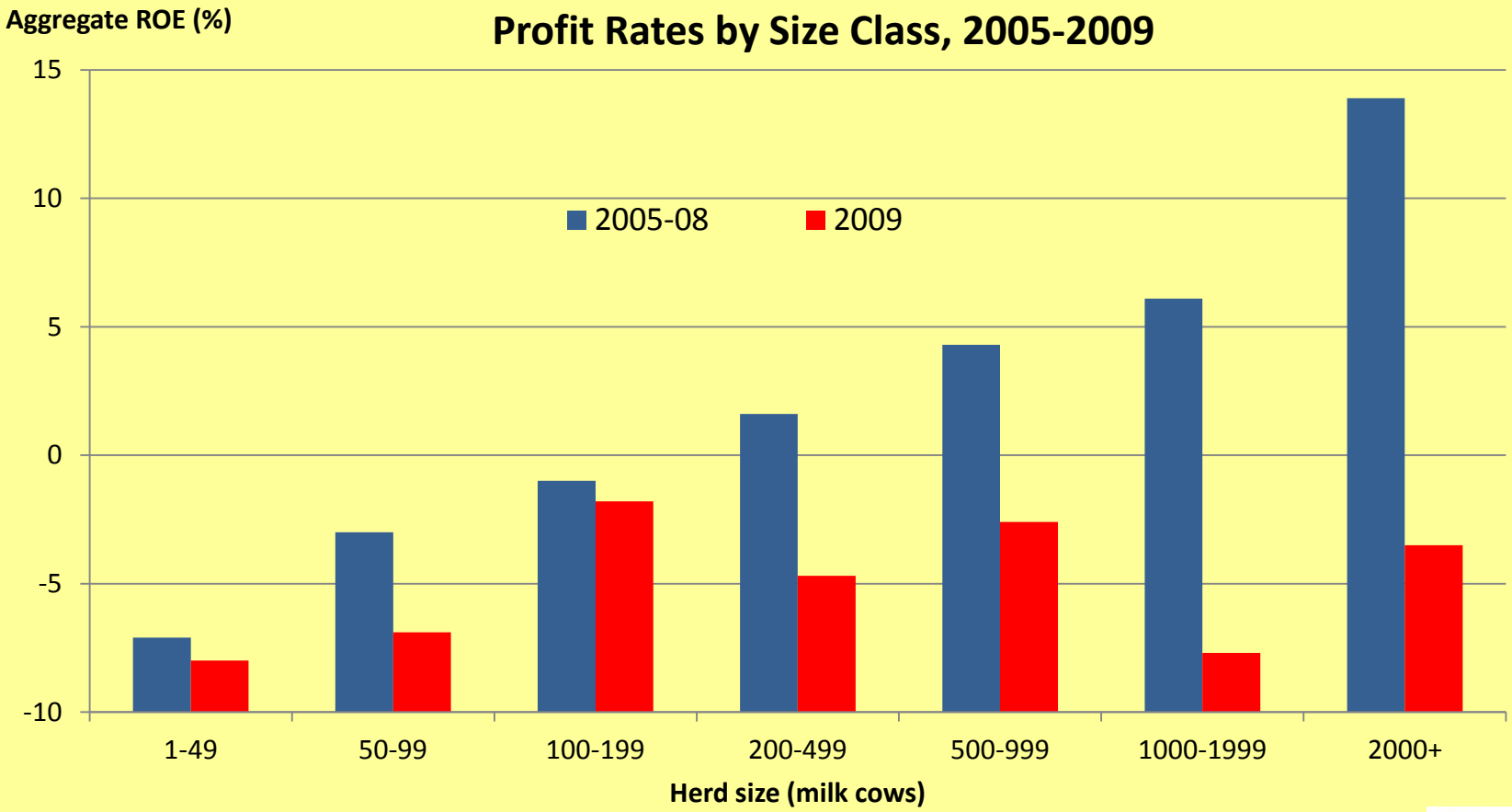
	Herd Size (Milk Cows			
	<50	50-99	100-499	500-999
USA (trad.)	2.27	1.42	1.18	1.23
Denmark	1.56	1.09	0.96	0.82
Germany	1.54	1.31	1.31	1.12
France	1.15	1.11	1.11	na
Italy	3.51	1.22	1.30	1.28
Spain	1.45	1.33	1.26	1.00
UK	1.71	1.49	1.35	1.32

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Interpretations

- Small farms (<50 cows) show substantial unrealized scale economies
  - Scale parameter moves to 1 as size increases
  - France and Denmark show smallest scale effects
  - Implies, higher costs at smaller farms
  - In US analyses, source of scale economies lie in labor and capital utilization (modest impacts from feed utilization)
  - Extensive margin is unclear

A Further Issue: Dairy Finances and Policy



The 2009 U.S. Price Crash

- Prices fell by half, feed costs by 10%
- Largest farms had the largest financial decline
  - Policy offset some of revenue losses at mid-size and small farms
  - Large farms purchased feed more often, with consequent impact on income statement
  - Largest farms locked in feed prices
- How will these financial risks affect structural change, and US policy?

Another Current Project

- Antibiotic use in hog and poultry operations
  - Primary focus is antibiotic use, and alternative production practices
  - Evaluate impact on costs and output through estimation of a production function
    - Which yields other insights as well
- Hogs for 2004, 2009, broilers for 2006, 2011

Broiler Work just Published

- "Foregoing Subtherapeutic Antibiotics: the Impact on Broiler Grow-out Operations", James MacDonald & Sun Ling Wang, *Applied Economics and Public Policy* (Spring 2011).
  - Estimates of scale and production relations in grow-out
  - Estimates of impact of antibiotics, and use of alternative practices
  - Follow-up survey to go into field in 2012, focused on 2011 outcomes.

Hog Work is Currently Ongoing

- 2009 survey data, available in Fall, 2010
  - Follows up in 1998, 2004 surveys
- Incidence of antibiotic use, alternative production practices, temporal changes
- Impacts on productivity, costs, in the context of earlier ERS analyses.

Looking Ahead for this Project

- Hog project should have paper ready for this summer (AAEA)
  - Bill McBride, Nigel Key, Ken Mathews
- ERS will aim to combine the research with prior literature & modeling for a agency report on the policy issues
- Considerable interest, given EU restrictions and US policy debate

In the Planning Stage

- Changes in the structure of field crop farming

- More complex and challenging issue
  - Multiple outputs
  - Temporal linkages matter (eg rotations)
  - Weather risks matter

The Motivating Force: Shifts to Larger Farms

The table shows the center of production, by acres. Half of all acreage is on larger operations, and half on smaller (the Florence median).

Crop	*1987*	*2007*
	-Harvested acres-	
Corn	200	600
Soybeans	243	490
Wheat	404	910
Cotton	450	1090
Rice	295	700

Source: Census of Agriculture microdata

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Key Issues

- What's the role of technology?
  - Technical scale economies?
  - Labor-saving innovations?
  - Relative price changes?
- What's the role of policy?
- What's the upper bound?
  - Will US shift to non-family farms?

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