

A Look at Ethanol Plant Profitability and Farmers' Investment Portfolios

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**North Central Farm Management Extension
Committee**

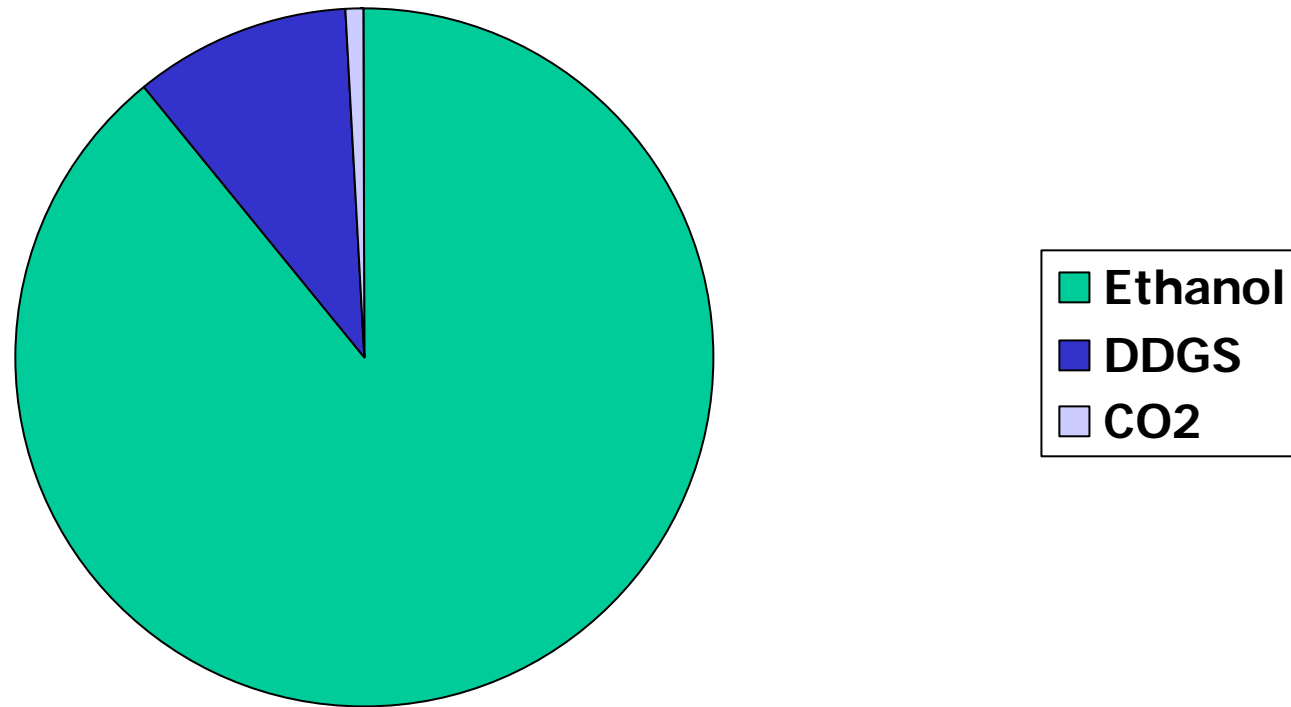
Ames, IA

May 9-11, 2006

Some Definitions and Rules of Thumb

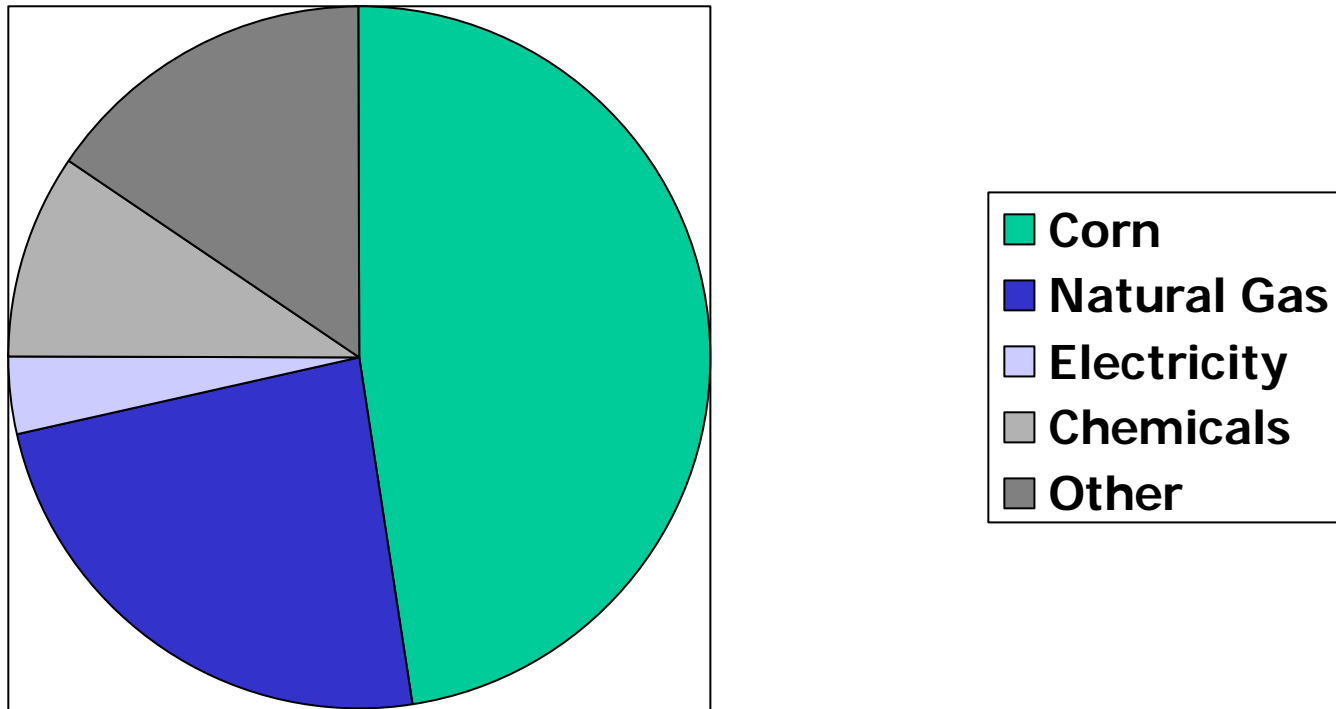
- **Nameplate capacity**
 - Contractor's certification
- **Actual production level**
 - 20% over nameplate capacity
- **Capital Costs**
 - \$1.50/gallon rated capacity
- **Ethanol yields**
 - Anhydrous 2.75 gallons/bushel
 - Denatured 2.83 gallons/bushel
- **DDGS yields**
 - 18 pounds/bushel
- **Natural gas consumption**
 - 35,000 BTU's/ denatured gallon
 - 1031 BTU's/cubic foot
- **Electricity**
 - 1.1 kWh/denatured gallon
- **Water**
 - 5 gallons/denatured gallon??

Ethanol Plant Revenue Composition



Source: Tiffany and Eidman

Ethanol Cost Components (per denatured gallon)

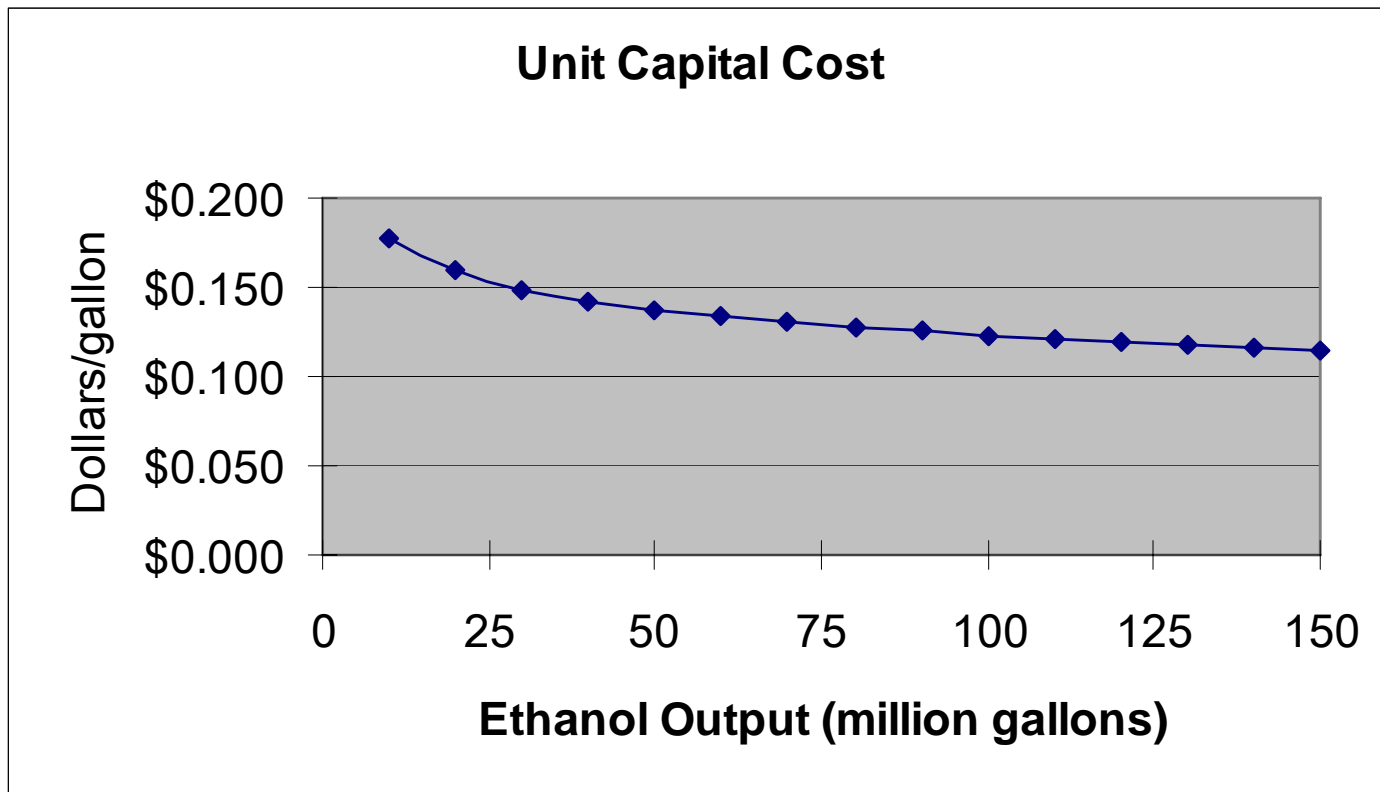


Source: Tiffany and Eidman

Some Stylized Facts

1. Capital Costs

- Cube-Square Rule
- Imagine an ethanol plant as a large cylinder
- Capital costs are proportional to the area
- Output is proportional to the volume
- Decreasing returns to scale

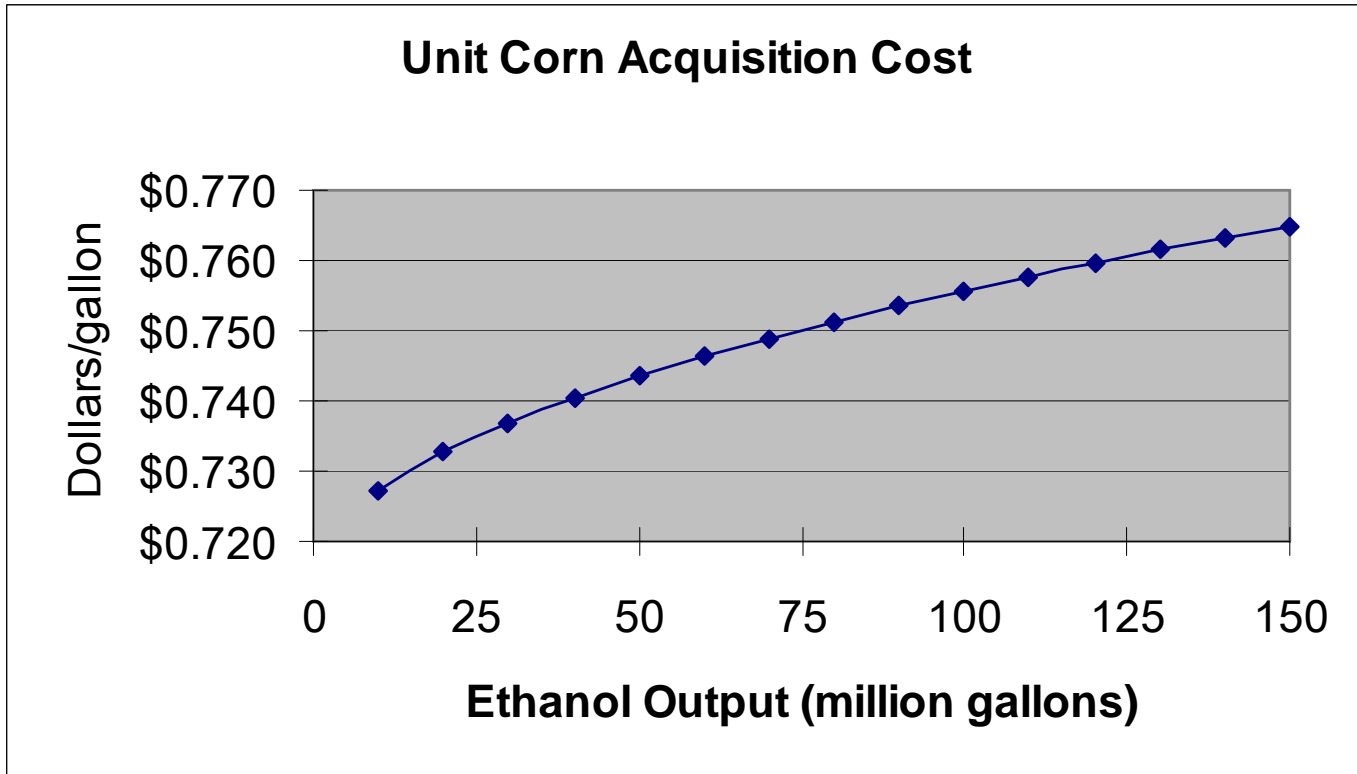


Derived from Gallagher et al, 2005

Some More Stylized Facts

3. Corn Assembly Costs

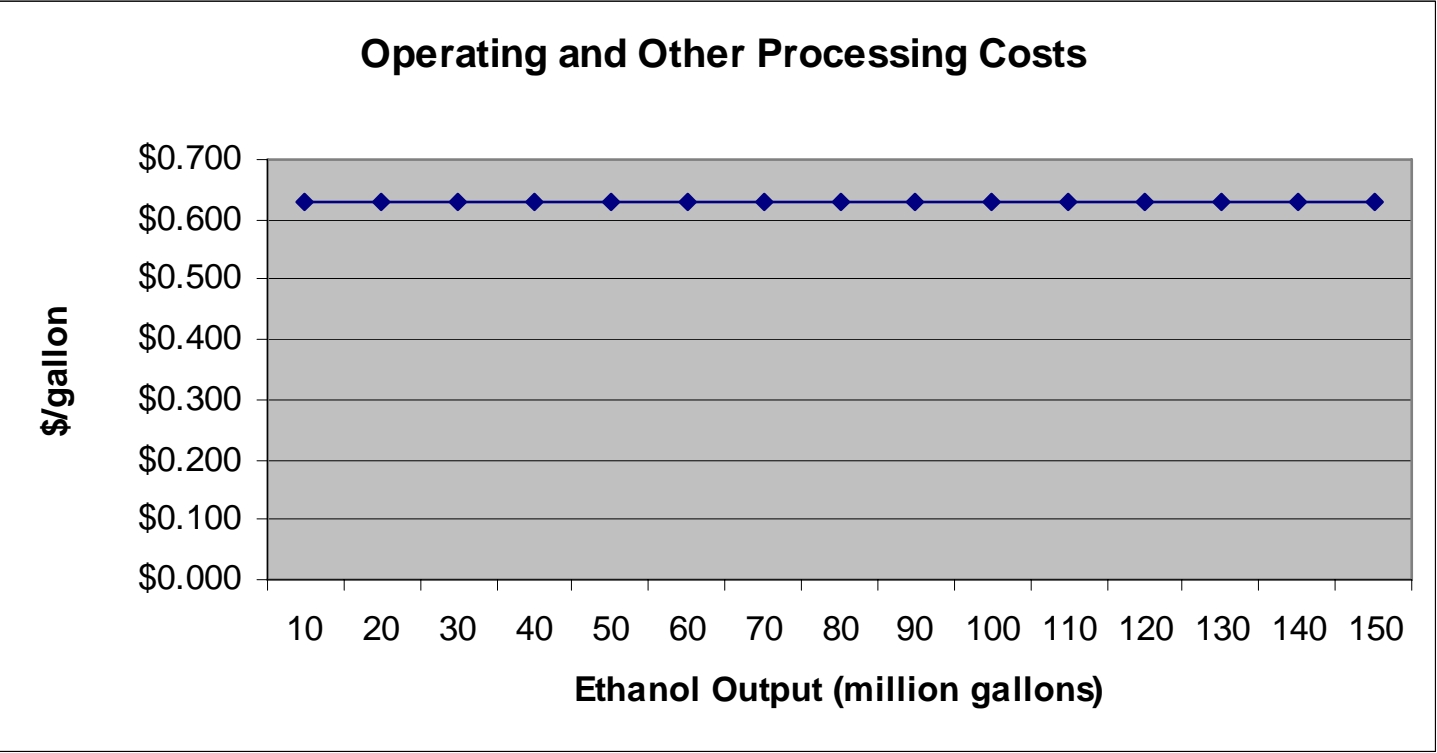
- Priced delivered to plant
- Total assembly cost is linear function of distance
- Unit assembly cost increases at a decreasing rate



And a Few More Stylized Facts for Good Measure

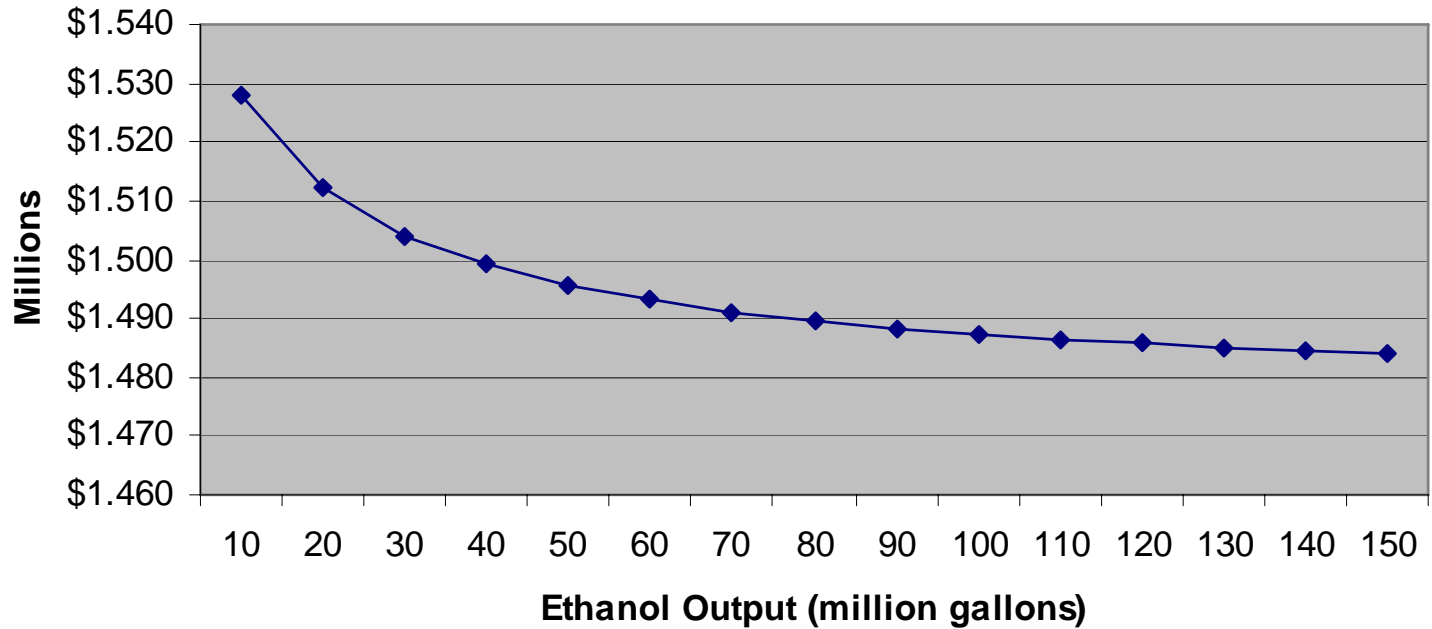
2. Operations Costs

- Fixed Proportions
- Chemicals and Water
- Energy

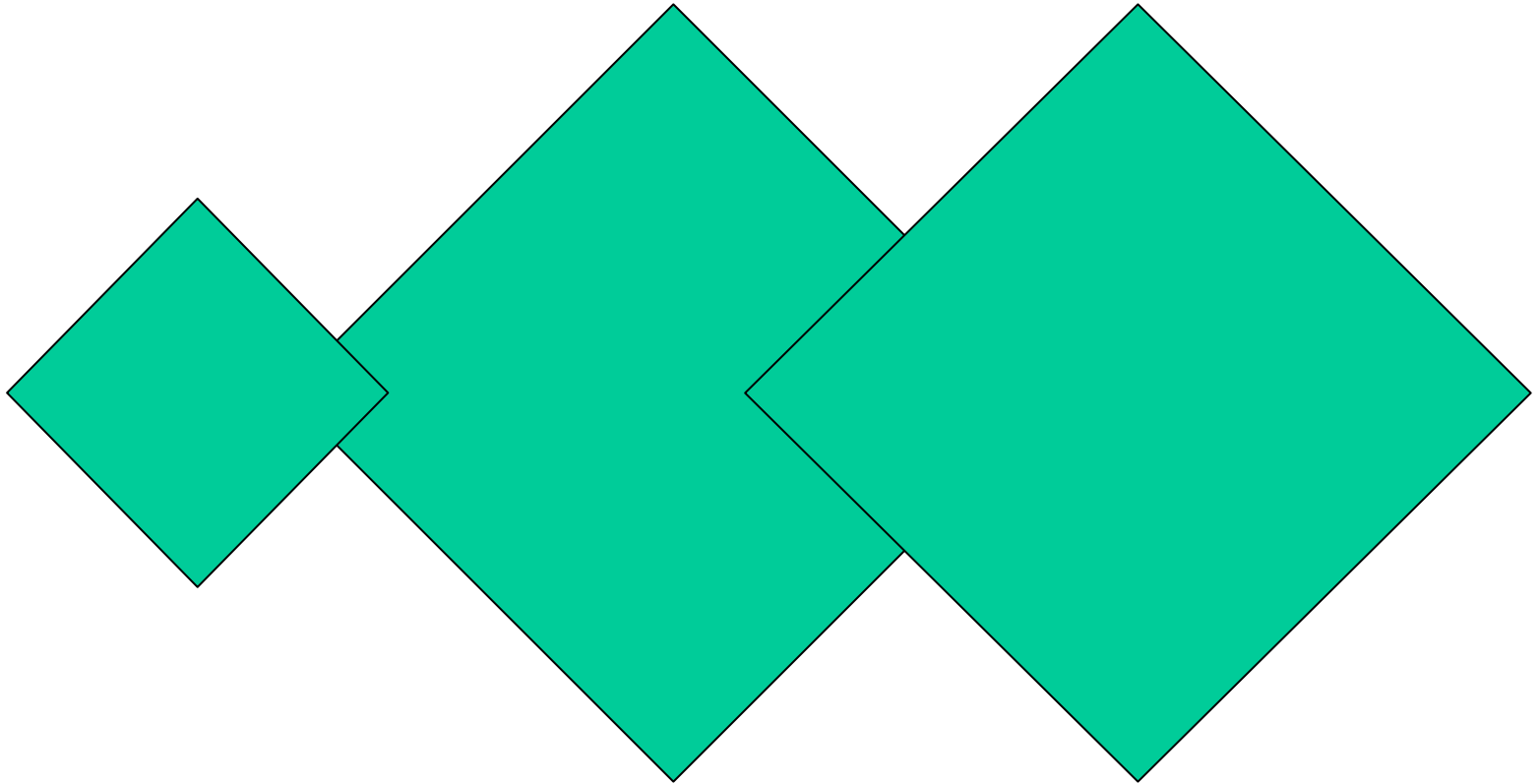


Putting the Costs together

Full Production Costs



Contested Market Areas



Discussion of Farm Results

Corn Price Where 50:50 = 2/3:1/3 (\$5.75 Beans)

		Soybean Yield				
		35	40	45	50	55
Corn Yield	150	2.92	3.13	3.34	3.56	3.77
	160	2.78	2.98	3.18	3.39	3.59
	170	2.66	2.85	3.04	3.23	3.42
	180	2.56	2.74	2.92	3.10	3.28
	190	2.47	2.64	2.81	2.97	3.14
	200	2.38	2.54	2.70	2.87	3.03

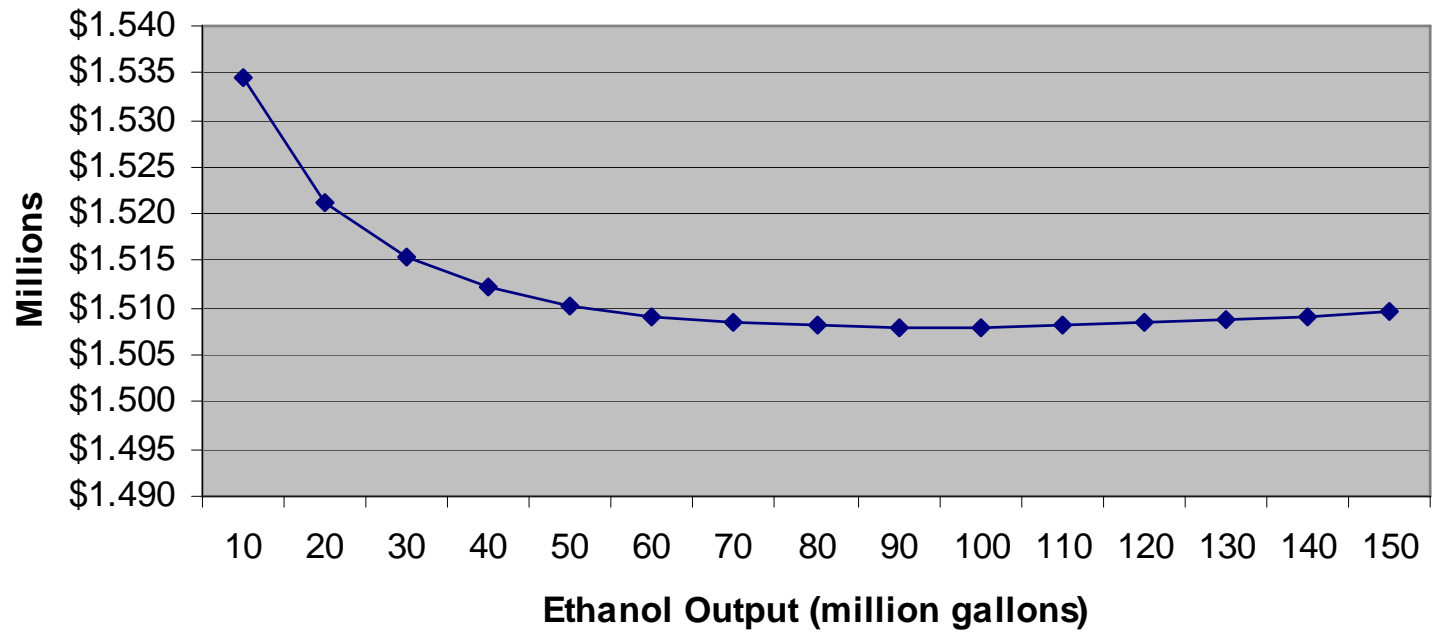
Discussion of Farm Results

Corn Price Where 50:50 = 2/3:1/3 (\$5.75 Beans)

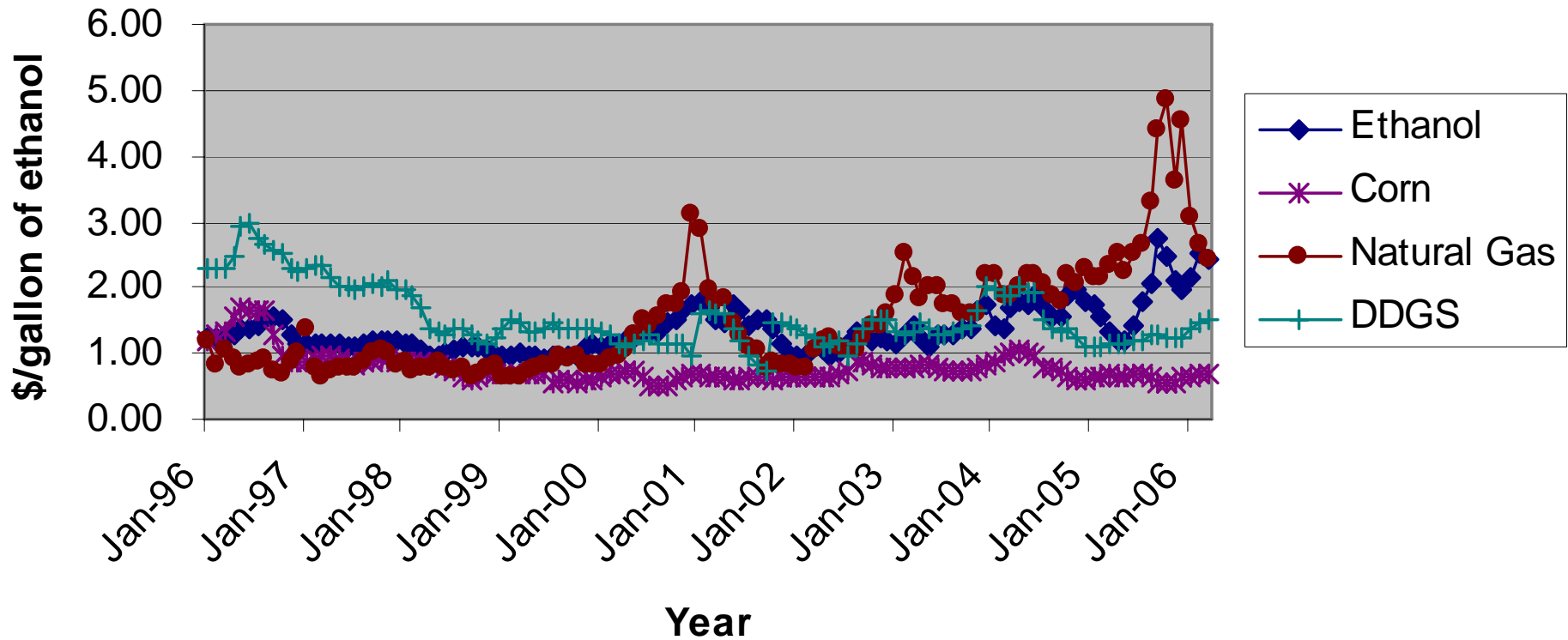
Soybean Yield *Asian Rust*

		35	40	45	50	55
Corn Yield	150	2.51	2.70	2.89	3.09	3.28
	160	2.41	2.58	2.76	2.94	3.12
	170	2.31	2.48	2.65	2.81	2.98
	180	2.23	2.38	2.54	2.70	2.86
	190	2.15	2.30	2.45	2.60	2.75
	200	2.08	2.22	2.37	2.51	2.65

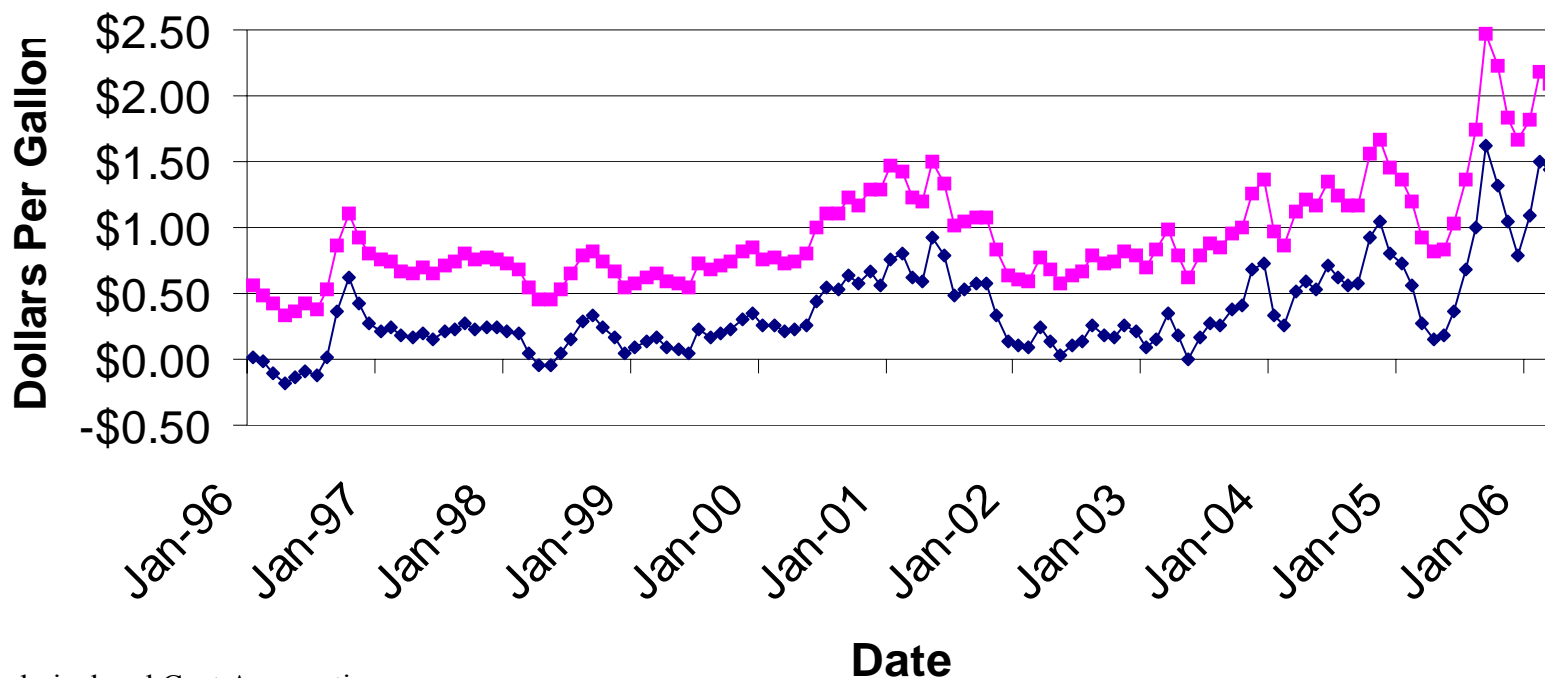
Full Production Costs



Monthly Ethanol Input and Output Prices



Estimated Ethanol Plant Monthly Profitability, 1996-2006



Technical and Cost Assumptions
Based on Tiffany and Eidman

◆ Net Margins ■ Gross Margins

**Sensitivity Table
Price of Ethanol (\$/Gal)
Net Margin Breakeven**

		Price of Natural Gas (\$/Dtherm)	
	Price of Corn (\$/bu.)	\$5.00	\$10.00
	\$2.00	1.02	1.19
	\$3.00	1.36	1.54
	\$4.00	1.71	1.88

**DDGS at \$80/ton
Depreciation at \$.08/gallon**

Value Added What?...Horizontal Versus Vertical Investment in Iowa Production Agriculture.

Josh Roe
Formerly of
Department of Economics,
Iowa State University
Now at
Kansas State University

Or... Do ethanol investments
make sense for farmers?

Sounds like a dumb question
given current (rumored) rates of
return!

Statement of The Problem

- Is Vertical or Horizontal Growth More Efficient for Iowa Agricultural Producers?
- What Attributes of a Farm Make it More Profitable for a Farm to Expand Vertically and/or Horizontally?
- Can a Farm's Attributes Predict Their Optimal Investment Pattern?

Model Specification

- Value Added Agricultural Investments
 - Investment in Ethanol Plant
 - Investment in Egg Production
- Stock Index
 - S&P 500
- Food and Agricultural Business Stocks
 - Fidelity Food Mutual Fund

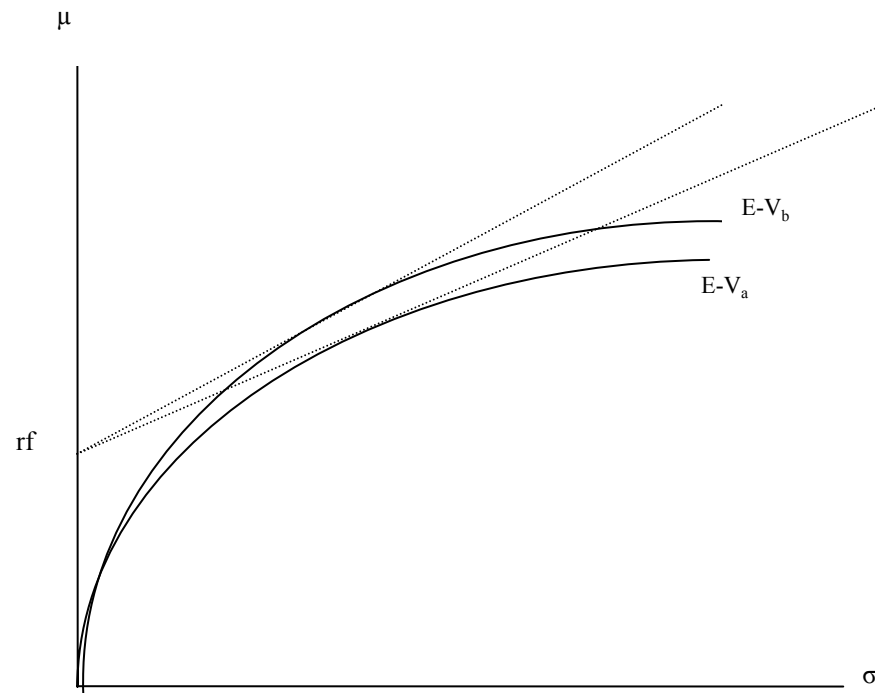
**Returns, Risk & Correlations
Value-Added Investments
1993-2003**

				Correlation Matrix				
	Mean %	Std %	CV	Ethanol	Layers	S&P 500	Fidelity Agri- business	Average Farm
Ethanol	10.13	16.51	1.62	1				
Layers	7.23	6.28	0.86	-0.092	1			
S&P 500	10.63	19.88	1.87	0.217	0.748	1		
Fidelity Agribusiness	11.56	16.98	1.46	0.257	0.626	0.418	1	
Average Farm	7.77	6.08	0.78	-0.249	0.663	-0.208	0.134	1

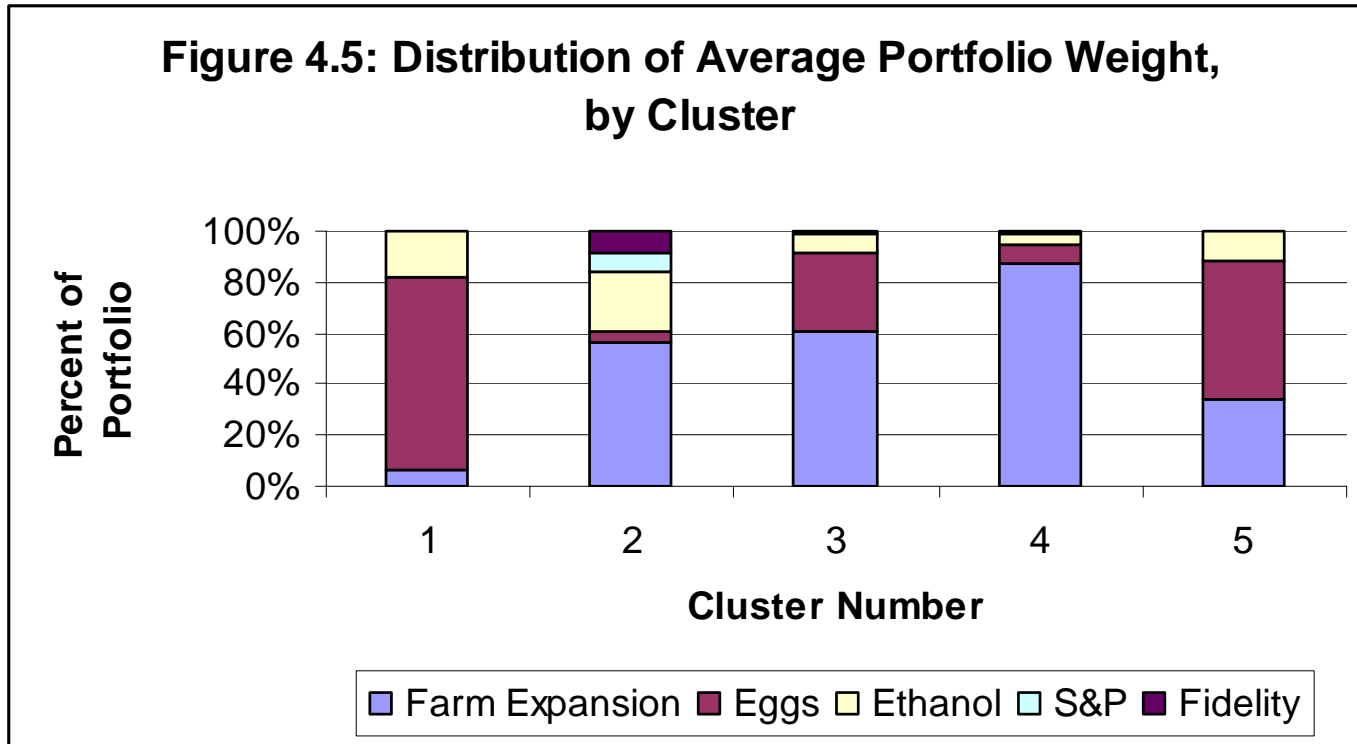
Source: Josh Roe, MS thesis

Model Specification

- Overall Implications
 - Farm Characteristics Not Accounted For
 - Each Producer Given a Unique Investment Alternative
 - Risk/Return Implications:



Results and Interpretations



Mean Values of Variables Used in Model, by Cluster

Variable	Cluster Number				
	1	2	3	4	5
Age of Operator***	59	43	54	52	55
Grain Sales Ratio*	0.73	0.35	0.77	0.77	0.64
Net Farm Income Ratio***	0.15	0.18	0.23	0.32	0.16
Return on Equity***	0.12	0.18	0.09	0.12	0.09
Debt to Asset Ratio*	0.30	0.51	0.22	0.18	0.33
Interest Expense Ratio**	0.06	0.05	0.04	0.03	0.06
Government Payments Ratio	0.07	0.07	0.08	0.09	0.08
Non-farm Income	16,671	3,456	9,772	14,314	12,416

Conclusions

- Value Added Investments Fit Well into a Portfolio:
 - The Farm is Highly Dependant on Grain Sales
 - The Farm is Highly Leveraged and/or Relatively Inefficient
 - The Farm is Highly Dependent on Government Payments
- Stock Market Investments Don't Appear to Be Profitable
 - Due to Greater Expected Risk
 - Would the Results Differ Across Another Time Period?
 - What About the Farms Who Heavily Invested in Them?