Class I Differentials with $2.50 Fuel to $5.00 Fuel*

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Living on a Roller Coaster: 18th Annual Workshop for Dairy Economists and Policy Analysts

Outline (Surprise!)

- Class I "Price Surface" with different fuel costs
  - Work funded by AMS Dairy Division
  - The main topic
- *Costs of "Localizing" the US Dairy Industry
  - Recent *Food Policy* Paper
- *Use of USDA and CBO Price Projections
  - Recent survey for Ag Policy course

*** Special bonus sections! Or "30% more presentation FREE"**

Outline

- Background
- US Dairy Sector Simulator (USDSS) basic description
- Modifications from original USDSS model
  - Additional final and intermediate products
  - Nonlinear yield functions
  - Revised plant locations
- Class I price surface results

Objectives

- Update the "cost-minimizing" price surface to 2006
  - (Okay, so now we should probably update the update)
- Examine the impacts of changing fuel costs on the Class I price surface
  - From the 2006 diesel cost of $2.36 to $5.00
  - At the start $5.00/gal diesel looked big!
  - May 2nd: $4.12/gal, with CA at $4.47/gal

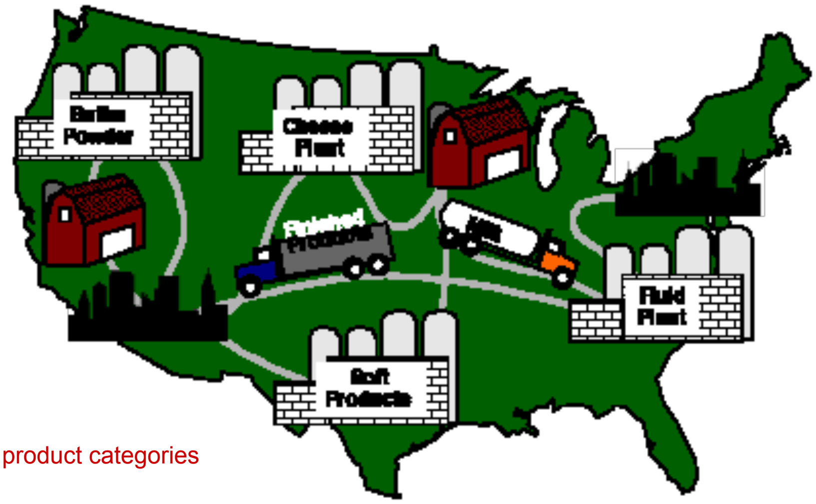
Methods

- Cost-minimizing model of the US dairy sector
- Long history of this analysis
  - Pratt et al. 1998 Class I differentials study
  - US Dairy Sector Simulator (USDSS)
  - Also funded by AMS
  - Input into the differential structure under order reform
- Model was given an "extreme makeover" in 2008

USDSS Model

- Spatially-disaggregated 'transshipment' model
- Minimizes the costs of milk assembly, interplant (intermediate product) use, and final product distribution
  - Some versions have included processing costs also
- Nonlinear programming solution technique

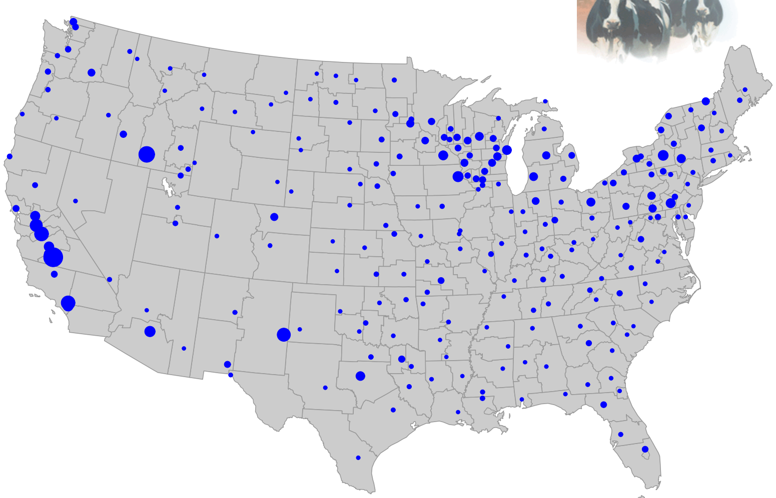
USDSS Model



5 product categories

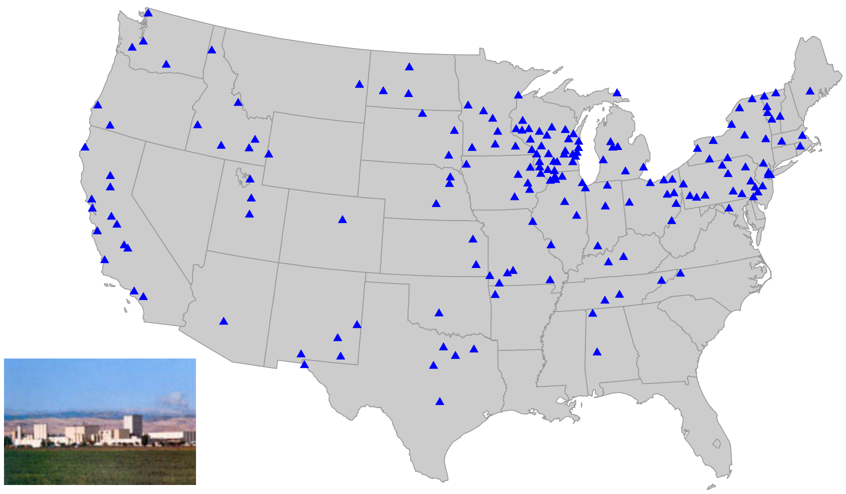
US Milk Supply Locations

Given milk supply locations…



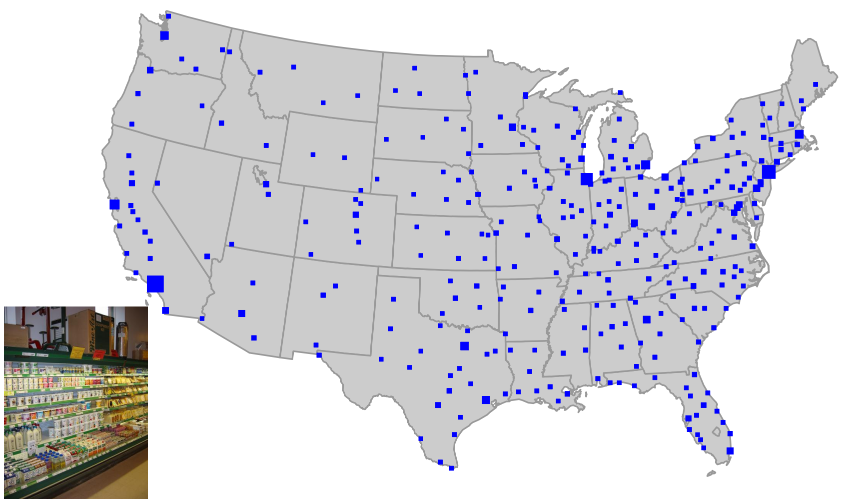
US Cheese Plant Locations

…and processing plant locations, like cheese…



US Cheese Demand Locations

…and demand locations…



The USDSS Model

- Figure out least overall cost for…
  - Farm to plant (milk assembly)
  - Processing at plant (products)
  - Distribution to demand

Model Solutions Represent:

- The work of an imaginary "Dairy Dictator"
  - Solution is least-cost for entire system
  - No emotion about keeping plants in business

Model Solutions Provide:

- Insights about some incentives for a plant to be at a location
  - Not actual outcomes
  - Many important factors omitted
- Uses data for two months
  - May and October
  - Original study used 1995 data
  - Most recent update 2006

Model Solutions Include:

- Plant locations
- Milk assembly flows
- Product distribution flows
- Spatial milk values

Revisions to Previous Model

Limitations of the previous USDSS:

- Limited product/component disaggregation
  - 5 products, 2 components (Fat, SNF)
- Newer products not represented
  - Dry Whey, WPCs, UF milks, MPC
- Fixed product composition (proportions)
- Least-cost solution
  - No 'policy'; shipment patterns not consistent with incentives for pooling at all points

Changes from Original Model

- Expanded number of final and intermediate (interplant) products
- Nonlinear yield functions based on use of cream and skim fractions and intermediate products
  - Results in endogenous composition
- Modifications to plant locations
  - Reduced fluid plants, added key locations not in previous

Revised Model Final Products

- Fluid
- Yogurt
- Ice Cream
- Cottage Cheese
- NDM
- Butter
- Cheddar Cheese
- Other Cheese
- Dry Whey
- WPC34 & WPC80
- Lactose
- Casein & Caseinates
- 4 MPC products
- Dried buttermilk
- Other ECD

Model "Intermediate" Products

- Cream
- Skim
- NDM
- Ice Cream Mix
- Fluid buttermilk
- Dry buttermilk
- Fluid whey
- Separated whey
- Whey cream
- Dry Whey
- WPC34 & WPC80
- Casein & Caseinates
- 4 MPC Products
- Condensed Skim
- 4 UF Skim Products
  - Permeates

Intermediate means used in the manufacture of another dairy product

Model "Intermediate" Products

Example of IP flow

NDM can be used in:

- Fluid (CA)
- Yogurt
- Cheeses
- Ice Cream Mix

Another Example

Separated Whey uses:

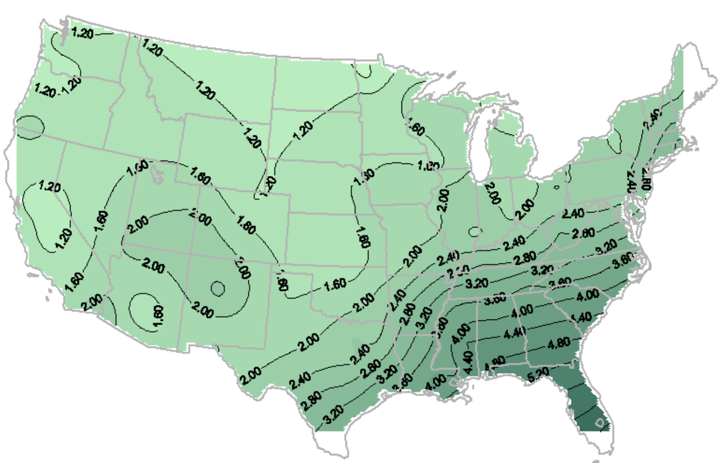
- Dry Whey
- WPC34
- WPC80

Fuel Cost Scenarios

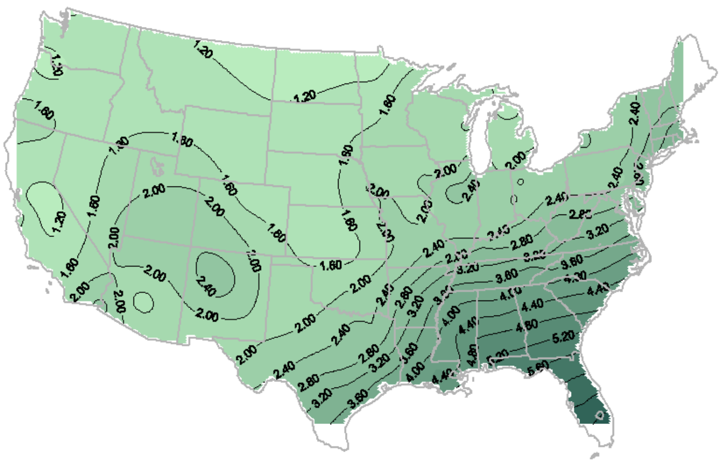
- Changes in Class I price surface with changes in fuel costs
- Three fuel cost scenarios:
  - $2.36/gallon diesel
  - $3.50/gallon diesel
  - $5.00/gallon diesel
- These average US diesel prices were modified to represent regional cost differences at origin points for shipments

Results

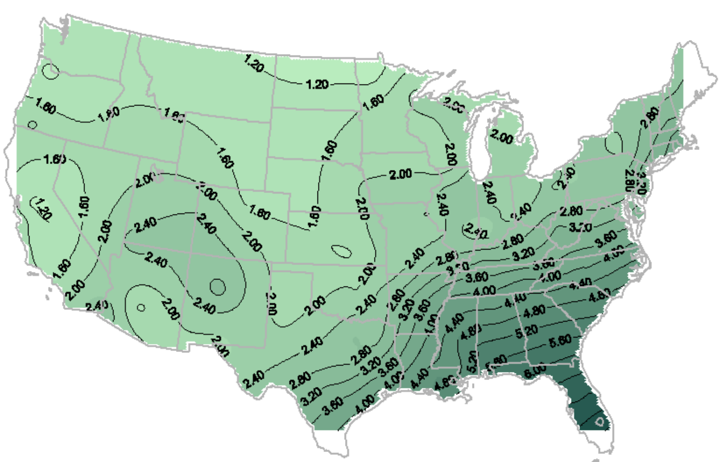
May 2006, $2.36



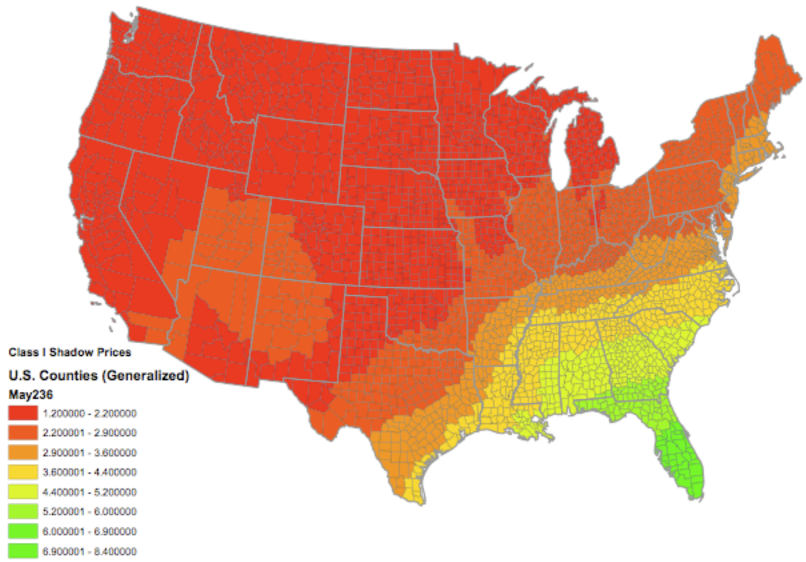
May 2006, $3.50



May 2006, $5.00



MAY 2006, $2.36 Fuel Cost



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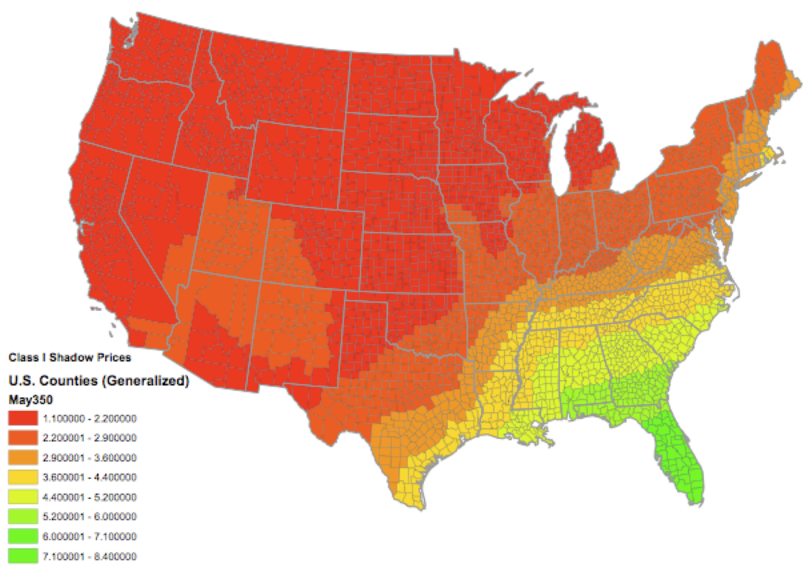
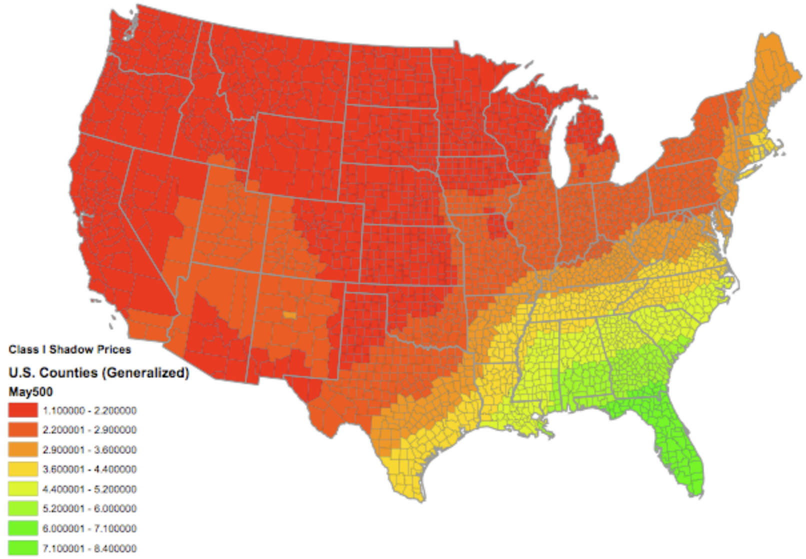
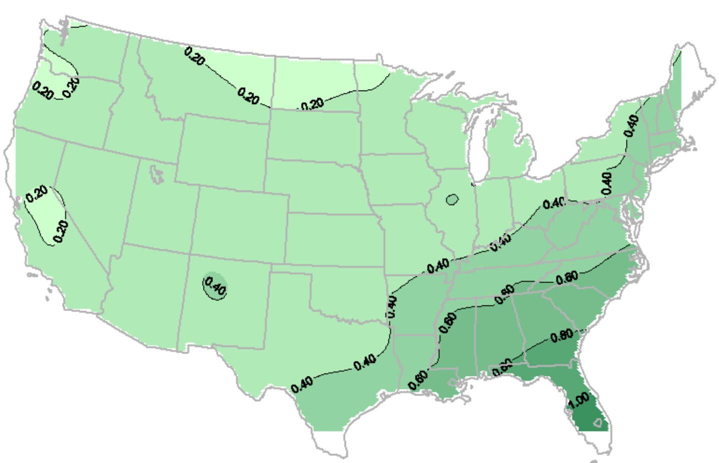


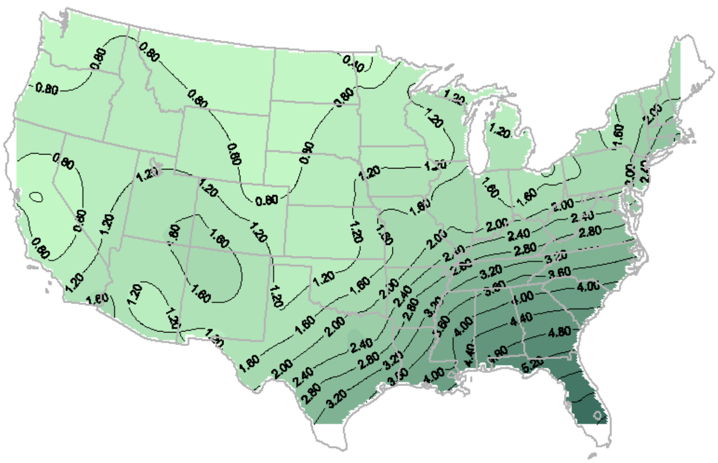
MAY 2006, $5.00 Fuel Cost



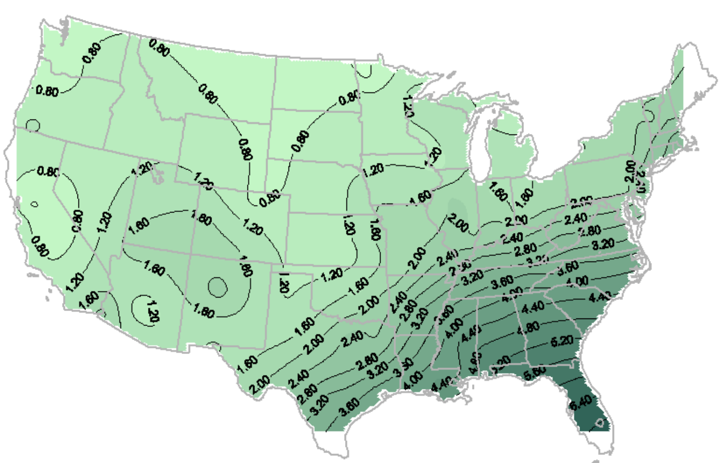
May 2006, $2.36 to $5.00 Difference



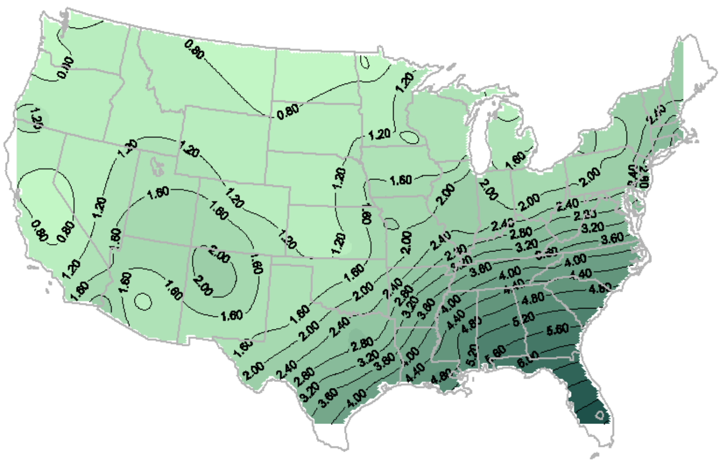
October 2006, $2.36



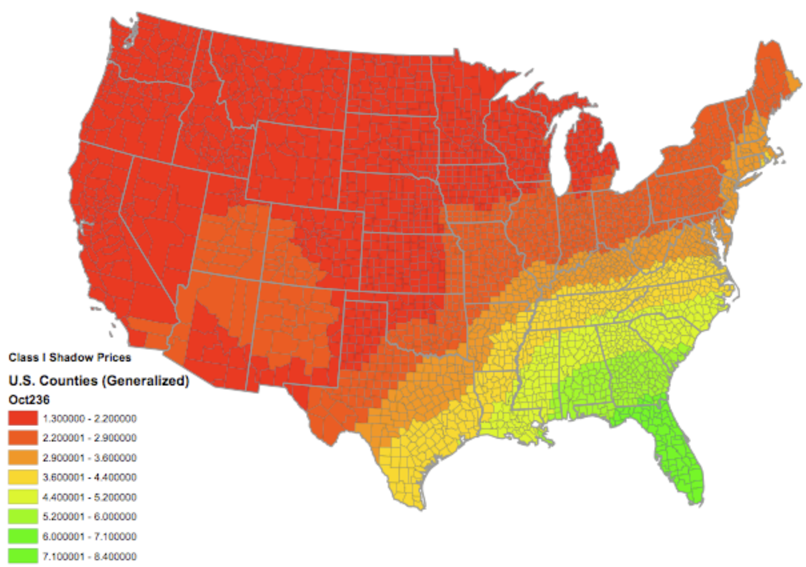
October 2006, $3.50



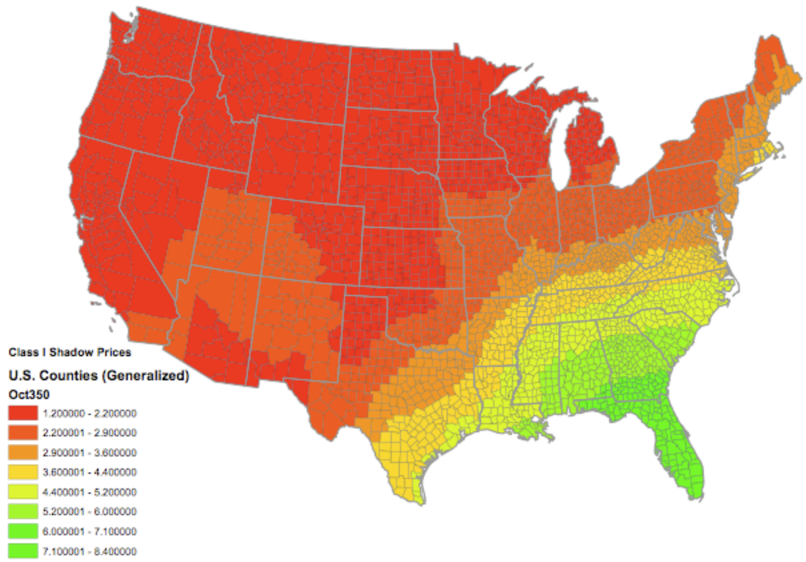
October 2006, $5.00



OCTOBER 2006, $2.36 Fuel Cost



OCTOBER 2006, $3.50 Fuel Cost



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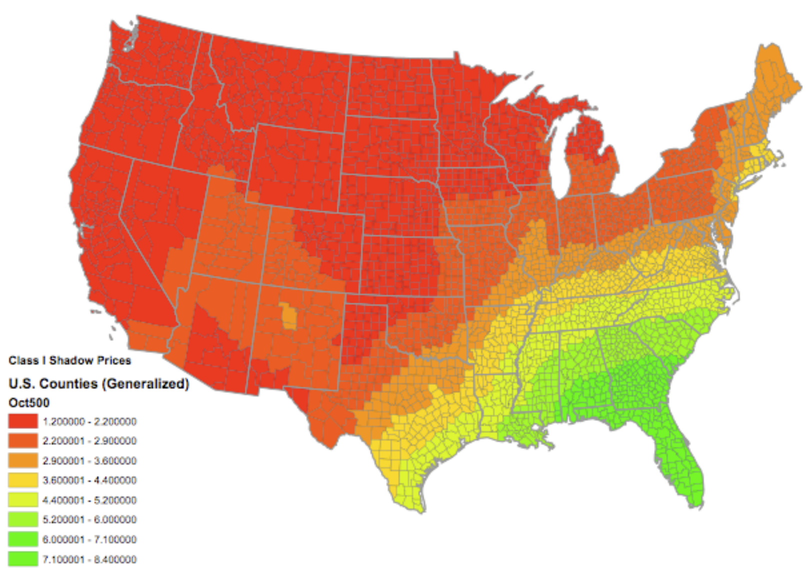
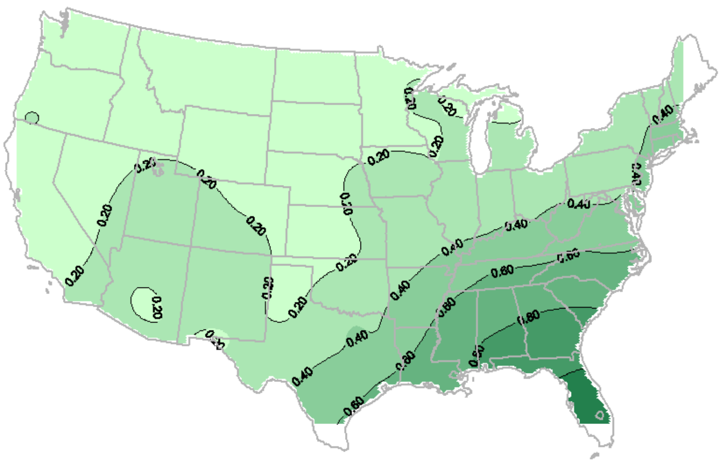


Oct 2006, $2.36 to $5.00 Difference

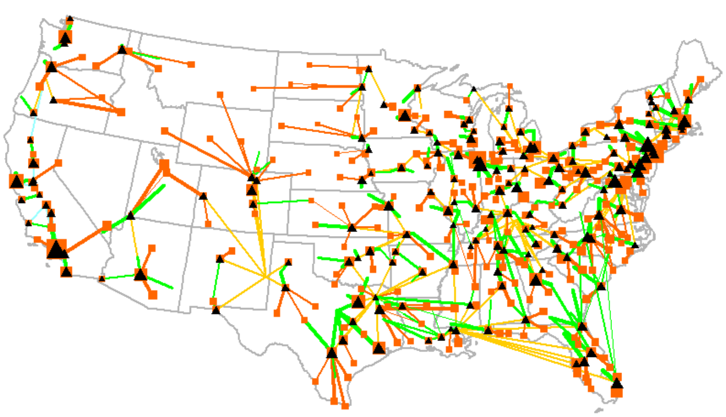


Key Results

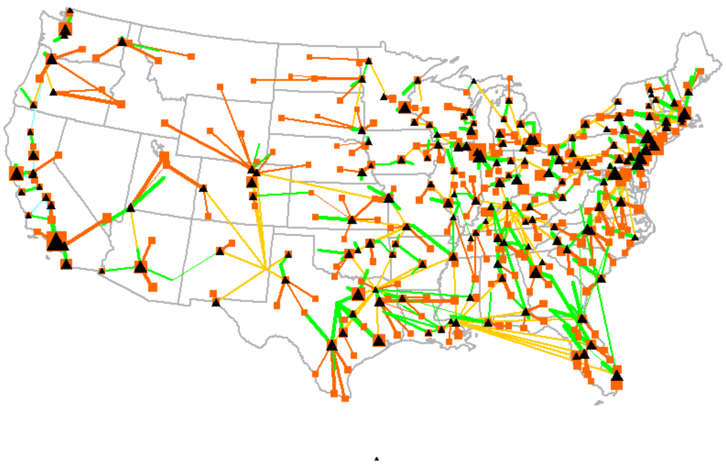
Can Also Examine Flows

- Movements of products
- Fluid plant inflows and outflows
- Cheese plant inflows and outflows

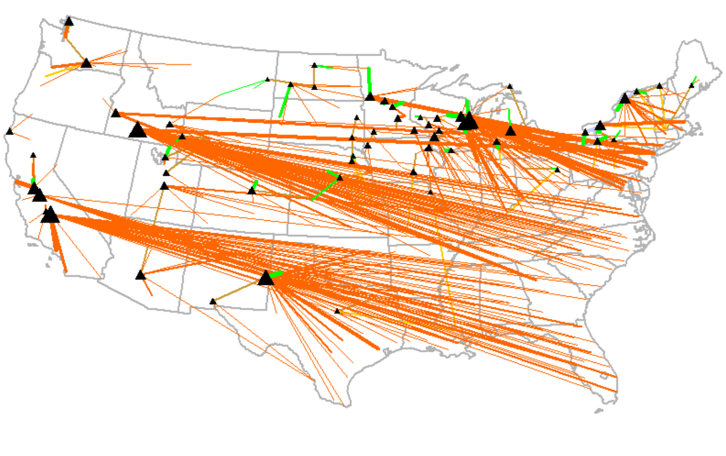
May 2006 $2.36 Flows, Fluid



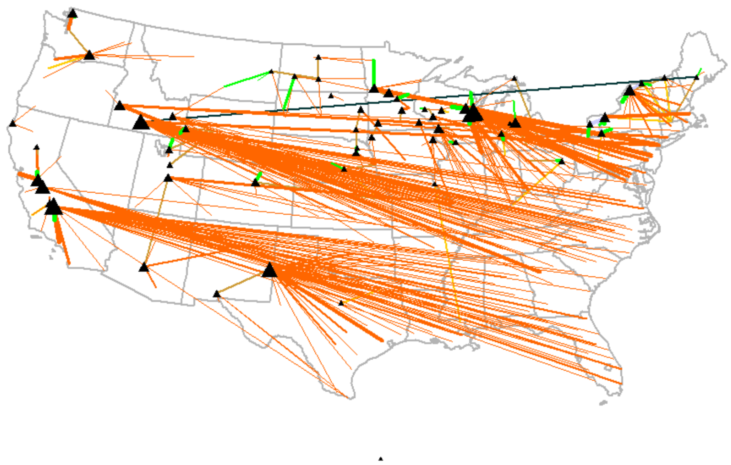
May 2006 $5.00 Flows, Fluid



May 2006 $2.36 Flows, Cheese



May 2006 $5.00 Flows, Cheese



Key Results, Flows

Now, Localization

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The costs of increased localization for a multiple-product food supply chain: Dairy in the United States

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ABSTRACT

There is increased interest in greater localization of food supply chains but little evidence about the effects of localization on supply-chain costs. Assessing these effects is complex in multiple-product, multi-process supply chains such as the dairy industry. In this study, we develop a spatially-disaggregated transshipment model for the US dairy sector that minimizes total supply-chain costs, including assembly, processing, interplant transportation and final product distribution. We employ the cost-minimizing solution as benchmark to compare alternative scenarios of increased supply chain localization. Our results indicate: (1) short-run limits to increased localization, (2) modest impacts on overall supply-chain costs, and (3) large cost re-allocations across supply chain segments, regions and products. We find that increased localization reduces assembly costs while increase processing and distribution costs. Cost increases are larger in regions with smaller raw milk supplies and during the season when less raw milk is produced. Minimizing distances traveled by all dairy products results in tradeoffs across products in terms of cost and distance traveled. The relationship between increased localization and costs appears to be nonlinear.

Food Industry Localization

- Given lots of positive talk
  - Reduction in food miles is often a goal
- Relatively limited analysis of the costs or the benefits
- Usually described on at a “local” scale
  - “Money stays in local communities, helps our farmers”
- (Not really consistent with trade theory)

Objectives

- Examine the costs of reducing "weighted average source distance" for the US dairy industry
  - For all products
  - For fluid milk (highly visible consumer product)
- Examine the limits too WASD reduction with current spatial organization of the industry
- A "systems" approach, not a local one

Methods

- Use the USDSS!
- Scenario 1: Add a constraint on the total WASD for all products
- Scenario 2: Add a constraint on the total WASD for only fluid milk
- Minimize costs given these constraints

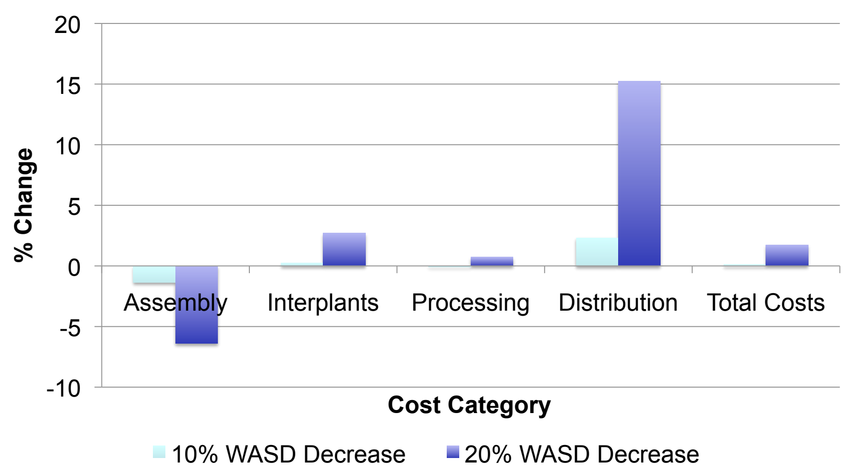
Scenario 1 Results

- Maximum feasible reduction is about 20%
  - 64 miles (from base of 317 miles for all)
- 20% decrease in WASD increases system costs
  - 2% (May) to 4% (October)
- Assembly costs are decreased (up to 14%)
- Distribution costs are increased (up to 24%)
- Redistribution of costs in supply chain

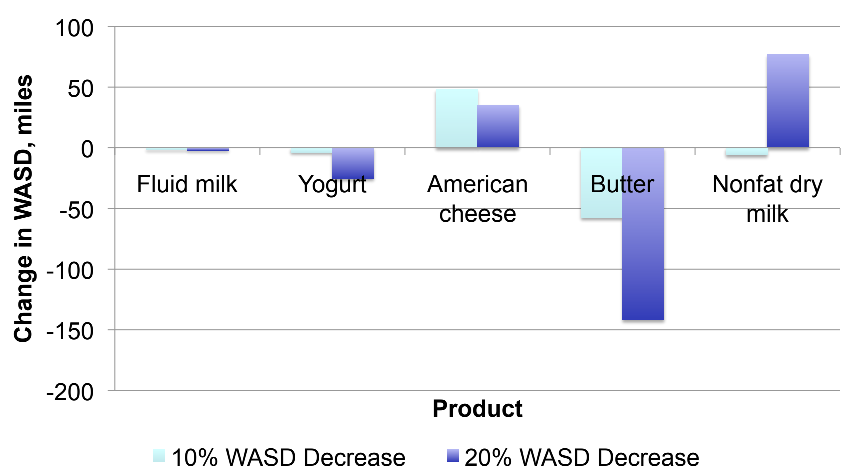
Scenario 1 Results, Continued

- Optimal plant numbers are lower
- Some products decrease WASD
  - Fluid milk butter, yogurt
- Some products increase WASD
  - Cheese, NDM

Costs of WASD Reductions



Product WASD Changes



Scenario 2 Results

- Maximum feasible reduction is 12 miles
  - From 112 to 100 miles (11%)
- This reduction would increase system costs by 12%
  - Lower assembly but higher processing and distribution costs
- Average US gallon cost increase $1.66
- Would increase total WASD by 30%
  - 98 miles, to 415 miles from 317

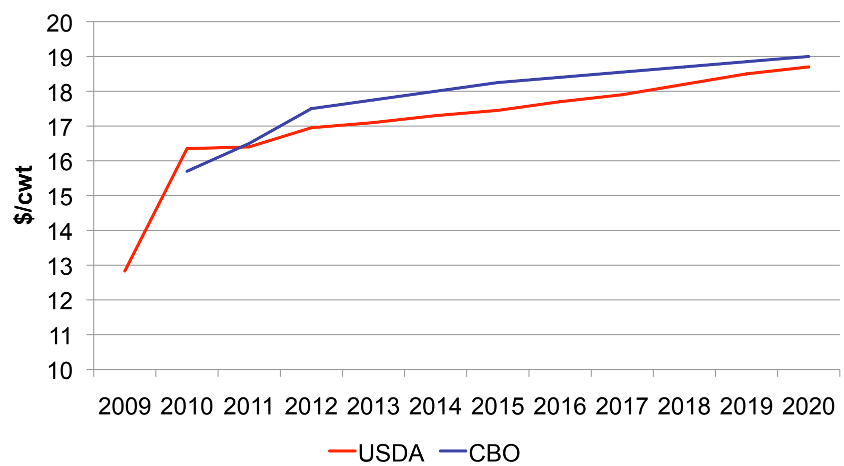
Summary

- Reducing WASD in dairy has limits with current spatial organization
- Total cost increases not large, but re-distribute costs in supply chain
- Overall WASD reductions do not reduce for all individual products
- Costs for reducing fluid milk WASD are higher

Finally, Price Projections

- Cal Poly Ag Policy Student:
- "Price volatility won't be a problem in the future. Just look at the USDA and CBO price forecasts."

US All-Milk Price Projections



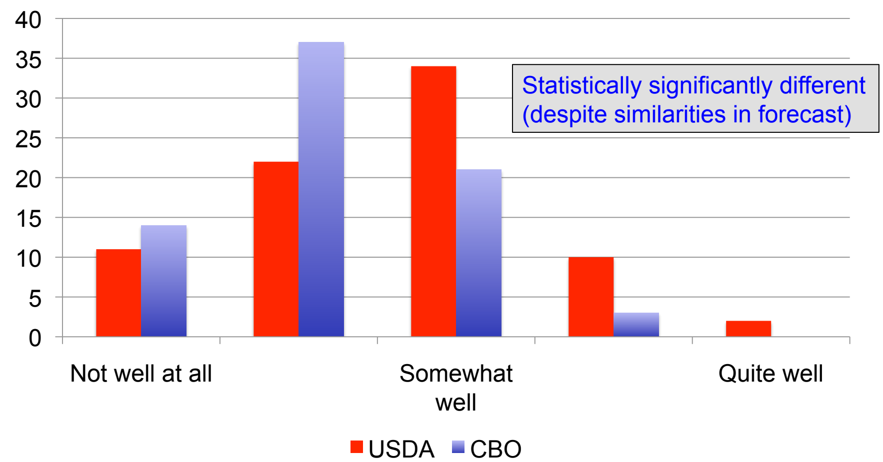
Finally, Price Projections

- Cal Poly Ag Policy Student:
- "Price volatility won't be a problem in the future. Just look at the USDA and CBO price forecasts."
- Cal Poly Ag Policy Professor:
- "Don't believe everything you read without understanding where it comes from and what it is used for."

Projections: Trusted? Used?

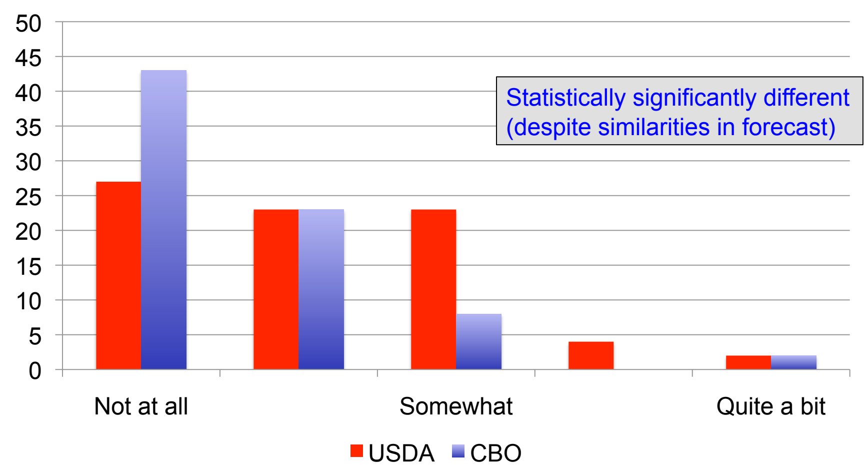
- 4-question survey
- Sent to workshop mailing list
- N = 79 responses (Thank you!)

How Well Predict Future Price Patterns?



Aggregated percentage > "Somewhat well" is < 10%

How Much Use for Decision Making?



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