

USDA, Economic Research Service Annual U.S. Dairy Sector Econometric Model: Focusing on Milk Supply Response

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The findings and conclusions in this presentation are those of the author and should not be construed to represent any official USDA or U.S. Government determination or policy.

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Documentation for the USDA, Economic Research Service Annual U.S. Dairy Sector Econometric Model

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Basics about the model and baseline

ERS Annual U.S. Dairy Sector Econometric Model:

- Dynamic simultaneous equation model projecting supply, demand, and prices.
- Supports 10-year dairy projections published in *USDA Agricultural Projections* (baseline) each year.
- Used for scenario analyses concerning changing market conditions and Federal policies.

Dairy projections for the USDA baseline:

- Determined each year through consensus of the USDA Dairy Interagency Commodity Estimates Committee (Dairy ICEC).
- Dairy ICEC includes representatives from: Economic Research Service; Agricultural Marketing Service; Foreign Agricultural Service; the Farm Production and Conservation Business Center; and a chairperson from USDA World Agricultural Outlook Board.
- Model results for the baseline can be calibrated to conform Dairy ICEC judgment.



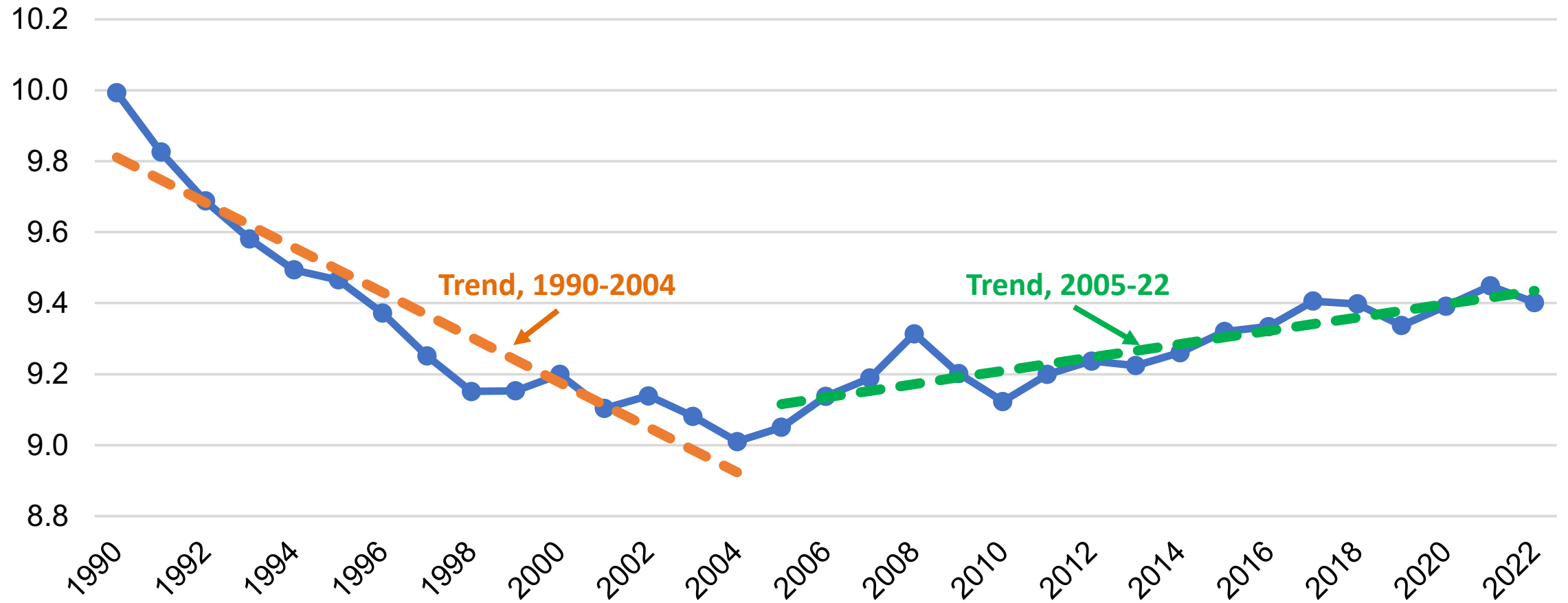


This presentation is focused on milk supply response as represented by the model.



Milk cows

Million head

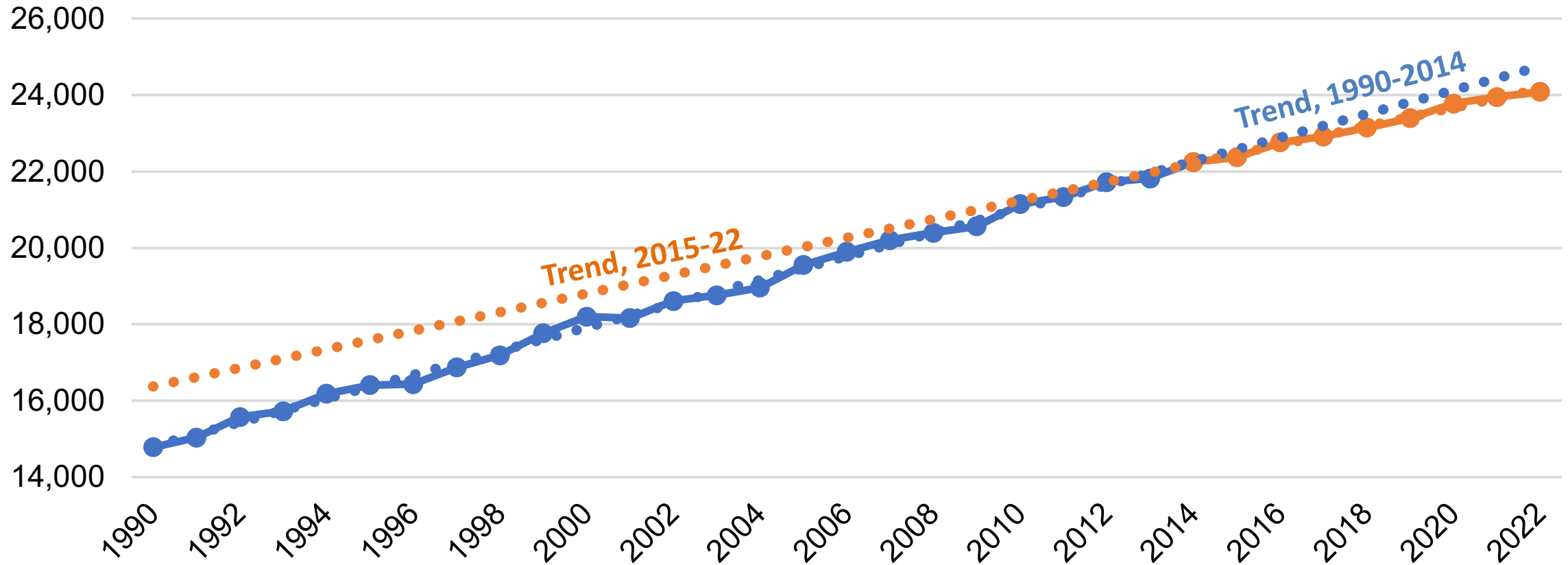


Source: USDA, National Agricultural Statistics Service.



Milk per cow

Pounds per year



Source: USDA, National Agricultural Statistics Service.



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Milk supply regressions table from documentation

Milk supply equations (using annual data from 1990 to 2020)

Dependent variable	Parameter ^{1 2}	Estimate	t Value	Pr > t	Elasti- cities ³	R- Square	Godfrey test 1st order (P-value)
Year-over-year change in average number of milk cows	Intercept	-363.800	-4.93	<.0001		0.6981	0.3003
	lag (All milk price / feed value)	121.056	5.23	<.0001	0.031		
	Cull cow price proxy / all milk price	-15.263	-1.04	0.3087	-0.013		
	Dummy for years after 2004	121.963	5.13	<.0001			
	Dummy for years after 2010	79.544	2.74	0.011			
Average milk per cow	Intercept	14,091.050	81.61	<.0001		0.998	0.8915
	lag (All milk price / feed value)	133.218	2.55	0.0171	0.016		
	Trend [year - 1989]	315.654	78.61	<.0001			
	Dummy for years after 2014 × trend	-11.316	-4.37	0.0002			

Notes for table on next slide.



Notes for milk supply regressions table

1. For years when the Milk Income Loss Contract (MILC) program was in operation, adjustments were made to the all-milk price to account for payments received by dairy operations that produced less than the annual production cap.
2. The cull cow price proxy currently used is the live equivalent of 90-percent lean cutter cows, 500 pounds and up, as reported in the *Livestock, Dairy, and Poultry Outlook* report published by USDA, Economic Research Service.
3. Point elasticities at the means of the variables are displayed. Although the dependent variable in the first equation is the year-over-year change in milk cows, the elasticities displayed reflect the percentage changes in milk cows relative to the explanatory variables.

Source: USDA, Economic Research Service analysis using data from USDA, National Agricultural Statistics Service; USDA, Agricultural Marketing Service; and USDA, Farm Service Agency.



Scenario analysis example

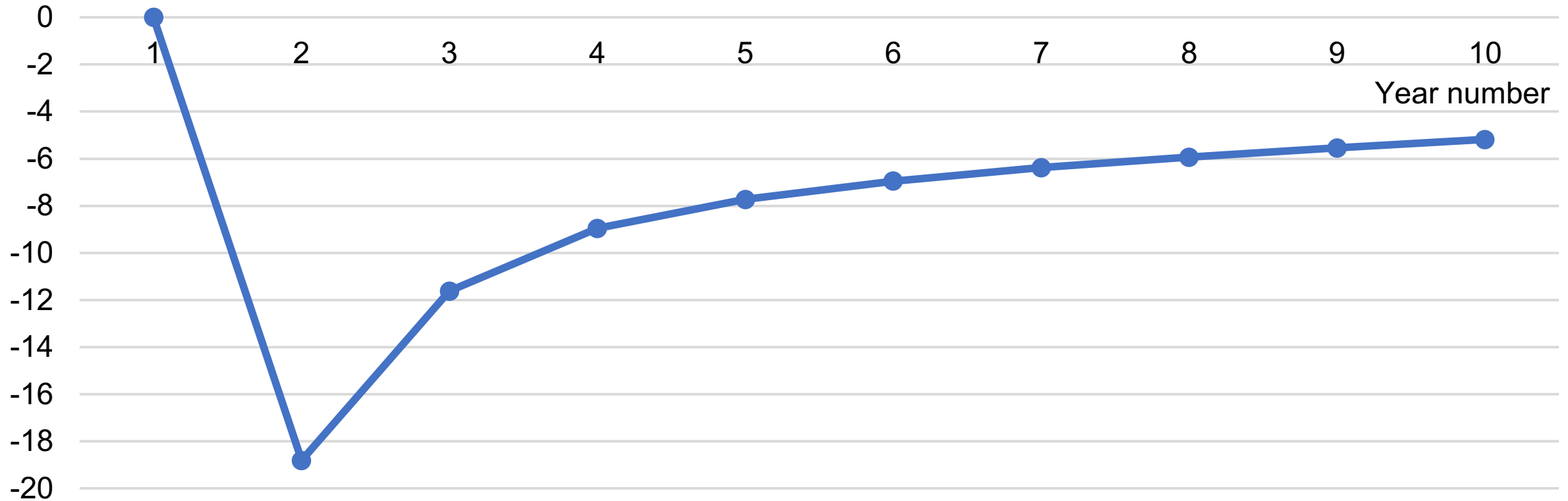
**10% increase in feed value
(\$1.05 per cwt of feed) in the
first year of the scenario (year 1)**

Used USDA Baseline as reported in *USDA Agricultural Projections to 2031* report, released February 2021.



Number of milk cows, changes from baseline

Thousand head

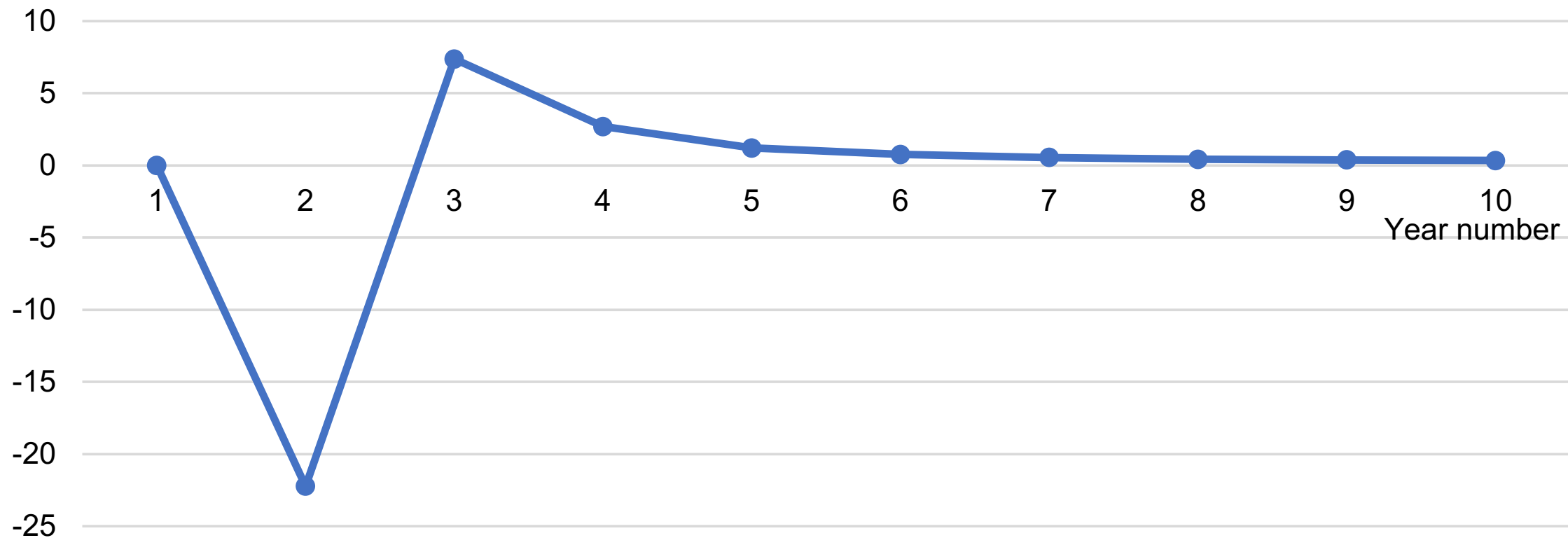


Source: USDA, Economic Research Service.



Milk per cow, changes from baseline

Pounds per head

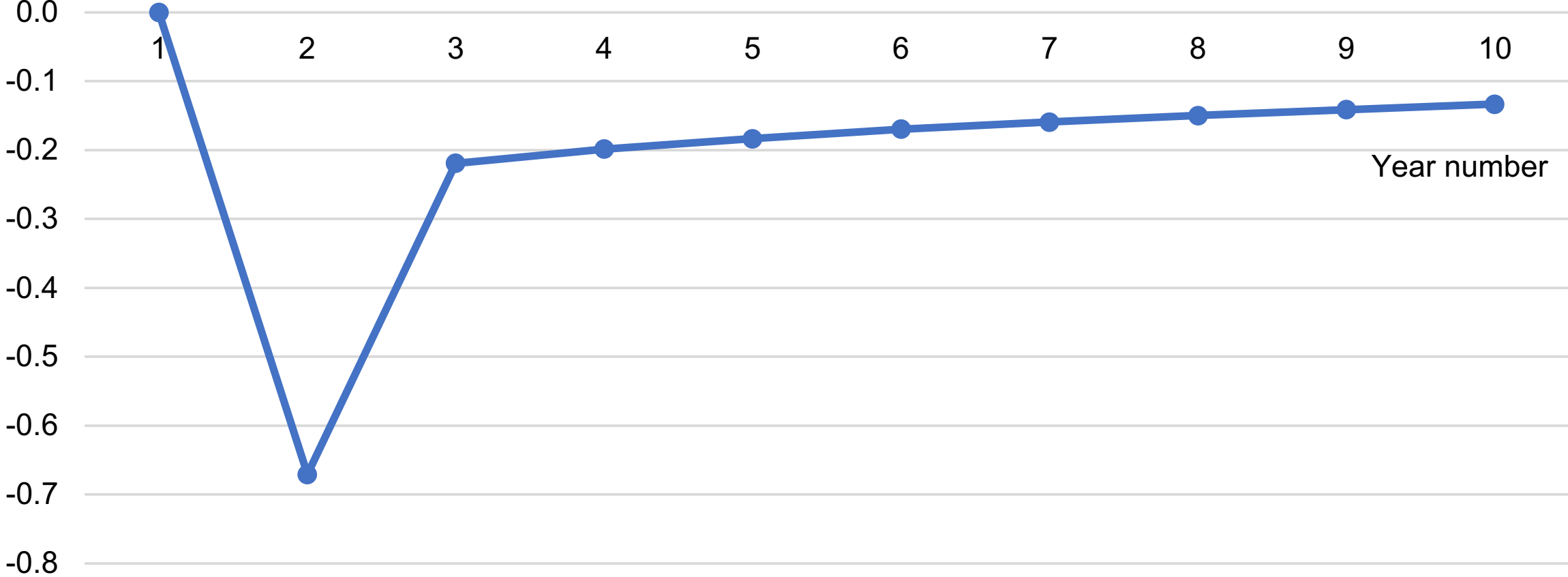


Source: USDA, Economic Research Service.



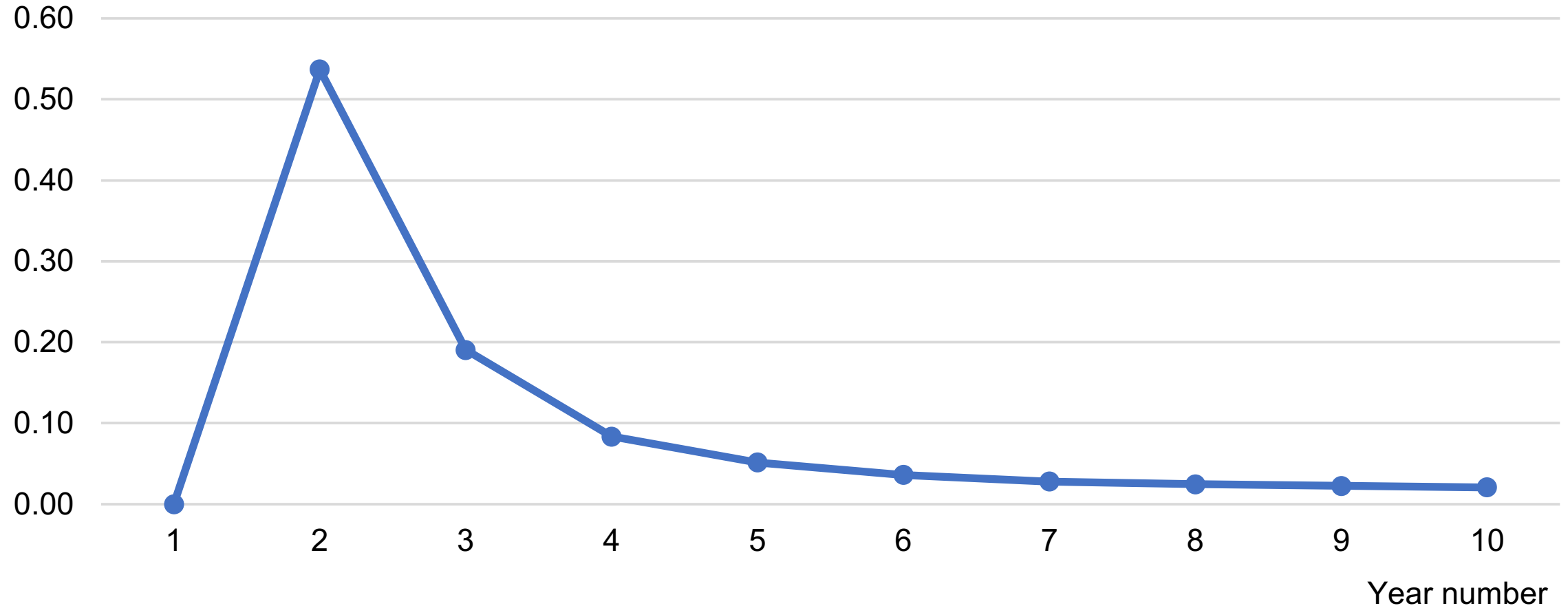
Milk production, changes from baseline

Billion pounds



All-milk price, changes from baseline

Dollars per hundredweight



Source: USDA, Economic Research Service.





Limitations of the model with respect to supply response



No milk-supply response to some Government programs in model projections

Dairy Margin Coverage:

- Payments are partly decoupled because they are based on historical production.
 - Depend on market conditions.
 - Do not depend on current production level of individual farmers.
- Response not like a price change impact; there are no direct changes to marginal revenue.
- Impacts due to wealth effects and risk reduction are difficult to quantify.
- Many changes over the years make the program difficult to analyze.

Dairy Revenue Protection (Dairy-RP):

- Covered milk production chosen by dairy farmer may be related to current production levels, but not necessarily. It is indexed to the State or region where the dairy producer is located.
- Milk supply response is complex because it is likely related to both indemnities received and risk reduction.



Other supply-response considerations

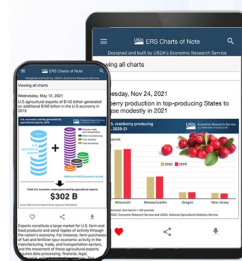
- The model does not account for programs initiated by dairy cooperatives and milk handlers in recent years to manage milk supplies.
- Equation parameters are based on data from 1990 to 2020.
 - The model must have enough observations (years) to be considered statistically valid.
 - However, the larger dairy farms of recent years may be more resilient than farms of the past, so supply response may be changing—becoming even more inelastic.
- The model uses national aggregate variables. It does not account for differences in regional responses.



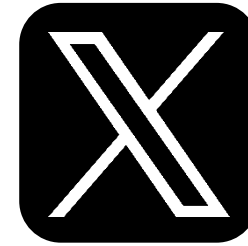
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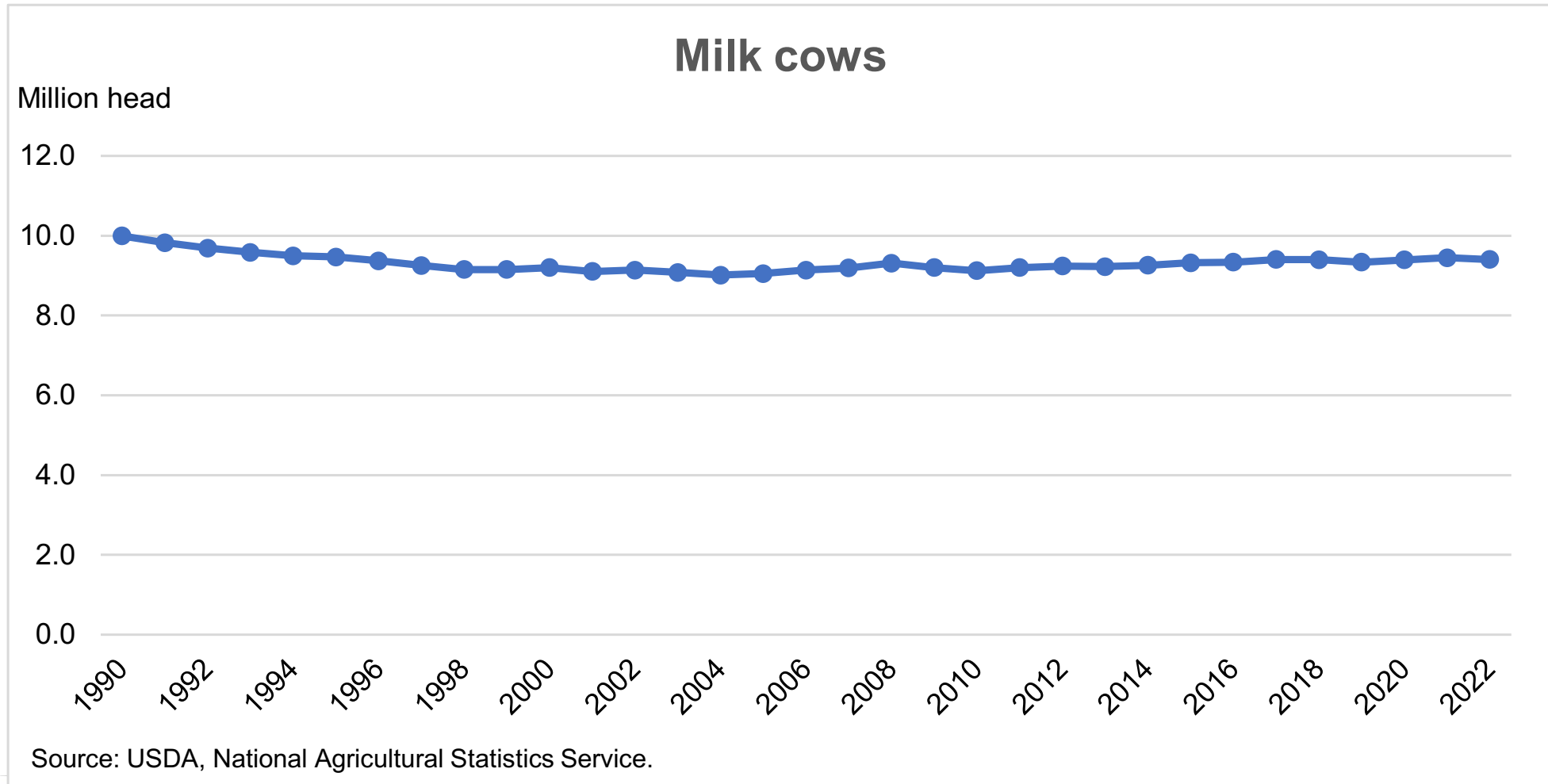
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Appendix slides



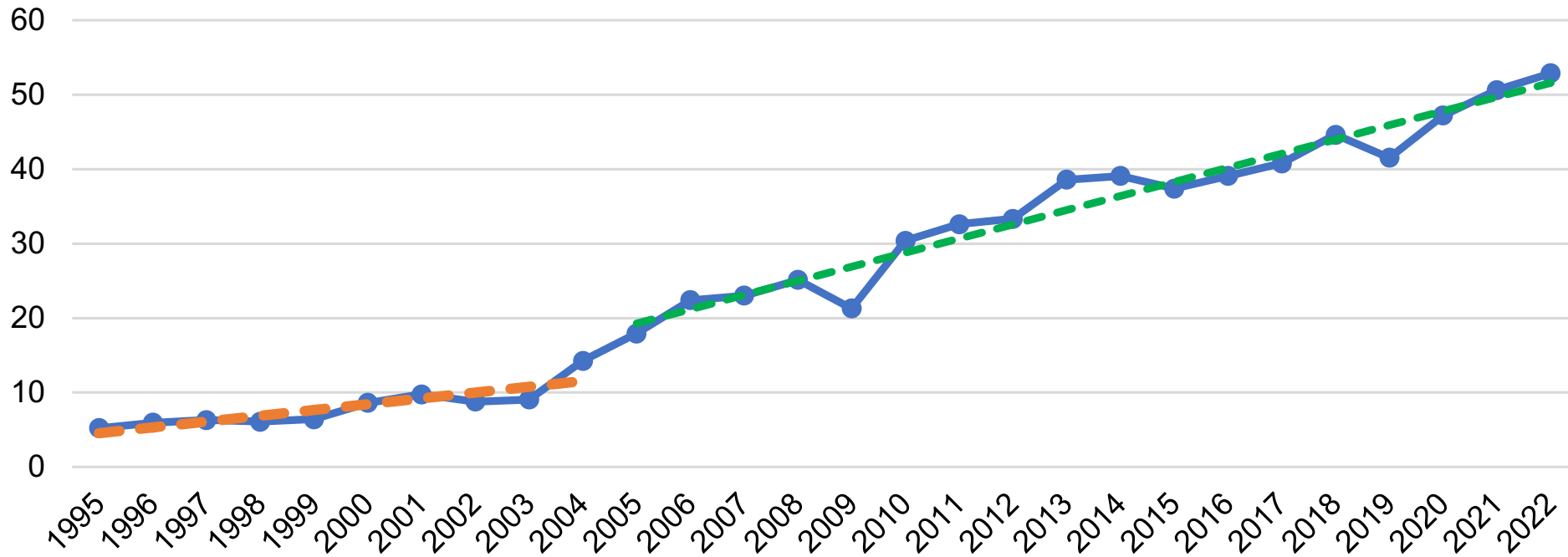
On this scale, changes in milk cow numbers look relatively flat in recent years.



Exports may explain changing trends of milk cow numbers to some extent.

Commercial exports, skim-solids milk-equivalent basis

Billion pounds



Source: U.S. Department of Commerce, Bureau of the Census; USDA, Economic Research Service calculations. Many sources were used for conversion factors. For more information, see ERS Dairy Data Documentation.



Milk-fat tests may explain changes in milk per cow to some extent.

