

Forecasting: Use Of Corn

**Price Analysis: A Fundamental
Approach to the Study of Commodity
Prices**

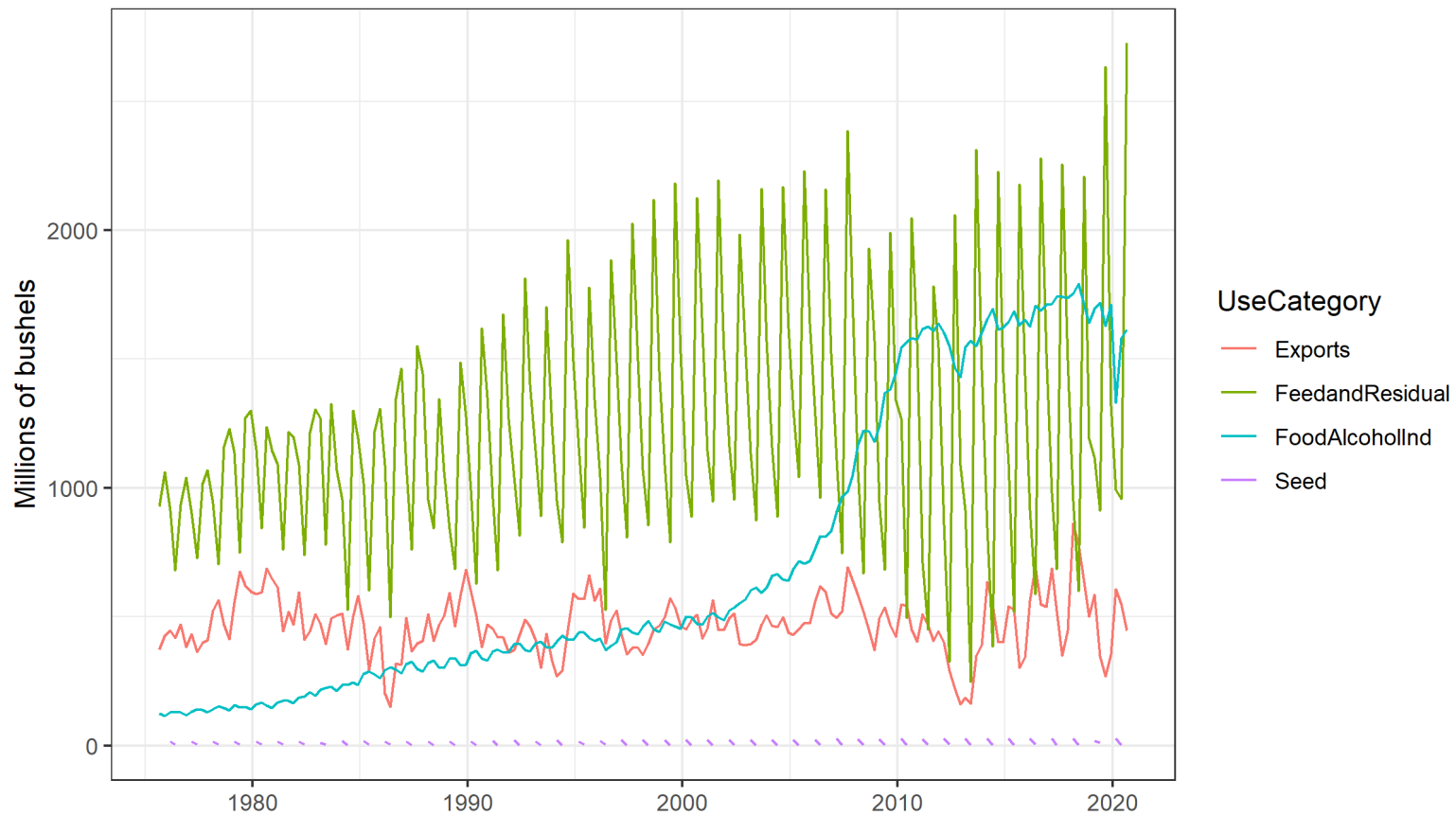
Highlights

- In the WASDE balance sheet for corn there are three use categories.
- Two account for domestic consumption:
 - Food
 - Seed and Industrial
 - Feed and Residual
- Exports make up the third category:
 - Ethanol makes up a large portion of the Food, Seed, and Industrial category, so it is given its own line in the balance sheet.

Highlights (CONT...)

- Historical use patterns are the first place to starting using the forecast categories for the marketing year.
- Looking at quarterly gives you a sense of using distribution across the marketing year in different categories.
- The annual histories, however, are probably the most useful.

Corn Quarterly Use Categories Since 1975



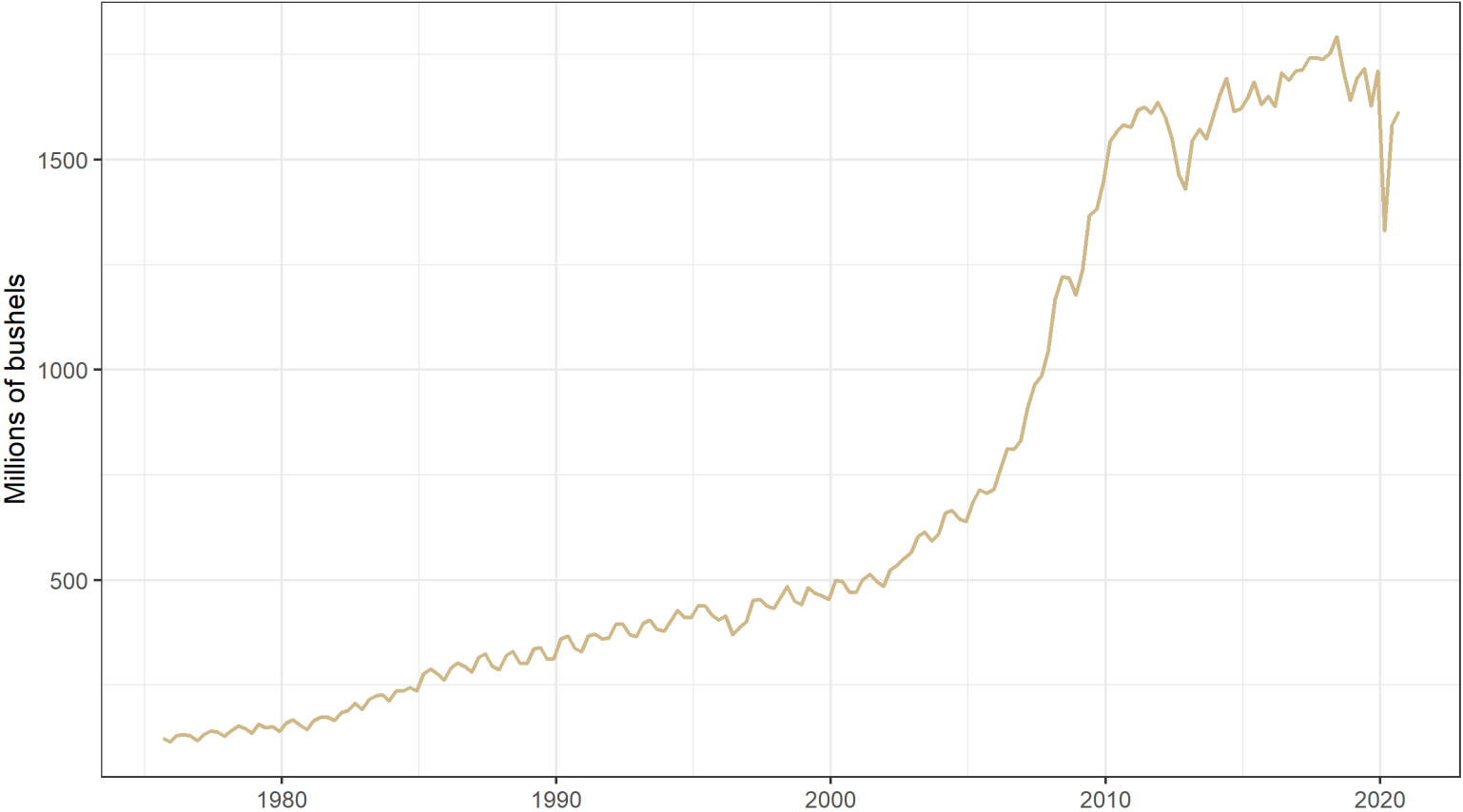
Food, Alcohol, and Industrial Use

- The data was queried from the **Feed Grains database** maintained by the USDA ERS.
- In Figure 1: the **Food, Alcohol, and Industrial** use category.

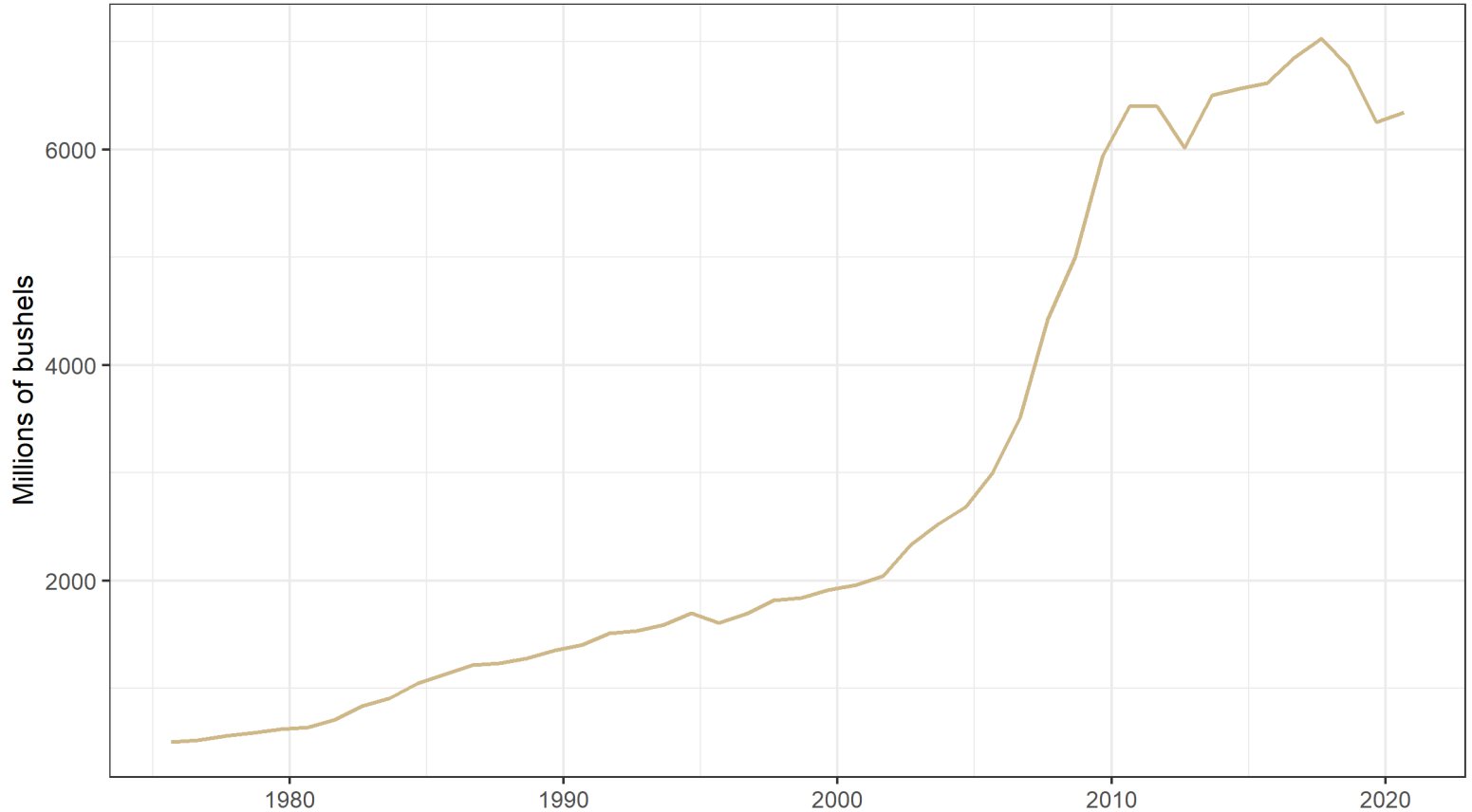
Food, Alcohol, and Industrial Use (CONT...)

- This omits seed from the **Food, Seed, and Industrial** category in the WASDE balance sheet.
- The Feed Grains database actually breaks out the seed.
- Use its own column, but corn used for seed is a very small proportion of production and it is largely predictable from year to year.

Corn Quarterly Food Alcohol and Industrial Use Since 1975



Marketing Year Food Alcohol and Industrial Use Since 1975

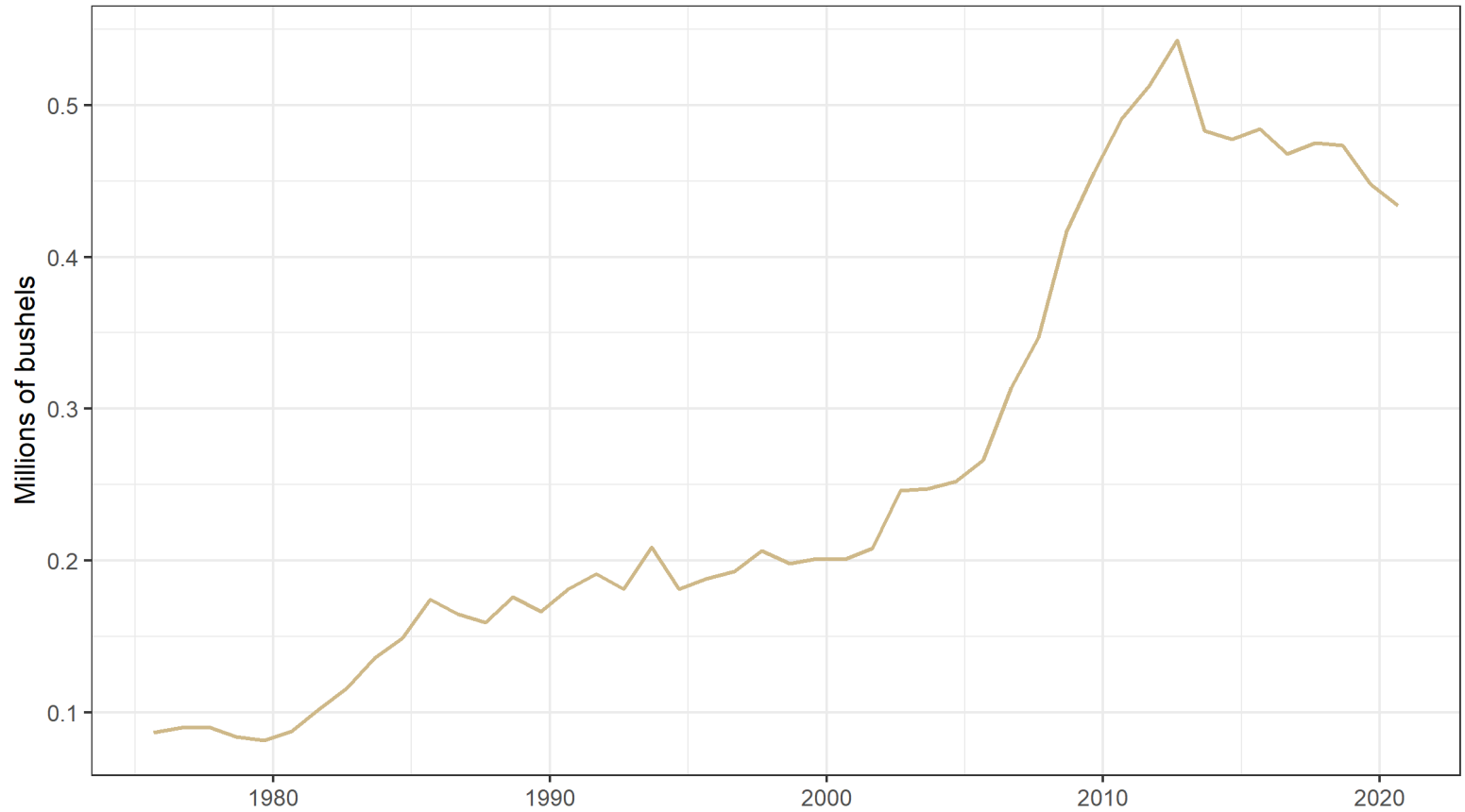


Food, Alcohol, and Industrial Use (CONT...)

Food, Alcohol, and Industrial Use (CONT...)

- From Figure 3, it is easier to see the shares of the crop.
 - The large increase in corn use in the Food, Alcohol, and Industrial use category.
 - In Figure 3 this category is presented as a percentage of that marketing year's production.
 - In the early 1990's, this category accounted for over 50% since 2010.
 - The drop in percentage of production in 2015 occurs because of the large crop in 2015.
 - The use level is flat.

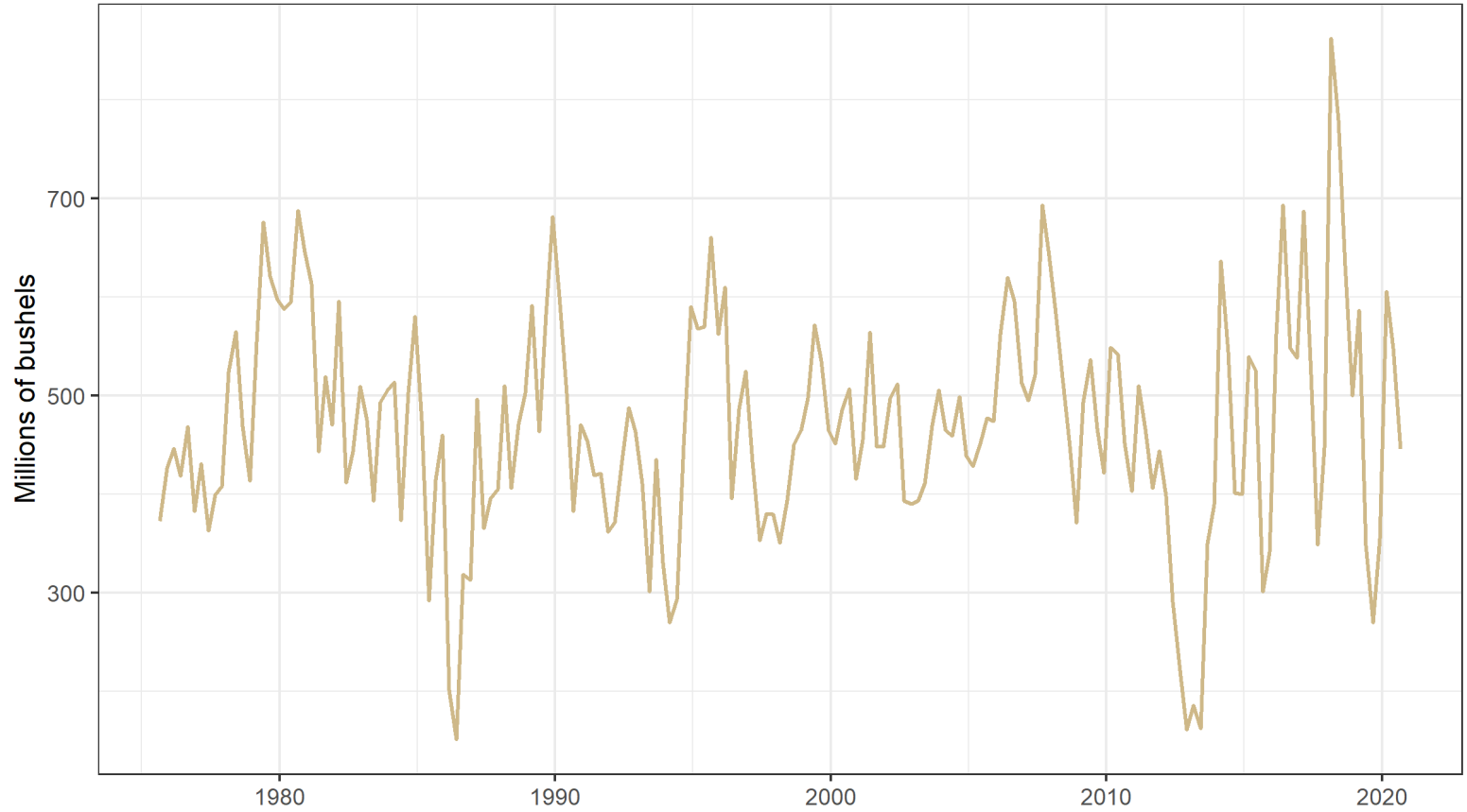
Corn Marketing Year Food, Alcohol, & Industrial as Proportion of Total Use



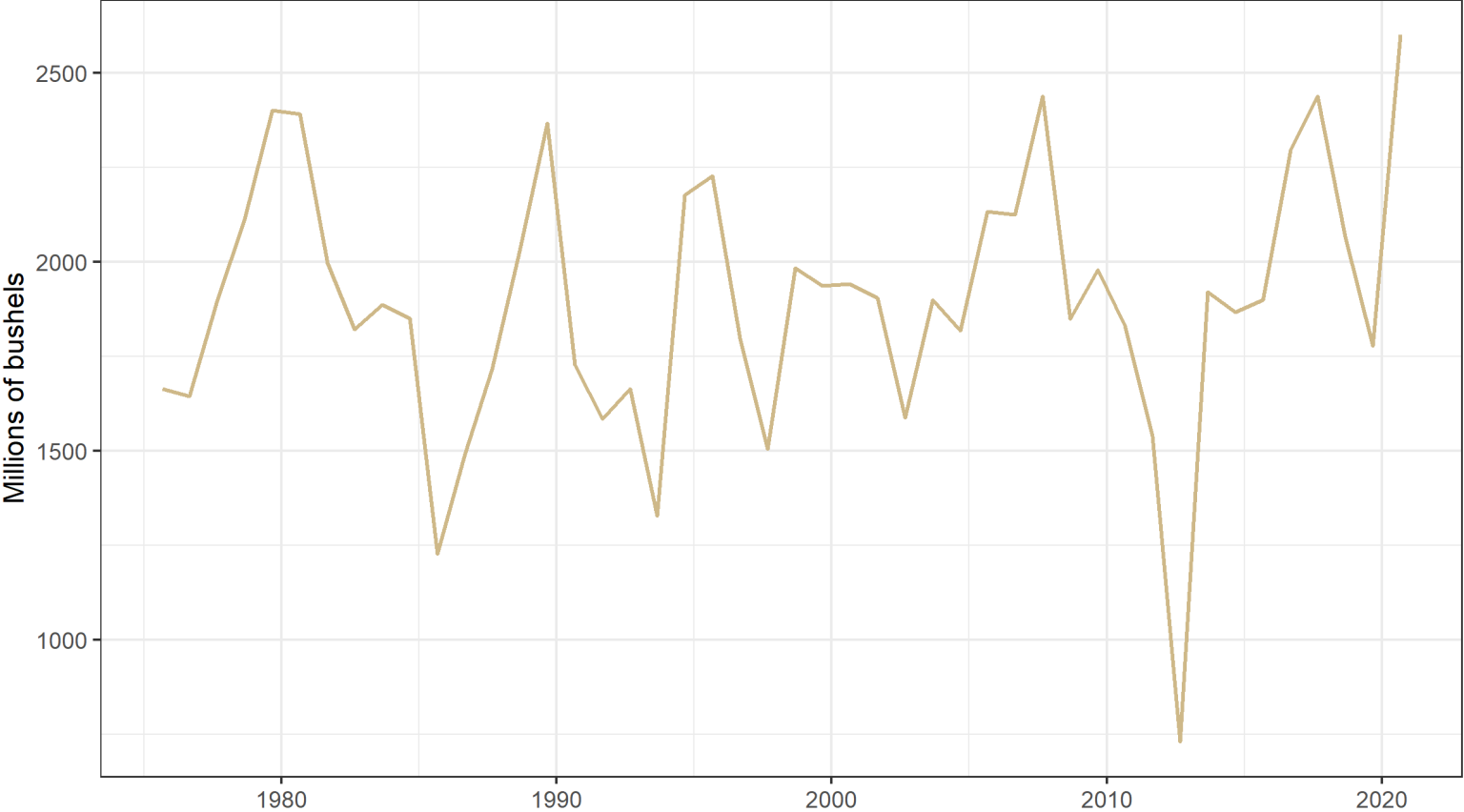
Exports

- Quarterly corn exports are displayed in Figure 4.
 - Unlike Food, alcohol and industrial use, exports tend to have a very seasonal or cyclical pattern.
 - Exports are large in the second quarter of the marketing year, december to February, right after we harvest the new crop.
 - The stocks are most plentiful and prices are at season lows in years exhibiting an upward sloped forward curve.

Corn Quarterly Exports Since 1975



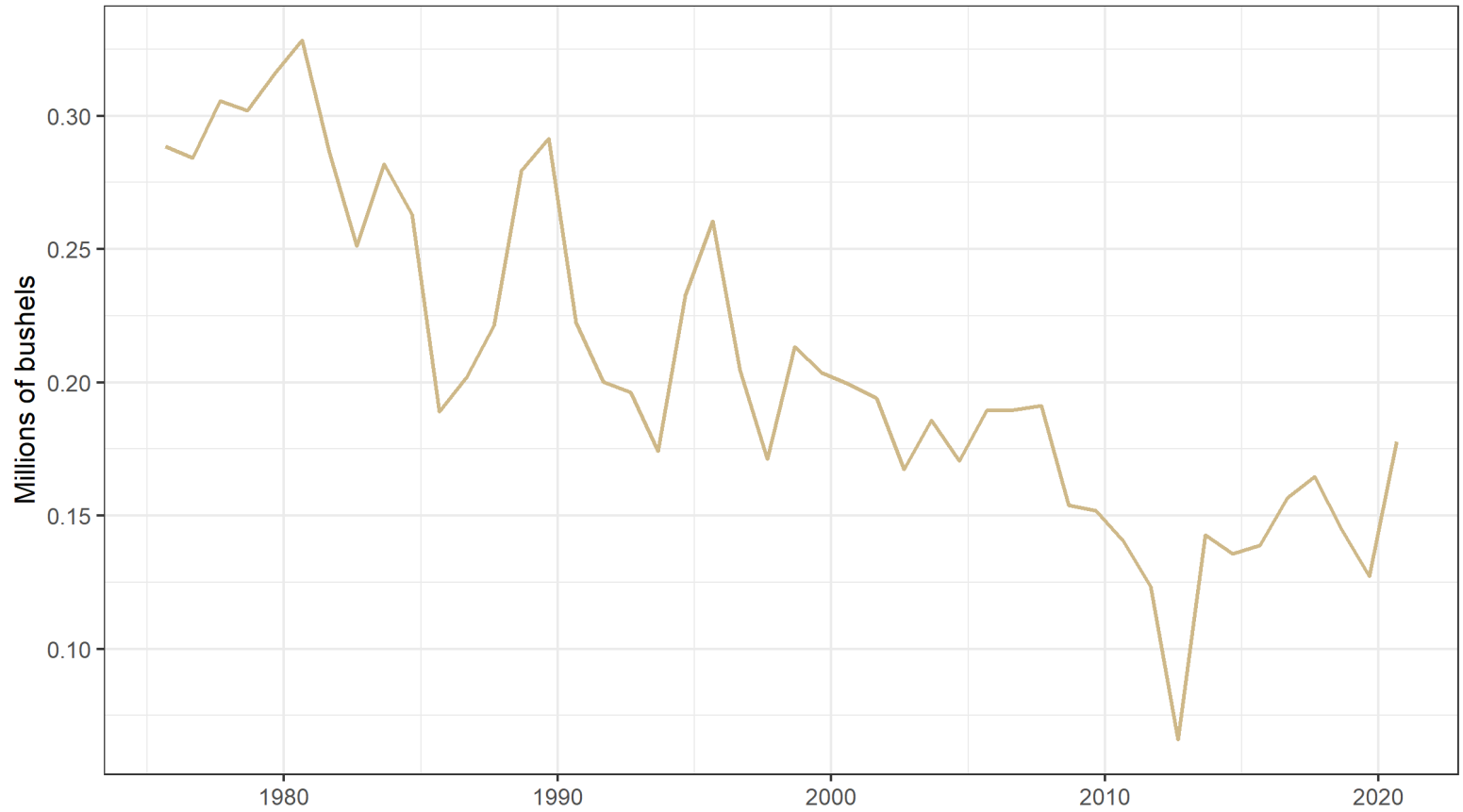
Marketing Year Corn Exports Since 1975



Exports (CONT...)

- Displaying the same data in Figure 5, but aggregating to an annual frequency, we see the marketing seasonality smoothed away.
- On average, it appears that exports follow a constant trend-line with variation around the mean produced by years of surplus or scarcity.
- The drought year of 2012, is clearly visible as an exceedingly low export year.
- In Figure 6, we display annual corn exports as a percentage of corn production.

Corn Marketing Year Exports as Proportion of Total Use



Exports (CONT...)

- When exports are viewed as a proportion of production, we see a pronounced downward trend.
- This is due to the increasing share of production allocated to the Food, seed, and Industrial category visible in Figure 3.
- Recall the category is comprised mainly of corn as feed-stock for ethanol production.
- The year-to-year variation is caused by price fluctuations with low prices encouraging and higher prices discouraging consumption.

Exports (CONT...)

- Table 1 shows the top 12 importers of U.S. corn for the 2016/2017 marketing year.
- Export totals are given in 1,000 metric ton units.
- Clearly Japan and Mexico are the dominant Importers of U.S. corn, with South Korea being a distant third.
- The Table shows that most countries rank has remained fairly stable across the marketing years.

: Table 1: Top 12 Importers of U.S. Corn 2012/2013 through 2016/2017 Marketing Years, Ranked in Descending Order for Marketing Year 2015/2016 (1,000 Metric Tons)

COUNTRY	EXPORTS 2016/2017	RANK	EXPORTS 2015/2016	RANK	EXPORTS 2014/2015	RANK	EXPORTS 2013/2014	RANK
MEXICO	13539.7	1	12558.6	1	10793.8	2	10526.3	2
JAPAN	11983.4	2	10506.6	2	11858.6	1	11487.0	1
KOR REP	5588.5	3	3021.6	4	3927.2	4	4844.2	3
COLOMB	4438.9	4	4629.5	3	4413.3	3	3359.4	4
PERU	3166.7	5	2490.9	5	2421.0	5	1414.5	8
TAIWAN	2773.2	6	2045.2	6	1755.0	6	1936.4	7
S ARAB	2240.4	7	1516.4	7	1312.7	8	1021.0	9
GUATMAL	1008.9	8	897.1	10	936.7	9	783.9	11
MOROCCO	905.3	9	438.4	15	310.9	18	201.2	22
C RICA	840.2	10	520.1	13	784.1	11	593.6	13
DOM REP	814.9	11	252.1	22	599.3	13	637.6	12
CHINA	717.9	12	184.8	24	473.5	15	2759.4	5

Feed and Residual

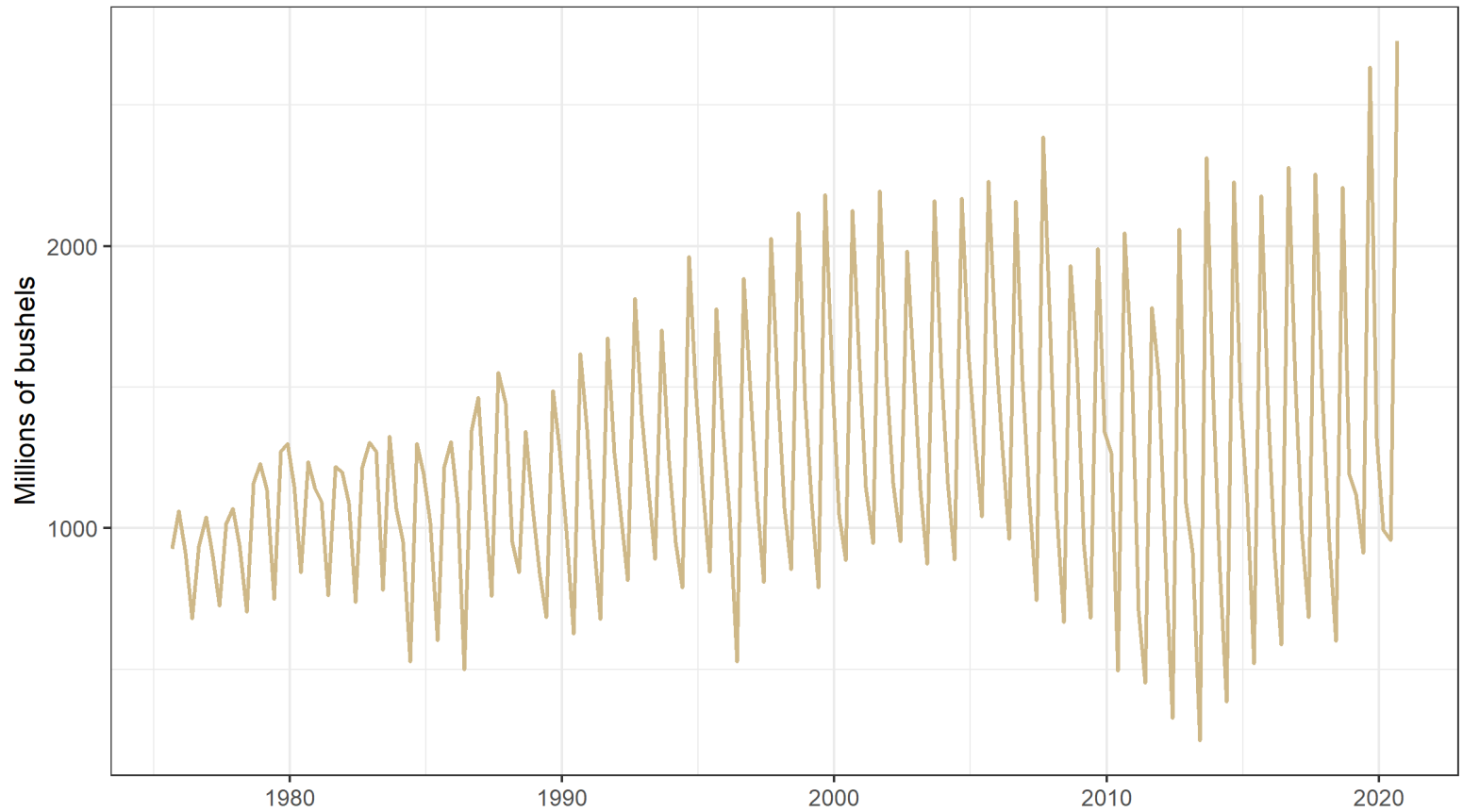
- The final use category is the most difficult to forecast because its quantity is derived, not estimated.
- The USDA makes estimates of every other row in the balance sheet.
- To ensure the numbers add up, they infer the Feed and Residual category by subtracting the other demand categories from supply.

$$\textit{Feed\&Residual} = \textit{Production} + \textit{Imports} + \textit{BeginningStocks} - \textit{EndingStocks} \\ - \textit{FoodSeed\&Industrial} - \textit{Exports}$$

Feed and Residual (CONT...)

- Each category on the right hand side is itself estimated with some error.
- The error for the Feed and Residual category is the sum of the errors of the other categories.
- The forecast errors from each of the categories get added together, creating a category with larger forecast error than all the others.
- For this reason, the Feed and Residual category is the most difficult to forecast.
- It should correlate roughly to livestock feeding units, but does not prove to be that effective in practice.

Corn Quarterly Feed and Residual Use Since 1975



Feed and Residual (CONT...)

$$\begin{aligned} \text{Feed\&Residual} = & (\text{Production} + \epsilon_{\text{prod}}) + (\text{Imports} + \epsilon_{\text{import}}) \\ & + (\text{BeginningStocks} + \epsilon_{\text{BStocks}}) \\ & - (\text{EndingStocks} + \epsilon_{\text{EStocks}}) \\ & - (\text{FoodSeed\&Industrial} + \epsilon_{\text{Food}}) - (\text{Exports} + \epsilon_{\text{Export}}) \end{aligned}$$

- Figure 7 below displays the Feed and Residual category since 1990.

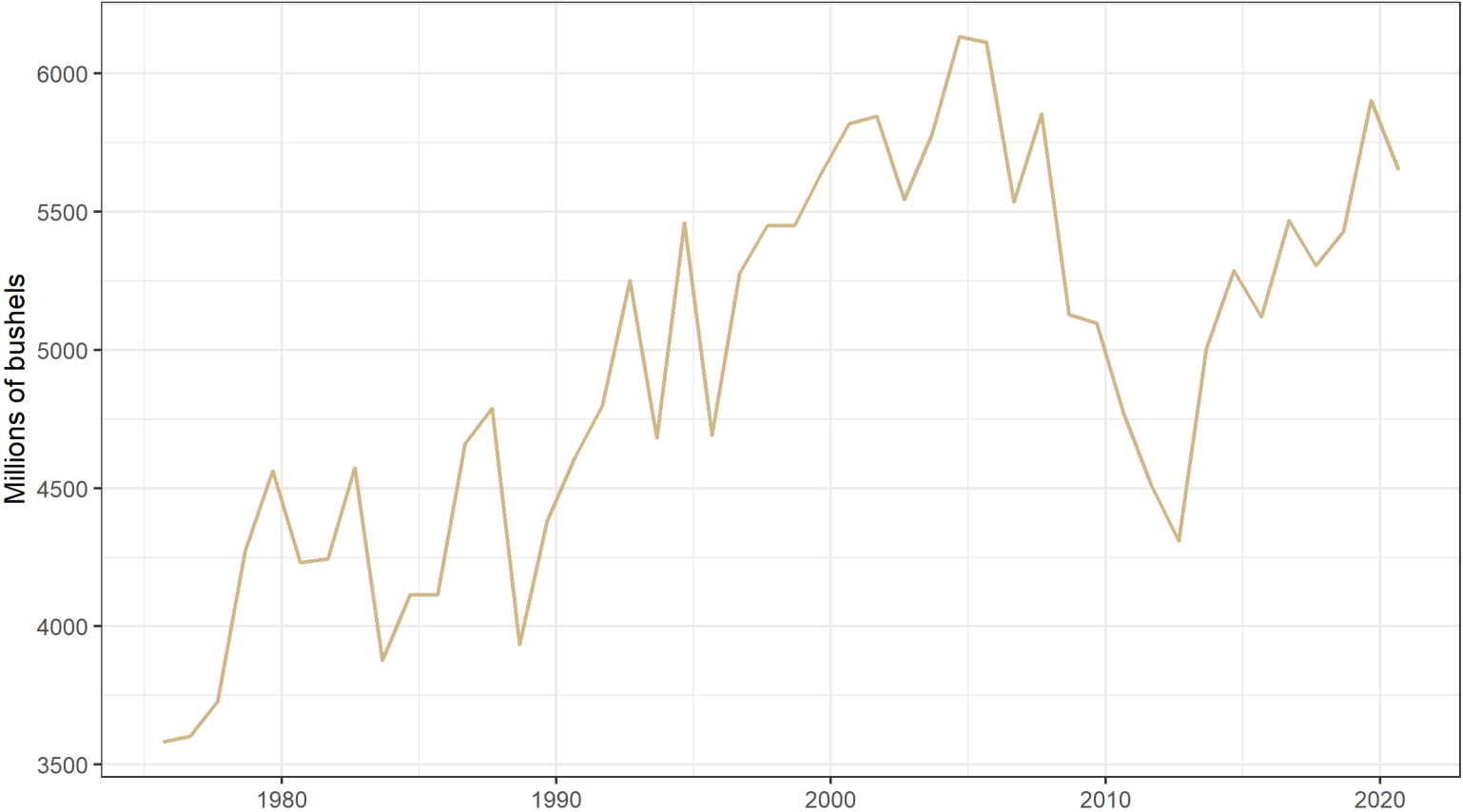
Feed and Residual (CONT...)

- Unlike Exports which saw its biggest quarter of use in the second quarter of the marketing year.
- The biggest quarter of use in the Feed and Residual category is the first (beginning in September).
- This is because at the end of summer, ranchers bring cattle home from grass and they begin eating grain and hay instead of green grass on pasture.
- This is also when calves born in the spring begin to be **Fattened** for slaughter.

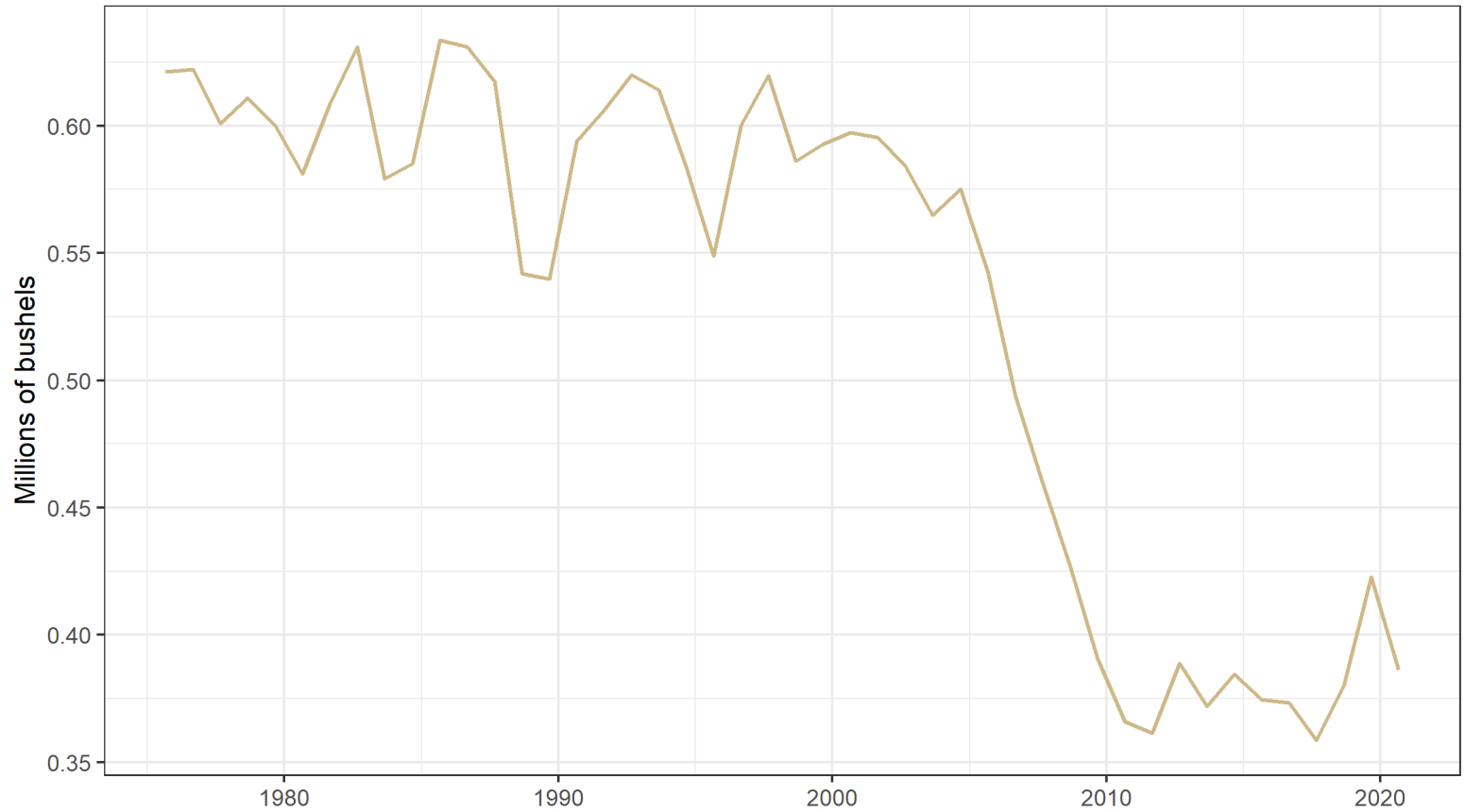
Feed and Residual (CONT...)

- Figure 8: shows the Feed and Residual category annually and Figure 9 shows the category annually as a percent of production.
- Figure 8 shows that the category has remained roughly constant over the time-period graphed.
- As a percentage of production it has fallen since 2005.
- Like the export category, this reflects a proportional shift in use toward ethanol production.

Marketing Year Corn Feed and Residual Use Since 1975



Corn Marketing Year Feed and Residual as Proportion of Total Use



Price Sensitivity of Use Categories

- Examining annual figures as a percentage of production reveals some interesting facts about the price sensitivity of the three use categories.
 - The least price sensitive category seems to be Food, Seed, and Industrial.
 - This should be intuitive because this category is composed primarily of corn for feedstock in ethanol production.
 - Since ethanol consumption is effectively mandated at a certain level by the Renewable Fuels Standard.
 - Users (gasoline blenders) must purchase a certain amount of ethanol to blend into the retail gasoline supply.
 - This implies a significant portion of the corn crop that will be used regardless of the price.

Price Sensitivity of Use Categories (CONT...)

- The second category is Feed and Residual.
 - Although year-to-year variation can come about due to price responsiveness of the U.S. livestock industry.
 - This variation tends to be overwhelmed by the variation due to the aggregate forecast errors in the other categories.
- The most price sensitive category is Exports, which is readily visible in Figure 5 and 6.
 - Foreign buyers of corn can substitute to purchase their corn from other parts of the world like (Argentina comes first to mind).
 - The consumers of meat in the less developed world are more price sensitive and presumably reduce consumption when prices are high.

Forecasting Use

- One method for forecasting is the use of categories during the marketing year, and to keep track of corn consumption which has been used to date.
- This pace of use can be compared to the pace of use in previous years.
- Alternatively, the pace of use can be expressed as a percent of the WASDE forecast use.
- Ideally this percent of WASDE forecast would be compared to historical percent of WASDE forecast.
- The idea behind such exercise being the seasonality in the historical graphs is likely to repeat itself.
- Information about the pace of use in each category must be obtained from different sources within the USDA.

Food, Seed, and Industrial

- Ethanol production is the primary user of corn in the Food, Seed, and Industrial Category.
- This becomes obvious by comparing Figure 10, which displays ethanol production and consumption over time, with Figure 1.
- Ethanol production and consumption begin to increase rapidly around 2005.
- The Energy Policy Act of 2005 and later the Energy Security and Independence Act of 2007 created the Renewable Fuels Standard (RFS).
- The RFS mandated quantities of ethanol that blenders of gasoline are required to blend into the retail gasoline supply.

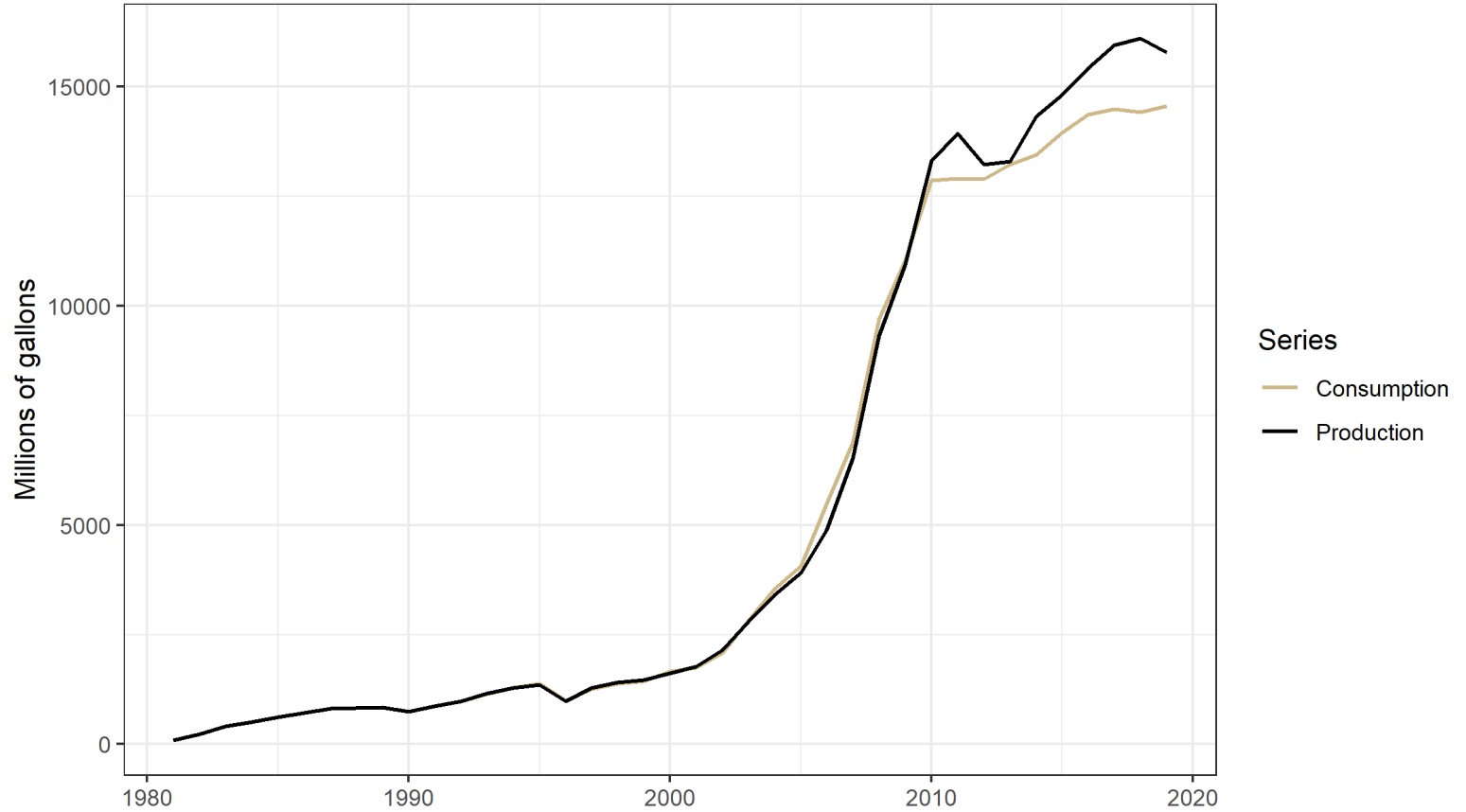
Food, Seed, and Industrial (CONT...)

- These annual mandates are revised every year.
- They were designed to steadily increase year after year until 2015 when the mandate reached 15 billion gallons per year.
- This Figure came because gasoline consumption in the United States was forecast to reach 150 billion gallons per year by 2015.
- The RFS mandates were designed to reach the point where the entire retail gasoline supply would include 10% ethanol.
- Incidentally, 300,000,000 barrels indicated in Figure 10 corresponds to 15 billion gallons ($300,000,000 \times 50 \text{ gallons/barrel} = 15,000,000,000$

gallons).

- The orange line shows that blenders of gasoline have been blending greater than 15 billion gallons of ethanol since 2010.

Production and Consumption of Ethanol



Food, Seed, and Industrial (CONT...)

- Without significant growth in the consumption of gasoline in the United States.
- This corn use category is likely to remain flat for the foreseeable future.
- Ethanol blenders sometimes experience an ethanol-to-gasoline price ratio that is favorable to blending ethanol even above the levels of the RFS mandate.
- Conducting a pace-of-use analysis for this corn use category makes sense.
- Data on monthly fuel ethanol production can be found at [EIA.GOV].
- Examining the current marketing year's production of ethanol.
- It gives some indication of whether ethanol production is likely to exceed the 15 billion gallon per year mandated level.

Exports

- Two USDA agencies are involved in providing estimates of export sales.
 - The USDA Foreign Agricultural Service
 - The USDA Grain Inspection, Packers, and Stockyards Administration

USDA FAS Export Sales Reporting System

- The **USDA Foreign Agricultural Service** maintains the Export Sales Reporting System.
- It reports weekly export quantities and daily reports of large export sales.
- The Export Sales Reporting Program has its roots from the unexpected purchase of large amounts of grain by the Soviet Union in 1972, “**The**

Great Russian Grain Robbery”.

- The huge, unanticipated purchases of U.S. wheat and corn that year depleted U.S.
- Reserve stocks which caused a sizable run-up in U.S. food prices.

USDA FAS Export Sales Reporting System (CONT...)

- There was growing concern that some companies might have an unfair advantage in situations.
- They had access to market-sensitive information which was unavailable to the public.
- To ensure that all parties involved in the production and export of U.S. grain had access to up-to-date export information.
- Congress mandated the Export Sales Reporting program in 1973.
- Before the program was established, it was difficult for the public to obtain information on exports until the products were actually shipped.
- The program helps facilitate price stability by guaranteeing that everyone has access to the same information at the same time.

Daily Reports

- Under the export sales reporting system, U.S. exporters are required to report all large sales.
- Report certain designated commodities by 3 p.m. (Eastern time) on the next business day after the sale is made.
- The designated commodities for these daily reports are wheat (by class), barley, corn, grain sorghum, oats, soybeans, soybean cake and meal,

and soybean oil.

- Large sales for all reportable commodities except soybean oil are defined as 100,000 metric tons or more of one commodity.
- In one day, single destination or 200,000 tons or more of one commodity during the weekly reporting period.
- Large sales for soybean oil are 20,000 tons and 40,000 tons, respectively.

Weekly Reports

- Weekly reports are also required, regardless of the size of the sales transaction.
- For all of these commodities:
 - Wheat products
 - Rye
 - Flaxseed
 - Linseed Oil
 - Cotton (by staple length)

Weekly Reports (CONT...)

- Commodities (Cont...):
 - Cottonseed, Cottonseed cake and meal & Cottonseed oil
 - Rice (by class)
 - Cattle hides and skins (cattle, calf, and kip)
 - And, beef.
- The reporting week for the export sales reporting system is Friday-Thursday.
- The Secretary of Agriculture has the authority to add other commodities to this list.

GIPSA

- USDA GIPSA mission is "To facilitate the marketing of:
 - Livestock
 - Poultry
 - Meat
 - Cereals
 - Oil-seeds and related agricultural products
- Fair and competitive trading practices for the overall benefit of consumers and American agriculture.

History

- The Grain Inspection, Packers and Stockyards Administration (GIPSA) was established in 1994 as part of the reorganization of the U.S.
- The formation of the agency resulted from the joining of two previously independent agencies:
 - The Federal Grain Inspection Service and the Packers and Stockyards Administration.
- GIPSA is part of USDA's Marketing and Regulatory Programs, which are working to ensure a productive and competitive global marketplace for U.S. agricultural products.

History (CONT...)

- The Federal Grain Inspection Service (FGIS) was established by Congress in 1976 to manage the national grain inspection system.
- It was initially established in 1916, and to institute a national grain weighing program.
- The goal of creating a single Federal grain inspection entity was to ensure development and maintenance of uniform U.S. standards.
- To develop inspection and weighing procedures for grain in domestic and export trade, and to facilitate grain marketing.

History (CONT...)

- Today's Packers and Stockyards Program (P&S) is the progeny of the Packers and Stockyards Administration.
- It was established in 1921 under the Packers and Stockyards Act.
- The organization was instituted to regulate livestock marketing activities at public stockyards.
- The operations of meat packers and live poultry dealers.

History (CONT...)

- The GIPSA's main objective is to maintain standard in quality grading and weighing.
- As a by-product of their reporting they also produce on export shipments.
- Monthly data on grains inspected and weighed for export by (U.S. region) and destination country is available.
- Annual reports are also available.
- FAS & GIPSA have a memorandum of understanding with one another and will be reconciled so the export totals reported by each agency will not differ substantially.

Feed and Residual

- The Residual component tends to dominate the variation in the Feed and Residual category.
- The USDA does publish statistics related to numbers of cattle, hogs, and poultry.
- Major changes in livestock numbers produce a detectable impact in the Feed and Residual use category.
- It is worthwhile knowing where to find these estimates.

Feed and Residual (CONT...)

- The USDA releases a monthly report which gives a sense of trends in beef cattle herd size and production.
- Similarly, the **Hogs and Pigs** report is released quarterly and provides inventory estimates.
- The monthly **Poultry Slaughter** report contains the number of head and live weight of:
 - Chickens
 - Turkeys
 - Ducks and other poultry slaughtered under Federal inspection.

CHAPTER END

