Evaluating the Historical Factors Influencing U.S. Agricultural Policy

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Introduction

Both the economics and political science literatures have devoted a great deal of attention to the topic of agricultural policy. Numerous models and explanations have been proposed to describe consistent trends in agricultural policy such as the support of small agricultural industries in developed countries and the lack of support or taxation of agricultural industries in developing countries. Likewise, several authors have reviewed the history and political motivations of U.S. agricultural policy (Black 1929; De Gorter and Swinnen 1994; Schmitz et al. 2010; Schultz 1945). Despite this attention, there has yet to be a comprehensive empirical analysis of the economic factors motivating U.S. agricultural policy.

The purpose of this paper is to investigate the evolution of U.S. farm policy over the last century using a model of economic policy formation. We test whether U.S. agricultural policy over the previous 50 years has reflected multiple distinct policy regimes possessing different policy outcome measures. We also examine how economic and political factors affect federal spending on agricultural programs that represent different intended policy outcomes. We consider variables such as agriculture’s share of total employment, unemployment, the parity ratio, federal spending relative to GDP, and an index of agricultural voting power. The intended policy outcomes we identify include economic growth, poverty abatement, labor reallocation, environmental protection, and risk mitigation.

This analysis of U.S. farm program spending contributes to the theoretical literature examining policy formation and the empirical literature evaluating U.S. agricultural policy. The
analysis provides further context as to how federal spending is distributed and may serve in a predictive capacity for future agricultural policy developments, both inside and outside the U.S. It may be that the set of agricultural policy objectives around the world is homogeneous, but policymakers weight these policy outcomes differently depending on a common set of political and economic factors.

The analysis begins with a brief review of major U.S. farm policy developments since the country’s founding. Using this context, we then develop a model describing farm program expenditures. This model describes much of the variation in government spending on farm programs and yields important insights regarding how U.S. agricultural policy has developed over the last 50 years.

Background
It is pertinent to review the history of U.S. agricultural policy legislation before analyzing the drivers of U.S. agricultural policy expenditures. U.S. agricultural policy has varied widely in purpose and execution over its history. These changes in agricultural policy have reflected evolving social and political motivations. Initially, U.S. agricultural policy was designed to encourage the development of available farmland and agricultural research and training programs. After World War 1, agricultural policy evolved into a support system for farmers facing falling agricultural prices. Direct agricultural price supports and supply controls were implemented to support a shrinking agricultural sector. Most recently, non-distortionary agricultural policies have become a global imperative and farm subsidies have become decoupled from production (Schmitz et al. 2010). This section serves as a brief, chronological review of major pieces of agricultural policy legislation in the U.S.
The initial thrust of agricultural policy in the U.S. was directed towards settling and developing the wide expanse of land in North America. The Land Acts of 1785, 1804, and 1820 enabled the U.S. government to sell land west of the original states after the end of the Revolutionary War in 1783. The basic premise of the Land Acts was to cheaply sell land to settlers, thus raising revenue for the U.S. government while simultaneously encouraging the westward expansion of the newly formed country. These favorable settlement policies were continued into the nineteenth and early twentieth centuries with the Homestead Acts and other similar policies. While very effective at expanding U.S. borders and raising revenue for federal spending, these land settlement policies also supported the confiscation of land from Native Americans.

Early U.S. agricultural policy was not only aimed at land settlement though; a number of policies were aimed at increasing agricultural research and education. The Morrill Land-Grant Acts of 1862 and 1890 created the framework for the modern land-grant college system. The Hatch Act of 1887 funded agricultural experiment stations. The Smith-Lever Act of 1914 established cooperative extension services. These legislative actions contributed to technological developments in agriculture that drastically increased the production capabilities of the American farmer (Benedict 1953; Schmitz et al. 2010).

Throughout the 20th century agriculture gradually shrunk its share of the U.S. economy. In 1900, agriculture employed 41% of the U.S. workforce, and by 2000 less than 2% of the U.S. workforce was still employed in agriculture. Agriculture’s share of GDP similarly shrank from 7.7% in 1930 to less than 1% by 2000. Farm size and output increased dramatically over this period as the remaining producers bought up land and incorporated technological innovations (Dimitri, Efland, and Conklin 2005).
Agricultural producers faced particularly depressed commodity prices during the Great Depression and the Dust Bowl. This was in stark contrast to the high food prices during World War 1. The U.S. government responded by enacting the first farm bill\(^1\) (see Appendix A for a complete list of farm bills), the Agricultural Adjustment Act of 1933, along with a number of other policies designed to restrict the supply of agricultural products (Schmitz et al. 2010). Some examples of supply control policies include land conservation programs, production quotas, and high tariffs (Dimitri, Effland, and Conklin 2005). This represented a significant shift from the policies focused on expanding agricultural production of the 19\(^{th}\) century. The Agricultural Adjustment Act was deemed unconstitutional in 1936, but many of its policies were altered or re-introduced with the Agricultural Adjustment Act of 1938. The 1938 farm bill made indirect price supports mandatory for corn, cotton, and wheat, and it introduced the Federal Crop Insurance Corporation (USDA 2015).

U.S. agricultural policy remained relatively stable until the 1970s while the agricultural sector continued to shrink in its relative share of the U.S. economy. The government offered subsidies to farmers via indirect price supports and land conservation programs, simultaneously distorting agricultural production and supporting producers. These price supports generally proceeded as follows. The Commodity Credit Corporation (CCC), which was managed by the USDA, would offer advance loans on crops, and if the grower failed to repay the loan the CCC would take ownership of the crop. This created a price floor for a number of commodities and thus stimulated production (Benedict 1955). Marketing quotas and land retirement programs also existed during this period. These policies limited the production of many commodities in an

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\(^1\) The topic of which acts to label as “farm bills” is a topic of some debate. Appendix A’s list of farm bills reflects the authors’ own opinions.
attempt to increase food prices by reducing supply. Generally speaking, U.S. farm bills between 1933 and 1970 focused on rural poverty, soil conservation, crop insurance, and farm credit (Schmitz et al. 2010).

In addition to these price supports and land retirement programs, other new agricultural policy developments occurred after WW2. During this period, farmers rapidly mechanized their operations, continuing to increase food production (Dimitri, Effland, and Conklin 2005). The National School Lunch Act of 1945 created the National School Lunch Program, which subsidized school lunches with the secondary intention of increasing the demand for agricultural products. The 1949 farm bill allowed the donation of surplus food held by the CCC to friendly countries as food aid and expanded the school lunch program. The Food Stamp Act of 1964 appropriated money to subsidize food purchases by the poor, and would later be renamed the Supplemental Nutrition Assistance Program (SNAP). These expanding food programs were created to serve a social purpose, but also subsidized food purchases in an attempt to increase agricultural prices.

The 1973 farm bill introduced target prices, loan rates, and deficiency payments as a new system of agricultural support. If farmers agreed to take a portion of their crop out of production, then the government would make deficiency payments equal to the target price minus the market price times a farmer’s historical yield on their base acreage (program acres established by past plantings). The CCC continued offering advance loans on crops at the loan rate, accepting the crop as payment for the loan when prices were low. This maintained the price floors for several commodities (Schmitz et al. 2010). Later, the 1985 and 1990 farm bills introduced the Conservation Reserve Program and offered more incentives for farmers to market their crop instead of selling them to the government and gave additional flexibility in planting options (Dimitri, Effland, and Conklin 2005). Overall, these policies led to overproduction and increasing
government-held stocks of program commodities, while a shrinking population of farmers continued to produce more food.

The 1990s represented another shift in U.S. agricultural policy. The 1996 farm bill, the Federal Agriculture Improvement and Reform Act, introduced subsidy programs that were decoupled from production, and eliminated target prices. To this end, the U.S. government issued fixed direct payments to farmers. Loan rates were maintained at 85% of recent past market prices, but the CCC no longer held food stocks. Instead, producers were allowed to sell their products on the market in return for a direct payment from the government. Several of the acreage set-aside programs of the previous farm bills were retired. This change in policy took place soon after the formation of the WTO in 1995 and was in large part a response to falling global barriers to trade via negotiations (Schmitz et al. 2010).

The 2002 farm bill, the Farm Security and Rural Investment Act, continued many of these 1996 policies and reintroduced target prices that were decoupled from production. Loan rates and direct payments were maintained. Countercyclical payments replaced deficiency payments and were based on historical acreage and yields. This differed from the prior deficiency payments that required the crop to be planted to receive payment. The 2008 farm bill, the Food, Conservation, and Energy Act, similarly continue many of these programs, but also introduced the Average Crop Revenue Election (ACRE) Program and renamed the Food Stamp Program as the Supplemental Nutrition Assistance Program (SNAP). The ACRE program allowed farmers to reduce their participation in the other farm bill programs in return for revenue insurance. The most recent 2014 farm bill included cuts to SNAP and introduced the Price Loss Coverage (PLC) and Agricultural Risk Coverage (ARC) Programs. These programs continue to provide farm subsidies that are decoupled from production.
U.S. agricultural policy objectives have changed drastically over time. These changing policy objectives inform government spending decisions and thus have had a significant impact on the federal budget. At first, U.S. agricultural policy encouraged the development of farmland and made considerable investments into research and education programs. However, falling agricultural prices shifted the focus of agricultural policy into the realm of market manipulation. Most recently, trade developments have led to the creation of policies that are intended to be non-distortionary. This analysis investigates the roles of different economic and political factors in influencing government spending on agricultural programs.

Data

Various data are necessary to estimate a model of government spending on agricultural programs. We have collected data spanning 1962 to the most recent farm bill in 2014 for this analysis. These data provide critical points of reference to contextualize the trends and policies in the agricultural sector and enable the empirical analysis. These data include federal spending on different programs, GDP for different industries, employment by state, prices received and paid in the agricultural industry, and a constructed variable representing the value of an agricultural employees’ vote relative to the average person. The following is a brief review and discussion of these data.

Federal spending data are available from the Office of Management and Budget (OMB), which is the largest component of the Executive Office of the President. These federal spending data are divided by department or other government units, and further subdivided by function (OMB 2015). We identify total federal spending, spending by the USDA, and spending on the functions of farm income stabilization, agricultural research and services, and food and nutrition
assistance from these data (see Figure 1 for a visual representation of these data). We use these data to construct variables representing the share of each function’s spending in total federal spending.

Figure 1: Spending on Agricultural Programs: By Category and as a Share of Total Federal Spending, 1962-2014 (PCE-adjusted with Base Year 2009)
Economic data for the agricultural sector are available from the U.S. Department of Commerce (USDC) Bureau of Economic Analysis (BEA). These data include U.S. GDP, the agricultural sector’s contribution to GDP, full- and part-time employment, and employment in the agricultural sector. These data are provided yearly at the state and national levels (USDC 2015a; USDC 2015b). These data are used to construct explanatory variables including total federal spending as a percentage of GDP and agriculture’s share of employment. Figure 2 shows the falling share of U.S. citizens who are employed through the agricultural sector.

**Figure 2: Share of Farm Employment in Total Employment, 1962-2014**

In addition, these data are used to construct the variable representing the value of an agricultural employees’ vote relative to the average person. Votes from the agricultural industry are often considered to be more valuable because more rural states with smaller populations command greater per capita voting power due to how Congress is structured. In this application, the value of a vote is evaluated equal to its corresponding representation in Congress. Congress is divided into the Senate and the House of Representatives. There are two senators for each state, and representation in the House of Representatives is equivalent to a state’s share of the total U.S.
population. Assuming that the Senate and House of Representatives have equal political power, represented by setting the weights \( \omega_1 = 0.5 \), we calculate the value of an agricultural employee’s vote as follows:

\[
\text{Ag. Vote Power}_t = \omega_1 \frac{\sum \text{Farm Employment}_{it}}{\sum \text{Total Employment}_{it}} + \omega_2 \sum_{i=1}^{50} \frac{\text{State Farm Employment}_{it}}{\text{State Total Employment}_{it}}
\]

where \( \omega_1 + \omega_2 = 1 \)

We collect unemployment data from the U.S. Department of Labor (USDL) Bureau of Labor Statistics (BLS) and parity ratio data from the USDA National Agricultural Statistics Service (NASS). The unemployment data correspond to the seasonal unemployment rate (BLS 2015). The parity ratio data represent the ratio of prices received to prices paid in the agricultural sector with years 1910-1914 serving as a base (USDA 2015). The parity ratio is of particular political interest because a significant amount of U.S. farm policy operated under the assumption that a parity ratio of one, corresponding to years 1910-1914, represented fair agricultural prices. As seen in Figure 3, the parity ratio has steadily declined over the 20\(^{th}\) century.

**Figure 3: The Parity Ratio (1910-1914 = ratio of 100), 1962-2014**
Methods

The purpose of this analysis is to investigate how U.S. farm program expenditures have changed over the last 50 years using a model of economic policy formation. Thus, we propose a model describing farm program expenditures as a function of economic and political variables. We then use this model to test whether U.S. agricultural policy has reflected multiple unique policy regimes, and the extent to which other factors have affected change in policy.

Following the insights of Tinbergen (1956), we use the following framework to model policy formation:

\[ y_k = \Gamma_z z_k + \Gamma_x x_k \rightarrow \Omega(y_k) \]

where \( y_k \) are measures of general interest such as unemployment or price volatility, \( \Gamma_z \) and \( \Gamma_x \) are structural coefficients in the economy, \( z_k \) are policy variables such as tariffs or price supports, and \( x_k \) are variables that represent the internal functioning of the economy. \( \Omega(y_k) \) represents a set of policy objectives influenced by \( y_k \).

Consistent with this specification, we model the choice and amount of agricultural support based on a set of economic and political factors. Agricultural support is defined as real expenditures on farm programs including research and development expenditures. Farm programs include agricultural subsidies and other U.S. Department of Agriculture (USDA) programs such as the Supplemental Nutrition Assistance Program (SNAP). Economic variables include total federal spending as a percentage of GDP, agriculture’s share of employment, and national unemployment. Political variables include the parity ratio and a constructed variable representing the value of an agricultural employees’ vote relative to the average person.

Likewise, we identify a set of political factors consistent with the previous theoretical findings outlined in Becker (1983) and De Gorter and Swinnen (1994). We identify representation
of agricultural interests by constructing a variable reflecting the voting power of agricultural voters. This representation variable is constructed by weighting the share of a state’s population involved in agriculture by that state’s representation in Congress. We also estimate the concentration of the agricultural sector by considering the real earnings of the average agricultural producer. Lastly, we test for structural changes in farm program expenditures, and whether major farm bills and trade agreements instigated structural policy changes.

We implement a reduced form vector autoregression (VAR) model with the possibility of structural change similar to that proposed in Sims (1980). The basic formulation of a VAR model with \( p \) lags, denoted \( \text{VAR}(p) \), is:

\[
y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + e_t,
\]

where \( y_t \) is a \( k \times 1 \) vector of endogenous variables and \( c \) is a \( k \times 1 \) vector of intercepts. \( A_i \) is a \( k \times k \) matrix of coefficients and \( e_t \) is a \( k \times 1 \) vector of error terms with mean zero and no serial correlation. In this application, there are six endogenous variables: the parity ratio, unemployment, the agricultural sector’s share of total employment, and the shares on government spending allocated to farm income stabilization programs, agricultural research and services, and food and nutrition assistance programs. We also include two exogenous variables: federal spending relative to GDP and the constructed index of voting power for agricultural voters. The final model specification can be represented as:

\[
y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + A_3 x_t + e_t,
\]

where \( y \) is the vector of endogenous variables and \( x \) is the vector of exogenous variables.

The econometric specification is chosen to represent the persistence of previous agricultural policies and is used to test for structural changes in policy objectives. The underlying assumption of the analysis is that farm program expenditures smoothly adapt to changes in
economic and political factors change over time. In this context, we evaluate the extent to which the economic and political factors affect federal spending on the different farm program areas. However, there may be structural breaks in farm policy that reflect significant changes in policy objectives. We test for structural breaks in the funding of different farm program areas over time to establish if and when significant shifts in agricultural policy objectives occur historically.

**Results**

The estimated model provides relevant insights regarding agricultural policy formation. Spending on farm programs is found to be closely tied to farm employment, national unemployment, the parity ratio, and the relative size of the federal budget. Spending on farm income stabilization programs and agricultural research and services is found to improve pricing margins for farmers. This section details the execution of the model, presents the estimation results, and further explains the effects of different variables.

Before executing the model, I first consider the role of trending behavior in the model’s variables. VAR models are designed for stationary variables without time trends, and many of the variables I employ exhibit clear trends. I test for unit roots, i.e. if a series is non-stationary, in each wage series using the Augmented Dickey-Fuller unit-root test (Dickey and Fuller 1979). Each series, except the index representing agricultural voting power, possesses a unit root and is therefore first-differenced. I also test for cointegrating relationships using the Johansen (1988) test, but find no evidence supporting the existence of such a relationship. The final model estimation results are presented in Table 1.
Table 1: VAR Model Estimation Results

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<th>D_income</th>
<th>D_research</th>
<th>D_food</th>
<th>D_farmshremp</th>
<th>D_unemployment</th>
<th>D_parity</th>
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<td>0.0279</td>
<td>0.000710</td>
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<td>278.2**</td>
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<td>(119.0)</td>
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<td>-3.809</td>
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<td>0.441***</td>
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<td>-0.014</td>
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<td>-0.0765</td>
<td>-54.34</td>
</tr>
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</table>

Observations: 42  42  42  42  42  42
R-squared: 0.57  0.62  0.74  0.58  0.82  0.48

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

There are several interesting interactions in this system. Decreases in the parity ratio explain increases in farm income stabilization program expenditures. This connection seems logical considering that these program expenditures are likely a response to low margins in the agricultural sector. Agricultural research expenditures shrink in proportion when total federal...
outlays increase relative to GDP, likely because these expenditures are the most stable over time. Food program expenditures increase with unemployment and when food prices are high. None of these programs have any significant effect on farm employment or unemployment, but income stabilization and research program spending are associated with better margins on agricultural sales.

Lastly, we test for structural breaks in the model. We use a basic likelihood ratio test to evaluate whether different time dummies correspond to structural changes in farm policy legislation and spending. The test statistic is:

\[ LR = (T - m)(\ln|\Sigma_u| - \ln|\Sigma_u|) \sim \chi^2(q), \]

where \( T \) is the number of observations, \( m \) is the number of parameters in each equation of the unrestricted system plus constants, \( \Sigma \) is the determinant of the residual covariance matrix for the unrestricted and restricted models, and \( q \) is the number of dummies multiplied by the number of equations. The unrestricted model is estimated with dummy variable representing a potential structural break. The restricted model excludes the dummy variable.

We find no clear evidence of structural breaks in farm policy according to this testing procedure. Despite the major policy changes in the 1970s such as the national rollout of the food stamp program and in the 1990s such as the formation of the WTO and NAFTA, neither of this periods represent a structural break in the funding of these farm program expenditures. This result suggests that even though the passing of legislation is a discrete process, much of the variation in U.S. spending on agricultural programs is explainable with economic factors that change smoothly over time.
Conclusion

Agricultural policy has been debated since before Adam Smith first wrote on the “invisible hand.” Historically, the agricultural sector occupied a much larger share of economies and received much less support, or at times was even taxed heavily. However, as incomes and productivity have continued to rise around the world, fewer and fewer people are involved in agriculture and its share of household budgets has fallen dramatically. This consistent trend has spurred many countries, particularly developed countries with rapidly shrinking agricultural sectors, to provide farm subsidies in a variety of forms.

While many theories of agricultural policy formation have been established and tested, a comprehensive empirical analysis of U.S. farm policy is lacking. By investigating the economic and political factors that determine U.S. agricultural policy, this study provides insights into how policy objectives affect farm program spending. Agricultural policy in the U.S. has changed significantly over time, but do these changes reflect discrete, structural changes in policy objectives, or predictable changes in economic variables.

We find that U.S. agricultural policy reflects economic trends that impact major agricultural policy objectives. This analysis provides insights into what factors have historically shaped farm policy in the U.S., and may help predict when, why, and how major farm policy changes occur. This framework for policy analysis may also have applications outside the realm of agricultural programs.
References


Office of Management and Budget. 2015. Historical Tables. Washington DC.


Appendix A

Farm Bills (1933-2014)

Agricultural Adjustment Act of 1933*
Soil Conservation and Domestic Allotment Act of 1936
Agricultural Adjustment Act of 1938
Agricultural Act of 1948
Agricultural Act of 1949
Agricultural Act of 1954
Agricultural Act of 1956
Agricultural Act of 1961
Food and Agriculture Act of 1965
Agricultural Act of 1970
Agriculture and Consumer Protection Act of 1973
Food and Agriculture Act of 1977
Agriculture and Food Act of 1981
Food Security Act of 1985
Food, Agriculture, Conservation, and Trade Act of 1990
Federal Agriculture Improvement and Reform Act of 1996
Farm Security and Rural Investment Act of 2002
Food, Conservation, and Energy Act of 2008
Agricultural Act of 2014

*While the Agricultural Adjustment Act of 1933 is considered by many to be the first Farm Bill, it built upon programs first initiated in the Federal Farm Loan Act of 1916. The Federal Farm Loan Act of 1916 established the Federal Farm Loan Board, which later became the Federal Farm Board in the Agricultural Marketing Act of 1929. The Agricultural Adjustment Act of 1933 established the Agricultural Adjustment Administration which inherited many of the powers of the Federal Farm Board. An executive order by President Roosevelt and the Farm Credit Act of 1933 finally replaced the Federal Farm Board with the Farm Credit Administration.