Agribusiness and Applied Economics Report No. 600 **April 2007**

THE ROLE OF PRODUCTIVITY GROWTH AND FARMERS' INCOME PROTECTION POLICIES IN THE DECLINE OF RELATIVE FARM PRICES IN THE UNITED STATES

Dragan Miljkovic, Hyun J. Jin, and Rodney Paul

Department of Agribusiness and Applied Economics
Agricultural Experiment Station
North Dakota State University
Fargo, ND 58105-5636

Acknowledgments

Thanks are extended to our colleagues, Dr. Rhenan Zhuang and Dr. Gregory McKee who reviewed this manuscript.

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Abstract

The paper emphasizes three interrelated questions about the decline in relative farm to non-farm prices in the United States since 1973: 1) Is it unusual, 2) What caused it, and 3) Is it likely to continue? We find that based on historical and international evidence this phenomenon may be considered unusual. Separating farm price and income support in 1973 and growing relative productivity in agriculture has been the major contributor to changing the trend of the relative farm goods inflation. This trend is likely to continue based on predicted steady growth of relative agricultural productivity and continuation of direct payments and other forms of farm income support policies.

Keywords: Government transfers; Productivity growth; Relative farm prices

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Introduction

High inflation has traditionally been one of major concerns among economic policy makers around the world. But just as high inflation may be dangerous and disruptive to the normal functioning of an economy; the same can be said about very low inflation, which can lead at an extreme to deflation or a sustained decline in the aggregate price level. It was noticed that the goods prices have been falling in the United States during last several years, while the services prices continue to rise (Bureau of Labor Statistics or BLS hereafter). While the rise in services prices more than offset the decline in the goods prices thus keeping overall inflation positive, the trend caused some concerns among economists in the United States. (Clark, 2004)

An equally interesting trend to people who follow agricultural commodity (farm level) prices in the United States is the increasing gap between consumer prices measured by the Consumer Price Index (CPI), Producer Price Index (PPI), and prices of all non-farm commodities on one side and the farm level agricultural commodity prices on the other side. For more than thirty years now agricultural prices grew at a rate below the growth rate of any other price index in the United States. This ultimately had to lead to the reallocation of resources, especially labor, that moved from agriculture to the sectors of the economy exhibiting more opportunities (services, for example).

This paper assesses whether the sustained slower growth of agricultural prices relative to other prices in the economy should be cause for concern among farmers or policy makers in the United States. The analysis emphasizes three interrelated questions about the decline in farm goods inflation relative to other goods and services: (1) Is it unusual, (2) What caused it, and (3) Is it likely to continue?

The paper is organized as follows. Second section examines the extent to which the last thirty years represent an experience unusual by historical and international standards. Third section evaluates potential explanations for the presence of this sustained gap in inflation rates. Fourth section reports results of empirical model. Final section concludes with an assessment of whether this gap is likely to persist or may be narrowed or widened in the future.

***Miljkovic is associate professor in the Department of Agribusiness and Applied Economics, NDSU, Fargo; Jin is assistant professor in the Department of Industrial Economics, Chung-Ang University, South Korea; and Rodney Paul is associate professor in Department of Finance, St. Bonaventure University, NY.

U.S. Historical and International Experience

Historically, farm prices in the United States have been analyzed and considered within agricultural sector and their relationship with other producer prices has not received much attention. Thus in spite of the evidence presented in this paper that relative farm prices have been declining only after 1973 it is commonly emphasized that real farm prices were declining during the period 1920-1970 and after 1974 until today (Cochrane, 1958, 1985, 1986; Cochrane and Runge, 1992; Knutson, Penn, Flinchbaugh, 1998). It is further argued that even in nominal terms there were long periods of declining and depressed prices. For instance, the price of corn declined from $1.52 per bushel to $1.33 between 1950 and 1970, while the price of wheat fell from $2.00 per bushel to $1.33 during the same period (Bowens, Rasmussen, and Baker, 1984, p.45). The only time of prosperous and favorable farm prices, according to these and other sources, was the period of the early 1970s, often compared to the golden years of agriculture (1910-1914). This increase in farm prices came about due to reduced feed grain production (due to early frosts and corn blight) and increased export demand (Knutson, Penn, and Flinchbaugh, 1998). Increased export demand occurred due to a combination of factors: falling value of the dollar (following the adoption of floating exchange rate), the opening of Soviet Union's borders to U.S. grain, and an increase in income in OPEC countries.

The above statements are of course true. However, the relevant question that one ought to ask here is how did farm prices fare relative to other prices in the economy? This is a relevant question because no sector performance over a long period of time can be meaningfully interpreted if it is isolated from the performance of other sectors or the economy overall. For instance, while real prices may be declining in a sector for long stretches of time it is possible to observe similar trends in the rest of the economy or in some of the sectors. Or maybe completely opposite situation is possible where prices in one sector are continuously higher in one sector than in the rest of the economy. And one can see from figures 1 and 2 that farm prices did fairly well relative to other producer prices or consumer prices for over sixty years. That trend changed in the mid 1970s becoming especially pronounced in the 1980s and 1990s when farm price index fell far below other producer prices as well as the CPI.

While casual observation of Figure 2 indicates the presence of the change in growth of relative farm prices after 1973, a formal analysis is in order to confirm or reject such a hypothesis. The relative farm price is defined here as the ratio of the non-farm commodity price index (NFCPI) and the farm price index (FPI). Annual data for the period 1913 to 2003 are from the Bureau of Labor Statistics. While similar trends are recorded when CPI or PPI are used instead of the non-farm commodity price index to create the relative price index, we believe, given that NFCPI does not contain prices of services and is producer oriented, it provides more appropriate basis for further analysis that accounts for productivity or producer groups' lobbying efforts.

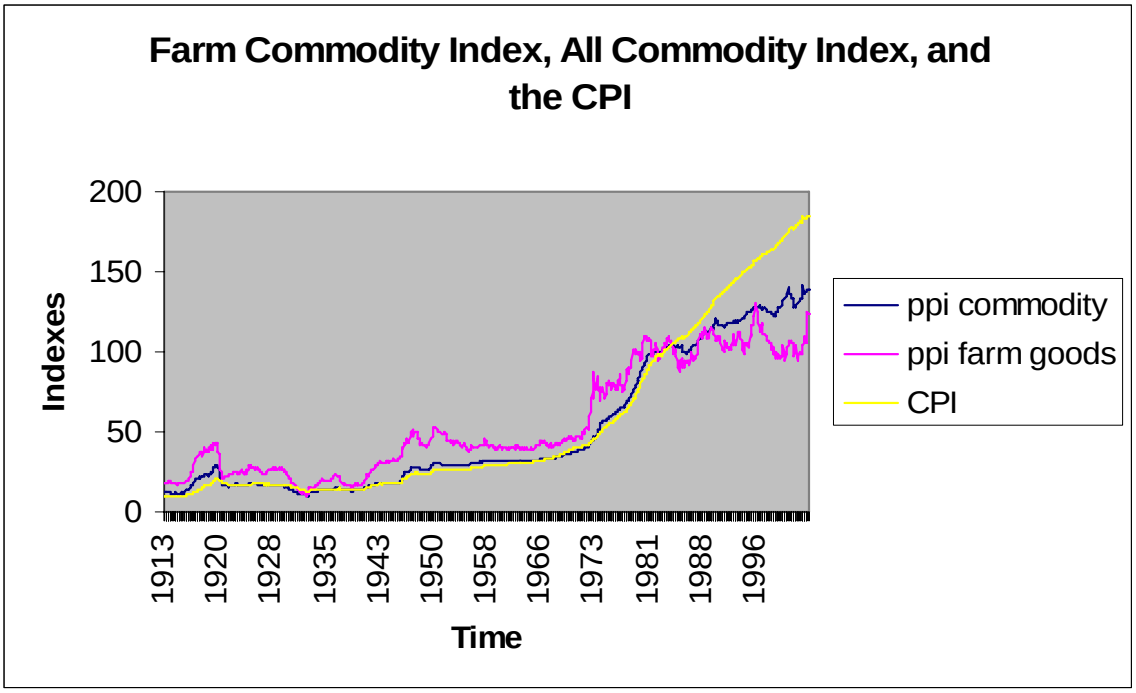

Figure 1. Farm Commodity Index, All Commodity Index, and the CPI

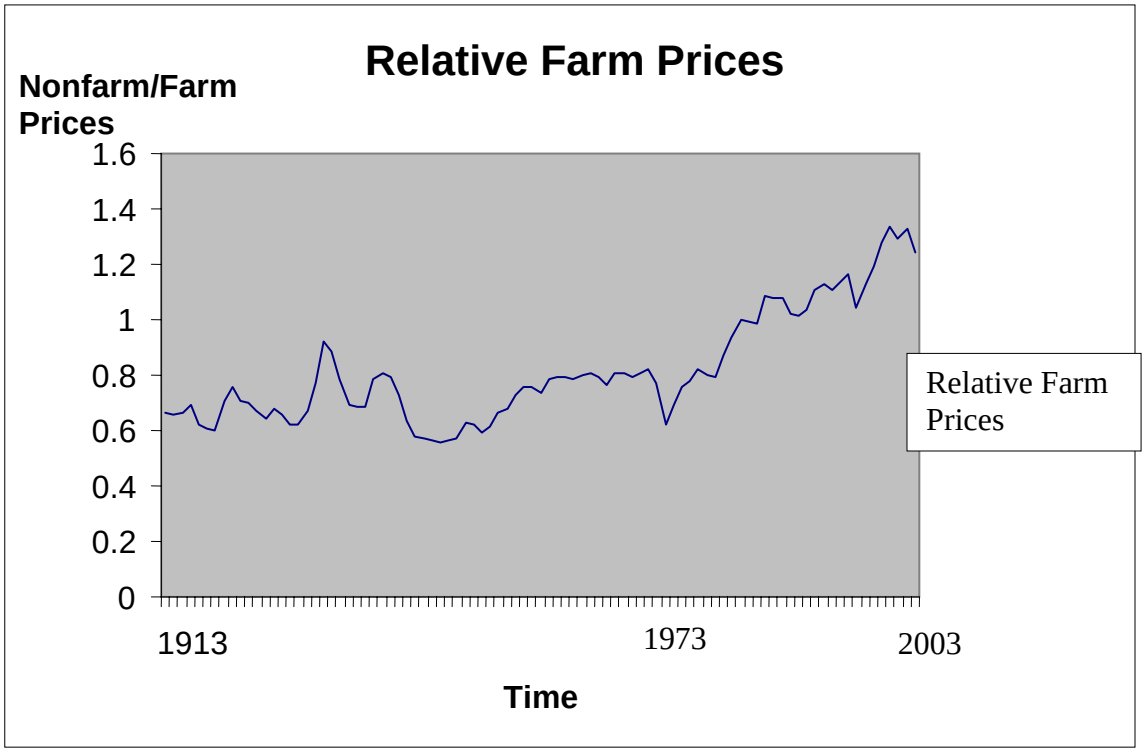

Figure 2. Relative Non-farm/Farm Prices

Source: Bureau of Labor Statistics and authors' calculations

Based on Perron's (1989) analysis of non-stationary time series, the so called "changing growth" model is tested. This procedure implies an exogenously determined time of break in the trend function. Considering the fact that the time of break is assumed to be known in this case, i.e., 1973 was the year of major changes in farm policy; Perron's approach seems to be appropriate. Under the null hypothesis in this model, it is specified that the drift parameter changes at the time of the break. Under the alternative hypothesis, a change in the slope of the trend function without any sudden change in the level at the time of the break is allowed. The actual estimated regression is as follows:

$$y_t = \tilde{\mu} + \tilde{\beta}t + \tilde{\gamma}DT_t^* + \tilde{y}_t \qquad (1)$$

where $\tilde{y}_t = \tilde{\alpha}\tilde{y}_{t-1} + \sum_{i=1}^{k} \tilde{c}_i \tilde{\Delta} y_{t-i} + \tilde{e}_t$,

and $DT_t^* = t - T_B$ (where T_B refers to the time of break). This procedure contains the lagged data and lagged first differences of the data as regressors in equation (1). The regression is estimated by OLS. The parameter *k* specifies the number of extra regressors added. Since in this case we specified a simple AR(1) process, *k* equals 1**.** Results are presented in Table 1.

Table 1. Test for a Unit Root

T_B = 1973	T	k	$\tilde{\mu}$	$\tilde{\beta}$	$\tilde{\gamma}$	$\tilde{\alpha}$	$\tilde{c}$	$S(\tilde{e})$
Annual Relative Farm Prices	89	1	0.685* (38.09)	0.003* (5.55)	0.008* (3.38)	0.006* (4.57)	0.005* (2.83)	0.0631

Note: t-test results are in parentheses and * denotes statistical significance at the 1% level.

Under the alternative hypothesis of stationary fluctuations around a deterministic breaking trend function, it is expected that $\mu \neq 0$, $\beta \neq 0$, $\gamma \neq 0$, and $\alpha < 1$. Our results conform to these expectations and all variables are significant at the 1% level. Most importantly, expected change in the slope of the trend function without any sudden change in the level at the time of the break occurred, as indicated by coefficient γ.

The available international evidence indicates the decline in farm prices relative to other producer or commodity prices during last thirty years is U.S. phenomenon. Of course, this is considering developed market economies of Europe, Oceania, and Canada. In all of these economies one can see that farm and non-farm prices move together over time. Figures 3 and 4 illustrate the relationship between farm and non-farm prices in Australia and the United Kingdom. Very similar patterns are observed in New Zealand, EU countries, and Canada

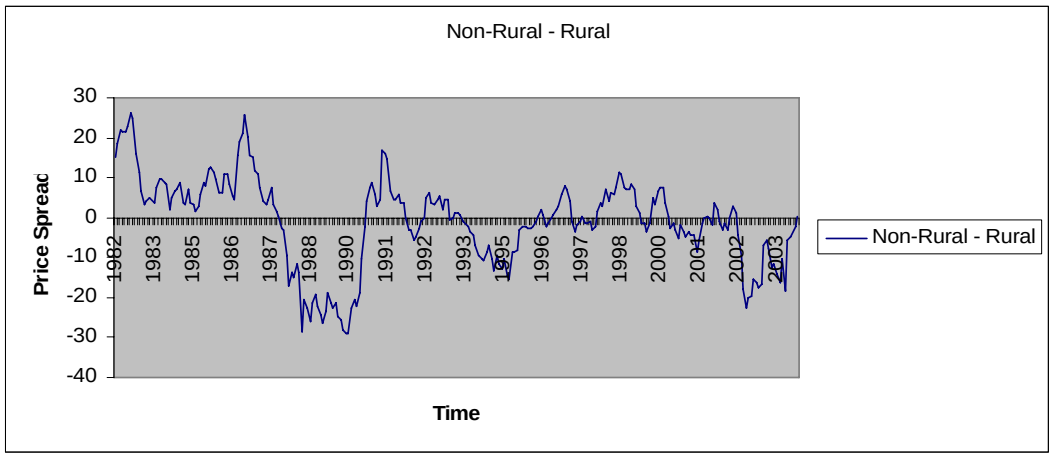

Figure 3. Australian Non-Rural less Rural Commodity Price

Source: **http://www.economagic.com/em-cgi/data.exe/rba/grcprcusd**

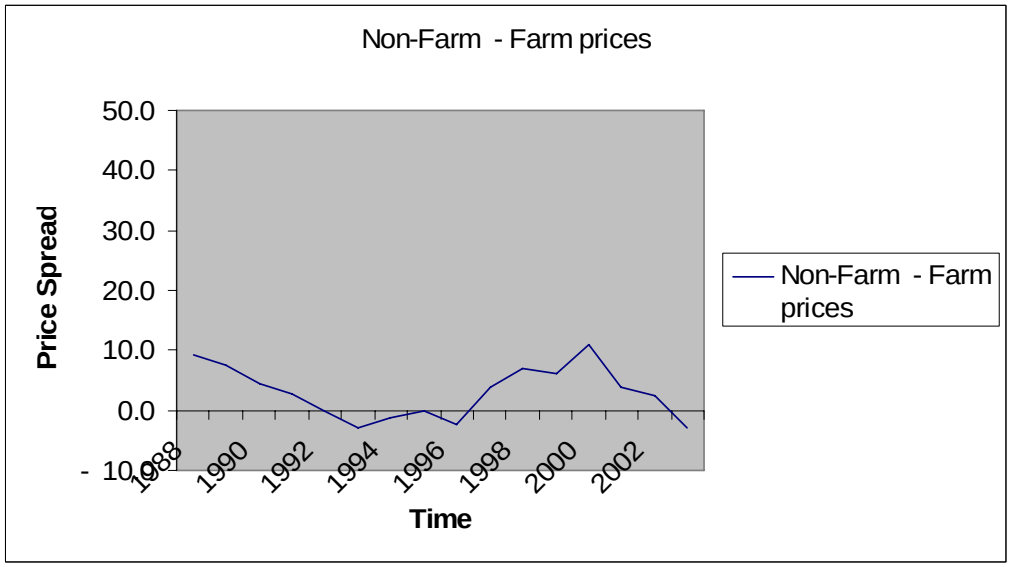

Figure 4. UK Non-farm minus Farm Prices

Source: **http://www.economagic.com/em-cgi/data.exe/rba/grcprcusd**

during the last 2-3 decades. While these foreign economies experienced a falloff in farm commodities inflation during some years, they experienced sustained periods of a relative rise in farm commodities inflation during last a couple of decades.

After considering historical and international evidence about the behavior of the relative farm price index, potential explanations of this changing trend are evaluated next.

Potential Explanations for the Presence of Sustained Gap in Inflation Rates

There are many possible explanations for the presence of sustained gap in inflation rates between farm commodities and both producer and consumer goods. The potential explanations evaluated in this paper include: (a) an increase in productivity growth in the farm sector relative to the productivity growth in the rest of the economy, (b) escalating concentration (changing market structure) in non-agricultural sectors compared to the farm sector that remains to be by far more competitive, (c) rising demand for other goods and services relative to demand for farm products, (d) downward pressure on farm commodity prices due to the rising value of the dollar, increased global competition, and the size of domestic market relative to the overall production, (e) a deterioration in the accuracy of measured farm, producer, and consumer prices (index numbers), and (f) the effect of income and other farm protection policies on farm level prices.

Changes in Productivity Growth

The productivity increase in U.S. farm sector has been a well researched topic (*e.g.*, Ahearn, Yee, and Huffman, 2002; Capalbo and Antle, 1988; Gardner, 1992; Huffman and Evenson, 2001). According to U.S. Department of Agriculture (USDA), yields per crop acre, a measure of productivity, have risen 94 percent during the second half of the 20th century (Penson, Capps, and Rosson, 1999, p.30). Main reason for this rising productivity, according to USDA, has been the technological advances embodied in farm inputs via first advances in chemical industry and later in bioengineering. Ball (2002) suggests alternatively that the net contribution of all inputs to growth in agricultural output over this same period (*i.e.*, second half of the 20th century) was less than one-tenth of one percentage point per year. He finds that the responsibility for agricultural output growth is in total factor productivity. Tweeten (1998) did not see the increase in productivity in agriculture as a factor that will contribute to the lowering relative farm prices in the future. On the contrary, he suggested that supply growth may be slowing relative to demand, and if so, commodity prices would strengthen relative to other prices.

Agricultural sector, however, was not the only sector experiencing high growth rates during this period. What is of ultimate interest here is the relative productivity growth rates, *i.e.*, productivity increases in agriculture versus productivity increases in other sectors. Numerous studies provide information about sectoral productivity growth rates in the United States (*e.g.*, Jorgensen, Gollop, and Fraument, 1987; Jorgensen and Griliches, 1967; Jorgensen and Stiroh, 2000; Stiroh, 2002). Data on productivity growth by industry for period 1958-1996 in Table 2 are from Jorgensen and Stiroh (2000).

Based on information from Table 2, productivity growth rates in agriculture were higher over a sustained period of time than all but three industries: electronic and electric equipment, industrial machinery and equipment, and textile mill products. It is also important to note how two out of three industries with higher productivity growth rates than agriculture, *i.e.*, electronic

Table 2 Productivity Growth by Industry, 1958-1996

Industry	***Annual Productivity Growth (%)***
Agriculture	1.17
Metal mining	0.44
Coal mining	0.84
Petroleum and gas	-0.44
Nonmetallic mining	0.46
Construction	-0.44
Food Products	0.54
Tobacco Products	-0.20
Textile mill products	1.23
Apparel and textile	0.80
Lumber and wood	-0.02
Furniture and fixtures	0.56
Paper products	0.42
Printing and publishing	-0.44
Chemical products	0.58
Petroleum refining	0.33
Rubber and plastic	1.04
Leather products	0.28
Stone, clay, and glass	0.41
Primary metals	0.22
Fabricated metals	0.65
Industrial machinery and equipment	1.46
Electronic and electric equipment	1.98
Motor vehicles	0.24
Other transportation equipment	0.18
Instruments	1.12
Miscellaneous manufacturing	0.82
Transport and warehouse	0.86
Communications	0.88
Electric utilities	0.51
Gas utilities	-0.24
Trade	0.98
FIRE	-0.18
Services	-0.19
Government enterprises	-0.52
Private households	0.00
General government	-0.00

Source**:** Jorgensen and Stiroh (2000, pp. 173-174), based on Bureau of Labor Statistics (BLS) and Bureau of Economic Analysis (BEA) data.

and electric equipment and industrial machinery and equipment, are high-technology industries.[1] In addition to the above information, Jorgenson, Ho, and Stiroh (2002) show that U.S. agriculture accounts for 21 percent of all U.S. growth in productivity over 1958-1999 (but only 1.3 percent of gross domestic product), and it ranks in the top 4 of 37 sectors in average productivity growth over this period. This information further strengthens our original contention that high relative increase in agricultural sector productivity contributes to lower relative farm sector prices. However, farm sector's increase in productivity has been above the national average for more than last forty years and still is above the average. Thus it is not obvious that higher productivity in agriculture was the sole or even the main factor behind the relative falloff of farm prices during the last thirty years. Moreover, productivity cannot explain the shift in trend of the relative price differential that occurred after 1973.

Market Concentration Changes in Agriculture versus Non-Agricultural Sectors

One of the four key interrelated structural characteristics used when discussing competitive behavior of a market is the number and size distribution of sellers and buyers or market concentration.[2] Market concentration is traditionally measured by Herfindahl-Hirschmann Index (HHI) or four-firm concentration ratio (C4) (*e.g.*, Golan, Judge, and Perloff, 1996; Lopez and Liron-Espana, 2003). U.S. farming sector has traditionally been considered as the prime example of a perfectly competitive industry. In spite of a dramatic change of the complexion of farming in the United States in terms of the number of farms during the post World War II period (*i.e.*, the number of farms has declined from 5.6 million in 1950 to less than 2 million in 2000 (Miljkovic, 2005)), farming sector market remained to be less concentrated than any other sector within the U.S. economy. This is the fact not only because of the presence of a large number of farmers within the sector but also because of inability of one or a few of the farmers to affect the market price significantly. The relevancy of this discussion becomes apparent when we remember that prices are lower in perfectly competitive industries than in other market structures.

Concentration varies considerably across industries in the United States. In the household laundry equipment, breakfast cereal, and cigarette industries, the four largest companies produce well over 80 percent of the industry's product. At the other extreme the four largest firms in wooden household furniture, fur goods, and women's and misses' dresses sell well under 20 percent. For all U.S. industries the average four-firm concentration ratio in 2000 was 37 percent. Weighted by industry sales, it was 36 percent. This average has been quite stable for a long time. In 1935 the average four-firm concentration ratio for U.S. industries was 40 percent; weighted by sales it was 37 percent. In 1977 the average was 37 percent, while the weighted average was 39 percent. In other words, there has been no discernible long-run trend toward concentration in U.S. economy since the Great Depression (Gilligan, 2001).

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[1] The impact of intermediate inputs on productivity growth in the industrial machinery industry is very significant. Note that a substantial portion of these inputs consists of semiconductors purchased from the electronic equipment industry.

[2] The remaining three characteristics are the degree of product differentiation, the extent of barriers to entry, and the economic environment within which the industry operates (Penson, Capps, and Rosson).

In one of his classical papers, Shepherd (1982) suggests an increase in competition in U.S. industries between 1939 and 1980. Shepherd defines four market types (structures): (1) pure monopolies, (2) industries with dominant firms, (3) tight oligopolies, and (4) effectively competitive industries. In Shepherd's classification scheme, monopolies exist when one firm accounts for 100 percent (or nearly 100 percent) of an industry's total sales. No close substitutes for its product exist and entry to the market is blocked. Industries with dominant firms are near monopolies. In such industries, the dominant firm accounts for 50 percent to 90 percent of total industry sales, no close rivals exist, and entry to the market is difficult. Tight oligopolies are industries in which the top four firms account for over 60 percent of total sales and in which entry barriers are high. Shepherd lumps all other firms together in the "effectively competitive" category. The classification "effectively competitive" signifies more than just perfect competition. It also includes all of what is commonly described as monopolistic competition. In Shepherd's effectively competitive group, the top four firms control less than 40 percent of the market, and entry barriers are low.

Table 3, based on Shepherd's estimates, shows what happened to the level of competition in the U.S. economy between 1939 and 1980. Pure monopolies, a category that includes most public utilities and some patented goods, accounted for only 2.5 percent of total national income in 1980, down from 6.2 percent in 1939. In fact, purely monopolistic and dominant-firm industries together accounted for just a little over 5 percent of national income in 1980. In contrast, 76.7 percent of national income originated in sectors that Shepherd classifies as effectively competitive, up from 52.4 percent in 1939. The estimates indicate that the percentage of national income originating in tight oligopolies was cut in half between 1958 and 1980.

Table 3 Trends in Competition in the U.S. Economy, 1939–1980

	1939	1958	1980
Pure monopoly	6.2	3.1	2.5
Dominant firm	5.0	5.0	2.8
Tight oligopoly	36.4	35.6	18.0
Effectively competitive firms	52.4	56.3	76.7
Total	100.0	100.0	100.0

Note: Percentage share of national income by industry category.

Source: William G. Shepherd, "Causes of Increased Competition in the U.S. Economy, 1939–1980," *Review of Economics and Statistics* LXIV (November 1982), 613–626.

The U.S. economy has apparently become more competitive over the years. A number of factors may have contributed to this change. Without going into detail here, Shepherd concludes that these factors include, among others, increased competition from imports, deregulation, and enforcement of antimonopoly laws.

Based on the above results it seems that one would come to expect lower prices in agricultural sector than in the rest of the economy. However, market has been more heavily concentrated in non-agriculture than in agriculture during the entire period under consideration, *i.e.*, from 1930s until today. Also, the trend seems to be reversing, albeit slowly, with agriculture getting more concentrated and non-agriculture being at the same level, or according to Shepherd, getting less concentrated. Therefore changes in market concentration in the United States do not seem to explain the trend of prices in agriculture falling relative to non-agricultural prices.

Rising Demand for Non-farm Goods and Services

The past three decades' falloff in farm relative to non-farm goods and services inflation might also be explained by an increase in the demand for non-farm goods and services relative to farm goods and services. Over time demand for non-farm goods and especially services has grown more rapidly than demands for farm goods. For instance, Clark (2004) determined that the share of nonfood and non-energy consumer spending devoted to services rose from 56 percent in 1959 to 70 percent in 2003. The spending for food, which may be used to approximate the spending for farm goods, decreased relative to spending for nonfood products between 1984 and 2002 from 15 percent to 13.21 percent (figure 5). This very modest shift in the composition of demand was unlikely to raise the relative price of nonfood (non-farm) goods and services, even in the short run. As it is known from the literature, the inflation effects of an increase in the relative demand for non-farm goods and services would be short-lived. Theoretically, only differences in productivity growth (or the quality bias in measurement) can account for persistent or long-term differences between goods and services inflation (*e.g.*, De Gregorio, Giovannini, and Wolf, 1994). Finally, it can be seen from the figure 5 that there was no sharp shift in the demand for non-food products that would lead to the falloff in farm goods inflation.

Rising Value of the Dollar, Increased Global Competition, and Relative Size of Domestic Market

Appreciation of the dollar, in principle, contributes directly to lower overall inflation by making imports cheaper, to the extent foreign producers pass the cost savings of the currency appreciation through to their U.S. prices. A rising value of the dollar also contributes indirectly to lower inflation to the extent lower import prices and market competition push down the prices of U.S. produced goods. As a cautionary note, recent evidence suggests that exchange rate movements might not have large effects on the domestic goods inflation (*e.g.*, Bernanke, 2003; Taylor, 2000).

The following question then can be asked: Are imports of agricultural goods considerably greater (relative to the amounts produced and marketed domestically) than imports of non-agricultural goods and services? If they are, a rising value of the dollar is likely to exert more downward pressure on agricultural goods prices than on non-agricultural goods prices. As a result, increases in the value of the dollar could cause agricultural goods inflation to fall relative to non-agricultural goods.

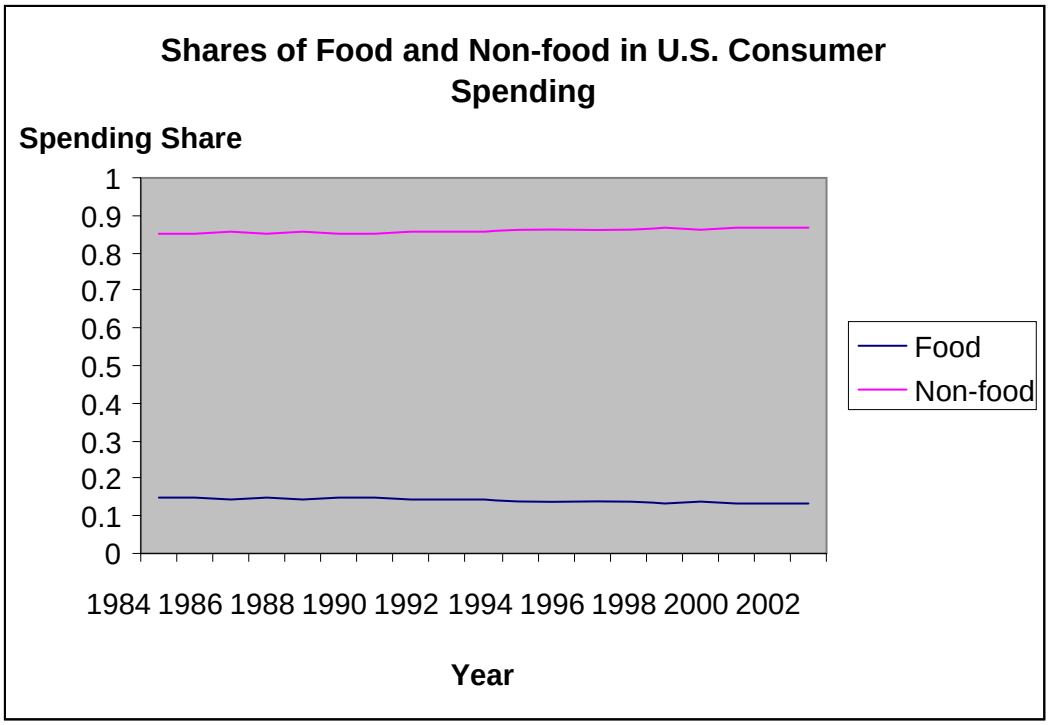

Figure 5. Shares of Food and Non-food in U.S. Consumer Spending

Source: Bureau of Labor Statistics and authors' calculations

The answer to the above question is pretty easy. While the United States experienced overall trade deficit throughout most of the last forty years, and consistently after 1975 (*Source*: Economic Report of the President, various issues), agriculture exhibited exactly the opposite trend. Indeed, the United States has been a net exporter of agricultural products since 1959, an uninterrupted span of 45 years (USDA-FATUS). This clearly indicates that the rest of the economy was, and still is, much more dependent on imports than agriculture. Thus any appreciation of the dollar in the post Bretton Woods era was likely to affect non-agriculture more seriously that agriculture.

It is certain that heightened global competition due to GATT, WTO, many regional trade agreements, as well as due to market deregulations in many countries (Miljkovic and Paul, 2003) put some downward pressure on domestic prices. Many observers have pointed to a rising volume of imports from such developing countries as China as a key source of downward pressure on goods prices (Rogoff, 2003). It is also true that due to generally greater level of competition in the United States than in most other countries (Baily, 2001) the globalization may have more effects than in tightly regulated economies. However the issue here is whether farming sector and prices have been more affected than other sectors and prices due to this increase in global competition. Recalling that U.S. agriculture has been a net-exporter for more than thirty years now, there is no credible evidence pointing out to an increase in global competition as the cause of the relative farm price decline.

Deterioration in the Accuracy of Measured Farm and Producer and Consumer Prices (Index Numbers)

The Producer Price Index (PPI) measures average changes in prices received by domestic producers for their output. Most of the information used in calculating producer price indexes is obtained through the systematic sampling of virtually every industry in the mining and manufacturing sectors of the economy. By contrast, the publication of indexes for the service sector of the economy, while expanding, is currently incomplete. The PPI program also includes data from other sectors as well—agriculture, fishing, forestry, and utilities (gas and electricity).

As of January 2002, the PPI program contained the following indices:

- Price indexes for approximately 500 mining and manufacturing industries, including more than 7,000 indexes for specific products and product categories;

- More than 3,000 commodity price indexes organized by type of product and end use;

- Nearly 1,000 indexes covering approximately 90 industries in the services sector and other sectors that do not produce physical products; and

- Major aggregate measures of price change, including product durability and stage-of-processing (SOP) classification schemes.

Together, these elements constitute a system of price measures designed to meet the need for both aggregate information and detailed applications, such as following price trends in specific industries and products.

Known until 1978 as the Wholesale Price Index, or WPI, the PPI is one of the oldest continuous systems of statistical data published by the Bureau of Labor Statistics (BLS, the Bureau), as well as one of the oldest economic time series compiled by the Federal Government. When it was first published in 1902, the index covered the years from 1890 through 1901. The origins of the index can be found in an 1891 U.S. Senate resolution authorizing the Senate Committee on Finance to investigate the effects of the tariff laws upon the imports and exports, the growth, development, production, and prices of agricultural and manufactured articles at home and abroad. The first index published, with base period 1890–99, was an unweighted average of price relatives for about 250 commodities. Since that time, many changes have been made in the sample of commodities, the base period, and the method of calculating the index. A system of weighting was first used in 1914, for example, and major expansions of the sample and reclassifications were implemented in 1952 and 1967.

The PPI program's original intent was to measure changes in prices received for goods sold in primary markets of this country. The conceptual framework and economic theory guiding the program's evolution, while more implicit than explicit, concentrated on obtaining the price received by either a domestic producer or an importer for the first commercial transaction. A major limitation of the traditional methodology was its reliance on *judgmental sampling* of

commodities and producers; that is, commodities and producers were selected without the use of probability-based statistical methods. This practice resulted in a system that was too heavily composed of volume-selling products made by larger firms. The PPI therefore did not adequately reflect the behavior of the multitude of products whose individual transactions values might have been small, but that collectively accounted for a sizable portion of the economy. Another result of judgment sampling was that the output of many industries was completely overlooked. Before the transition to the current methodology began, products covered by the PPI program accounted for only about half of the total value of output by the mining and manufacturing sectors. The practice of assigning equal weight to price reports from each producer of a given commodity, regardless of any disparity in size among these firms, may have caused some distortions. Another limitation of the traditional PPI methodology was its commodity orientation, which, while important, was not compatible with the industry orientation of most other Federal economic time series. The PPI's unique commodity classification scheme made it difficult to compare producer price movements with data for most other economic variables that were expressed in terms of the Standard Industrial Classification (SIC).

These and other weaknesses in the PPI program, combined with increased development of the theory of price indexes in preretail markets, spurred several changes in terminology and operations during the 1970s. The 1978 change in the program name from Wholesale Price Index to Producer Price Index, for example, was intended to reemphasize the fact that the PPI program continues to be based on prices received by producers from whoever makes the first purchase. Also in 1978, the new nomenclature was accompanied by a shift in the Bureau's analytical focus from the All Commodities Price Index (which was popularly called "the" Wholesale Price Index) to the Finished Goods Price Index and the other commodity-based SOP price indexes. This overhaul was phased in gradually, until the transition to the current methodology was essentially completed in January 1986.

Given that the farm price index is a part of the PPI program, all methodological changes and adjustments discussed about the PPI above are pertinent to the farm price index as well. Thus one cannot see the falloff of farm goods inflation relative to the non-farm producer goods inflation stemming from the difference in the accuracy of measured inflation. This may not be so when we consider the falloff of farm goods inflation relative to consumer goods and services (measured by CPI) inflation. According to Griliches (1994) and Nordhaus (2002) the measurement of inflation is subject to biases attributable to difficulties in adjusting for changes in the quality of goods and services. Moreover, they believe the measurement problem is considerably more severe for services than goods. As a result, the overstatement of measured inflation, *i.e.*, the quality bias, is widely thought to be greater for services than goods. In light of this problem, one potential explanation for the falloff of farm goods inflation relative to CPI is that indexes of service inflation became even less accurate over the past three decades, due to an increase in the quality bias. However, according to Triplett and Bosworth (2003), measurement of price and quality in the U.S. services sector has improved dramatically over the past a couple of decades. This improvement would make deterioration in CPI measurement relative to the farm goods unlikely.

The Effect of Income and Other Farm Protection Policies on Farm Level Prices

Prior to the 1970 farm bill, supporting farm prices and incomes was not separated. That all changed in 1973 when farm price and income support were finally separated. While price support was provided by traditional Commodity Credit Corporation (CCC) loans, income support was provided by direct farmer payments. It is important to first establish that direct payments to farmers in the United States actually increased significantly since 1973. Data in Table 4 on direct government payments to U.S. farmers is from the U.S. Department of

Table 4. Direct Government Payment to U.S. Farmers

Year	Direct Payment (in 1,000 U.S. dollars)
1974	530,448
1975	807,081
1976	733,624
1977	1,818,879
1978	3,030,004
1979	1,375,153
1980	1,285,672
1981	1,932,190
1982	3,491,965
1983	9,295,099
1984	8,430,370
1985	7,704,154
1986	11,813,351
1987	16,746,732
1988	14,749,808
1989	10,886,702
1990	9,298,030
1991	8,214,399
1992	9,168,920
1993	13,402,015
1994	7,879,129
1995	7,279,451
1996	7,339,570
1997	7,495,294
1998	12,380,016
1999	21,513,119
2000	22,896,433
2001	20,727,496
2002	10,961,465
2003	15,949,402

Source: USDA-ERS Data Base

Agriculture, Economic Research Service (USDA-ERS) for the period 1974 to 2003, and indicate that payments on average doubled every year during this period. In 1974, U.S. farmers were given direct payments of approximately $530 million, while that number in 2003 was almost $16 billion. The payment peaked at almost $23 billion in 2000.

The motivation for increased direct payments in 1973 was to lower price supports to restore competitiveness in the world market (Knutson, Penn, and Flinchbaugh, 1998). That was the time when farmers and government came to the realization that they are becoming more and more dependent on the world market in order to sell their products. There have been several mechanisms of direct payments since 1973. The target price mechanism was the first to separate price support from income support, i.e., target prices support only income. A target price is the level of returns per unit of commodity on certain acreage guaranteed to farmers who participate in farm programs. Target prices provide for direct payments to producers of the difference between the target price and the average market price whenever the average market price for a specified time period falls below the target price. The difference between the target price and the average market price is called a deficiency payment (Gardner, 1992). Target prices have been established for all major food grains, feed grains, and cotton as a means of supporting farm income.

Another direct payment mechanism is called the fixed payment. It was initially established in the 1996 farm bill. The idea behind this concept, unlike the target price, was to sever the production stimulating effect of direct payments. The amount of the payment was predetermined annually for the life of the farm bill. Producers were eligible for so called fixed production flexibility contract (PFC) payments independent of the production of specific crops. Another supplemental instrument called market loss assistance (MLA) payments was made available to the farmers under similar terms where a producer could not increase or decrease MLA payments by increasing or decreasing production. Since the size of the payment is not related to the market price, it is argued to have no effect on output, although the benefits still are capitalized into land values (Knutson, Penn, and Flinchbaugh, 2004). However, Adams et al. (2001) suggested that even though the payments are fixed, they may increase production and thus lower market price. This may be because frequent changes in farm policy may lead farmers to conclude that future payments will depend on current production decisions. For more details on these and other direct payment mechanisms refer to Knutson, Penn, and Flinchbaugh (2004).

After establishing that farmers were major beneficiaries of government support policies during the last 30 years and after describing some of the mechanisms of the disbursement of these benefits, the critical question becomes why are the farmers so successful in attracting government support? The answers may be found in a series of political economy papers including Grossman and Helpman (1994, 1996) and Baldwin and Robert-Nicoud (2002). They all address the issue of why, in many developed countries, declining industries have lobbied the government repeatedly for different kinds of protection and support and how in most cases the governments provided the requested significant protection and support. All of this is happening even, “long after conceding their nations’ loss of comparative advantage in these activities.” (Grossman and Helpman, 1996, p. 795).

The argument made by Baldwin and Robert-Nicoud (2002) seems to be especially applicable to the case of U.S. agriculture. They argue that when a profitable or expanding

industry lobbies the government successfully for support, the extra rents are dissipated by an even larger entry than otherwise (i.e., without lobbying). That will go on until the industry again earns only a normal rate of return. If an industry is unprofitable or declining, success in similar lobbying/political activities would bring the rate of return closer to or at best up to the normal rate. Thus, newcomers are not attracted to enter the industry and share the rents. A different model of lobbying benefits applied to agricultural policies was proposed by Rutstrom and Redmond (1997).

Agriculture in the United States cannot be considered a declining industry based on its output growth. As we saw earlier, agriculture has been one of the most productive sectors in the United States during last 30 years (Jorgenson and Stiroh, 2000). However, if measured by the number of employees (or number of farms in this case), agriculture may be considered a declining industry since that number declined from 5.6 million in 1950 to about 2 million in 2000 (Miljkovic, 2005). But one key feature of agriculture that limits entry into the industry is asset fixity or, more specifically, land fixity. This is one input necessary in agricultural production, yet it is limited to available agricultural land and cannot be expanded beyond what is available. Also, different crops cannot be grown in all agricultural areas due to climate. For instance, if cotton or rice growers are successful in their lobbying efforts, the landowners in the agricultural states of North Dakota or Minnesota cannot switch from wheat or corn production (which are the most popular crops grown in these states) to cotton or rice production to share the rents because these two crops cannot be grown in the moderate or cold climate of the Upper Midwest.

Grossman and Helpman (1996) suggest how it is not rent dissipation but rather the potential for free riding that prevents the expanding industries to engage in costly lobbying activities. The reason is that if an organized pressure group cannot prevent latecomers from entering the industry after a lobbying effort has been made and without contributing for its cost, then the early entrants will find little incentive to lobby in political equilibrium. Given the asset fixity and possibility of no entry (or very limited entry at best) into agriculture, lobbying efforts within agriculture are not affected with the possibility of free riding. Therefore, it comes as no surprise the success that organized pressure groups had within agriculture during the last several decades.

Empirical Analysis

Empirical model is estimated in this section measuring the effect of relative productivity in the farm and non-farm sector and the increase in direct payments on relative farm prices. Given that microeconomic theory suggests relative productivity as the sole contributing factor in affecting relative prices and that we established that permanent changes in government support may be having an effect on relative prices as well, the estimated model here is fairly simple. Data for all three variables are available for the period 1949 to 2003. Direct payments data are from the USDA-ERS data base, while data for the relative farm price measured by the ratio of the non-farm commodity price index (NFCPI) and the farm price index (FPI) are from the Bureau of Labor Statistics and have been described in an earlier section. Finally, relative productivity is measured by the ratio of manufacturing and farm productivity indexes obtained also from the Bureau of Labor Statistics. The estimated equation is as follows:

$$RFP = \beta_1 + \beta_2 RP + \beta_3 DP + \varepsilon. \quad (2)$$

RFP stands for relative farm prices, RP for relative productivity, and DP for direct payments to farmers. The equation is estimated in log-log form in order to obtain estimates in elasticity form. An AR(1) term was added after the Durbin-Watson statistic in the original equation indicated the presence of serial correlation. Both AIC and Schwarz criteria suggest the model with no lags. Results are provided in Table 5.

Table 5 Regression Results.

Variable	*Coefficient*
Constant	-0.8791* (-3.062)
LOG(RP)	-0.6234* (-5.148)
LOG(DP)	0.0617* (3.457)
AR(1)	0.4957* (3.096)
R^2	0.9096
Adj R^2	0.9037
Durbin-Watson test	2.0681
Inverted AR Roots	0.50

Note: t-test results are in parentheses and * denotes statistical significance at the 1% level.

Before interpreting the coefficients, we notice that the Inverted AR Root of 0.50 is well inside the unit circle and as such indicates a stationary AR model. R^2 and the Durbin-Watson statistic are based on the one-period ahead forecast errors. Based on R^2, the model seems to explain rather well the behavior of the relative farm prices.

All variables in the model are statistically significant at the 1% level. Our primary interest is the size and the sign of the relative productivity and direct payments coefficients that may be interpreted as the elasticities. Both estimated coefficients have the anticipated signs.

Since relative productivity was defined as the ratio of manufacturing and farm productivity indexes, a decrease in relative productivity (due to relatively higher growth of the farm productivity index) by 10 percent led to an increase in relative non-farm to farm prices by 6.23 percent (due to relatively slower growth of the farm price index). An increase in direct payments to the farmers, as a form of government support of agriculture, by 10 percent led to an increase in the relative non-farm to farm price index by 0.6 percent due to the relatively slower growth in farm than non-farm commodity prices. While both coefficients are significant, it is obvious that fast productivity growth in agriculture was the primary contributor to the declining relative farm prices. Impacts of government policies, however, cannot be ignored. Finally, as one would expect, the carry-over effect of historical relative farm prices on current relative farm prices is also significant, as indicated by the AR(1) coefficient.

Implications for the Future and Conclusions

It was determined in the paper that the past three decades' falloff in farm goods inflation relative to non-farm producer goods and services is a U.S. phenomenon. Multiple causes for this phenomenon were contemplated, and both theory and empirical evidence suggest that increase in relative agricultural productivity and income directed farm policies are main reasons for the occurrence of this trend in relative prices. The resulting question before us becomes: is the differential between non-farm and farm prices more likely to remain (or further increase) at an elevated level or decline in the period ahead? Recent technological advances in bioengineering contributed to a significant, and still lasting, productivity growth in agriculture. The same trend is expected to continue. As one could see, agriculture already experienced much higher productivity growth rates than the rest of the economy in last several decades. Thus relatively high productivity growth rate in agriculture are likely to keep high or even further increase the difference between prices of non-farm goods and services and farm commodities.

At the same time, agricultural lobbying in the United States has traditionally been among the most successful lobbying efforts in attracting government support. We hypothesized that, in addition to increasing relative productivity of agriculture, U.S. government support of the agricultural sector significantly contributed to the sustained decline of farm prices relative to non-farm prices. However, our results indicate that although the size of the government policy effect is relatively small, it is statistically significant. This implies that government policies directed towards directly supporting farmers' incomes still contribute to the observed trend in relative prices.

This result has some very interesting implications. While the political economy background of the increase in direct payments and government support to farmers can be determined, it is very difficult to rationalize this type of behavior from the purely public policy point of view. By increasing direct payments to the farmers, government encouraged continuous overproduction in the sector and misplacement of resources, in particular labor. Moreover, continuous overproduction in the sector due to direct (income) payments to the farmers may have been less effective in increasing producer income, as increased production leads to lower market prices and returns (assuming relatively inelastic demand for agricultural commodities). On the flip side of this argument one could conclude that some of the benefits of the direct payments to the farmers have been transferred to consumers via lower prices.

There are some other possible implications of this type of government policies that have not been in the focus of the analysis specifically but are nevertheless important and as such deserve to be mentioned. If production indeed increased due to increases in direct (income) payments to the farmers, that may have had detrimental environmental consequences. This is especially true if new production came from environmentally marginal or most vulnerable land. Also, the United States declared to the World Trade Organization (WTO) that PFC payments fall under the category of so-called "green box" and as such result in minimal distortions of agricultural markets. Our results indicate that it is not quite clear that these payments are truly production neutral.

The effects of this "bad policy" on relative prices are relatively small, and the main damage from the policy comes from the misuse or suboptimal spending of budgetary funds, and possibly through environmental degradation of agricultural land. On the other hand, the argument made by farm communities and rural development specialists is that these programs have never been designed to conform to economic principles, but rather to serve and protect rural America and its way of life. The cynical side-effect of this argument is that the biggest beneficiaries of this government policy are the largest farmers that happen to be, in most cases, corporate farms that have nothing to do with rural America and its way of life. The largest beneficiary of the USDA's subsidy programs received over 533 million U.S. dollars in income payments between 1995 and 2004, while top four recipients of direct income payments totaled over 1 billion U.S. dollars during the same period. (**http://www.ewg.org/farm/**)

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