Evolution of the Economics of Agricultural Policy

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Agricultural economists helped develop farm programs to respond to the dire economic situation of the 1920s and 1930s. Some early authors appreciated that such policies created problems in markets for commodities and inputs. Over time, our understanding of agricultural issues and policies has deepened. Through the application of improved models and tools of analysis to more extensive data, we have developed better answers to old questions, and have responded to changing policy instruments, market contexts, and policy concerns. This article traces the evolution of our deepening economic understanding of the causes and consequences of agricultural policy.

Key words: agricultural policy, crop insurance, ever-normal granary, agricultural R&D policy, government stockholding, buffer stocks, farm commodity programs, history of economics.

JEL codes: B29, Q11, Q16, Q18.

For most of human history, agriculture was the largest part of the economy. So it was natural for the economics of agricultural policy to be a central part of the economics of government activity. The Corn Laws, and their adverse impacts on the well-being of the poor in eighteenth- and early-nineteenth-century England, famously led Adam Smith and David Ricardo to address the negative economic consequences of import protection. Engagement with agricultural policy concerns was also evident earlier, in the work of Quesnay and the French Physiocrats, who urged the use of taxes and other policies to favor agriculture as the fundamental engine of wealth creation. During the later part of the nineteenth century and the early part of the twentieth, agricultural economics developed as a distinct field, and agricultural policy economics became a part of the economics of agriculture. This article considers the most recent 100 years of economic research into the causes and consequences of agricultural policy. Our scope is global, but the article inevitably devotes more attention to economic analysis of policy in the United States and to authors who published in English.

Much of the research we review was published in the *Journal of Farm Economics* (JFE) and its successor, the *American Journal of Agricultural Economics* (AJAE). Smith, Pardey, and Chan-Kang (2004) documented a relatively steady 10% of Journal pages devoted to agricultural policy in the decennial years from 1930 to 2000. Arnold and Barlowe (1954) detailed the subjects of Journal articles and pages in the period 1918–1953 and also found substantial shares devoted to policy topics. In addition, the Agricultural and Applied Economics Association (AAEA) and its predecessor organizations have sponsored several sets of publications dedicated to agricultural policy. For example, in 1945, concerns about postwar agricultural prices spurred the American Farm Economic Association (AFEA) to sponsor a contest for best papers on "A Price Policy for Agriculture." Eighteen winners were selected from more than 300 entries, and the top three papers were published in the JFE (Nicholls and Johnson 1946). In 1949, the AAEA sponsored *Readings on Agricultural Policy*, which collected important policy publications from the middle and late 1940s (Jesness 1949). Then, in 1977, Brandow's (1977) 85-page overview

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of post–World War II research on policy was included in Volume 1 of an AAEA-sponsored literature survey.

Many other nongovernmental organizations also stimulated analysis of agricultural policy. For example, the American Enterprise Institute has sponsored a 30-year series of projects in anticipation of the periodical farm bills. Each of these projects (led by D. Gale Johnson in 1977 and 1981, Bruce Gardner in 1985, Daniel Sumner in 1996, and Bruce Gardner and Daniel Sumner in 2007), involved leading agricultural policy economists and produced a body of analysis published as books and monographs.

In an area of economic research where topical conditions tend to dominate much of the literature, our emphasis is on economic research that has made lasting contributions. Some of this research stands out by cogently illuminating causes and consequences of particular policies while applying current economic tools of analysis. However, some of the best work in agricultural policy economics developed analytical innovations in the context of current issues and policies. We discuss both kinds of contributions that were important to the development of subsequent research and that can still be read with profit today.[1]

The Early Years

The collapse of export opportunities, and hence of agricultural prices and incomes, after World War I had a profound effect on views about commodity markets, the appropriate role of government, and the economic relationships in agriculture (Benedict 1953). This postwar period coincided with the beginnings of a professional core in the newly formed USDA Bureau of Agricultural Economics (BAE), led by Henry C. Taylor. The BAE took responsibility for providing new data and analysis to explore potential remedies to the farm depression of the 1920s, including analysis of the various formulations of the McNary–Haugen bills for agricultural marketing arrangements, and international trade management.

Nourse (1925) devoted his AFEA presidential address to "Some Economics of an American Agricultural Policy." He discussed the role of agricultural policy economists in helping to clarify objectives and observed:

> Furthermore, once the public mind is made up as to the proper objectives of agricultural policy, we should be of assistance by giving trustworthy directions as to how real progress can be made toward the attainment of those goals and how, in turn, the most serious mistakes may be avoided. (p. 2)

Nourse discussed the role of economists in the policy debate and put forward his own policy suggestions. Foreshadowing the writings of Schultz in the decade surrounding World War II, he was concerned about deep and debilitating poverty in agriculture and the perceived imbalance between living standards on and off the farm (Schultz 1945). Unlike Schultz, however, Nourse favored policies designed to maintain farm numbers and insulate U.S. farmers from world commerce by allowing higher domestic prices to prevail, but he provided no analysis of how his proposals would achieve higher farm prices and incomes, or at what cost.

Some saw the decade of the 1920s as a period of undifferentiated agricultural depression. However, Joseph Davis (1939) characterized the situation in 1927 as follows:

> The central facts are these: American farmers suffered severe depression after the war. Despite considerable improvement, they have not yet emerged from this depression, and they fear prolongation of the period of subnormal incomes. Meanwhile, other classes of the population have enjoyed an unprecedented and sustained accession of prosperity, and the persisting disparity excites agitation for radical measures of farm relief. (p. 75)

While John D. Black focused mostly on farm management issues during his tenure at the University of Minnesota, he also delved into policy proposals and analysis. In his review of Black (1929), Davis (1929) commended Black's explanation of the economic situation of agriculture in the 1920s but demurred from Black's analysis of evidence about and

[1] Gardner (1987b) provided a systematic treatment from the perspective of the middle 1980s of many of the topics discussed here without attempting a full review of previous literature.

support for tariffs, storage programs, and supply controls, arguing that Black underappreciated the difficulties and ultimate costs of such policy measures. Davis emphasized that the share of agriculture in the economy and the share of farmers in the population would continue to decline and that analysis must incorporate low income elasticities of demand and steady improvements in agricultural technology.

In the United States, active price and income policy for agriculture began with the establishment of the Federal Farm Board by the Agricultural Marketing Act of 1929. Versions of more interventionist McNary–Haugen bills had been rejected or vetoed, but by the late 1920s evidence of low prices and incomes convinced the Hoover administration to accept government participation in exports and stocks in an unsuccessful attempt to raise farm prices (Davis 1935). Weather and macroeconomic conditions combined to overwhelm the limited funds and authorities of the Farm Board. Policies changed rapidly during this period in response to changed economic conditions of agriculture, especially relative to the rest of the economy.

Many economists and others interpreted the experience of the 1920s and early 1930s and the failure of the Federal Farm Board to mean that more thorough intervention in agricultural markets was required. No quantitative projections or counterfactual modeling was undertaken, but economists such as Black, Nourse, and even Davis accepted that market intervention would yield positive effects for agriculture and redress disadvantages that farming was presumed to have relative to other industries and occupations (Nourse, Davis, and Black 1937).

The New Deal, in the legal form of the Agricultural Adjustment Act (AAA) of 1933 and amended in 1938, adopted policies of the sort that Black had suggested in 1929. He and USDA economists such as Louis Bean, Chester Davis, Mordecai Ezekiel, Howard Tolley, and M. L. Wilson played major roles in developing, implementing, explaining, and analyzing the impacts of the farm programs of the period. Secretary Henry A. Wallace made heavy use of his economic advisers, as emphasized by Ezekiel (1966):

> Quite early in his administration, Wallace took one step of great importance to the economics profession. That was the adoption of a rule that every decision on production control or agricultural marketing agreements, under the provisions of the Agricultural Adjustment Act, should be preceded by a professional economic study of the current and prospective conditions with respect to that commodity and of the probable effects of the proposed order or action on the economic situation of the commodity. (p. 795).

The early agricultural policy literature dealt with many of the same issues that continue to be important, and leading economists understood those issues well and expressed them clearly. Many early agricultural economists had insights into policy consequences and which parameters were most significant. However, the early literature lacked formal modeling and quantitative tools to frame questions and arguments precisely or to measure the magnitudes of many relationships. Therefore, policy arguments often remained relatively vague, and disagreements about policy conclusions were unresolved. Some of these problems remain.

Lesson #1: Despite lacking adequate data or research tools, the best early economists demonstrated that deep insights about policy consequences could be gained by close observation of market relationships, careful application of economic intuition, and relatively simple models.

The Farm Problem

Much of the early analysis of agricultural policy was predicated on special agricultural relationships that warranted specialized government interventions into farm commodity markets. The core observation, going back to the 1920s, was that agriculture suffered from low returns on human and other capital, low incomes for farm families, and undue variability (and especially downside shocks) on investment returns and incomes. Before World War II provided a reversal, commercial agriculture in most developed countries, including the United States, had faced depression conditions for a generation. It is not surprising that economists helped develop and support activist commodity policies designed to correct the perceived farm problem that seemingly could not be solved by market forces alone.

The iconic statement of the farm problem for subsequent generations was formulated in 1945 by T. W. Schultz (Brandow 1977; Gardner 1992). Schultz conceived of the farm problem as being driven in large part from outside of agriculture but being amplified by conditions inherent in agriculture within a mainly nonagricultural economy. Observations of severe poverty and hardship combined with lack of opportunities within agriculture suggested to Schultz, as to Davis, that migration out of agriculture was inevitable. Schultz characterized lack of stability to include natural variability of supply and demand for farm commodities along with other forces giving rise to highly variable but generally declining relative prices of farm commodities and rapid reductions in labor used on farms. In his long review *Agriculture in an Unstable Economy,* Davis (1947) challenged some interpretations of "instability" in the historical record, but mainly disagreed with the prescriptions for active market interventions of Schultz and his colleagues.

In proposals for government-sponsored forward prices, D. Gale Johnson (1947), among others, emphasized that farmers made investment and production decisions before they could know the market conditions they would face later and therefore, with variability, often made what would, *ex post*, turn out to have been mistakes. Johnson, Schultz, and contemporaries urged the use of government-guaranteed forward prices to guide better agricultural decisions.

A generation later, putting aside the variability arguments, Houthakker (1967) wrote, "The Farm Problem, it will be argued here, is primarily a problem of economic growth. To put it briefly: the demand for farm products grows more slowly than the demand for nonfarm products; consequently economic growth requires a steady shift of labor and other resources from agriculture to other sectors. Since there is resistance to this shift, there are usually too many people in farming and as a result per capita farm income is depressed." Bruce Gardner (1992) drew the link from Houthakker back to an insightful paper by Simon (1947), who showed how agriculture evolves with a steady outflow of labor in a two-sector model under economic growth.

Glenn Johnson oriented his book *The Overproduction Trap in U.S. Agriculture* by stating: "Most people would agree that the United States has a 'farm problem"' (Johnson and Quance 1972, p. 1). Building on Johnson (1950), the rest of the book provided his model of "asset fixity" arising from adjustment costs that retard movements of resources out of farm industries, and marshaled evidence that such adjustment costs were important. Cochrane (1958) emphasized that rapid marginal cost reductions through technology adoption would lower prevailing farm prices and disadvantage lagging adopters, and went further to use this as a rationale for government supply control programs. Of course, agriculture faced many problems, most of which have been used as rationales (or sometimes rationalizations) for farm policies (Benedict 1953; Johnson 1958; Hathaway 1963; Tweeten 1971). But the economics of the farm problem per se has focused on low and variable farm prices and incomes.

Schultz (1945), among many others, pointed to several important stylized facts about agriculture in a modern society, including: (*a*) aggregate supply and demand functions for agricultural products are inelastic in an intermediate run, and (*b*) technical change shifts the supply curve out faster than income growth shifts the demand curve out, in part because (*c*) income elasticities of demand for many farm commodities are low. Johnson (1950) showed that because input prices fell together with output prices in the Great Depression, agricultural supply functions were more elastic than raw observations or crude estimates might suggest. Still, relatively inelastic supply remained an accepted stylized fact.

Policy economists had long recognized that the more inelastic the demand function for domestic farm production, the greater the price variability resulting from a given amount of supply variability, and the greater the potential for domestic supply control to raise agricultural product prices. Davis (1935), among others, recognized that accounting for international export markets was fundamental to assessing the causes of agricultural price declines and evaluating New Deal policy. Early supply control policies were developed together with trade barriers that insulated domestic markets from imports. Exports were important for products such as wheat, and economists recognized that programs that caused high domestic prices would reduce or eliminate commercial exports (i.e., a relatively elastic export demand). The proposals therefore included stocks management and government export dumping policies to shift production out of the domestic market.

By the 1940s and especially in the 1950s, some economists had rejected their previous

notions that core economic features of agriculture required permanent supply control and price supports. Galbraith (1954), however, overstated the case when he claimed that agricultural policy economists were essentially unanimous in stridently rejecting the political consensus that agriculture required farm subsidy programs to perform adequately in the postwar economy. Clearly, influential policy economists, such as Willard Cochrane, continued to favor price support and supply control programs. Galbraith himself argued that appropriate data and relevant economic theory still showed that agriculture could not achieve efficiency or income goals without a heavy government role of the New Deal sort, and that those opposing price supports and supply controls had willfully misread relevant evidence. For example, referring to the claim that the demand for farm commodities might be elastic, Galbraith (1954), citing econometric studies by Karl Fox and George Mehren and a review of estimates by Schultz (1953), asserted that "the statement on price elasticity of demand [of supply control skeptics] is flatly in conflict with the evidence" (p. 51).

The distinction between the efficiency and income objectives of farm policy was emphasized often—for example, by Schultz (1941). Although severe poverty on farms motivated support programs in the 1920s and 1930s, many economists recognized that price supports benefited larger farms most and did relatively little to mitigate rural poverty. Johnson (1944) reemphasized the traditional distinction between the allocative and distributional roles of prices and price policy. He also noted that in some cases farm prices could be important to poverty relief and, quoting Marshall, emphasized that debilitating poverty had long-term implications for the future economic success of individuals, especially children, and the nation as a whole.

One clear change in the 1950s was the emergence of more thorough and systematic applications of explicit mathematical modeling of farm policy questions. For example, in a neglected article in the *Quarterly Journal of Economics*, Howell (1954) developed an explicit indifference curve approach to comparing the welfare effects of price supports and direct payment programs, concluding in favor of direct payments. In addition, Brandow and others were beginning to develop better statistical evidence on important parameters and using parameter estimates for policy simulation modeling (Schulze 1971).

Facing data showing low incomes and low returns (*ex post*), economists developed models in which economic adjustments are costly and take time. Economic development required shifts of resources out of farming, and during the transition this meant relatively low returns and in some cases extreme poverty. But, in rich countries the farming sector is small relative to the rest of the economy, the major adjustments are now complete, and farmers who make their living from the farm tend to earn normal returns and relatively high incomes. Furthermore, with integration between the farm and nonfarm economies and markets available to deal with price risk, annual variability in prices is less a factor in the variability of incomes or consumption on farms (Gardner 2002).

Lesson #2: The transition of labor resources out of agriculture in developed countries took decades. Farm incomes were relatively low during much of that period of transition, but low incomes and periodic low returns were not evidence of inherent problems with markets for agricultural inputs or outputs.

The Economic Consequences of Price Supports and Related Policies

As Gardner (1992, 1996) noted, by the 1980s, most economists, including many who had earlier supported subsidy programs, had abandoned the use of the farm problem as a basis for policy recommendations. Nevertheless, in one form or another, the "farm problem" argument has remained popular among farm subsidy advocates, and the New Deal programs built on the concept of the "farm problem" still dominate farm commodity policies.

One long-standing issue has been how farm programs affect the size distribution of farms and related structural measures. In listing four assumptions without which there could be no AAA, Wilson (1937) wrote, "Assumption No. 1: That we want to maintain a proprietary family farm system, I shall take for granted" (p. 17). In 1945 Schultz stated, "Much has been said and written in this country about the desirability of the family farm as a social-economic goal" (p. 210). In the writings of Wilson and Schultz, and in the more recent literature, discussion of farm policy and the family farm includes much speculation but little analysis of the consequences of farm

programs. The postwar literature through 1985 included no robust empirical tests of the effects of policies on farm size, and the economic modeling was often unconvincing about significant effects, while different authors provided economic reasoning that suggested that farm programs might increase or decrease farm size. In his review of the relevant literature, Sumner (1985) found that farm price and income support programs as pursued in the United States had indirect and mostly small or offsetting effects on farm size distributions.[2]

The Economic Welfare Impacts (Incidence) of Agricultural Policies

The analysis of the economic impacts of agricultural policies has evolved significantly over the past 100 years, along with the policies themselves. Early analysis was often prescriptive and focused on farm prices and incomes (e.g., see the award-winning farm policy essays summarized by Nicholls and Johnson [1946], and the collection of readings edited by Jesness [1949]). Progressively the analysis of policies has shifted toward a more analytical approach, seeking to understand the choices of policy instruments and their settings relative to their disaggregated welfare consequences. It is now common for agricultural economists to represent the economic effects of policies in terms of the distribution of the costs and benefits among different interest groups, defined in terms of their roles as consumers, taxpayers, or producers (or suppliers of factors of production), and the net effects on society as a whole (the sum of the effects on producers and others).[3] It was not always so. As noted above, in the early days, qualitative projections of the effects of programs centered on the effects of aggregates such as production quantities, exports, numbers of farms, farm prices, consumer prices, land prices, and farm incomes as measured in national accounts. Of course, practical discussion of the policy outcomes and many simulation model results continue to be presented in terms of these outcomes rather than producer or consumer surplus or related concepts.

Discussions of the formal analysis of the welfare consequences of agricultural policy often begin with Wallace (1962).[4] Wallace (1962) compared the effects of two stylized policies in a competitive market for a nontraded commodity: a marketing quota and a target price and deficiency payments scheme. In Wallace (1962), these two policies are set to generate a given price for producers, above the market-clearing price, but the quota policy benefits producers at the expense of consumers, with no effect on taxpayers, while the subsidy policy benefits consumers as well as producers, all at the expense of taxpayers. Producer benefits are greater under the subsidy. The net social cost or deadweight loss from the quota may be greater or smaller than that for the subsidy, depending on the relative sizes of the elasticity of supply and the elasticity of demand. A weakness of this analysis is that in comparing the instruments, it may not be appropriate to hold the producer price effect constant. A more useful basis for comparing policies has its roots in articles by Nerlove (1958), Dardis (1967), and Josling (1969).[5] Rather than comparing social costs for a given increase in price or gross revenue, policies are compared in terms of their efficiency of redistribution, or transfer efficiency. Measures of transfer efficiency provide a means for comparing the benefits to producers with the combined costs to consumers and taxpayers, and to society as a whole. The idea was popularized by Gardner (1983), who used surplus transformation curves (STCs), which are typically attributed to Josling (1974), to compare policies in terms of their marginal and average transfer efficiency.[6] He showed how the all-or-nothing choice between subsidies and quotas depends on elasticities, the size of the transfer from consumers-cum-taxpayers to producers, and the marginal social opportunity cost of government funds.

These graphical representations allow us to compare policy consequences, to prescribe more efficient policies, and to understand policy choices. A number of studies have subsequently extended Gardner's analysis to

[2] Recent econometric evidence from an innovative use of very large data sets has suggested that programs may benefit larger farms in supported industries (Roberts and Key 2008).

[3] We do not review the evolution of the tools of applied welfare economics, which are dealt with comprehensively by Just, Hueth, and Schmitz (1982, 2004).

[4] As with Wallace, other important articles of around the same time can be traced to the influence of Harberger. These include works by Nerlove (1958), Parish (1962), Floyd (1965), Johnson (1965), Dardis (1967), and Dardis and Learn (1967).

[5] Nerlove (1958) expressed welfare losses per net increment to producer surplus, as did Dardis (1967) and Dardis and Learn (1967).

[6] Alston and James (2002) discussed in more detail the links between Gardner's analysis and earlier work.

allow for different policy instruments, interest groups, or market situations—including cases with market power in trade. Alston and Hurd (1990) showed that if the policies are not mutually exclusive and may be combined efficiently, transfers from taxpayers to producers could be made without any distortions in production or consumption. The idea that combining instruments can increase transfer efficiency has been formalized and extended in several articles, going beyond two interest groups and two policies. Bullock, Salhofer, and Kola (1999) presented a synthesis and review of these and related studies.

Multimarket Models

The conventional single market commodity supply and demand model, while powerful, has some limitations. In particular, participants in the commodity market are characterized as either producers or consumers, and their welfare is aggregated accordingly. To address an interest in disaggregated welfare impacts or provide other details requires the use of models that disaggregate horizontally between domestic and foreign producers and consumers and vertically across various suppliers of factors of production and final consumers. The appropriate degree of elaboration of the vertical structure and factor markets and the horizontal structure in terms of different commodities and spatial aggregates may depend on the purpose of the analysis. Modeling several linked markets allows us to take account of cross-market effects, which may be important for accurately measuring the incidence in the market for the commodity in question, as well as for studying the effects in the related commodity market.

Capitalization of Program Benefits into Land Values

Following Floyd (1965), two-factor, one-output models of agricultural commodity markets have been used to explore the incidence of agricultural policy among factor markets (see also Muth 1964). It is commonly suggested by agricultural economists that the benefits from agricultural subsidies will ultimately be capitalized mostly, if not entirely, into land, as the fixed factor.[7] However, as shown by Alston and James (2002) using a variant of Floyd's model, this view depends on the use of assumptions that are extreme and likely to be inappropriate for most applications.

Analysis with such models indicates that we should expect a fully decoupled payment attached to land to be reflected entirely in land rents and capitalized fully into land. Under extreme assumptions (such as a fixed supply of land), the same would be true of an input subsidy on the use of land. More generally, however, even a subsidy on land will have some effects on input combinations and output, and thus the incidence will be shifted partly to suppliers of nonland inputs and consumers. A subsidy on output is expected to have even less of its incidence on land, but still it will have a disproportionate incidence on landowners as the suppliers of the least elastic factor of production. Econometric studies generally have found a surprisingly small share of subsidy benefits going to landowners (e.g., Kirwan 2009). One possible interpretation is that the authors are estimating an intermediate-run effect, which is smaller than the long-run effect, because of fixity associated with contracts or roles played by expectations or other dynamics.

Lesson #3: Over time, the emphasis shifted from analysis of the effects of policies on prices to focus on the economic welfare incidence of policy. Deadweight losses from farm commodity programs are generally small relative to the distributional impacts among different groups of factor suppliers, middlemen, taxpayers, and consumers. More work is needed to reconcile recent econometric findings with the predictions from analytical models, but it is clear that landowners do not receive all or even the majority of the benefits from farm subsidies.

Practical Policy Models

As computing capacity expanded in the 1960s, it soon became routine for policy analysis undertaken to evaluate government programs to include quantitative simulations using specifications of relevant supply and demand functions in output and input markets. Schultze (1971) reviewed results of early models by Brandow and USDA-ERS to simulate farm income and other effects of alternative farm policies, including supply controls and price supports. By the late 1960s and early 1970s,

[7] For example, see Rosine and Helmberger (1974).

such efforts were being institutionalized with large multimarket models that incorporated many equations to recognize linkages among crop and livestock markets. Subsequently, the USDA routinely provided quantitative estimates of policy impacts on a variety of economic variables, including prices, farm income, and government budget costs. Models typically did not report effects on welfare measures such as producer or consumer surplus. Beginning in the 1980s, the Food and Agricultural Policy Research Institute (FAPRI) provided Congress with projections. Such models were also used extensively to evaluate trade policy options and by organizations such as the World Bank, which drew on the work of Tyers and Anderson (1992).

Modeling innovations have included the addition of more detailed commodities, countries, and linkages, and the incorporation of stochastic elements in simulations. The strength of these large models is their recognition of multimarket linkages. A drawback, however, is that policies typically have been more complex than the model specifications allow, so that even elaborate models often start with rough approximations of how policies affect incentives. In particular, in many models, policies are treated as universal *ad valorem* subsidy equivalents, whereas the actual policies might involve voluntary participation choices, side-conditions or other elements of multiple instruments, other nonlinearities, or other features that make an *ad valorem* subsidy equivalent far from equivalent in relevant respects. Voluntary output- and input-based supply control policies together with price supports and direct payment schemes, as applied in the United States, have been difficult to characterize successfully in models that attempt to cover many commodities and many countries together.

Limitations on commodity coverage mean that few if any broad multicommodity models deal with fruits, vegetables, tree nuts, and other important crops that cover relatively few acres. Furthermore, aggregation means that models often ignore market differentiation—for example, by class of wheat or type of rice, which is sometimes vital to understanding a market or a policy applied to it. As discussed in Josling et al. (this issue), these concerns are more manifest for computable general equilibrium (CGE) models of the type that began to be widely applied in the 1980s but became popular for modeling global agricultural policy with the spread of the GTAP (Global Trade Analysis Project) system and data sets in the 1990s (Hertel 1997).

A variety of simulation approaches have become available to applied researchers who face the challenge of matching the modeling framework to the nature of their research or policy question, and getting the relevant details right. Broad general models have some advantages but may not be sufficiently flexible to respond to many specific policy questions. All empirical models require parameters, and many general-purpose systems, such as those associated with FAPRI or GTAP, have particular parameter values incorporated. The challenge for the user of such models is to understand how the parameters of the model fit the research question in terms of length of run, prices held constant, policy expectations, and other characterizations.

In addition to modeling innovations, new data on subsidies and measures of subsidies facilitated policy analysis. Among the most influential measures was the producer subsidy equivalent (PSE) developed by Josling in 1973 (FAO 1973), which is discussed by Josling et al. (this issue) and Hertel (1989).

For research to contribute to a better understanding of specific policy questions and options, it must carefully characterize the policies considered and the most crucial aspects of the market relationships. Multipurpose multimarket models sometimes bring consistency and broad reach, but often this is at the cost of inaccurate representations of policy instruments and parameters such that model results do not accurately reflect policy tradeoffs.

Lesson #4: Practical contributions to policy analysis require careful tailoring of model specifications to policy options and market specifics. This is particularly challenging for large, complex general-purpose models.

Political Economy Models

In the 1940s and 1950s, political scientist Charles Hardin and others published regular analyses of the politics of agricultural policy in the JFE. Hardin included economic concepts and evidence but did not apply economics to agricultural politics in the way that evolved a few decades later. In the 1970s and early 1980s, the economics of public choice was much in vogue, with various studies of rent seeking and other interest-group models of government

policy written by influential economists such as Anne Krueger, Gary Becker, Richard Posner, Gordon Tullock, and James Buchanan. Agricultural economists were quick to seize the ideas and apply them to explore the causes along with the consequences of agricultural policies. Issues addressed in the literature include the determinants of the choice of policy instruments and their settings (related in part to the transfer efficiency literature) that define the pattern of benefits and costs and how those choices vary among countries and across commodities, and why.

Some applications proposed political preference function models and applied them to quantify the parameters of public choice. Rausser and Freebairn (1974) were among the first to infer implicit welfare weights from policies. Other applications were not always so formal. Sieper's (1982) *Rationalizing Rustic Regulation* is a tour de force treatment that revolutionized economic perspectives on the history of Australia's farm policies when it first appeared as a conference paper in 1979. Around the same time, Rausser (1982, 1992) discussed U.S. policy in terms of those that are "productive" and those that are "predatory," while Anderson and Hayami (1986) illuminated international differences in rates of assistance to agricultural producers. Gardner (1987a) attempted to account for the pattern of assistance to U.S. farmers econometrically, and Bullock (1995) explored the foundations of efficient redistribution in agricultural policies. These and other important contributions are described in the review by de Gorter and Swinnen (2002).

Lesson #5: Political economy models have provided some insight into agricultural policy outcomes, but much of the policy process is not well captured in the simple and parsimonious models that have been used. More work is needed to explain the diverse patterns of changes in farm policies among commodities, among countries, and over time.

Economics of Quota and Price Discrimination Programs

Much of the economics discussion of U.S. farm commodity policy has centered on price supports and related programs for grains, oilseeds, and cotton. Influential economists such as Cochrane (1959) proposed systems of production quotas for all major program crops, which became the basis for the welfare comparisons undertaken by Wallace (1962) and later in a more general model by Innes and Rausser (1989). But while land set-asides were applied for many years, no such allotment or quota program was consistently applied to the main field crops or livestock products.

The policy literature on other major U.S. program crops such as tobacco, peanuts, and dairy has focused on implications of allotment and quotas and price discrimination schemes. Beginning with the New Deal, these commodities were dealt with separately because their markets and supply conditions were distinct. This section considers quota programs first and then considers price discrimination schemes, especially those of the type applied to U.S. dairy markets to discriminate among end uses for milk and to distinguish between domestic and international markets for various commodities.

Major issues for input and output quotas include (*a*) measurement of effects on prices and quantities, including trade, (*b*) welfare incidence, (*c*) costs of transfer restrictions, (*d*) program operation given yield and demand variability, and (*e*) capitalization of benefits. Each of these has its own body of literature, which we can only touch on here.

Modern analysis of U.S. quota programs began with Glenn Johnson's (1952) analysis of Burley tobacco programs. His comprehensive consideration of price, income, and other impacts of input quotas was considered an exemplary model of applied policy analysis. In an influential article, Paul Johnson (1965) used a more explicit graphical exposition to show the economic consequences of production quotas and then applied this model with detailed empirical estimates to measure the welfare effects in terms of producer and consumer surplus as illustrated by Wallace (1962). Rucker, Thurman, and Sumner (1995), extended the model to estimate supply parameters and show that restrictions of quota transfers had imposed relatively small aggregate deadweight losses but shifted substantial amounts of income among interest groups. Quota and allotment programs have provided convenient cases in which to investigate the rents to government-created assets and the capitalization of rents in asset values. Seagraves (1969) provided innovative econometric estimates of the capital value of tobacco allotments to show that rates of return to allotment ownership were quite high. Subsequent research (e.g., Barichello 1995) has

documented rates of return to quota ownership of 20% or more, suggesting that quota prices were depressed by policy risk (Johnson 1991).

Marketing quotas have been used to implement price discrimination in many countries and for many commodities, but especially dairy. Ross Parish and Alan Lloyd made early contributions to this literature in studies of Australian dairy policy in the 1960s. Rucker and Thurman (1990) thoroughly measured the welfare and other effects of a complex policy of marketing quotas and price discrimination for U.S. peanuts. In other countries, price discrimination and pooling policies were used more extensively (e.g., for dairy, wheat, sugar, and eggs in Australia and Canada), usually to maintain domestic prices above international prices, and attracted a series of studies (e.g., Parish 1962), some of which were published in AJAE. Sieper (1982) presented a comprehensive review and analysis of these and other Australian agricultural price policies, considering both causes and consequences.

In the United States the most prominent case of price discrimination and pooling policy has been milk marketing orders. The welfare economics and other implications of these programs were explored initially by Kessel (1967) and developed more fully by Ippolito and Masson (1978) with a model that has been widely applied and extended. Examples include work by Cox and Chavas (1991) and others who developed comprehensive dairy policy simulation models and by Balagtas, Smith, and Sumner (2007), who found that incentives for individual farms to participate in the pool caused excess milk quality and consequent rent dissipation.

As with other policies, details of supply control and price discrimination policies matter for deadweight losses and distributional impacts. Quantitative effects of programs depend on limits on quota transfers and ownership, and whether quotas apply to inputs or outputs. Rates of return to quota ownership have generally been high, perhaps because of policy risk and the perception that the policy may be short-lived. Typically, however, substantial compensation payments were made to quota owners when programs were removed. Price discrimination schemes can benefit producers at the expense of consumers in the high price market, but the effectiveness depends on the supply response to the policy. In some instances, rents are dissipated through added production and through expenses of meeting the costly entry criteria.

Lesson #6: Supply control programs and price discrimination policies have benefited producers and quota owners mainly at the expense of consumers. Detailed impacts depend significantly on details of policies. Common program features such as quota ownership restrictions and policy risk have affected the magnitude and distribution of benefits from quotas, and incomplete barriers to entry have undermined price discrimination and pooling programs.

The Economics of Government-Run Price Stabilization and Buffer Stock Schemes

Interest in the effects of government policies for commodity storage and price stabilization dates at least as far back as the Old Testament story of Joseph, who told the Pharaoh to store grain during times of abundance to forestall shortages during times of drought (Genesis 41:53–57). In China, government grain storage schemes were implemented as early as the first century BCE (Chen 1974). In the 1930s, as secretary of agriculture, Henry A. Wallace championed the establishment of an "ever-normal granary" to smooth out consumption and stabilize prices. Yet at the time when these ideas were implemented in the Agricultural Adjustment Act of 1938, little was understood about how public and private storage affected consumers and producers. Since then, much progress has been made in understanding the economics of price stabilization and the role of storage.

Henry Wallace and the Ever-Normal Granary

Henry Wallace was greatly influenced by the writings of Chen, whose 1911 Ph.D. thesis described the administration of an "ever-normal granary" in China two thousand years earlier (Bodde 1946). Wallace (1937) described the ever-normal granary as a "definite system whereby supplies following years of drought or other great calamity would be large enough to take care of the consumer, but under which the farmer would not be unduly penalized in years of favorable weather" (p. 9). Under the proposal, the government would support prices when crops were large by providing producers commodity loans at guaranteed levels (the loan rate). If prices were high enough at time of loan maturity, producers would repay the loans; if prices were low, however, producers could

forfeit the collateral (i.e., the crop) to the government, thus in years of bumper crops effectively providing a floor under market prices. When prices were high because of short crops, the government would release stocks on the market, thus dampening price hikes.

Not all economists were admirers. Davis (1938) was an early critic who pointed out the problems of administering buffer stock schemes, including: (*a*) the problems of setting support prices relative to market prices without acquiring large surpluses; (*b*) the high probability of stockouts, particularly in the event of back-to-back droughts; (*c*) the high taxpayer costs of public storage; and (*d*) the negative effect that buffer stock programs would have on trade. "My own considered conclusions are that, whatever its real intent, the ever-normal granary system is essentially a scheme for far-reaching regulation of farm production and marketing, at great expense to taxpayers and probably consumers. It would fail of its major avowed objectives. In operation it would sometimes seem successful, sometimes a great fiasco. It would probably create more emergencies than it would forestall. It would bring less weal than woe" (Davis 1938, p. 20).

There is now a long and rich literature on the welfare effects of price stabilization. Myers, Sexton, and Tomek in this issue provide an overview. A central weakness of the early price stabilization literature (e.g., Waugh 1944; Oi 1961; Massel 1969) was that to achieve tractable analytical results, the models had to be unduly simple: Stabilization policies were assumed to be costless, production decisions were assumed to be based on perfect foresight, and trade and private storage were typically excluded from consideration altogether. As researchers sought to build more useful models, it became increasingly difficult to produce algebraic results that could easily be interpreted.

Gustafson and Storage Models

The shock in world grain prices that occurred in the early 1970s prompted a wide range of research on government and multilateral programs for carryout and the role of private storage in government activities. A key feature of this literature was the assumption of rational, forward-looking storage decisions. Robert Gustafson (1958a, 1958b), in work sponsored and published by USDA, was the first to use dynamic programming to develop optimal storage rules that considered future supply variation. Widely regarded as pathbreaking methodologically and appreciated in that context, further application of Gustafson's work was delayed until the studies by Johnson (1975), Johnson and Sumner (1976), and Gardner (1979). Other important contributions to the development of forward-looking storage models were by Helmberger and Weaver (1977) and Newbery and Stiglitz (1981).

Drawing on this earlier work, Wright and Williams (1982, 1984) developed solution methods for storage models with responsive supply and rational price expectations. Their 1991 book remains one of the clearest formulations of the storage model (Williams and Wright 1991). Miranda and Helmberger (1988) and Wright and Williams (1988) extended the storage model to include buffer stock schemes in the presence of private stockholders, and Miranda and Glauber (1995) further extended the model to include trade. These conceptual developments supported practical applications in contexts where government buffer stocks and other public storage schemes had been implemented and, as had been predicted by Davis many years previously, generally failed. A relatively recent and spectacular example was the failure of the Australian wool reserve price scheme in the 1990s, analyzed by Bardsley (1994).

The importance of storage models for policy analysis is that they have enabled researchers to examine government price-stabilizing mechanisms in the context of forward-looking producers and private inventory holders. While results depend on parameter specifications, numerically based storage models have provided additional insights into welfare issues and stock management policies.

Lesson #7: Governments have very limited potential to use carryover programs to stabilize markets in ways relevant to producers or consumers without causing other problems that are even more severe.

The 2007–2009 spike in food prices again raised the issues of food security and commodity price stabilization schemes such as international grain reserves. Significantly, most discussions concerned the establishment of strategic humanitarian reserves in vulnerable countries rather than the large buffer stock schemes of the type envisioned in the 1970s. The recent policy debate on storage and

stabilization reflected the major findings of the economics literature. Analysts and officials recognized that plans to stabilize prices through physical buffer stocks or "virtual stocks" schemes involving short speculative positions in futures and options markets were likely to be costly, ineffective, and short-lived (Wright 2009). Moreover, private stockholders, once ignored or mistrusted in policy discussions, are today recognized as key contributors to price stability.

The Economics of Government Policy for Subsidized Crop Insurance

Economic research on crop insurance can be traced at least as far back as Valgren's (1922) study of private insurance markets. With the establishment of the federal crop insurance program in 1938, the JFE and USDA publications featured many reviews of the policy and some analysis. This work was largely descriptive in nature, but there was much discussion of the problems facing crop insurance, including what would later be characterized as adverse selection and moral hazard issues (Rowe and Smith 1940).

Economists began to devote serious attention to government programs to subsidize crop insurance with passage of the Federal Crop Insurance Act of 1980. The 1980 act (and subsequent legislation in 1994 and 2000) transformed the crop insurance initiative from a small pilot program with limited participation to a nationwide program covering most major field crops in most major growing regions. The amount of research on crop insurance has increased dramatically, particularly since 1994, paralleling the growth in the program and availability of actuarial data.

Economic Evaluation of Government Programs for Crop Insurance and Disaster Assistance

Early writings on the federal crop insurance program were largely favorable toward it. Even New Deal critics like Joseph Davis (1938, p. 21) allowed that the program merited "limited and careful government experimentation." In their analysis of the U.S. crop insurance program, Gardner and Kramer (1986) concluded that premiums would have to be subsidized as much as 50% to achieve 50% participation. Goodwin and Smith's (1995) comprehensive examination of crop insurance showed why there were few if any private markets for crop insurance and concluded that the costs of properly addressing adverse selection and moral hazard problems made crop insurance premiums prohibitively expensive without subsidies. Glauber (2004) pointed out that even as increased subsidies brought more participants into the program, the overall performance of the program as measured by indemnities paid to producers, as a percentage of premiums collected, was unchanged over the twenty-five years.

Of course, moral hazard and adverse selection problems have been central to developing successful government crop insurance programs (Chambers 1989 and 2002). Botts and Boles (1958) developed numerical methods for evaluating crop yield risks based on crop yield distributions, and early insightful work was refined with better individual farm data (Skees and Reed 1986; Knight and Coble 1999; Babcock, Hart, and Hayes 2004).

Using aggregate or indexed risks rather than individual risks provides another approach to address adverse selection and moral hazard problems. Halcrow (1949) showed that insurance contracts based on area yields could provide significant protection to producers yet avoid adverse selection and moral hazard problems. Miranda (1991) recast Halcrow's concept using a methodological approach drawn from financial economics based on the capital-asset pricing model. Following Miranda, numerous papers have examined area yield and indexed insurance contracts. Bourgeon and Chambers (2003) discussed the design of optimal area yield contracts.

The Effects of Subsidized Crop Insurance on Production Decisions

To the degree that subsidies or risk reduction affect production decisions, producer and consumer welfare is likely to be affected. Nelson and Loehman (1987) recognized the output-enhancing potential of crop insurance. Empirical work on insurance has focused on its effects on planted area and on input use. Wu (1999) concluded that farms that purchased insurance were more likely to produce soybeans and less likely to produce forage crops. Goodwin, Vandeveer, and Deal (2004) found small effects of crop insurance premium costs on crop mix. Cross-commodity effects are likely to be mitigated by the fact that in the United States, subsidized insurance is now available for numerous crop alternatives.

While no studies have directly analyzed the effects of crop insurance on yield, much research has been done on the effects of crop insurance on input use (see review in Glauber 2004). Babcock and Hennesey (1996) and Smith and Goodwin (1996) concluded that the effects of crop insurance on input use are negative, suggesting that the resulting effect on yields is likely to be negative. Whether this effect is large enough to offset any positive effect on crop acreage remains an open question.

Lesson #8: It is very difficult to design and implement government crop insurance that does not entail large subsidies and potential production distortions.

Models and empirical research have established the extreme difficulty of designing agricultural insurance systems that are appealing to producers without large premium subsidies. Moral hazard and adverse selection combine to make break-even premiums high and participation low. Furthermore, the inevitable political demand to use insurance schemes as modes of subsidy, especially for regions with low or variable productivity, causes government-sponsored insurance programs to be expensive and distorting.

The Economics of Agricultural R&D Policy

Agricultural research has transformed agriculture and, in doing so, has contributed to the transformation of whole economies. Economic and policy issues arise because agricultural research is subject to various market failures, because the resulting innovations and technological changes have important economic consequences for net income and its distribution among individuals and among factors of production, and because the consequences are difficult to discern. These issues have been studied and documented in a literature on the economics of agricultural R&D that began as such in the 1950s, with work by T. W. Schultz and others.

Over the ensuing half century or so, economists have developed analyses, models, and measures of the economic consequences of agricultural R&D and related policies in contributions that relate to a very broad literature, drawing on, and at times contributing to, the full range of subfields of economics. Early foundations have led to subliteratures on (*a*) incorporating roles for knowledge and technology in models of production (e.g., Schultz 1956; Griliches 1964; Evenson and Kislev 1973), (*b*) the adoption of innovations (e.g., Griliches 1957; Evenson 1967), (*c*) studies of research policies (e.g., Ruttan 1982), and (*d*) modeling and measuring research impacts (e.g., Griliches 1958; Petersen 1967).

Studies of Research Institutions and Investments

A significant part of the economic literature on agricultural R&D policy comprises studies that describe, document, and quantify the institutions that fund, regulate, and conduct agricultural research, and the investments that they make (e.g., Ruttan 1982; Huffman and Evenson 1993; Alston and Pardey 1996; Alston et al. 2010). These "descriptive" studies are of value in their own right, but they also provide an institutional frame of reference and data for econometric and other modeling studies. Agricultural R&D policies discussed in this literature have emphasized responses to market failures that otherwise have led to an underinvestment by the private sector relative to the social optimum in certain kinds of R&D (and farmer education and extension). These responses have included (*a*) enhanced intellectual property rights for invention, (*b*) prizes, subsidies, or other incentives, and (*c*) government production of R&D in public institutions, the main instrument and the subject of most of the work. Many other government policies have a fairly direct influence on agricultural innovation, including (*a*) various kinds of technological regulation (e.g., animal welfare regulations, pesticide regulations, varietal restrictions, including those applied to biotech crop varieties), (*b*) other environmental policies, and (*c*) certain types of farm commodity policies, such as quotas. Each of these has its own literature.

Models of the Size and Distribution of Research Benefits

Agricultural economists have used supply and demand models of commodity markets to represent agricultural research impacts, beginning with Schultz (1953) and Griliches (1958), with important subsequent contributions by Petersen (1967), Duncan and Tisdell (1971), and Lindner and Jarrett (1978), among others. In a standard model of research benefits, research causes the commodity supply curve to

shift down and out against a stationary demand curve, giving rise to an increase in quantity produced and consumed, and a lower price. The benefits are assessed using Marshallian measures of research-induced changes in consumer surplus for consumer benefits and of research-induced changes in producer surplus for producer benefits. Some issues in the literature relate to the methods used for measuring the time-varying research-induced reduction in the industry-wide unit cost of production. Other important influences are the size and structure of the market to which the shift factor pertains.

Much of the literature is about the determinants of the incidence of agricultural R&D policy—the distribution of the benefits (and costs) of taxpayer-funded R&D. The distribution of the benefits between producers and consumers depends on the relative elasticities of supply and demand, the nature of the research-induced supply shift, and, less importantly, the functional forms of supply and demand (Alston, Norton, and Pardey 1995). In particular, producers must benefit from a vertically parallel supply shift but will lose from a pivotal supply shift if demand is inelastic (e.g., Lindner and Jarrett 1978). The nature of the research-induced supply shift has been controversial because it matters for results and is not easy to observe. The possibility of losses to producers in aggregate is often discounted, on the grounds either that demand is relatively elastic or that a parallel research-induced supply shift is relatively likely, but concrete empirical evidence on that issue has been elusive.

Another issue is distribution of producer benefits among producers. Even if we can be assured that producers as a whole would benefit, those who do not adopt the new technology will not gain, and may even be made worse off if the adoption by others leads to price reductions. In addition to issues about the distribution of benefits and costs between adopters and non-adopters, there may be further distributional issues associated with how the "producer surplus" is distributed among factor suppliers—do landowners benefit at the expense of suppliers of farm labor, including farm operators, or vice versa?

The standard model treats R&D as having been provided by the government and the resulting technology as provided for free. In an important contribution, Moschini and Lapan (1997) extended the basic model to deal with proprietary research. The basic model also assumes competition in the market for the commodity and the absence of any other market distortions. Models of research benefits have been extended to incorporate various types of market distortions, including those resulting from (*a*) government policies such as farm commodity programs or trade barriers, including the failure to impose optimal trade taxes in the large-country case; (*b*) the exercise of market power by middlemen; and (*c*) environmental externalities. A general result is that in most cases the main effect of a market distortion in this context is to change the distribution of research benefits, with comparatively small effects on the total benefits (e.g., see Alston, Norton, and Pardey 1995 for details).

Models of agricultural research in a distorted market setting have been used to draw inferences about implications of market distortions for the rate of investment in agricultural research and the rate and direction of technological change (e.g., Hayami and Ruttan 1971; Schultz 1978; Mellor and Johnston 1984, as reviewed by Alston, Norton, and Pardey 1995). Some studies have used political economy or interest group models in which the distortions themselves are endogenous, being determined jointly with the research investment (e.g., de Gorter and Zilberman 1990; Swinnen and de Gorter 1998).

Models and Measures of Research Impacts

Many studies have modeled agricultural production or productivity as a function of agricultural research and extension, often with a view to estimating the rate of return to research. A comprehensive evaluation of this literature is provided by Alston et al. (2000) (see also Schuh and Tollini 1979; Evenson 2002; Alston et al. 2010). Alston et al. (2000) conducted a meta-analysis of 292 studies that reported estimates of returns to agricultural R&D. A predominant and persistent finding across the studies was that the rate of return was quite large. The main mass of the distribution of internal rates of return reported in the literature is between 20% and 80% per annum. Other reviews of the literature may not have covered exactly the same studies in exactly the same ways but nevertheless reached similar general conclusions (see, e.g., Evenson 2002). Key issues identified in these reviews are associated with modeling R&D lags and spillovers.

The lag distributions employed in models of R&D impacts have evolved. Until quite recently, it was common to restrict the lag length to be less than twenty years. In the

earliest studies, available time series were short, and lag lengths were assumed to be very short, but the more recent studies have tended to use much longer lags, as supported by the work of Pardey and Craig (1989) and Huffman and Evenson (1993). A comparatively long lag has implications for econometric estimates of the effects of research on productivity and typically implies a lower rate of return to research.

Griliches' (1957) analysis of the generation and dissemination of hybrid-corn technology throughout the United States was a seminal study in the economics of diffusion as well as the spatial spillover of an agricultural technology. This work inspired others on adoption of individual technologies, some of which entailed spatial spillovers. Other studies have sought to assess the overall effects of R&D on aggregate agricultural productivity, including spillover impacts, with regression-based methods (e.g., Huffman and Evenson 1993; Alston et al. 2010).

Lesson #9: Studies of agricultural productivity and research benefits have revealed very high rates of return. These returns reflect a significant and persistent underinvestment in agricultural R&D, in spite of substantial government intervention. Measures of distributional impact are less definitive and more fragile. We still do not have compelling, direct econometric evidence to show that farmers have in fact benefited from technological change.

Conclusion

Economists have been contributing to a better understanding of agricultural policy since the beginning of economics. However, the economics of agricultural policy has been an intensive and distinct research enterprise for about eighty-five years. Over that time, the analysis and evidence brought to bear on policy questions have deepened, and our understanding of consequences of policies has improved. But the research agenda remains full.

In agricultural policy, perhaps more than in most areas of agricultural economics, important empirical issues remain unsettled or in dispute. Work remains to be done to understand the sources of differences and to narrow them. Some uncertainty arises because answers depend on parameters and relationships that are inherently difficult to measure confidently with precision, and the data and empirical tools are only now becoming available. This pertains especially to questions of the incidence of policies, the answers to which depend on values for elasticities and the nature of market relationships. One good example is the question of the share of farm subsidies accruing to landowners versus others. Another example is the issue of who benefits from agricultural R&D, the answer to which turns on the elasticity of demand for the relevant product and markets and the nature of the research-induced technical change, which is hard to identify with confidence.

In policy research, different perspectives about the issue at hand often influence the choice of methods, which in turn influence model results and their interpretation. Often answers turn on the counterfactual scenario being contemplated, which is sometimes left unclear. Are we considering global versus local adoption of new technology? Are we holding all other policies fixed when we change one? Is the analysis vulnerable to the "Lucas Critique"? Answers to empirical questions about policy turn on details of the analysis, such as how the policy instruments are represented in the model, as well as choices about modeling approach (small single market versus multimarket) and particular values for parameters. Often the models are not transparent.

Some important current research reflects continuing efforts to better model and measure policy-relevant relationships that have been studied since the beginning. For example, economists continue to consider how farm subsidies affect input markets, including prices of variable farm inputs and other inputs that may be quasi-fixed, such as human capital, R&D embodied in new seeds, and land (see, e.g., Kirwan 2009; Alston 2007). Supply response in the context of farm subsidy programs remains important, and new models and estimates are emerging on how complex programs, including those with indirect production incentives, affect planted acreage and output (see, e.g., McDonald and Sumner 2003; Goodwin and Mishra 2006; McIntosh, Shogren, and Dohlman 2007).

Other important policy research topics reflect the evolving policy agenda or a confluence of both motivations. Perennial issues such as the relationship between commodity programs and international trade policy, environmental policy, and nutrition raise new research questions in the context of evolving

topical concerns, such as new trade agreements, new environmental regulations, or public health issues such as obesity. Moreover, such topical issues as heightened food safety and traceability concerns and climate change have agricultural policy economists involved at the cutting edge of research on widely ranging public policy issues.

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