Giannini Foundation Contributions to Agricultural Marketing Studies

Julian M. Alston and Richard J. Sexton

Julian M. Alston and Richard J. Sexton are professors in the Department of Agricultural and Resource Economics at UC Davis.

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The purpose of this paper is to review and evaluate the research activities and achievements of the economists who have served as members of the Giannini Foundation of Agricultural Economics over the past seventy-five years with specific reference to marketing of California farm products. This is a subject of very broad potential scope and it is necessary to impose limits on the scope, both as a coping strategy and to avoid overlapping too much with the other papers in this collection.

One limitation on scope will be the form of the evaluation, much of which will be strictly descriptive (i.e., nonquantitative) and largely speculative (i.e., based on factoids rather than actual evidence), partly because it is an area where quantification is difficult. Foundation members have made scholarly contributions, both directly and by having influence on the work of others, especially graduates from the departments at Berkeley, Davis, and Riverside that make up the Foundation. The resulting information and knowledge in turn has its ultimate payoff through influences on knowledge and understanding and on decisions made by managers of farms and agribusiness enterprises and in the public sector. These influences and the corresponding benefits to society, however, are notoriously difficult to demonstrate, let alone quantify, and attribute to particular causes (for instance, see Pardey and Smith (2004) and the chapters therein). Rather than seek to measure and apportion benefits, a reasonable compromise approach is to take for granted that the overall field of agricultural economics has been socially valuable and consider the roles and achievements of the members of the Foundation relative to the profession as a whole. Even so, comprehensive coverage is not feasible. An overview is provided of the range of contributions with detailed attention to some important, indicative examples.

A second limitation on the scope is imposed by defining the set of topics that are included under the rubric "marketing." What is marketing? The marketing textbooks say "marketing isn't just selling." It includes business activities related to decisions about what to produce when and how, as well as merchandising roles that we first think of when marketing is mentioned. Thus marketing includes some on-farm activities, as well as activities beyond the farm gate all the way through to the final consumer. For the present purposes the key distinction is between "marketing" and "production" (which is covered elsewhere in this volume by Sumner), each of which could encompass the entire marketing chain from one perspective or another. In Sumner's paper on production, emphasis is given to economic activities on the farm and to the resources used in production. Here, emphasis is given to

the economic activities beyond the farm gate that determine the nature of the markets for farm products and to the individual and collective actions of farmers to enhance their returns through marketing activities, with and without the assistance of the government. Hence, our coverage of scholarly work in agricultural marketing relates to the study of markets and marketing institutions, including studies of private individual and collective marketing activities, and of the causes and consequences of government intervention in the market.

This paper proceeds in the next section with a review of external factors that influenced marketing economics as conducted within the Giannini Foundation, including developments in agriculture, in the Experiment Station, and in agricultural economics more broadly, and in the parent discipline of economics. The third section presents a brief discussion of the evolving history of agricultural marketing in California and the unique nature of California agriculture and the marketing issues it faces. Against that background, the paper then provides a quantitative overview of marketing economics within the Giannini Foundation in terms of the number of publications and dissertations per year and the balance between marketing and other subfields over its more than seventy-five-year history. That section also considers other measures of leadership roles played by members of the Foundation. The paper concludes with a caveat recognizing some limitations of our work.

Influences on Marketing Economics in the Giannini Foundation

Like other applied scientists, agricultural economists are influenced by their circumstances. What we find interesting to work on depends on what is happening in the world, what is happening in our parent disciplines, and the types of resources that are available to us and the strings that are attached to them. Thus, as their circumstances have changed, we have witnessed changes in the work of the economists in the Giannini Foundation. At the time when the Giannini Foundation was first established, California agriculture and agricultural economics in the University of California were very different from today. With the evolution of the state's agriculture, we have witnessed an evolution in the scale and focus of the agricultural economics enterprise conducted initially at Berkeley and progressively over time also at Davis and Riverside. This evolution has been influenced by the changing fortunes of the State Agricultural Experiment Station and the university more generally and by developments in economics more broadly, among other things.

Critical Features of California Agriculture

California agriculture today is large, complex, diverse, dynamic, economically important, and different in many ways from agriculture in most of the rest of the United States.[1] With a gross value of farm output of around $30 billion in recent years, California agriculture accounts for around 12% of the national total, almost twice as much as the next largest agricultural state (Texas).[2] This output was produced with just 3% of the nation's agricultural land, reflecting California's unique combination of (1) a rich natural endowment of soil and climate, (2) a very substantial public investment in research, education, and knowledge, as well as in irrigation and other infrastructure, (3) a very substantial private investment in biological and physical capital on farms, (4) highly sophisticated technology and management, and (5) an abundant supply of relatively cheap farm labor.

As Table 1 shows, the index of total California agricultural output increased from 100 in 1949 to 443 in 2002. This 4.5-fold increase in total output reflected slightly slower growth in

output of fruits and nuts, livestock, and vegetables; much smaller growth in production of field crops; and much greater growth, by a factor of fourteen, in greenhouse and nursery.[3] Aggregate inputs grew by only 68% from 1949 to 2002, reflecting significant reductions in the use of land and especially labor and some increases in capital and purchased inputs. Combining the information on inputs and outputs, the index of multifactor productivity grew from 100 in 1949 to 264 in 2002, an increase in productivity of 164% over the fifty-three-year period and slightly greater than the U.S. national aggregate agricultural productivity growth of 160% over the same period.[4]

California's agricultural output consists of a diverse range of well more than 250 agricultural commodities, including a host of horticultural products for which California is an important producer (and sometimes the only significant producer), not just in the United States but in the world as a whole. The nature of the product mix and California's importance in the specific product markets have marketing implications. For those commodities for which California is a "large-country" trader, able to influence national or world prices, there is potential to introduce marketing arrangements designed to exploit market power in trade or otherwise to manage market prices and this potential has been exploited at times. For those commodities for which California is the main or only producer, consumption necessarily occurs at a distance from production and many of these commodities are highly perishable. These factors combined give rise to questions about the economics of transport, storage, handling, and distribution; the market mechanisms for conducting transactions at long distance; and the nature of competition in the industry and the efficiency of the market mechanism. Similar questions can arise in any commodity market but they become different and perhaps more pronounced when the production is more spatially concentrated and the commodity is perishable.

In addition, many of the California specialty crops are perennials for which production is highly capital intensive, requiring substantial investments in irrigation and other infrastructure and planting materials. For these crops, the dynamic structure of supply response to price is different from that for annual crops. There are long biological lags as tree and vine stocks grow and mature, which also mean that short-run supply response is negligible and markets may be subject to periods of overcapitalization and sluggish adjustment, and yields may be subject

	1949	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2002
Fruits and Nuts	100	99	111	106	130	129	174	217	233	246	278	379	390
Vegetables	100	118	134	150	152	194	205	255	284	332	363	438	421
Field Crops	100	93	118	150	152	157	243	282	265	259	250	254	232
Greenhouse and Nursery	100	106	141	196	245	278	409	607	726	962	942	1,280	1,442
Livestock	100	106	137	161	188	208	216	245	272	336	356	408	430
Total Output	100	102	127	145	165	181	223	268	291	334	352	432	443
Total Input	100	102	107	121	122	120	128	134	129	151	166	169	168
Productivity	100	101	118	120	135	150	174	200	227	221	212	256	264

Source: Figures in this table were supplied by Matt Andersen, personal communication. Data beyond 2002 are not yet available.

to significant systematic movements associated with alternate bearing patterns. Consequently, because of differences in the nature of demand, the nature of supply, or the nature of the product and how it is marketed, the relevant marketing and policy issues in California specialty crop industries may differ from those that are important for the intensive livestock and annual grain crops that predominate in other states. In particular, California produces a number of commodities for which demand is comparatively inelastic (because of California's large market share) and supply is highly inelastic in the short run over a wide range of prices (either because it is a highly perishable crop, like lettuce, or a perennial crop, like almonds).[5] These market characteristics can have important implications for pricing and market performance and appropriate marketing institutions.

Because of the different character of California agriculture, there is a range of economic and marketing questions that are more important for California agriculture than for agriculture in other places and less likely to have been answered for us by economists working in other places—for instance, in the U.S. Midwest. This is so both because the general issues are not so relevant when the product mix is dominated by corn, soybeans, hogs, and dairy products and because specific issues about particular California crops (e.g., wine grapes or almonds) are of no relevance at all elsewhere. This structure—where California faces a comparatively unique set of production and marketing issues that are likely to be neglected by agricultural economists and other agricultural scientists in other states—is inherent and enduring. It means that California has had to be relatively self-reliant in the study of production and markets for many of its farm products and will have to continue to be so as agriculture and agricultural marketing issues continue to evolve.

The Professional and Institutional Context of the Giannini Foundation

Some useful perspective is gleaned by considering the Giannini Foundation in the context of the California Agricultural Experiment Station (CAES) and the University of California more generally, and also beyond that in the context of the broader national and global agricultural economics industry.

Table 2 shows the total number of members of the Giannini Foundation over time compared with (1) the total number of CAES scientists in the counterpart colleges of Agriculture, Environmental Science, and Natural Resources at Davis, Berkeley, and Riverside and (2) the total budget of the CAES. In Table 2 it can be seen that Agricultural (and Resource) Economics in

	1930	1950	1970	1990	2000
CAES Funding – thousands of 1999 dollars	18,593	57,158	120,121	229,134	253,475
CAES Scientists – full-time equivalents	210	566	509	439	NA
Foundation Members – full-time equivalents	14	19	49	74	56
American Agricultural Economics Association (AAEA) Members – domestic total	650	1,439	3,165	3,613	2,785

Source: Data on CAES funding and CAES full-time equivalents were taken from *Valuing UC Agricultural Research and Extension* published by the University of California Agricultural Issues Center in 1994. AAEA membership data were provided by Philip Pardey. Foundation member data were compiled by the authors from various sources—see notes to Appendix Table A-1.

the University of California shared in the growth of the Agricultural Experiment Station and in the corresponding colleges at Davis, Berkeley, and Riverside but that the patterns of growth were not fully congruent or consistent over space and time. These figures also provide a basis for considering the relative role of support from the Giannini Foundation compared with other resources used by members of the Foundation and other factors.

In 2005, the Giannini Foundation contributed $800,000 to the operating resources of the member departments at Berkeley, Davis, and Riverside. In that same year, a total of fifty-nine economists were employed in those departments, including fifty in professorial appointments and nine Cooperative Extension specialists. The total operating budget across the three departments was in the range of $3–4 million and the total operating cost of the enterprise, including faculty and staff salaries and benefits, was in the range of $10–12 million. Thus the Foundation contributed around $13,000 per member in 2005, perhaps 6% of the total resources used by the members but closer to 20% of the operating funds.[6] Even though the Giannini Foundation does not provide a very large share of the total resources spent by its members, the funding is high powered because it is incremental and, at least to some extent, flexible, whereas most of the other resources are not. Accordingly, and particularly through their use to support mini-grants, Giannini funds can have and have had a disproportionate influence on the agenda of the agricultural economists.

It is relevant (and perhaps important) to recognize that, although they have some common ground, the missions of the Giannini Foundation, the CAES, and the University of California are different and perhaps increasingly so over time. In particular, the missions of the university and the Experiment Station extend well beyond California agriculture and the California agriculturalists that were the focus of the founding charter for the Giannini Foundation. In addition, it is relevant (and perhaps important) to recognize that the output from the members that is consistent with the purposes of the Giannini Foundation is only partly attributable to the Foundation. At the same time, work partially or even fully funded by the Foundation may have incidental benefits that extend beyond its charter and yet may be a very appropriate use of Foundation funds. Such considerations mean that even a notional benefit-cost analysis is complex.

Developments in the Broader Economics Profession

Like most other disciplines, economics has been evolving in the direction of increasingly narrow individual specialization within the field in terms of subject matter or methodological focus. As the parent discipline has moved upstream into less applied (more theoretical or less empirical) research, so too has the subdiscipline of agricultural economics. In many places, so-called agricultural economists today are generally more narrowly focused and more technically oriented than their predecessors were seventy-five or even twenty-five years ago, to the extent that many of them nowadays do work that does not have much specific relevance to agriculture. To some extent, agricultural economists are occupying a gap created by the upstream movement of the parent economics discipline—a drift that has counterparts in the other disciplines represented in other departments within the College of Agriculture.

In the University of California, agricultural economists have enjoyed a particular form of academic freedom in an institutional environment that encourages and rewards particular forms of academic achievement. High rewards are conferred for publishing in more general economics journals, especially at the top tier, compared with publishing in the top field-specific journal,

the *American Journal of Agricultural Economics*, and members of the Giannini Foundation have responded to these incentives. In turn, the types of scholarly contributions being made by members of the Foundation have evolved, away from providing specific research results relevant to a particular context in California agriculture and in the direction of providing research results possibly relevant to a broader range of settings, beyond agriculture and beyond California. These developments are perfectly consonant with the missions of the university and the Experiment Station but perhaps less so with the original charter of the Foundation.

In some senses, these developments are especially appropriate when we consider the place of the Giannini Foundation in the global profession of agricultural economics. The University of California occupies a special place in a world that has depended on the United States to provide a predominant share of all science funded and conducted in both the public and the private sector. As shown by Pardey and Beintema (2000), a small number of rich countries have provided the lion's share of global investments in all science, including agricultural research and development (R&D) and the United States has played a particularly important role in generating past global agricultural productivity improvements. Presumably the same may be said about global investments in agricultural economics as a component of the agricultural R&D portfolio—i.e., the United States has provided a disproportionate share of the world's agricultural economics research. Recent work (Pardey, Alston, and Piggott 2006) indicates a worsening of the global underinvestment in agricultural science, and presumably that trend too will extend to agricultural economics as a component of agricultural science. These observations may have implications for how we should balance the different missions of the Foundation, the Experiment Station, and the university.

Agricultural Economics at the University of California

The members of the Giannini Foundation excel relative to the agricultural economics profession more broadly by most measures used in academic comparisons, such as publication counts, citations, professional awards, and subjective peer rankings. Accordingly, the agricultural and resource economics departments at Berkeley and Davis have typically been ranked within the top two or three (and often as the top two) agricultural economics departments in the world (not just in Northern California) in most rankings over the past thirty to forty years. Yet California invests relatively little in public-sector agricultural economics.

Even though California agriculture accounts for more than 12% of the total value of U.S. farm output, a much smaller percentage of U.S. agricultural economists employed in land grant universities are employed in the University of California. Data are not available on the national total number of U.S. agricultural economists employed in land grant universities but some data are available on the numbers in the leading departments of agricultural and resource economics in 2004/05 and information is available on membership of the American Agricultural Economics Association (AAEA) over time. The AAEA had a total of 2,785 domestic members in 2000. At the time of writing, based on the classification in the AAEA's online membership directory, California had 126 members, Illinois had 92, Maryland had 46, Michigan had 60, Minnesota had 52, and Ohio had 43. California's 126 was less than 5% of the total membership in the AAEA, much smaller than California's share of U.S. agricultural output.

A more relevant measure may be the number of agricultural economists employed as faculty members in departments of agricultural economics. These numbers are compared with the value of agricultural output for a selection of states in the first three columns of Table 3. The

number of agricultural economists per state may rise with the size of the agricultural sector but it generally rises less than proportionally. The states with larger agricultural sectors, like Illinois and Minnesota, had one "agricultural" economist per $359 million or less in agricultural output; the states with smaller agricultural sectors had a lower value of agriculture per agricultural economist. California, with the nation's largest agricultural sector, had one agricultural economist in the land grant system for every $572 million of agricultural output. Moreover, a relatively high proportion of California's "agricultural" economists are not working on California agriculture but rather are working on aspects of economic theory, natural resources and the environment, and international economic development, endeavors that have only indirect relevance for California agriculture.

In addition, recall that the total number of farm products in California is much larger than in any other state.[7] California, with the nation's most diverse agricultural sector, had 1.7 agricultural economists in the land grant system in 2004 for every significant agricultural output with an annual value of $100 million or more in 2002–2004, compared with 4 to 5 for Midwestern states like Illinois and Michigan. (And, as the numbers in parentheses show, California had six economists for every output with an annual value of $500 million compared with twelve to eighteen in the Midwestern states.) Marketing mechanisms and requirements differ significantly among California specialty crops (consider lettuce versus almonds versus wine grapes) and relative to the crops that dominate production in the Midwest (such as wheat, corn, and

Institution	Dept. Size in 2004[a] Faculty Members (FTE)	Value of Agricultural Output in 2004 ($ million)	Agricultural Output per FTE in 2004 ($ million)	Number of "Significant" Agricultural Outputs in 2000–2002[b,c]	FTE per "Significant" Agricultural Output[b,c]
University of California	60	34,294	572	35 (10)	1.7 (6.0)
University of Illinois	38	11,634	306	7 (3)	5.4 (12.7)
University of Maryland	22	2,058	94	4 (0)	5.5 (NA)
Michigan State University	35	5,067	145	8 (2)	4.4 (17.5)
University of Minnesota	31	11,143	359	11 (5)	2.8 (6.2)
Ohio State University	24	6,801	283	8 (4)	3 (6)

[a] Estimates for California taken from Giannini Foundation membership tables, including Cooperative Extension specialists; other estimates of FTE provided by Phil Pardey (personal communication, April 2006) and checked against departmental Web pages.

[b] "Significant" agricultural outputs defined as the number of commodities with a farm-level value added in the state greater than $100 million per year on average over 2000–2002.

[c] "Significant" agricultural outputs defined alternatively, in parentheses, as the number of commodities with a farm-level value added in the state greater than $500 million per year on average over 2000–2002.

soybeans). Further, recall that the potential for research spillovers and synergies is relatively high among the Midwestern states because they have relatively similar agro-ecologies whereas California has to be relatively self-reliant for research related to its agriculture, especially the many specialty crops.

One inference we might draw from the cross-state comparison is that agricultural economics as a field is characterized by very substantial economies of scale and scope. If we double the size of the agricultural industry in a state, it is not found necessary to nearly double the scale of the agricultural economics investment in the land grant college; similarly, if we double the scope of the industry in terms of the number of agricultural commodities (or other dimensions of the problem, such as the number of endangered species), it is not found necessary to nearly double the scale of the agricultural economics investment. An alternative inference is that there is a relative underinvestment in agricultural economics in California with its large scale and large scope of agricultural industries. This can be seen as representing a challenge and a burden to the agricultural economists in the Giannini Foundation—requiring them to be more efficient and more productive than their interstate counterparts. Alternatively, the same factors may be considered as presenting opportunities that have helped account for the remarkable success of the enterprise.

The appendix provides details on the membership of the Giannini Foundation over time with some indication of the changing field emphasis. The fields of individual faculty members were designated—somewhat subjectively but using published information and some knowledge—as (1) agricultural economics, (2) development economics, (3) environmental and resource economics, or (4) other, encompassing specializations in econometrics or other things. Some allowance was made for faculty members who spanned multiple fields but the shares were assumed to be equal and fixed over the entire period of an individual faculty member's appointment. The figures in Appendix Table A-1 are for faculty in professorial teaching and research appointments (i.e., excluding Cooperative Extension) while the figures in Appendix Table A-2 include Extension as well.

The aggregate figures show that agricultural economics has been shrinking as a share of the economist labor force within the Giannini Foundation, which itself has been shrinking in recent years, after having plateaued from the early 1980s through the early 1990s. Other information, to be presented later, indicates that agricultural marketing, broadly defined, has held a fairly steady share of around half of the total effort in the area of agricultural economics. Hence, agricultural marketing likewise must represent a shrinking share of a shrinking total effort. Given that an increasing share of the consumer food dollar over time has been generated by off-farm activities, now up to around 80%, the comparative decline in the share of marketing in Giannini Foundation activities is even more significant.

Marketing California Farm Products, 1930–2005

In 1930, California had a population of 5.7 million people and 136,000 farms. Milk cost 14¢ per quart and was still being delivered in many places by a horse and cart; bread cost 9¢ per loaf. Gasoline cost 25¢ per gallon but most people did not buy any. Horsepower was provided mainly by horses, and they in turn consumed a very

significant fraction (in the range of 10–20% in the 1920s and 1930s) of the total output from agriculture. Olmstead and Rhode (2001) reported that in 1930 sixty-three million acres of crop land were used to feed horses and mules on U.S. farms; only 13.5% of farms had a tractor (21% in California).

The year 1930 was in the midst of the agricultural depression that had begun in 1920 and lasted for twenty years and was the first year of the more general "Great Depression," which was characterized by large-scale and long-term unemployment and depressed markets with very low prices for farm products. Farmworkers were paid as little as 25¢ per hour. It was also the time of the establishment of key legislation that underpins federal farm policy today—the Agricultural Adjustment Act (AAA) of 1933 (amended in 1938) and the Agricultural Marketing Agreement Act (1937)—as well as the counterpart legislation enacted by the State of California, the California Marketing Act of 1937. Around the world, similar legislation was being enacted by many countries at about this same time, reflecting similar forces at work and, to some extent, a loss of confidence in the effectiveness of the unfettered workings of the free market mechanism for allocating resources and achieving a satisfactory distribution of income. The same factors must have influenced the thinking of A.P. Giannini when he was defining the purpose of the Foundation he was to endow.

California agriculture has undergone large and rapid changes over the past seventy-five years, many of which have implications for markets and marketing, and these changes have influenced the working agenda of the economists in the Giannini Foundation. One of the roles of the Foundation's economists has been to document the economic history of California agriculture. Olmstead and Rhode (2003) summarized the key features of California agricultural history over 150 years, 1850–2000, including most of the period that is relevant for the present purpose. Selected landmark events in U.S. and California agricultural history, taken from Olmstead (2006), are listed in Appendix Table A-3. These include the introduction of major pieces of legislation that govern the marketing of agricultural products, as well as some other economic events that had significant implications for agricultural marketing and the related work of members of the Foundation.

During the seventy-five-year history of the Giannini Foundation, California agriculture has been characterized by continuous, interconnected, and substantial changes in technology, markets, product mix, and industry structure. Some of these changes have mirrored general changes in agriculture nationally and globally but others have been more uniquely Californian. One important trend has been in technology, which was a particular focus of Olmstead and Rhode (2003) and was the subject of the chapter by Alston and Zilberman (2003) in the same volume. Changes in varieties, mechanization (especially of the harvest), the introduction of irrigation technology combined with expanded irrigation capacity, and improved transportation and preservation technologies allowed California to become the dominant producer of a range of Mediterranean crops at the expense of the traditional producers in Europe. Consequently, over time, the broad-acre field crops like wheat and barley have been steadily supplanted by horticultural crops. These new crops have entailed substantial investment in biological and physical capital, leading to an intensification of production that has contributed to the growth in productivity and changed the total volume of production as well as the product mix.[8]

Changes in the product mix have been multidimensional. As well as changes in the crops grown, we have seen very substantial product differentiation within crops—witness the expansion of the number of varieties of lettuce, strawberries, or table grapes, for example, to encompass different uses and to extend seasonal availability and the range of varieties to include natural and organic. Further product differentiation has come beyond the farm gate with the addition of a range of services associated with food—for instance, bagged lettuce and the many other forms of prepared consumer food items. The farmers' share of the consumer food dollar has fallen, reflecting both these changes and the falling real price of farm products as raw ingredients, and this has been accompanied by a host of studies of marketing margins and related issues. These changes have been accompanied by changes in the industrial organization both of the farming industry in California and of the rest of the agribusiness industry engaged in food and fiber transport, processing, distribution, and marketing. With these changes in structure have come changes in marketing methods with a long-term trend for contractual arrangements in which farmers undertake to supply products with specified characteristics in space, form, and time to replace traditional commodity market approaches.

California agriculture is different from agriculture in most other U.S. states because of (1) the large number of diverse (and often differentiated) products grown, (2) the perishable nature of many of the products, (3) the long distance from markets both domestic and international, (4) the state's large market share and thus the comparatively inelastic demand facing California, (5) the capital intensity and associated dynamics of supply response for California specialty crops, especially the perennials, and (6) the lack of substantial government farm support programs for most of the industry (i.e., apart from rice, dairy, and cotton). Taken together, these factors mean that agricultural marketing issues in California are often different from those that arise in other states where the commodities are produced and sold in bulk, production within individual states does not affect market prices appreciably, and substantial government interventions mitigate the vagaries of the market and the potential consequences of market power of firms.

As a consequence of these differences, the agricultural industry in California has sought solutions to its marketing problems that may not be relevant for producers in other states. Some of these solutions can be found through private individual action without any involvement of the government. Much of what has happened in the past seventy-five years in California agriculture falls into that category, including, for instance, changes in the industry's structure through vertical integration and the use of contracts to manage the information problems that arise in California's modern, complex form of agriculture. These developments have been much studied by members of the Giannini Foundation. Other solutions may entail collective action in which producers act together to achieve a common purpose or government intervention.

The collective action option has involved government intervention of a sort—to exempt producer groups from anti-trust restrictions or to empower them to voluntarily form an organization that becomes mandatory if a sufficient majority supports it. Giannini Foundation members have worked extensively on such schemes, which include mandated marketing programs and voluntary cooperatives.

The failure of the voluntary cooperatives to achieve the lofty goals set for them inspired the creation of these mandated programs.[9] Other forms of government intervention do not entail producer participation and may not be supported by a majority of producers but are done in consideration of broader public purposes. These interventions, too, have been studied by Giannini Foundation members.

Overview of Marketing Economics in the Giannini Foundation

An assessment of marketing economics in the Giannini Foundation can be conducted by reviewing the published research of the members and this section is devoted to doing that. Much of the work conducted by members of the Foundation is oriented to more general questions related to broader economic issues, to theoretical questions, or to techniques and methods and is not associated with agricultural "marketing" per se but may have relevance for more applied or empirical agricultural economics work in California or elsewhere. Thus, work may be relevant to the mission of the Foundation even when the relevance is not obvious. Conversely, contributions of a more general sort are often the result of problem solving, which may be done in the context of a specific project that is directly relevant to the Giannini Foundation. For reasons of this sort, it is not easy to clearly distinguish "agricultural marketing" work from other work. Further, the achievements and contributions extend beyond the publications in several dimensions that are harder to assess. Some of the achievements are made indirectly through the students trained by Foundation members and it is not clear how (or whether) we should count those indirect contributions to the literature. Some of the contributions are made through the development of institutions such as the International Agricultural Trade Research Consortium (IATRC). Some are made through bringing the results of analysis to bear and influencing decisions by industry or government.

Marketing Publications by Members of the Giannini Foundation, 1930–2005

The previous sections (based on a type of "induced innovation" argument) documented major developments and issues in California agriculture that influenced the work of the members of the Giannini Foundation, tempered by the influence of the evolving broader mission of the university and the Experiment Station and the disciplinary drift occurring within economics more broadly and agricultural economics as a part of that. Through this work, the members of the Giannini Foundation have made critical contributions to economic understanding of California issues and broader contributions to economic understanding of agricultural issues nationally and globally. They have made practical and empirical contributions but also more technical contributions to economic theory and methods used by economists. The scope, size, and evolving nature of these contributions can be seen by considering the publications that are the most tangible evidence of the effort. In the seventy years ending in 2000, members of the Giannini Foundation published more than 9,000 items (Table 4) of which more than 3,700 (41%) dealt with topics that fit under the broad concept of "marketing" when it is defined to encompass studies of markets for farm commodities, including all economic activity beyond the farm gate in the food and fiber chain, and government policy and programs related to those economic activities.

It is not possible to explicitly represent everything contained in that very large contribution to the agricultural economics literature. Some perspectives can be gleaned by reviewing the specific focus of doctoral dissertations and Giannini Foundation monographs over time, as shown in Tables 5 and 6. Table 5 shows that, over the period 1930 to 2005, a total of 492 dissertations were completed at Berkeley and, since 1967, a further 260 at Davis, making a total of 752 for the two departments. After a steady climb through the 1950s and 1960s, the rate of production held fairly steady at around fifteen per year in the 1970s and 1980s and around seventeen per year in the last fifteen years.

These dissertations are classified loosely as either agricultural economics or nonagricultural economics and agricultural economics was divided broadly into marketing (including policy) and other agricultural economics. Some interesting patterns are revealed. Over the entire seventy-five years and across the two campuses, marketing topics accounted for only 12% of the dissertations and other agricultural economics topics accounted for only 24%, with two-thirds of the total on nonagricultural economics topics. More striking is the trend over time with nonagricultural economics topics accounting for a steadily rising share of the total, especially at Berkeley, and the number that addressed marketing shrinking.

Table 6 shows the distribution of publications of Giannini monographs and the predecessor series, *Hilgardia*, since it began in 1950 over time and across the same categories as used for the dissertations. These publications have been specifically designated for agricultural economics topics and about 40% of them have been about subjects that fit into "agricultural marketing."

	Five Years Ending														1930
	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	–2000
Number of Publications															
Marketing	93	65	55	153	175	295	486	321	224	305	355	436	477	281	3,721
Other Agric.	41	27	37	58	102	75	56	50	113	162	278	289	321	233	1,842
Nonagric.	28	34	45	38	57	129	205	206	279	475	598	519	562	368	3,543
Total	*162*	*126*	*137*	*249*	*334*	*499*	*747*	*577*	*616*	*942*	*1,231*	*1,244*	*1,360*	*882*	*9,106*
Percentage of Column Total															
Marketing	57.4	51.6	40.1	61.4	52.4	59.1	65.1	55.6	36.4	32.4	28.8	35.0	35.1	31.9	40.9
Other Agric.	25.3	21.4	27.0	23.3	30.5	15.0	7.5	8.7	18.3	17.2	22.6	23.2	23.6	26.4	20.2
Nonagric.	17.3	27.0	32.8	15.3	17.1	25.9	27.4	35.7	45.3	50.4	48.6	41.7	41.3	41.7	38.9
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Source: Compiled by the authors using data supplied by Daniel Sumner. Numbers prior to 1995 were based on the listings in *Economic Research of Interest to Agriculture* published triennially (1951–2000) by the Giannini Foundation Library, University of California, Berkeley, and these numbers included a range of types of publications, including mimeographs and so on. Numbers after 1995 were based on publications reported in the *Giannini Reporter* and these only include "List 1" publications such as refereed journal articles, books, and book chapters.

Notes: *The Giannini Reporter* classifies publications by Giannini Foundation members into nine categories. These were condensed into the three classes listed here as follows: *Marketing:* Marketing and Trade, Policy. *Other Agric.:* Economic Development, International, Production, Finance. *Nonagric.:* Microeconomic Theory, Human Resources, Community Development and Consumer Economics, Natural Resources and Environmental Economics, Quantitative Methods, Other.

	Five Years Ending															1930
	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	–2005
	Number of Doctoral Dissertations															
Berkeley																
Marketing	5	1	3	2	4	6	10	7	2	6	1	3	4	1	1	56
Other Agric.	0	1	0	2	7	10	16	17	15	5	10	4	10	8	3	108
Nonagric.	5	6	0	2	12	9	20	31	31	25	24	31	45	41	46	328
Subtotal	*10*	*8*	*3*	*6*	*23*	*25*	*46*	*55*	*48*	*36*	*35*	*38*	*59*	*50*	*50*	*492*
Davis																
Marketing								6	0	9	3	7	2	6	4	37
Other Agric.								7	9	8	15	13	11	6	5	74
Nonagric.								10	13	18	17	15	24	24	28	149
Subtotal								*23*	*22*	*35*	*35*	*35*	*37*	*36*	*37*	*260*
Total																
Marketing	5	1	3	2	4	6	10	13	2	15	4	10	6	7	5	93
Other Agric.	0	1	0	2	7	10	16	24	24	13	25	17	21	14	8	182
Nonagric.	5	6	0	2	12	9	20	41	44	43	41	46	69	65	74	477
Total	*10*	*8*	*3*	*6*	*23*	*25*	*46*	*78*	*70*	*71*	*70*	*73*	*96*	*86*	*87*	*752*
	Percentage of Column Total															
Berkeley																
Marketing	50.0	12.5	100.0	33.3	17.4	24.0	21.7	12.7	4.2	16.7	2.9	7.9	6.8	2.0	2.0	11.4
Other Agric.	0.0	12.5	0.0	33.3	30.4	40.0	34.8	30.9	31.3	13.9	28.6	10.5	16.9	16.0	6.0	22.0
Nonagric.	50.0	75.0	0.0	33.3	52.2	36.0	43.5	56.4	64.6	69.4	68.6	81.6	76.3	82.0	92.0	66.7
Subtotal	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*
Davis																
Marketing								26.1	0.0	25.7	8.6	20.0	5.4	16.7	10.8	14.2
Other Agric.								30.4	40.9	22.9	42.9	37.1	29.7	16.7	13.5	28.5
Nonagric.								43.5	59.1	51.4	48.6	42.9	64.9	66.7	75.7	57.3
Subtotal								*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*
Total																
Marketing	50.0	12.5	100.0	33.3	17.4	24.0	21.7	16.7	2.9	21.1	5.7	13.7	6.3	8.1	5.7	12.4
Other Agric.	0.0	12.5	0.0	33.3	30.4	40.0	34.8	30.8	34.3	18.3	35.7	23.3	21.9	16.3	9.2	24.2
Nonagric.	50.0	75.0	0.0	33.3	52.2	36.0	43.5	52.6	62.9	60.6	58.6	63.0	71.9	75.6	85.1	63.4
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Source: Compiled by the authors using data supplied by Daniel Sumner derived from the *Annals of the Giannini Foundation of Agricultural Economics*.

Notes: Dissertations were categorized by Conner Mullally and Chris Gustafson based on the titles of the documents. Classifications are similar to those described in the note for Table 4.

	Five Years Ending												1950
	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	–2000
Number of Monographs													
Marketing	0	2	2	4	3	3	2	0	0	1	0	1	18
Other Agric.	1	0	3	4	6	7	2	0	1	0	1	1	26
Nonagric.	0	0	0	0	0	0	0	0	1	0	0	0	1
Total	*1*	*2*	*5*	*8*	*9*	*10*	*4*	*0*	*2*	*1*	*1*	*2*	*45*
Percentage of Column Total													
Marketing	0.0	100.0	40.0	50.0	33.3	30.0	50.0	0.0	0.0	100.0	0.0	50.0	40.0
Other Agric.	100.0	0.0	60.0	50.0	66.7	70.0	50.0	0.0	50.0	0.0	100.0	50.0	57.8
Nonagric.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	2.2
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*0.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Source: The Giannini Foundation website (http://giannini.ucop.edu/monograph.htm) and the Giannini Foundation's *Hilgardia* publications.

Most of the activity in the monograph series was during the period 1960–1980, reflecting both the interests of the members and periodic changes in the faces and policies of the editors of the series.

Leadership Roles by Members of the Giannini Foundation

The members of the Giannini Foundation and their former students tend to be disproportionately represented in the literature. One example of this is provided by the *Handbook of Agricultural Economics* (Gardner and Rausser 2001), which is a part of the prestigious Elsevier series of *Handbooks in Economics*. It is not surprising that one of the two editors for the *Handbook of Agricultural Economics* was a member of the Giannini Foundation. Perhaps more interesting is the representation of the Giannini Foundation among the authors of the chapters in the handbook, as summarized in Table 7.

As Table 7 shows, 29.2% of the authors of chapters in the handbook were members of the Giannini Foundation and a further 26.2% were graduates from the Department of Agricultural and Resource Economics at Davis or Berkeley. Thus, more than half of the authors are either members of or graduates from Foundation departments.[10] The Giannini Foundation share is greater yet for the parts of the handbook dealing with marketing (broadly defined to include policy as well), Parts 2 and 5, for which 60–70% of the authors are either members of or graduates from Giannini Foundation departments.

Members of the Giannini Foundation have been active in various leadership roles within the profession and otherwise, on and off campus, in ways that do not necessarily show up in lists of publications. The faculties at Davis and Berkeley were instrumental, for instance, in establishing the IATRC, which is funded jointly by the USDA and the Canadian government. This institution has significantly enhanced research and communication about agricultural trade

policy with particular reference to the General Agreement on Tariffs and Trade (GATT) and its successor, the World Trade Organization (WTO). Members of the Giannini Foundation have played significant roles in contributing tailored research programs that feed into other policy processes. Some of these processes are periodic and recurring, such as the U.S. Farm Bill cycle, while others are more episodic in nature, such as the Canada U.S. Trade Agreement or the subsequent North American Free Trade Agreement, each of which engendered demand for work by agricultural economists both before and after being implemented and involved specific issues of interest to California that were not necessarily the same as those of other states. The congressionally mandated "Embargo Study" (McCalla et al. 1986) is another good example of a case where events in the world—the U.S. embargo against wheat exports to the Soviet Union—led to a demand for analysis that was met with leadership and other participation from members of the Giannini Foundation and other members of the IATRC. In addition, Foundation members have contributed in an ongoing way to addressing marketing and policy problems in California through their leadership roles and other contributions to the work of the University of California Agricultural Issues Center and the now defunct Center for Cooperatives, both of which have been closely affiliated with the Department of Agricultural and Resource Economics at Davis but also enjoyed significant involvement of colleagues from Berkeley and Riverside.

	Number of Authors				
	Giannini Member	**Giannini Graduate**	**Member or Graduate**	**Other**	**Total**
Handbook Volume					
Part 1 – Agricultural Production	4 *21.1*	5 *26.3*	9 *47.4*	10 *52.6*	19
Part 2 – Marketing, Distribution, and Consumers	6 *46.2*	3 *23.1*	9 *69.2*	4 *30.8*	13
Part 3 – Agriculture, Natural Resources, Environment	0 *0*	2 *50.0*	2 *50.0*	2 *50.0*	4
Part 4 – Agriculture in the Macroeconomy	3 *23.1*	3 *23.1*	6 *46.2*	7 *53.8*	13
Part 5 – Agriculture and Food Policy	6 *37.5*	4 *25.0*	10 *62.5*	6 *37.5*	16
Total	19 *29.2*	17 *26.2*	36 *55.4*	29 *45.6*	65

Note: Numbers in the table refer to authors of chapters in the handbook and the numbers in italics express the numbers of authors as percentages of the row totals that represent the total number of authors of chapters in that part of the handbook.

Conclusion and Caveat

This paper was written as a companion to the one by Sexton and Alston, which follows. The aim in writing these two papers was to review and evaluate the applied research activities and achievements in the area of agricultural marketing of the economists who have served as members of the Giannini Foundation. We adopted an approach to this subject that combined (1) a broad overview of the entire (sub)field of agricultural marketing at the University of California over the seventy-five years of the Giannini Foundation (in the present paper) with (2) a more detailed and more nearly comprehensive and representative look at the contributions by Foundation economists to work on the economics of collective action in California agriculture with particular emphasis on cooperatives and mandated marketing programs (in the next paper). An unfortunate side-effect of our chosen approach is that we have said nothing specific about the contributions of Foundation economists to other aspects of the agricultural marketing field and we have, as a consequence, failed to mention some seminal contributions by Foundation members.[11] However, as noted, our purpose was not to be comprehensive but to try to be representative. We hope that we may have at least achieved that and, in the process, demonstrated the important roles played by members of the Giannini Foundation over seventy-five years in contributing to the evolution of this key field in the economics of agriculture.

Notes

1. Sumner (2006) and various others (e.g., Kuminoff, Sumner, and Goldman (2000, 2005); Johnston and McCalla (2004); and various authors in Siebert (2003)) discuss and document the current structure and recent history of California agriculture.
2. Data used here were taken from www.ers.usda.gov/Data/farmincome, accessed 22 April 2006.
3. The output mix has shifted significantly away from traditional field crops (from 22% to 7%) and livestock (from 39% to 23%) to higher value, more diverse, and more capital-intensive forms of agriculture (from 34% to 53% for fruits, nuts, and vegetables combined and from 3% to 15% for greenhouse and nursery products).
4. It is notable that productivity was relatively flat during the 1990s and then grew again at the end of the series, possibly reflecting a period of capital investment during the 1990s—particularly an expansion in perennial crops—that began literally to bear fruit relatively recently.
5. Sexton and Zhang (1996) studied the curious nature of lettuce supply response in the market period. Alston et al. (1995) reviewed perennial crop supply response models and presented results for California almonds.
6. In the 1930s, the Giannini Foundation had only ten members and five associate members (holding Extension appointments), all at Berkeley, and presumably contributed a greater share of operating and total expenses.
7. California's top twenty commodities in 2004 included milk and cream ($5,366 million), grapes ($2,757 million), nursery products ($2,650 million), almonds ($2,200 million), cattle ($1,634 million), lettuce ($1,462 million), strawberries ($1,219 million), tomatoes ($1,091 million), hay ($1,010 million), cotton ($807 million), chickens ($715 million), broccoli ($625 million), oranges ($563 million), carrots ($448 million), pistachios ($444 million), walnuts ($439 million), avocados ($380 million), rice ($352 million), and peppers ($352 million). Several of these include more than one distinct commodity (e.g., wine and table grapes, fresh and processing tomatoes, and cut flowers versus other nursery products), each of which is worth more than $500 million per year.

8. As always, large changes, especially technological ones, are not embraced by everyone affected by them. In California agriculture these tensions came to a head with the ending of the Bracero program, which stimulated the introduction of the tomato harvester that had been developed with the involvement of the University of California. The resulting controversy over the alleged displacement of farmworkers and ensuing lawsuit led to several studies of the economic impact of the harvester by Foundation members, including Schmitz and Seckler (1970), Brandt and French (1982), and Martin and Olmstead (1985).
9. Indeed, the issue of collective action to manage markets was a primary focus of members in the early years of the Giannini Foundation, as discussed by Sexton and Alston (this volume).
10. Authors who are members of the Giannini Foundation include (in alphabetical order) Julian Alston, Alain de Janvry, Rachael Goodhue, Larry Karp, Jeffrey LaFrance, Philip Martin, Alex McCalla (emeritus), Jeff Perloff, Gordon Rausser, Elizabeth Sadoulet, Richard Sexton, Daniel Sumner, David Sunding, J. Edward Taylor, Jeffrey Williams, Brian Wright, and David Zilberman. Authors who are alumni of the Giannini Foundation departments include (in alphabetical order and including some who are also current members of the Foundation) Pier Ardeni, David Bessler, Robert Chambers, Alain de Janvry, Harry De Gorter, Gershon Feder, John Freebairn, Richard Just, Rachael Goodhue, Robert Innes, Jennifer James, Larry Karp, Jeffrey La France, Nathalie Lavoie, Erik Lichtenberg, Yair Mundlak, Rulon Pope, Gordon Rausser, Arthur Small, David Sunding, J. Edward Taylor, James Vercammen, Michael Wohlgenant, and David Zilberman.
11. At the risk of exacerbating this error of omission, let us note some of the book- or monograph-length contributions that we have in mind. The work by Raymond Bressler and Richard King (1970) is a classic in the field that laid a foundation for several different lines of work on spatial markets and market structure. Several members at both Berkeley and Davis have worked on the analysis of demand for farm products. The Giannini Foundation monograph by P.S. George and Gordon King (1971) is regarded as a classic within this literature. The definitive reference on the application of welfare economics is the 1982 book by Richard Just, Darrell Hueth, and Andrew Schmitz. The classic work on the economics of storage and commodity markets is the 1991 book by Jeffrey Williams and Brian Wright.

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Appendix

	Current Total Number of Members														Person Years
	1920	1930	1940	1950	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	1930–2005
Berkeley															
Agricultural	6.0	9.0	7.5	9.0	6.5	5.5	4.5	4.5	5.5	7.0	6.0	4.0	4.5	4.5	547.5
Development	0.0	0.0	0.0	0.0	0.5	0.5	1.8	1.3	2.3	4.3	4.3	3.8	2.8	3.3	120.0
Envir./Resources	2.0	3.0	4.0	4.0	6.0	8.0	8.3	6.3	7.3	7.3	7.3	6.3	7.8	7.3	476.0
Other	1.0	2.0	2.5	3.0	5.0	6.0	5.3	3.8	3.8	1.3	2.3	1.8	1.8	5.8	267.5
Subtotal	*9.0*	*14.0*	*14.0*	*16.0*	*18.0*	*20.0*	*20.0*	*16.0*	*19.0*	*20.0*	*20.0*	*16.0*	*17.0*	*21.0*	*1,411.0*
Davis															
Agricultural			1.0	3.0	10.0	11.5	14.8	15.3	14.3	17.8	20.5	14.5	11.0	10.0	738.2
Development			0.0	0.0	0.5	0.0	0.8	1.8	1.8	2.3	3.0	4.0	5.0	5.0	107.7
Envir./Resources			0.0	0.0	1.0	1.0	1.3	1.8	2.8	2.8	4.5	4.5	4.5	3.0	133.7
Other			0.0	0.0	1.5	0.5	3.0	7.0	9.0	8.0	6.0	6.0	6.5	6.0	237.5
Subtotal			*1.0*	*3.0*	*13.0*	*13.0*	*20.0*	*26.0*	*28.0*	*31.0*	*34.0*	*29.0*	*27.0*	*24.0*	*1,217.0*
Riverside															
Agricultural									2.5	2.5	3.5	2.0	3.5	0.5	14.5
Development									0.0	0.0	0.0	0.0	0.0	0.0	0.0
Envir./Resources									0.5	0.5	0.5	1.0	0.5	4.5	85.5
Other									1.0	0.0	0.0	0.0	0.0	0.0	6.0
Subtotal									*4.0*	*3.0*	*4.0*	*3.0*	*4.0*	*5.0*	*106.0*
Total															
Agricultural	6.0	9.0	8.5	12.0	16.5	17.0	19.3	19.8	22.3	27.3	30.0	20.5	19.0	19.0	1,371.2
Development	0.0	0.0	0.0	0.0	1.0	0.5	2.7	3.2	4.2	6.7	7.3	7.8	7.8	8.8	242.2
Envir./Resources	2.0	3.0	4.0	4.0	7.0	9.0	9.7	8.2	10.7	10.7	12.3	11.8	12.8	10.3	586.7
Other	1.0	2.0	2.5	3.0	6.5	6.5	8.3	10.8	13.8	9.3	8.3	7.8	8.3	11.8	498.0
Total	*9.0*	*14.0*	*15.0*	*19.0*	*31.0*	*33.0*	*40.0*	*42.0*	*51.0*	*54.0*	*58.0*	*48.0*	*48.0*	*50.0*	*2,698.0*

Source: Foundation member data compiled by the authors from various sources, including various issues of *The Giannini Reporter*, various issues of the UC Davis catalog, and tables supplied by Grace Dote showing employment dates for faculty.

	Current Total Number of Members														Person Years
	1920	1930	1940	1950	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	1930 –2005
Berkeley															
Agricultural	6.0	9.0	7.5	9.0	7.5	8.5	9.5	9.5	10.5	13.0	12.0	9.0	6.5	6.5	773.0
Development	0.0	0.0	0.0	0.0	0.5	0.5	1.8	1.3	2.3	4.3	4.3	3.8	2.8	3.3	120.0
Envir./Resources	2.0	3.0	4.0	4.0	7.0	11.0	11.3	9.3	10.3	10.3	9.3	9.3	8.8	8.3	606.0
Other	1.0	2.0	2.5	3.0	5.0	6.0	5.3	3.8	3.8	1.3	2.3	1.8	1.8	5.8	270.0
Subtotal	*9.0*	*14.0*	*14.0*	*16.0*	*20.0*	*26.0*	*28.0*	*24.0*	*27.0*	*29.0*	*28.0*	*24.0*	*20.0*	*24.0*	*1,769.0*
Davis															
Agricultural			1.0	3.0	10.0	11.5	15.8	16.8	16.8	23.3	25.0	19.0	15.5	15.5	874.7
Development			0.0	0.0	0.5	0.0	0.8	2.3	2.3	2.8	3.5	4.5	5.5	5.5	125.2
Envir./Resources			0.0	0.0	1.0	1.0	1.3	1.8	2.8	2.8	4.5	4.5	4.5	3.0	133.7
Other			0.0	0.0	1.5	0.5	3.0	7.0	9.0	8.0	6.0	6.0	6.5	6.0	237.5
Subtotal			*1.0*	*3.0*	*13.0*	*13.0*	*21.0*	*28.0*	*31.0*	*37.0*	*39.0*	*34.0*	*32.0*	*30.0*	*1371.0*
Riverside															
Agricultural									2.0	3.0	2.0	2.0	0.5	0.5	57.0
Development									0.0	0.0	0.0	0.0	0.0	0.0	0.0
Envir./Resources									3.0	3.0	4.0	2.0	3.5	4.5	94.0
Other									2.0	1.0	1.0	0.0	0.0	0.0	23.0
Subtotal									*7.0*	*7.0*	*7.0*	*4.0*	*4.0*	*5.0*	*174.0*
Total															
Agricultural	6.0	9.0	8.5	12.0	17.5	20.0	25.3	26.3	29.3	39.3	39.0	30.0	22.5	22.5	1,670.2
Development	0.0	0.0	0.0	0.0	1.0	0.5	2.7	3.7	4.7	7.2	7.8	8.3	8.3	8.8	245.2
Envir./Resources	2.0	3.0	4.0	4.0	8.0	12.0	12.7	11.2	16.2	16.2	17.8	15.8	16.8	15.8	820.7
Other	1.0	2.0	2.5	3.0	6.5	6.5	8.3	10.8	14.8	10.3	9.3	7.8	8.3	11.8	528.0
Total	*9.0*	*14.0*	*15.0*	*19.0*	*33.0*	*39.0*	*49.0*	*52.0*	*65.0*	*73.0*	*74.0*	*62.0*	*56.0*	*59.0*	*3,264.0*

Source: Foundation member data compiled by the authors from various sources, including various issues of *The Giannini Reporter*, various issues of the UC Davis catalog, and tables supplied by Grace Dote showing employment dates for faculty.

1862	President Lincoln approved the Homestead Act and the Morrill Land Grant College Act.
1868	A refrigerator car widely used by railroads in the 1870s was patented by William Davis.
1872	Luther Burbank produced the Burbank potato, the first of a long series of new or improved varieties of vegetables, fruits, and flowers.
1873	The "Washington navel" orange was introduced to California from Brazil.
1875	The California Agricultural Experiment Station was founded by Eugene W. Hilgard.
1887	The Hatch Experiment Station Act was approved, providing federal grants to states for agricultural experimentation.
1888	Refrigerated rail cars were used to ship meat and to long-haul fruit from California to New York.
1892	The first successful gasoline tractor was built by John Froelich.
1895	Sunkist Growers, Inc., for many years called the California Fruit Growers Exchange, was incorporated as the Southern California Fruit Exchange.
1906	The Holt Company produced a caterpillar tractor powered by a gasoline engine. The Pure Food and Drug Act was approved.
1914	The Smith-Lever Cooperative Agricultural Extension Act, which formalized cooperative agricultural extension work, was introduced.
1920/21	Agricultural prices plunged and remained low for the next twenty years.
1922	The Capper-Volstead Act declared that a cooperative association was not, by reason of the manner in which it was organized and normally operated, a combination in restraint of trade in violation of federal anti-trust statutes.
1926	Henry Wallace developed commercial hybrid seed corn. Congress passed the Cooperative Marketing Act.
1927	John D. Rust patented the first successful spindle cotton picker.
1929	The Mediterranean fruit fly was discovered in Florida and an all-out program was instituted to combat it.
1930	The Plant Patent Act was approved.
1933	The Agricultural Adjustment Act was approved and the Commodity Credit Corporation was established.
1935	The Rural Electrification Administration was established by Executive Order 7037 and was incorporated into the U.S. Department of Agriculture on June 1, 1939. A one-man combine was developed for harvesting wheat.
1937	The first soil conservation district in the United States was organized.
1938	The Agricultural Adjustment Act of 1938 replaced the Agricultural Adjustment Act of 1933.
1946	The Research and Marketing Act was signed.
1949	The usefulness of antibiotics in promoting animal nutrition was demonstrated. The Agricultural Act of 1949 became the "permanent" legislation upon which most subsequent farm subsidy programs were appended.
1959	The mechanization of specialty crops proceeded with the introduction of the first mechanical cherry picker and the development of the mechanical tomato harvester.
1968	96% of all U.S. cotton was being harvested mechanically.
1970	The Plant Variety Protection Act was passed.
1994	The Uruguay round of the WTO marks a milestone in the movement to reduce export subsidies and promote trade by opening world markets.
1996	Genetically engineered, herbicide-tolerant soybeans become available to farmers.
2000	Genetically modified cotton was planted on more than 60% of U.S. cotton acreage.

Source: Olmstead (2006).