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# The Making of Informational Efficiency: Information Policy and Theory in Interwar Agricultural Economics

## Preprint, accepted version in the *History of Political Economy*

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**Abstract:** This article offers a historical analysis of American interwar agricultural economists and their interest in information. Believing that the main problem facing farmers was a lack of information, agricultural economists designed an information policy aiming to produce, format, and disseminate information. Using administrative archives, we analyze the motivations of these economists and the implementation of this policy. We show that the policy was a prerequisite for theoretical discussions on information, and established institutional tools that are still active today, such as the USDA market news service.

**Keywords:** history of economics, agricultural history, information, market efficiency

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In October 1<sup>st</sup>, 1927, H. G. Hester, Secretary of the New Orleans Cotton Exchange, complained in the *New York Times* that the information on future cotton supply provided by the United States Department of Agriculture (USDA) was “grossly inaccurate” and had a “serious effect on the values of cotton” (New York Times 1927). A few months later, on May 29<sup>th</sup>, 1928, a Senate report estimated that forecast information on cotton prices from the Department caused a market collapse and incurred cotton grower losses estimated at between \$300,000,000 and \$400,000,000 (New York Times 1928). The Department agency under attack was the Bureau of Agricultural Economics. The USDA was a powerful federal department, and its Bureau of Agricultural Economics constituted one of the most important groups of economists in interwar American economics. These economists focused on the production of market information and its dissemination to a wide audience through their publications, press, telegraph and even radio. How and why did these civil-servant economists focus on producing information on agricultural markets? This article examines the policy of information production, the theoretical motivations of these economists, and how it influenced their economic thinking.

In the history of economics, information is mainly perceived as a concept that emerged from the socialist calculation debate and which was subsequently developed in a more formal framework through the influence of other sub-disciplines such as cybernetics and mathematics (e.g., Mirowski and Nik-Khah 2017). Little has been said about the prewar economics of information. Nevertheless, historians acknowledge that early U.S. agricultural economists viewed information as a key issue for improving the efficiency of agricultural markets (McDean 1983; Kunze 1990). More recently, another line of research has brought to light the figure of Holbrook Working and his economics of information (Berdell and Choi 2018; Saleuddin 2018). This agricultural economist is notably recognized in the history of economics as an early econometrician. However, he also formulated many theoretical insights regarding the

role of information in economics. Working developed a theory in which traders in agricultural exchanges use all the information available, leading the current price to be an unbiased expectation of the future price. Retrospectively, he might be viewed as an early precursor of the rational expectation hypothesis (or its counterpart in finance, the efficient market hypothesis).

The present article makes the link between these two strands of research. It shows that interwar agricultural economists were actively concerned with the informedness of market participants and how it influenced their economic thoughts. In the 1920s, in the context of the expansion of the USDA, economists were at the forefront of agricultural market reforms that sought to improve the production and circulation of information. We show how agricultural economists shared a set of knowledge on information, how this materialized in concrete economic policies, and how the application of these policies in turn called into question their prior knowledge.

Agricultural economists' knowledge on information was twofold. First, they believed that improving the informedness of market participants was the best way to achieve the proper functioning of agricultural markets. While allowing farmers to obtain better prices, such a reform also aimed to direct the efficient allocation of resources. Second, they thought that market participants, and especially farmers, were mostly ill-informed and thus that the Federal Government might help to produce and disseminate economic information.

These beliefs led to the development of a policy aimed at improving economic information on agricultural markets. This interest in information production on the part of interwar agricultural economists has already been highlighted, notably by McDean (1983) and Kunze (2006). Generally speaking, the interest of agricultural economists in the informedness of farmers has also been studied indirectly through the outputs of their efforts, and in particular their interest in data collection and statistical analysis. But we show that the efforts of these economists also focused on the formatting and dissemination of information

to farmers.<sup>2</sup>

The last part of the paper shows that, in pursuing this policy, agricultural economists faced unforeseen theoretical problems, which gave rise to various insights into the economics of information. In particular, they realized that their effort could produce feedback effects. They started questioning the different classes of agents about their use of information and how information aggregated into prices. Most of these reflections remained theoretical intuitions, but some of them eventually materialized in important contributions in the history of economics, such as the Cobweb theorem (Ezekiel 1937) or the efficient market hypothesis (Working 1934; Working 1949).

Regarding the sources we use, it is important to note that interwar agricultural economics was essentially public-funded. The boundaries between academia and expertise were not drawn clearly: many agricultural economists were civil servants within the USDA or employed in land-grant colleges and State universities. They not only published scientific writings; they also built institutional arrangements—even very material arrangements such as a radio broadcasts as we will see—to reform and improve the agricultural economy. Consequently, a large of part our work focuses on the role they played within this administration. One set of sources we use are the annual USDA public reports—the USDA yearbook, the report of the chief of the Bureau of Agricultural Economics (BAE), and the report of the chief of the Grain Futures Administration (GFA). It complements the published writings from economists affiliated or closed with the USDA.

## **1. Agricultural Economics and the Knowledge on Information**

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<sup>2</sup> On the role of the agricultural economics and the USDA in the development of econometrics, see, for instance, Morgan (1991), Banzhaf (2006), Tyler (2023) and Biddle (1999; 2021). The USDA and the BAE have been extensively examined by historians interested in agricultural politics. On this point, see, for instance, Didier (2006) and Hamilton (1990). D'Onofrio (2016) offers a comprehensive study of the relationship between agricultural economists, statistics, and politics, focusing on the Italian case.

Historically, providing reliable information to farmers was a core feature of USDA's agenda, as it was for many federal institutions. It became a major political issue due to the agricultural crisis that hit the country in 1920. This agricultural crisis was notably caused by the First World War. During the conflict, the United States experienced a positive demand shock and served as a granary for a war-torn Europe. When the war was over, the fall in European demand caused a depression of American prices and of the incomes of farmers (Federico 2005: 964). Half of the Americans were still living in rural areas and farmers represented a powerful political force. For instance, the "Farm-Bloc", a coalition of Senate and Congress members serving agricultural interests emerged at this period. By the early 1920s, the USDA was already an important Department in terms of budget. Its growth significantly over the rest of the decade. In 1933, the Agricultural Adjustment Act, a federal law of the New Deal era, definitively strengthened the power and the capacity of the Department.<sup>3</sup> One of the main concerns of the USDA was the asymmetry between a powerful class of informed dealers and the supposedly isolated and uninformed farmers. During the interwar era, the modern exchanges such as the Chicago Board of Trade were already developed and the business of farmers depended on the markets that were managed by dealers living in the urban areas. The importance of these markets increased from the mid-19<sup>th</sup> century, notably thanks to the development of railroads and the telegraph that had favored the centralization of products (Cronon 1991). Farmers felt that they were paying a price set by these exchanges without having any real information about how the price was determined. At the time, agricultural exchanges were subject to frequent market manipulation, which added to farmers' resentment.

The growing political demand for market information led to the development of publicly funded economic research. In the early 20<sup>th</sup> century, agricultural economics emerged as a distinct

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<sup>3</sup> In 1923, the USDA budget was less than \$50 million. By 1928, it had tripled to \$144 million. By 1934, when the Agricultural Adjustment Act was passed, the budget had grown to \$200 million. The archives of the budgets of the United States Governments are available here: <https://fraser.stlouisfed.org/title/budget-united-states-government-54?browse=1920s>.

subfield and came to be very influential in the USDA and American agricultural policy (McDean 1983). Agricultural economists were notably involved in two federal agencies, the Bureau of Agricultural Economics and the Grain Futures Administration.<sup>4</sup> The BAE brought together a large group of economists or economic-oriented scholars and functioned as a research agency at the intersection of economics, statistics, and planning. Its mandate was “to [conduct] studies and [disseminate] information relating to agricultural production, crop estimates, marketing, finance, labor, and other agricultural problems” (National Archives 1995).

The Grain Futures Administration (GFA) was established in 1921 (Grain Futures Act 1922) as a response to farmers’ demands for the regulation of futures markets. Some of the public viewed the futures markets as gambling, causing prices to rise artificially at the expense of farmers and the GFA was tasked with preventing “the dissemination of false or misleading market information” that could lead to excessive price fluctuations (GFA 1924: 3). The GFA was thus imbued with the USDA agenda of improving market information. The dissemination of “accurate and comprehensive information” was a “prime requisite for the efficient working of the grain futures markets” (GFA 1924: 25). However, the GFA remained a small agency within the USDA compared with the BAE. In terms of budget, the GFA’s regular expenditure was \$100,000-200,000 in the 1920s and the 1930s, compared with the BAE’s expenditure of millions of dollars (see USDA’s yearbooks, e.g., USDA 1926: 98).<sup>5</sup>

Agricultural economists were both imbued with neoclassical theory and American institutionalism. They viewed competitive markets as the best institution to allocate agricultural supply and incomes, but, as institutionalists, they also thought that it was not achievable without proper policies to bring existing markets closer to the theory. Their role, they believed, was precisely to elaborate such policies (Banzhaf 2006: 12).

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<sup>4</sup> The BAE lasted until 1953. After being dispatched to other bureaus, it became the Economic Research Service in 1961. The GFA became the Commodity Exchange Administration in 1936, and eventually the Commodity Futures Trading Commission.

<sup>5</sup> \$100,000 in 1920 is about \$1 million today (using the GDP deflator). See [measuringworth.com](http://measuringworth.com).

Agricultural economists fully embraced the USDA's concerns about farmers' information. Their main effort during the 1920s was to reduce the unfair asymmetry between farmers and dealers in their ability to exploit available information. Beyond the issue of fairness, economists also thought that this policy would increase market efficiency. Within this community of economists, it was already understood that prices convey information and that information influences prices. Better-informed farmers will make better business decisions, improving the price as signal, which, in turn, will improve the future business decisions of farmers. Overall, they believed that such a policy would reduce waste and increase the well-being of the population (e.g., Ezekiel and Haas 1926: 3).<sup>6</sup>

To achieve this goal, they launched an ambitious program to collect and disseminate information to the farmers. The daily work of USDA's economists was a combination of economic research and policymaking. In the first place, a large part of their effort was neither theoretical nor empirical, but practical. In addition to analyzing agricultural markets, they wanted to reform them by collecting, processing, and formatting information for market participants. Their fuller theoretical understanding of exactly how information would affect market behavior, which we will see later, was developed in their practice of economic policy, to which we now turn in the next sections.

## **2. Collecting and Gathering Information**

The relationship between market participants and agricultural economists was not a unilateral one in which the uninformed agents learned from the expert economists. In fact, the Federal Government and the economists knew little more than the market participants about the economy of the agricultural sector. In the early 1920s, the Bureau of Census provided estimation of

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<sup>6</sup> The idea that asset prices integrate available information is arguably an old one. For instance, such an opinion could be found from the mid-19<sup>th</sup> century in the pamphlets of various traders (see Preda 2004).



the annual crops for central commodities such as wheat, but the price data remained largely incomplete. This was especially true for futures markets where simple information such as price levels or trading volumes did not exist or was kept private by traders (Saleuddin 2018: 281). Before any dissemination of information, the work of the USDA's economists was to collect and gather raw information on the agricultural economy. Taylor, the first chief of the BAE, argued that its purpose was to "serve as a sort of barometer of the agricultural industry" (BAE 1924: 2).

At first, what agricultural economists regarded as relevant information for farmers, and what they considered irrelevant, was not defined clearly. In a pragmatic way, they cared about anything that could potentially improve the economic condition of farmers. Beyond economic information *stricto sensu*, they had a broad conception of information that included elements that they believed could lead, overall, to a better allocation of the national production (such as home economics, field and farm management, and even recent research in agronomy and biology).

While they promoted a number of empirical methods such as cost accounting, surveys, and experimental methods, they viewed data on crops, stocks of products and prices as the most important information. And as early econometricians, a significant part of the information they collected was statistical. It is known that the USDA was an important and innovative actor in the development of U.S. statistics in the 1920s and the 1930s, in terms of both information production and statistical analysis (Didier 2009; Biddle 2021). But it is rarely mentioned that the fundamental motivation for these numerous statistical innovations was to improve the information available for farmers and to increase market efficiency.

Pioneers in statistical analysis, agricultural economists had a major interest in price forecasting. As described in a 20-year retrospective, agricultural economists "felt that economic research should become less a record of the past and more guide to the future" (USDA 1942: 5). For BAE's economists, price forecasting allowed for wise farm planning

and, ultimately, a better allocation of the national production:

Every farmer must plan in advance and forecast for himself what he expects the future market to be. The two principal benefits to be derived from agricultural forecasting are: First, it will assist the individual farmer in wise planning in production and marketing; second, from a national standpoint, it will tend to promote the right utilization of land and to avoid the losses to producers from excess production and the unusually high prices to consumer which accompany a shortage of production (BAE 1923: 2)

Alongside this statistical work, the BAE endeavored to improve the grading and the standardization of agricultural products (BAE 1923: 7). Categorization was a long-standing initiative of trading exchanges such as the Chicago Board of Trade (Cronon 1991: 136) and the USDA wanted to unify this system. This issue remained very important in the department during the 1920s. Grades and standardization aimed at avoiding fraud and poor quality of products. But more importantly, from an economic viewpoint, the standardization facilitated the efficient transmission of information on prices and quantities of agricultural commodities (Lenfant 2017: 17).

Standardization was particularly important for futures markets, which were still little known to the government. One of the main tasks of the GFA in the 1920s was to build a legal environment that would enforce more transparency on futures exchanges, like the Chicago Board of Trade (Saleuddin 2018: 165). The Grain Futures Act (1922) obliged traders to report daily or weekly information such as their net position and the number of contracts traded on the period, and the quantity of goods received or delivered. To achieve such transparency, the GFA collected crucial information on futures exchanges that were necessary to understand and analyze these markets. In 1923, the GFA delivered their first studies about futures markets, on price movements, volumes exchanged, and the features of economic agents engaged in futures trading (GFA 1924).

The GFA and BAE offices in Washington relied on their branch offices and their county

agents to collect local information. The various experiment stations dispatched in the country also worked in collaboration with the BAE. By 1930, more than one hundred of the research projects conducted in the stations were devoted to agricultural economics (USDA 1930: 2).

A major event for aggregating local information collected over the year was the agricultural outlook conference. The agricultural outlook conference was an annual conference gathering various actors from the agricultural economy. The initial motivation of the first conference in 1923 was to receive feedback on the reports being prepared in the bureau from well-known economists and statisticians.<sup>7</sup> The conferences was attended by representatives of many public and research institutions. It quickly became an institution within the BAE. A conference was organized each year. The resulting research was compiled in a publication, the “Agricultural Outlook”, which was issued in February of each year.

The main focus of the Outlook program was price analysis. The BAE provided statistical analysis, such as price forecasts, and the analysis of factors influencing supply and demand, or of the relationship of prices between markets. It recruited several economists who focused on one commodity. In the first years, Mordecai Ezekiel and G. C. Haas were in charge of research on the hog market, B.B Smith on the cotton market, and Dr. Stine, E.M. Daggit and E. J. Working on the wheat market. Statistics on prices and supplies progressively improved over the decades, mainly by increasing the range of goods and the periodicity of price data.

### **3. Formatting Information**

Beyond collecting information, agricultural economists paid special attention to the way they formatted the information. This included disseminating the information in a way that was both meaningful and of practical use to farmers. Economic information took many

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<sup>7</sup> In addition to representatives of the BAE, the Department of Commerce, and the Federal Reserve Bank, the first conference was attended by many economists from private research institutions such as Wesley C. Mitchell from the NBER. See Taylor and Taylor (1952: 449).

forms: exhibits, posters, charts, models, films, addresses, radio talks, correspondence, and press releases. On top of discussions about the collection of information, formatting was subject to arguments that in the end reflected different conceptions of expertise.

These forms needed strong editorial work beforehand, and the editing of such information was at the heart of many discussions about the expertise of agricultural economists: should information be sent raw or should the information be formatted by economists to facilitate their reading? Should economists only provide price data, or should they interpret them and provide forecasts? Providing “vague generalization” or “specific forecasts” have always been “two school of thoughts” within the BAE (USDA 1942: 6).

In the 1920s, a number of articles from agricultural economists directly discussed the issue of formatting of information.<sup>8</sup> Fred F. Lininger, an agricultural economist from Pennsylvania State College, summarized the issue as follows:

From the great mass of information available, it is possible to glean something like answers to the four abiding questions of the farmer: “What, when, where, and how shall I sell, in order to obtain the highest net price?” In other words, what do all these statistics and expert calculations mean to the farmer himself.

(Lininger 1929: 348)

Leon M. Estabrook (1923)—associate chief of the BAE—stated that farmers should use crop reports as material to make their forecasts, and that information should not be sorted by the USDA. He argued that even though the problem was complex, farmers were able to compare today’s prices (either local, national, or world market conditions) with past prices or averages (Estabrook 1923).<sup>9</sup> Replying to Estabrook in the *Journal of Farm Economics*, Carl Williams—a farmer-stockman—stated that “they get nothing out of past movements of

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<sup>8</sup> See for instance (Lininger 1929; Hart 1929; Williams 1929; Cooper 1929; Estabrook 1923).

<sup>9</sup> The simple rule was then the following: “If [the crop report indicates] more, prices are not likely to advance and may not be maintained. If less, prices are likely to advance or at least to be maintained”. (Estabrook 1923: 35)

prices unless they can be made to see the relationship between this past movement and future ones” (Williams 1929: 86). Moreover, according to him, the farmers knew what kind of information they wanted and agricultural economists should edit it as requested.

These discussions are also apparent in the evolution of the BAE reports. Initially, it was usual for the outlook to give farmers explicit guidance on their future production decisions, but this was gradually replaced by a more nuanced discussion about prospective prices (Tolley 1931: 532). From normative advisers, the economists gradually adopted the role of informed observers, giving farmers more freedom to interpret the information contained in the price.

This was a means to protect economists from criticism. By making explicit recommendations about production, the BAE risked overlooking local circumstances. Production decisions became viewed as the responsibility of farmers. Price analysis, on the other hand, was seen as scientific information that belonged to the expertise of economists. But focusing on price analysis rather than production advice implied more and more considerations about educating readers to correctly interpret economic data (Kunze 1990).

A last concern about formatting involved the replicability of the information produced. While a popular format was necessary to disseminate statistical analysis among farmers, it was also essential that such analysis be discussed in the economics community. For example, Working pointed out that “results of correlation studies of prices must be made by the worker himself and his fellow-workers in the field” and it was necessary to publish results “not only in relatively popular form [...] but also in technical form for the study of technical workers.” (Working 1926: 232).

Formatting information depended crucially on the technological support through which it was diffused. In the early 20<sup>th</sup> century, news might take days to reach the more isolated parts

of the country. It was thus materially impossible to keep farmers inform about the daily price changes in major exchanges, which the urban dealers were capable of. The final stage of the USDA information policy was to disseminate the information they have collected.

## **4. Diffusing Information**

The issue of diffusing market information existed before the arrival of economists in the USDA. In 1914, the Smith Lever Act (1914) established the Extension Services of the Agricultural Experimental Stations, which the goal was to “[diffuse] among the people of the United States useful and practical information [...] in cooperation with the United States Department of Agriculture” (United States 2017, §341). In 1914, the Bureau of the Secretary established an Office of Information, primarily to facilitate the diffusion of USDA information to newspapers.

In the following year, the market news service was established by the Bureau of Markets (USDA 1915: 30). The market news service aimed to build a national network to diffuse information quickly countrywide. The service was conceived in these early days as a tool for coordinating the sharp increase in American production, which was responding to the rising demand from European countries in the midst of the First World War. The service was composed of a central office in Washington and local offices, also called “market stations”. The market stations managed the collection and diffusion of information at a local level. After the war, it had more than 30 permanent local offices (USDA 1919) but suffered from budget constraints in the following years.

However, from the mid-1920s, the BAE resumed funding of the service, allowing it to reach 50 permanent local offices in the mid-1930s. The market news reports primarily focused on a few fruits and vegetables. In the 1930s, it eventually covered 42 agricultural

products (BAE 1931: 5). The USDA also worked to collect and diffuse information on the agricultural conditions of other countries against which U.S. farmers might compete (USDA 1927: 57-58). In the early 1930s, the USDA claimed having offices in London, Berlin, Marseille, Shanghai, Belgrade, Buenos Aires, Pretoria, and Sydney.<sup>10</sup>

The market news service used several means to convey information to farmers. USDA reports were sent to local offices and then mailed to the market participants. Economists mostly used newspapers, which remain over the period the medium with the largest audience. In particular, the USDA wrote daily or weekly columns to be published in cooperating newspapers. As early as 1913, the telegraph was used bidirectionally to transmit information from the field and after study and compilation, to send the information back down to subscribers:

As a result [of the Congress's directive], government reporters stationed in most of the states were asked to telegraph market prices and crop conditions to the Washington office. Here the data was compiled, and the results released to subscribers of the service. In 1920 there were 75 observation stations linked to Washington D. C. by 4,500 miles of telegraph (Wik 1988: 179).

Around the early 1920s, the market news service also provided the "Agriogram", a radio broadcast. While no recording of this broadcast survives, contemporary periodicals described it as delivering news about agricultural economy, household management (such as recipes) and market quotations (O'Farad 1922: 2). W. A. Wheeler, in charge of the Market News Service of the USDA, gave in 1923 a brief overview of its contents:

At 1 o'clock the market message came: 'Chicago live stock market: Hogs opened strong to 15 cents higher, light and medium weights closed firm at advance. Bulk

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<sup>10</sup> The pioneering work of the USDA statisticians in collecting data on international markets has been studied in detail by Tyler (2023).

of sales \$9.30 to \$1.60. Better grades steers ...' (Wheeler 1923: 212)

In the early 1920s, the radio network was mostly established in the North and East of the country. Other regions (e.g., Nebraska, Kansas, South Dakota, Iowa, Oklahoma) were beyond the range of the existing telegraph and radio network. In the following years, the radio network expanded to central and western regions (see Figure 1). The USDA claimed in 1926 that its reports were broadcast on more than 80 radio stations (USDA 1927: 624). The USDA also advocated the use of radio in farms. The results of their surveys showed an estimate of 145,000 radio sets on farms in 1923, 365,000 in 1924, and more than 553,000 in 1925—there were around 6,500,000 farms in the country in the early 1920s.



FIG. 195.—Location of stations having the market news service of the Bureau of Agricultural Economics

Figure 1: The network of the market-new services in 1927 (Source: USDA 1927: 634)

In the first two decades of the 20th century, radio was barely regulated. The USDA was among the first players in the radio industry, alongside a number of early private companies and amateurs. Nevertheless, although USDA reports mention the existence of broadcasting in 1915, the use of radio only became a major tool of the USDA after the war.<sup>11</sup>

<sup>11</sup> Another important public figure in the history of radio was the U.S. Navy, which took control of the country's stations in 1917 to serve the war effort. After the war, the multiplication of stations in the 1920's motivated in large part the writing of the Radio Act of 1927. It led to the establishment of "Clear-channel" stations in the following year, a national radio network. Each station in the network has an exclusive AM frequency, allowing it to be listened to without interference from other radios (Sterling and Kittross 2001: 55, 93).



It has already been noted by historians of radio that the USDA was an enthusiastic supporter of new communication technologies (Wik 1988; Craig 2001). The regular changes in market conditions, and especially in prices, pushed the BAE to acknowledge the relevance of diffusing these changes promptly. Although newspapers remained the main tool for disseminating information, economists saw radio as the most promising way to solve their problem. The radio was viewed as the best means for diffusing information because it enabled the bureau to communicate *directly* with the farmers without any intermediaries. Wheeler promoted radio as “the only means of giving [farmers] quickly and at small cost the economic information necessary in the proper conduct of the farm business.” (Wheeler 1923, see also figure 2).

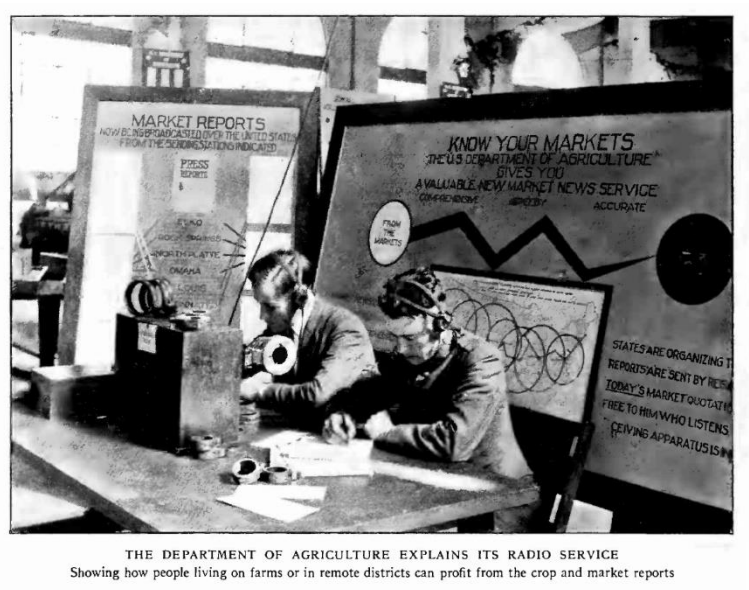


Figure 2: The marketing of the BAE for the development of radio (Source: Radio Broadcast 1922: 186)

If BAE’s economists primarily worked for the benefit of farmers, they also served other market participants such as trading agencies (e.g., BAE 1928: 53). Through market news services and the others means of diffusing information, economists viewed the BAE as the producer and distributor of accurate information on the agricultural economy to all parties. Chief economists of the BAE repeatedly emphasized the “unbiased” nature of the

information they provided. One of the more explicit advocates of BAE's informational role was the economist Nils Olsen, chief of the BAE between 1928 and 1935. He viewed the market news service as an "unbiased, impartial, accurate source of information", the "eyes and ears of the agricultural markets", providing "facts in a world of rumors" (BAE 1933: 13). Olsen did not hesitate to claim that farmers, thanks to the radio, were "better advised than many individuals actually trading on the market" (BAE 1934: 7) or that the market news service was comparable in "speed and precision [...] to that supplied by the ticker service in the financial world" (BAE 1933: 13).<sup>12</sup>

Agricultural economists who remained outsiders to the USDA were more equivocal about the impartiality of the information produced by the Department. For instance, some agricultural economists warned that information produced by the Department was incomplete and potentially biased. This is a concern that Joseph Davis, the head of the Stanford Food Research Institute economics department, shared with BAE's economists at the 1927 American Statistical Association. Davis was discussing the incomplete and the inconsistency of some of USDA statistics and suggested that improvements in the estimation and the analysis of these data should also come from "outside investigators" (Davis 1928: 10). He also warned about the potential existence of biases in the selection of statistics by the BAE. The latter could be tempted to emphasize the economic difficulties of the American agricultural economy, in order to ensure the financial support of policymakers:

Can one accept as entirely without bias the statistical data of the Department of Agriculture, in particular where estimates and interpretations are involved? Can one assume that competent scientific investigators outside the Department, with the same resources, would reach substantially the same results as those published? [...]

Workers in the Department almost necessarily develop, if they did not have it on

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<sup>12</sup> See Preda (2006) for a historical account about the ticker service.

entering, a strong sympathy with the farming class. [...] It is natural and desirable that pains should be taken, in the selection, analysis, and presentation of evidence on the economic and financial position of the farmer, to avoid showing the position in too favorable a light; but I am not sure that equal pains have invariably been taken to avoid showing it in too unfavorable a light. How far this tendency, if it exists, may be due to the statistical workers themselves, and how far to those higher up, I am not in a position to say (Davis 1928: 13)

The Stanford Food Research Institute was one of the rare private organizations conducting agricultural and statistical research during the interwar (the Social Science Research Council funded by the Rockefeller Foundation was another example).

It is difficult to evaluate Olsen's claim or the efficiency of the USDA information policy. But it certainly had an effect on the economic thought of contemporary economists. Since the accurate information was thought to reach quickly and efficiently farmers, a question naturally arose: what were the feedback effects on the behavior of prices? The informedness of the market participants was a political solution but it brought theoretical problems.

## **5. Making Things Theoretical**

### **5.1. The Feedback Effects**

From the early 1920s, agricultural economists anticipated that their effort would affect agricultural prices. The first outlook conferences were "held behind locked doors" because economists were worried about the "effect [the] outlook information might have on the markets" (USDA 1942: 6). The first effect that economists believed their effort produced was the increasing integration of local markets. Combined with the standardization of goods, economists thought that the dissemination of information would naturally cause the prices of

competing markets to converge. This argument was often used to justify or promote the market-news service. For instance, Haas and Ezekiel (1926: 7-8) stated that prices between local exchanges “fluctuate together rather closely” because “dealers in one market keep in constant touch with prices in other markets by wire and telephone; and the market news service by press, mail, and radio helps farmers to keep in touch with the prices”. Holbrook Working claimed that the market-news service “has done much to make it easy for dealers to keep informed regarding prices and supplies in other markets” which result in the fact that “prices in all the markets of the country are very closely related.” (Working 1922: 6). However, such claims from agricultural economists were more wishful thinking than verified statements. Assessing the concrete influence of USDA policy was not easy and raised many theoretical issues.

Agricultural economists understood that prices convey information and that new information influences prices. In 1923, the very first outlook reports concluded with a reminder that “[t]he facts that have been presented [...] are well known in the trade and have been discounted in the markets (USDA 1923: 10). But the understanding of how this “discounting” was done was far from being established. From the moment economists claimed to improve market efficiency by disseminating information, they also questioned the ways this efficiency was actually achieved in fact.

In the 1920s, this question was embodied in the broader issue of forecasting. Agricultural economists realized that making forecasts publicly available would affect the dynamics of the system they were trying to forecast. In other words, making the forecast available to the public could affect the accuracy of the forecast, and suddenly the supposed efficiency became less clear. This argument was well-known by economists from the bureau, and they used it to justify errors in forecasting when they occurred (Banzhaf 2006). Any error was viewed as a sign that the market was taking the information into account:

It is worth noting that the usefulness of early outlook forecasts was often measured

by the number of times in which they proved wrong. S. W. Mendum, who was for a number of years editor for the outlook committees, recalls that many early outlook workers took this position: If, for example, farmers in a year of prospective surplus planted a smaller acreage of wheat than the “intentions to plan” had indicated, it was a sign that the outlook reports had warned them of an impending surplus and they had modified their original intentions accordingly” (USDA 1942: 5).

For some detractors, however, the forecasting program had the opposite effect. Because of its prestigious statistical research, the forecasts of the BAE were accused of causing self-referential price changes and creating the sort of extreme fluctuations they were supposed to be fighting (The New York Times 1927).

Agricultural economists eventually acknowledged that they had to add their own publications to the long list of factors influencing prices. But for them it remained puzzling exactly how market participants interpreted this information and how the future demand and supply, and thus prices, were affected. The BAE members understood that they were missing a model of how market participants use information. For instance, in a 10-year retrospective about the outlook program, Howard Tolley, one of the leading agricultural economists in the bureau, called for a better understanding of how farmers adjust to price changes:

Some farmers respond quickly to changes in price relationships; some respond slowly. A knowledge of how different classes of farmers “react” to changes in prices and costs, and to non-economic factors as well, would help outlook workers to see the problem from the standpoint of the farmers they are endeavoring to serve (Tolley 1931: 524)

Having recognized that market participants behaved differently to the information provided by the BAE, agricultural economists felt it necessary to understand these different behaviors. This led them to venture into the field of rationality and expectations.

## 5.2. Expectations

Normative considerations about the good and bad behaviors of market participants appeared in various materials related to the analysis of agricultural prices. If these analyses were mainly empirical, they were often introduced by an institutional analysis of the market, which left room for theoretical digressions. One example was the study of the price and supply of hogs by Haas and Ezekiel (1926). Based on the close relationship between the price of hogs and the price of corn, their main feed, the authors argued that farmers adjusted their production according to their relative prices. But this adjustment, they observed, was systematically too slow and therefore suboptimal:

When hog prices are high relative to corn prices, farmers are encouraged to increase their production of hogs. [...] Unfortunately, however, this tendency of farmers to readjust their production to the price always seems to carry them too far in the other direction, because of the piling up of the changes before they are reflected in market receipts and in prices. [...] This explains the more or less regular “cycles” which have characterized hog prices ever since records have been kept. Starting with a period of corn and hog prices favorable to hog production, farmers breed more sows, and continue to increase their breeding stock so long as the current price relation is favorable, ignoring the fact that by the time the pigs will be ready for market the relation may have changed. (Ezekiel and Haas 1926: 22-23)

Ezekiel and Haas (1926: 23) concluded that the existence of this cycle in hog prices was due to the “failure of producers to look ahead”. They were developing here the intuition of the Cobweb theorem that Ezekiel (1937) eventually brought to light and that became for the profession a classic example of an extrapolative expectations model.

Another figure in the development of such intuitions was Holbrook Working. Towards

the end of his career, Working, a specialist in futures markets, notably developed a theory about expectations and speculation, which, in retrospect, might be viewed as close to the efficient market hypothesis (Working 1949). In particular, in 1949, Working suggested that futures prices should be interpreted as the unbiased “market expectations” of spot prices and that such unbiased expectations could explain the unpredictability of futures price changes.<sup>13</sup> Our goal here is not to exhaustively cover the intellectual trajectory of Working, but to show that his belated contribution was a logical development of global interest of agricultural economists in the informedness of agents.

In the 1920s, Working worked mainly on the analysis of prices, applying correlation analysis to the newly-collected data on agricultural market conditions. His first publication was a contribution to the USDA price analysis program (Working 1922). Working subscribed to the standard belief among agricultural economists that dealers were more rational than farmers in their use of available information. He argued that while “most dealers base their judgments on extensive experience and observation”, farmers formed their judgement regarding prices “on a most inadequate basis of experience and observation” (Working 1926: 235) Like other agricultural economists trained under the umbrella of institutionalism, he did not consider that dealers were rational, however. He acknowledged the existence of some “errors of dealer’s judgments in estimating the price justified by current conditions of supply and consumers’ demand”.

At the time, Working discussed this issue in relation to forecasting, which was the central problem of agricultural economists. Working viewed the errors of judgment made by “dealers and speculators” as a possible cause of predictable patterns in price series and thus “highly

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<sup>13</sup> “If it is possible under any given combination of circumstances to predict future price changes and have the predictions fulfilled, it follows that the market expectations must have been defective; ideal market expectations would have taken full account of the information which permitted successful prediction of the price change. Since any predictability of price change is evidence of [predictable] error in market expectations, a necessary condition for absence of [predictable] error is that the changes be completely unpredictable.” (Working 1949: 160).

useful for practical purposes in forecasting price changes”. But he immediately warned that “[t]he results are always subject to the limitation, however, that as soon as dealers generally know of the existence of such a situation, the situation itself is likely to disappear” (Working 1925: 521).

It was the first step for Working in the understanding of the relationship between errors of speculators and the statistical behavior of prices. An accumulation of the same errors in the valuation of a commodity had to cause a predictable trend in price series, which had to be observable by statisticians. But if a statistician could observe such a trend, it was likely that a professional of the market could also observe and correct it.

This question of errors of judgment also led Working to question the comparison between the technical knowledge of economists and the practical knowledge of professionals. Working believed that in the matter of anticipations and price forecasting, statistical analysis was not a sufficient tool to replace the expertise of traders, and that economists could not “make money by speculating in the market on the basis of the forecasts alone” (Working 1926: 228). In the years that followed, Working noticed the difficulty in forecasting price changes. In 1934, he wrote a note in which he observed the random nature of price changes for various commodity price series (Working 1934). This issue and his paper became popular within the profession only with the development of financial economics after World War II.<sup>14</sup>

Reasoning about the ability of market participants to react correctly to available information led Working, and other economists, to question the way that information is integrated into prices and thus to raise the issue of informational efficiency.

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<sup>14</sup> In his 1934 paper, Working writes a note in which he “observed” the accumulation of evidence about the unpredictability of many series of commodity price changes (Working 1934). But there wasn't really a way to “observe” it at the time. His argument was based on a visual comparison between existing price data and randomly generated series thanks to a “random” number table, created by the statistician Leonard Tippett only few years ago.



### 5.3. Informational Efficiency

Working's intuition about the ability of dealers to react promptly to new market conditions was not disputed by economists from the BAE. The very purpose of the institution was to level out the inequalities in information between the urban agents and the farmers. Overall, the problem for them was not so much that prices were not based on economic fundamentals, but that farmers misused the information. For instance, Ezekiel and Haas (1926: 3) argued that the problem was that farmers changed their production "blindly and usually at the wrong time" and had to "base their action not on what current prices are, but on what current prices *mean*". Within the USDA, the economists more sceptical of market efficiency were those of the GFA, primarily interested in futures markets.

From their emergence in the mid-19<sup>th</sup> century, futures exchanges have always been controversial. For their opponents, they are mere casinos that accentuate price fluctuations; for their proponents, on the contrary, traders' informed opinions about the future reduce price volatility (Santos 2008). The GFA's members were more nuanced. They believed that futures prices gathered important information on *current* economic conditions across markets. But they were more critical about traders' ability to forecast future economic conditions and recommended tighter regulation of futures trading. On the other side, Holbrook Working, and other economists at the Stanford Food Research Institute, were more optimistic about traders' ability and more critical of futures market regulation.<sup>15</sup>

One illustration of their disagreement is provided by the discussion between George Hoffmann, one the leading GFA's economists, and Working at the 1936 annual conference of the American Farm Economic Association. In his presentation, Hoffman argued that futures trading "provides a sensitive, continuous, fact-gathering market of value in supplying

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<sup>15</sup> We do not describe in detail here the debate between Working and the GFA, already analyzed by Berdell and Choi (2018), but we only illustrate how it prompted very important theoretical insights about price and information.

quotations, current trade news and a ready market” (Hoffman 1937: 308). But he also added that:

But on the matter of price forecasting, and through price forecasting price leveling, the question of doubt may rightly be raised. The evidence is insufficient to support the belief that future trading contributes much in this direction. It is easy to understand how, deductively reasoning on the matter, one might conclude that the combined opinion of thousands of futures traders must cause present prices to anticipate future needs and so iron out unusual price swings to a degree not possible in the absence of these traders. This can result, however, only to the extent that these traders display superior knowledge in their actual trading. Here the evidence if anything points in the opposite direction. Hedgers and arbitragers do display unusual ability through the impact of their trading upon relative prices between futures and between markets. But the composite effect of the large body of speculators upon the direction and movement of absolute prices is a very random and uncertain affair. (Hoffman 1937: 308)

The GFA acknowledged the expertise of professional traders, but they were much more sceptical about the composition effect of their decisions on prices. It was hard to find evidence, however. Unlike spot prices, futures prices were intrinsically oriented toward the future, and it was much harder for economists to assess whether those prices were determined solely on the basis of accurate economic information. As Hoffman argued “[t]his question is impossible to answer in the absence of an independent measure of what prices ought to be in the light of fundamental supply and demand factors” (Hoffman 1937: 307).

Working discussed Hoffman’s article and although he praised Hoffman and GFA’s pioneer research on futures exchanges, he also expressed his early belief in the efficiency of futures markets. His main point of disagreement on this issue was Hoffman’s shift between the

microeconomic scale, traders' information, and the macroeconomic scale, prices:

Prices, as they are determined in modern speculative markets, are not so haphazard and imperfect as one may judge from too restricted a view of the information and trading habits of individual speculators. Consider this analogy. My finger is composed entirely of molecules. If I correctly understand the physicists, they know that these molecules are moving about at tremendous speeds, and in an almost wholly haphazard fashion. On hasty deduction, it might appear that since all its particles are rushing madly about in such haphazard fashion, my whole finger should also be gyrating erratically about the room. This analogy should not be pushed too far; but it correctly suggests a line of theoretical analysis that must be followed up before sound conclusions can be drawn from certain observations cited by Professor Hoffman. In the futures market, the individual trader is a molecule. Influences that may be wholly negligible in their effect on the motion of the single molecule may dominate the motion of the body into which the molecules are united.

(Working 1937: 310)

The need to justify their respective points of view on regulation led GFA's economists and Working to raise the issue of the aggregation of dispersed information into prices. They also touched on how to infer the informedness of traders from correlation analyses and how prices should statistically behave accordingly (Hoffman 1937: 307; Working 1937: 310-11).

Working would eventually develop his ideas, which remained during the interwar period only insights used to discuss USDA information policy.<sup>16</sup> But while having some disagreements, Working and economists from the GFA and BAE had far more in common than they had in the way of differences. They belonged to the same class of economists: empirical

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<sup>16</sup> Working's late view of futures markets was that of an institution disseminating the dispersed and private information of individual traders. Futures traders, guided by the search for arbitrage opportunities, were "forced and induced to engage in a sort of informal division of labor in their use of available information" (see, in particular, Working 1958: 194).

economists steeped in institutionalism, who, in their desire to bring market reality into line with theories, were forced to evolve their ideas and thus anticipated central reflections on the role played by information in economics.

## 6. Concluding Remarks

Overall, in the 1920s and the 1930s, agricultural economists built a set of intuitions rather than a full theory, but their writings show how they were already thinking deeply about the way agents integrated the available information and formed their anticipations. In retrospect, Working's reflections were particularly pioneering, as they found an echo in the macroeconomic and financial economic research of the 1970s. Working was certainly the agricultural economist who most developed these insights, but he was not an isolated pioneer of postwar economics. This article illustrates how pioneering figures such as Working are embedded into more general collective dynamics.

This study also indirectly raises the question of expertise. These economic thoughts on information were firstly embodied in policy-oriented rather than academic contributions. The development of theoretical arguments on information was the last chapter in our story. Early economic policies led to a program aiming to collect and disseminate information. Before becoming a concept, information was a *concrete* object for these economists, which had to be produced, formatted and diffused. Then, and only then, some agricultural economists formulated analytical arguments about the accuracy of market participants' information and suggested empirical relations to the behavior of prices. Here, in other words, economic expertise not only consisted in the passive application of existing knowledge, it also played an active role in shaping economic ideas.

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