

**EXAMINING THE IMPACT OF COOPERATIVES AND SPATIAL  
EXPANSION ON AGRICULTURE-BASED GROWTH**

An Undergraduate Research Scholars Thesis

by

LEXIE FORD, AASTHA RAJAN, AARON ROSS, and JASMINE SAUSEDO

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Dr. Samuel Cohn

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## **ABSTRACT**

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Lexie Ford  
Department of Economics  
Texas A&M University

Aastha Rajan  
Department of Economics  
Texas A&M University

Aaron Ross  
Department of Economics  
Texas A&M University

Jasmine Sausedo  
Department of Sociology  
Texas A&M University

Research Advisor: Dr. Samuel Cohn  
Department of Sociology  
Texas A&M University

The prosperous nations of today have a history of economic growth based on flourishing agricultural activity. This project aims to investigate causes of agricultural-based growth in the United States of America and Canada by drawing a comparison to Denmark. We compare the Danish dairy model with the dairy and wheat agriculture in the U.S. and Canada. We focus on Senghaas' theory of social capital development by cooperative organization and Harvey's theory of spatial fix by geographic expansion as possible explanations for agricultural productivity growth in the U.S., Canada, and Denmark. A qualitative analysis of agricultural histories provides weak evidence for successful cooperative movement in the U.S. and Canada as compared to the successful Danish model. The productivity comparison among the nations

provides conclusive evidence for highest productivity in favor of the successful Scandinavian case while demonstrating productivity growth in all cases. However, historical agricultural production statistics do show evidence of massive volume of production in other cases despite low productivity. We further expand our analysis to understand the differences in Danish and North American experience based on the existence of frontier in the latter case. The results of correlation between productivity growth and input expansion also fail to explain the observed difference in productivity growth amongst the three cases. Thus, we conclude that neither cooperative organization nor availability of widespread arable land were causes of increasing agricultural productivity in the U.S. and Canada. Their impressive agricultural growth can likely be attributed to their massive scale of production made possible due to widespread arable land.

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# CHAPTER I

## INTRODUCTION

The early economic development of currently wealthy nations was primarily based on agricultural activity. This project focuses on the agricultural experience of American and Canadian wheat and dairy activity. We attempt to understand the reasons for the seeming success of their agricultural production by testing two theories of economic growth. We analyze the rise of cooperative institutions in the U.S and Canada and contrast it to the successful Danish model to test the impact of egalitarianism on agricultural growth in these countries. This is based on Senhaas' proposed theory that demonstrates the far-reaching impact of social capital development through grassroots community organization in forming successful agricultural economies. Moreover, acknowledging that U.S. and Canada are geographically huge as compared to the case of comparison i.e., Denmark, we also study the effect of spatial expansion on agricultural productivity. This is done to assess whether the expansion into the frontier made more productive land available, thus, eliminating the need for a technological fix in the form of cooperative organization. We find that both the egalitarian and spatial fix theories fail to explain the agricultural growth of the U.S and Canada. Nevertheless, we find evidence of huge volume of production in the U.S. and Canada as compared to Denmark despite low productivity. Thus, we conclude that former nations were likely successful due to their raw volume of production and not because of any notable productivity growth. This massive scale of production was made possible by availability of large tracts of land.

## Literature Review

It is a common belief that industrial distinction is the primary means of economic growth. David Landes' *Unbound Prometheus* (2010) is a renowned work that elaborates on the Industrial Revolution in England. Landes credits the economic growth seen in industrialized societies to the development of manufacturing technology. Indeed, much of the economic history attributes the prosperity of Europe and the United States to industry-magnates and factory-based production. However, this fails to take into account the significant role of agriculture in supporting the foundation for their economic success. Thus, this research paper attempts to shift attention to agrarian-led economic growth. The study of agricultural growth is significant for understanding economic development as it helps bring into perspective the historical rise of developed nations and also helps examine the currently developing nations. The concept of agricultural growth has been widely examined. We are particularly interested in examining the egalitarian and spatial fix theories of agricultural-led growth, as explained below.

Dieter Senghaas (1985) in his work, *The European Experience: A Historical Critique of Development Theory*, explains how agrarian exports, starting in the late 19<sup>th</sup> century, promoted an egalitarian social structure in wealthy nations in Scandinavia. Land reform measures allowed an equal stake in output that promoted a cooperative need to invest in technology development and farm education available for use by all. Senghaas credits the prosperity of Scandinavian countries to their egalitarian social principles of accessible technology, education, social capital, willingness and capability of farmers to invest in technologies, and pressure on state governments to enforce regulatory procedures. Thus, egalitarianism promoted social capital

development that led to economic prosperity through a successful increase in agricultural productivity.

There are other theories of growth that analyze the complex relationship between socio-ecological factors and agricultural production. Jason Moore (2010) analyzes the agricultural revolutions from an ecological perspective. According to him, ecological surplus, i.e., labor, food, power, energy, etc., is produced through a “combination of capitalized production [mechanization] and the appropriation of nature as a gift” (394). In the case of the U.S. and Europe, this appropriation refers to expansion in to frontiers. For example, Europe solved its food crisis of the 18th century by expanding vertically (extraction of coal) and horizontally (colonizing America). Further, he credits the historical food surplus in the U.S to agricultural production in the Midwest, the South and California. This ties in with David Harvey’s (2001) proposed theory of a “spatial fix” that explains the desire of capitalism to resolve its inner crises due to overaccumulation of capital through geographic expansion. He also cites globalization as a contemporary “spatial fix”. According to him, capitalistic economies cannot survive only on innovation in technology and require continuous geographic restructuring and expansion. This can be assumed to be relevant in contrasting the North American and Danish agricultural experience due to the presence of the frontier in the U.S and Canada. The successful conduction of spatial and egalitarian tests on these countries seeks to highlight the nuances of their agricultural growth and is significant in understanding the agrarian basis of economic development.



## **CHAPTER II**

### **METHODS**

We tested two theories of growth, namely, Senghaas' theory of growth by cooperation and Harvey's theory of growth by spatial expansion.

#### **Case Selection**

For our research, we analyzed the cooperative industries of dairy in Denmark and dairy and wheat in the United States and Canada. We selected these nations due to their historical nature of development by agricultural growth. Denmark was chosen as the comparative case due to Senghaas' discussion of the Danish nation as a positive model of cooperative-based growth in Scandinavia. The United States and Canada were chosen due to the huge size of their industries. We examined dairy cooperatives in U.S. and Canada to be compared with cooperatives in Denmark. We further studied wheat cooperatives in the U.S. and Canada due to the importance and size of the industry.

#### **Data**

##### *Assessing Agricultural Histories*

For examining the egalitarian nature of dairy and wheat production in the U.S, Canada and Denmark, we studied and compared their secondary histories. Extensive case studies of agricultural histories were conducted. We studied sources of a wide variety by utilizing the library and online sources. All sources are listed in the references section of this paper. We assessed this qualitative research against a rubric of egalitarian institutions. We noted the effects

of the factors such as community and state efforts in areas of education, infrastructure development, marketing, brand name management, anti-adulteration measures, aid provision, and technology development among others.

### *Analyzing Agricultural Productivity and Productivity Growth*

To conduct the spatial fix test, we created flow and stock measures of wheat/dairy productivity and land/cows expansion. The data on wheat production, milk production, land under wheat cultivation and cows kept for milk production were obtained from historical agricultural censuses. The data was collected from decennial censuses. The time-period under study was restricted to the late 19<sup>th</sup> to early 20<sup>th</sup> century. All the different cases had data available for different time periods, but data was available for most cases for 1890-1940. The productivity for dairy was measured as milk produced per cow and for wheat, as bales per acre. The average of productivity across the years was used to calculate stock of productivity. Following this, the regression measures of productivity on time, number of cows kept on time, and number of acres on time were calculated for each state or province in the U.S. and Canada. The slope coefficients were used as proxy measures for flow of productivity and input, respectively. Then, we calculated the Pearson coefficients for input expansion and productivity growth along with input expansion and average productivity to ascertain the impact of increase in land or cows on productivity.

## CHAPTER III

### RESULTS

#### **Discussion of Cooperative Organization**

##### *Denmark: Dairy*

We chose to research Danish dairy because it was an industry that was similar to the other Scandinavian agriculture industries examined by Senghaas. The historical literature attributes the prosperity of Danish farmers in the late 19<sup>th</sup> century to the cooperative manufacture and export of agricultural products, especially butter. Due to the severely limited amount of arable farmland available in Denmark, it would be highly unlikely that any major economic growth was due to spatial expansion as explained by David Harvey or Jason Moore. Denmark's small scale of production also rules out the possibility of growth being a result of mass production of agricultural goods. In our research, we found the dramatic increase in productivity of Danish dairies to be a result of widespread egalitarian farmers' organizations and the development of social capital in the form of farmer education and accessible technology, supporting Senghaas' model of egalitarian economic growth.

As depicted in Figure 1, cooperative dairies were rapidly established in massive numbers from the years 1882 to 1930.

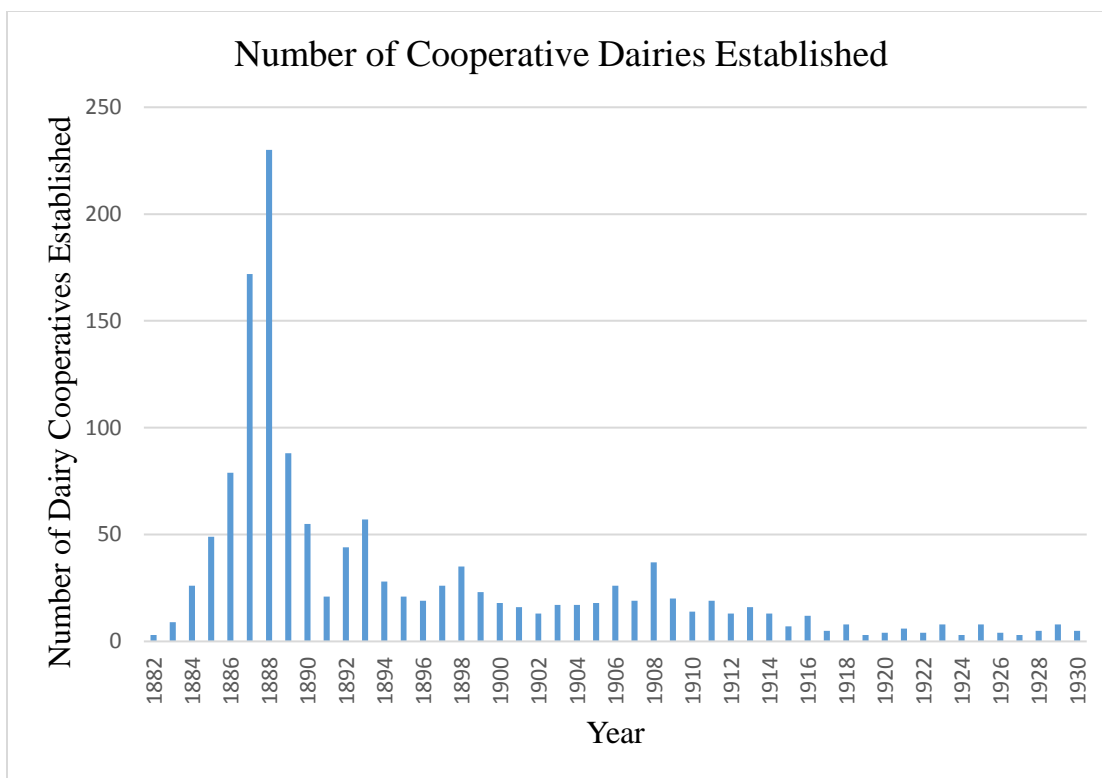


Figure 1. No. of Cooperative Dairies Established in Denmark by Year<sup>1</sup>

Table 1. Proportional Contribution of Cooperatives in Danish Agriculture in 1935<sup>2</sup>

Enterprise	Percentage on all farms	Percentage of all livestock
Dairies	90	86
Slaughterhouses	70	75
Egg Sale Societies	22	26
Fodder Societies	31	33 and 35 (cows and pigs respectively)
Fertilizer Purchasing Societies	24	29 (area)
Livestock Export Societies	11	18

<sup>1</sup> Source: Bjerke 1935

<sup>2</sup> Source: Bjerke 1935: VI (Appendix)

Note: Table 1. demonstrates that by 1935, 90% of all dairies were cooperative and were responsible for 86% of all Danish cattle. Therefore, Danish dairy was a notably cooperative industry.

The flood of mass-produced grain imported primarily from the United States into the European market in the years 1876 – 1877 resulted in a dramatic drop in the price of grain and plunged the grain producing countries of western Europe into an agricultural crisis (Skrubbeltrang 1953). Danish farmers on small and middle-sized farms could no longer rely on grain production as their primary source of income because they could not compete with the foreign volume of grain production. Large estates had earlier demonstrated the economic viability of dairying. However, alone, the ordinary Danish farmer could neither afford the adequate technology nor produce sufficient yields of milk to produce enough butter for sale on the market. Thus, farmers of small to middle-sized farms produced butter that could compete on the market by establishing cooperative dairies that utilized technological innovations, locally based farmer's education, and democratic organization of production. The first cooperative dairy started operation on June 10<sup>th</sup> 1882 and was an economic success (Faber and Hertel 1918). By 1890, 656 imitator dairies had emerged in Denmark (Bjerke 1935). These dairies produced large quantities of high quality butter through the successful efforts of each member to improve the yield of milk and productivity of their herd.

### *Structure of Danish Cooperative Dairies*

Most members were owners of small to middle-sized farms, but any farmer who owned cattle could become a member of a cooperative dairy. The dairy building and equipment were paid for by a loan that all members were jointly responsible for and was based on the security of the real property of the members (Manniche 1952). Members were held liable in the rare instance that the association were to fail and go into default. However, farmers were comfortable with the associated risk because the cooperative dairy enterprises were managed at a local level and therefore were easily supervised and controlled. When cooperative dairies began to operate at larger than the local scope, liability was limited for each member. However, there were never attempts to restrict membership of farmers, merge dairies, or establish a monopoly (Jensen 1937). Management decisions for the cooperative dairy were decided upon by a vote of all the members who each had one vote regardless of herd size. To form a cooperative dairy, farmers would vote on a contract, enforceable in courts, that detailed the rules of operation for the dairy that its members were to abide by. Members elected a Board of Directors which represented the local districts present in the cooperative dairy. Farmers of the dairy also hired a highly trained dairy manager to supervise the production of butter, but management of the dairy was the responsibility of the farmers themselves.

The purpose of the Danish cooperative dairies was to produce butter from milk collected from several farms. Farmers became members of the cooperative dairy for a fixed period and were to deliver all milk that was not used for household purposes to the dairy. Proceeds from the sale of the butter went first towards the expenditures of the dairy. Once the cost of maintaining the dairy was paid, the leftover surplus was apportioned to each member in proportion to the weight and

fat content of milk contributed. The dairy also returned to the farmers an equivalent proportion of skim milk, which could then be used as livestock feed. The farmers worked to improve the productivity, yield, standardization, and quality of milk produced by their herds because the improvement of the quality of butter produced at the cooperative dairy was in the best interest of all the members. This in turn allowed the dairies to produce large quantities of high quality butter, which demanded higher prices on the market than estate butter.

The success of cooperative organization in the production of butter soon spread to several other endeavors of the dairy industry. Two of the most prominent of these undertakings were for the export of butter and the purchase of livestock feed. These cooperatives allowed dairy farmers to collectively bypass misinformed or exploitative middlemen to trade directly with suppliers. Some of the prominent cooperatives were Danish Butter Cooperative Company (1895), Jutland Cooperative Society for the Purchasing of Feeding Stuff (1898), Aalborg Butter Export Association (1901), Danish Dairies Cooperative Butter Export Association (1904), Funen Cooperative Feeding Stuffs Company (1901), and Vejile District Butter Export Association (1914) (Faber and Hertel 1918).

### *Social Capital Development in Denmark*

The success of the Danish dairy cooperatives was closely associated with farmer-led efforts to develop social capital through locally-based agricultural education and the cooperative adoption of technological innovation. Agricultural schools contributed to the success of Danish dairy farmers in aiding in the improvement of farming practices that would increase productivity of their herds. They were organized and funded privately by local associations or individuals, with

some limited funding from state grants and financial aid for certain students (Haggard 1913). The Royal Veterinary and Agricultural College in Copenhagen was the only agricultural school that was primarily state-funded. Farming communities strongly encouraged young farmers to attend agricultural schools. The lessons primarily covered theoretical information about farming topics such as botany, farm economy, judging of livestock, organic chemistry, feeding of livestock, physics, and bookkeeping (Campbell 1928). The Dalum and Ladelund agricultural schools were particularly notable for the dairy courses they offered in training dairymen. Many schools had research laboratories or experimental farms where agricultural studies and experiments were carried out. These findings would then be published and shared with the public. As of 1935, 2,500 students annually attended the 20 existing agricultural schools (Bredkjær 1935).

Danish farmers formed and directed local agricultural societies for the advancement of the industry. These societies held cattle shows and herd competitions, kept herd books, established bull clubs, and appointed agricultural advisers (Manniche 1952). Livestock exhibitions served to improve the quality of Danish dairy cattle breeds and reward farmers for the superb maintenance and milk production of their herds. The Danish government provided funding to these societies. These agricultural societies also hired agricultural advisers to provide guidance to local farmers. The advisers were responsible for assisting in purchasing supplies and livestock, arranging shows and exhibitions, performing experiments on plant culture, and keeping herd books (Bredkjær 1935). They lectured on agricultural matters to engage farmers in discussion with one another.



A defining characteristic of a successful cooperative organization is technological development. Danish dairy farmers cooperatively purchased and incorporated the newest technological innovations into their production process. The dairying technology of Denmark developed in accordance with the progress and demands of the dairy industry. Jensen (1937) credits the collective purchasing of cream separators by Danish farmers with the rise of the Danish cooperative dairies. Along with cream separators, farmers also needed to cooperatively adopt other advanced machinery in their dairies such as churners, heaters, pasteurizers, coolers, and automatic milk scales. By 1935, five continents were importing advanced dairying technology from Denmark (Christensen 1935).

Denmark's dairy industry demonstrated all the hallmarks of a successful agricultural cooperative organization that resulted in economic prosperity for the agriculture industry as well as the farmers who participated in the cooperatives. Throughout their existence, the cooperative dairies remained a grassroots effort that was completely under the agency of the farmers themselves. The success of the cooperatives resulted from the development of social capital within the farming communities in the form of local agricultural education and cooperative adoption of technology. In the following sections, we examine the cooperative efforts in United States and Canadian agriculture industries. We will compare these industries to the Danish cooperative model to explain which aspects of their organizations differed from the Senghaasian model.

#### *U.S.A: Dairy*

The dairy industry in America was very diverse in terms of character of ownership. Cooperatives were not the principal form of organization.

Table 2. Character of Ownership of Dairy Products' Establishments in the United States<sup>3</sup>

Character of Ownership	%age of Establishments			Value of Products	
	1899	1904	1909	1904	1909
Years	1899	1904	1909	1904	1909
Percent of Total	100.0	100.0	100.0	100.0	100.0
Individual	48.8	42.8	39.7	26.1	22.4
Firm	14.5	14.5	12.0	13.5	9.8
Corporation	17.6	15.5	15.5	36.5	41.3
*Cooperative	19.1	27.3	32.7	24.0	26.5

Note: As is evident from the information in Table 2, individual firms were the most prevalent while corporations accounted for the highest value of products manufactured. During the period 1899-1909, all types of ownerships declined except cooperatives which show an increase of 13.6%, but their share of value of products increased by a mere 2.5%. Contrary to this, the corporations show a 4.8% increase in value of products despite a decrease in establishments by 2.1%. Thus, American dairy was not overwhelmingly cooperative nor were the cooperatives more successful than the corporations.

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<sup>3</sup> Source: Wiest 1926:71.

\*Note from original source: Listed as miscellaneous in table [census], but characterized as cooperative in descriptive part.

The following section elaborates on the history and characteristics of cooperatives in the American dairy industry. We examined American dairy in order to draw a contrast with the successful Danish cooperatives by investigating their supposed egalitarian nature. The Senghaasian cooperative model focuses on grassroots cooperative effort that is committed to equality in authority of operations, community involvement in agricultural education, shared technology and a spirit of fraternity in the best interests of the society. However, American dairy had more differences than similarities with Danish dairy in many such aspects. Danish cooperatives explicitly focused on production operations whereas the American cooperatives were organized as federations that dealt with marketing and bargaining. Moreover, the problems of adulteration and middlemen in U.S. dairy were not addressed efficiently by the cooperatives. More importantly, efforts in the realm of social capital development in the USA were heralded by the government. Thus, the cooperative experience of American dairy does not replicate the Senghaasian cooperative model seen in Denmark.

#### *Nature of American Dairy Cooperatives*

The early beginnings of dairy were cooperative and constituted the lending of milk and cream among farmers. In fact, Erdman (1962) cites the beginning of formal cooperation among American farmers to the cheese dairymen of New York in 1850s and 1860s. In 1851, Jesse Williams' efforts of organizing a common cheese factory gave rise to the associated system of dairying. In this, a group of dairymen contracted with a cheesemaker who was responsible for equipping the factory and manufacturing operations. The proceeds from the sale of cheese were divided among the dairy farmers in accordance with the quantities of milk delivered. In some cases, these took the form of a joint stock enterprise which was a manufacturing unit established

by an association of farmers for processing milk into other dairy products. Gradually, the structural organization of these associations gave way to incorporations which were characterized by distribution of shares among farmers. Management decisions were decided by a Board of Trustees with no direct say of stockholders in management besides the election of Trustees (Erdman 1962).

The national and regional federations that formed as a result of incorporation distanced the factory operations from grassroots farmer organization. These large-scale organizations focused on the distribution aspect of dairying. Although they carried out some manufacturing, they were primarily concerned with the price of products and brand name management. Unlike Denmark, these organizations did not focus on increasing productivity. The following table lists a few such prominent associations in the dairy market along with their organizational purpose.

Table 3. Associations in American Dairy<sup>4</sup>

<b>Name of Organization</b>	<b>Year and Place of Establishment</b>	<b>Purpose</b>
Wisconsin Dairymen's Association***	Wisconsin (1872)	Organized to market regional dairy product beyond state market
Tillamook County Creamery Association*	Oregon (1903)	Cheese Selling Cooperative
New York's Dairymen's League Cooperative Association*	New York (1907)	Price negotiation with distributors and operation of milk plants
Challenge Cream and Butter Company**	California & Idaho (1911)	Organized to manufacture, market, grade and standardize butter cooperatively
Sheboygan County Cheese Producers' Federation*	Wisconsin (1914)	Organization of cheese factories to build a sales campaign for sale of cheese to wholesalers and handle warehousing operations
Twin City Milk Producers' Association*	Minnesota (1916)	Organized to bargain with distributors and handle surplus milk
National Milk Producers' Cooperative Association**	(1917)	Organized as a protective organization for regional marketing associations, federations of cooperative creameries and cheese factories
Chicago Milk Producers' Cooperative Marketing Company**	Chicago (1918)	Acted as sales agents for producers, operated plant for bottling milk and handle surplus
Land O' Lakes Creameries Inc.**	Minnesota (1921)	Federation of cooperative creameries in Minnesota for scoring, grading, branding and selling butter of member creameries

<sup>4</sup> The information of cooperative associations listed in the table has been taken from the following sources: (Refer to works cited section for detailed references)

\* Filley 1929

\*\* Bartlett 1931

\*\*\* Merk 1926

Note: The list presented in Table 3. is not exhaustive but a mere representative sample of the organizations of that time. These organizations emphasize the defensive formation of cooperative associations in response to the presence of middlemen in the dairy market. Historical accounts of the American dairy industry also refer to the development of Boards of Exchange that brought together dealers and producers to negotiate price. The earliest producer's exchange organization was for the sale of cheese in New York. Then, butter was traded through the Elgin Board of Trade in Illinois (Selitzer 1976). Later, dairy cooperatives expanded to form their own marketing federations, as listed above, to act as middlemen between farmers and wholesalers. Thus, the cooperatives were in a continuous struggle to eliminate the middlemen without any conclusive results.

There also existed cattle organizations such as breeding associations and cow testing associations. These organizations mainly focused on breeding productive cattle of various kinds. The first cow-testing association was the Newaygo County Dairy Testing Association, established by the Michigan State Dairy and Food Department in 1905. And by 1926, their number had expanded to 777 (Pirtle 1926). It is worth noting that the establishment of this cow-testing association was a state-led effort and not a farmer-initiative. This deviates from their cooperative focus. Moreover, the discussion presented above does not mean to discount the communal efforts of agricultural societies, dairy journals, and agricultural fairs. They were a critical part of the social fabric of rural dairy activity. However, the literature on them does not show evidence of their critical impact on the cooperative effort of dairy farming.

### *Adulteration in American Dairy*

The failure of successful cooperation in American dairy is also reinforced by the problems of adulteration in milk, butter, and dairy markets. Adulterated milk, oleomargarine production, and skimmed cheese production depressed prices and urged state intervention. Massachusetts passed an anti-adulteration milk law in 1856 and by 1900, most other states had pure milk laws (Selitzer 1976). The oleomargarine production was dealt with by the passage of the Oleomargarine Act in 1902 after successful lobbying of the National Dairy Union and other state dairy associations (Lampard 1963). In 1844, New York passed laws against filled cheese followed by Wisconsin in 1895 (Selitzer 1976). In comparison to the U.S, the only prominent instance of butter adulteration in the Danish dairy industry occurred in the 1890s when imported butter was being sold domestically or exported as Danish butter (Jensen 1937). Danish dairies solved this issue cooperatively by adopting Lur brand as the official brand for all the butter they produced. Although Danish law made the adoption of this brand compulsory by law for all Danish butter in 1906, the cooperative creameries had already been using the brand since 1899 (Jensen 1937). Thus, the cooperatives took the lead for implementation of anti-adulteration measures without major intervention of federal or state authority.

### *Social Capital Development in American Dairy*

One of the hallmarks of cooperative organization is the acquisition of social capital by community education. The U.S. dairy industry does not exhibit this characteristic of communal commitment to shared knowledge or technology. The educational revolution in agriculture was spearheaded by the land grant state agricultural colleges instituted by the Morrill Act of 1862. Later, in 1887, the Hatch Act established experiment stations as distinct departments in each land

grant college (Wiest 1916). They demonstrated to the farmers scientific advancements in dairying such as the Babcock butterfat test. Station bulletins at these schools made information about advances in pasteurization and homogenization available (Selitzer 1976). State Dairy Associations also spread agricultural education by organizing conventions in which the professors of dairy schools presented improved methods of dairying, discussed problems of marketing, and encouraged adoption of new farming methods (Wiest 1916). At the national level, the Dairy Division of US Department of Agriculture was organized in 1891 to “disseminate information, coordinate sanitation and regulation ordinances” (Wiest 1916:142). This division also conducted research in bacteriological and chemical problems with milk, ice cream, and the utilization of by-products (Pirtle 1926). This discussion of human capital development reflects on the importance of governmental authority in directing and conducting research activity related to dairy goods production. This system of state-sponsored education is a departure from the Danish social structure of community education, which is heavily reliant on voluntary communal effort.

In conclusion, as the historical data shows, the dairy industry was not majorly cooperative. The cooperative associations that existed focused more on marketing and bargaining rather than production. The problems caused by middlemen and adulterated products points to a failure of successful cooperation. Moreover, the major role of government in agricultural education departs from Senghaas’ model of community led cooperative effort.



### *U.S.A: Wheat*

The following sections discuss the structure and history of American egalitarian wheat institutions. We compare them to Danish cooperatives in terms of both structure and the extent of social capital spillover. American cooperatives do not qualify as Senghassian cooperatives and exhibit very few similar characteristics. The majority of American cooperatives were formed in reaction to external stimuli and were defensive by nature, contrasted with the proactive nature of Danish cooperatives. During the mid-1800's the social structure of an American wheat community seemed to promote cooperation, but the existence of an open frontier with fresh fertile soil incentivized farmers to simply migrate westward to increase their production, instead of forming successful cooperatives. Ultimately, the mechanization of threshing further supplanted farmer interdependence, making the formation of true cooperatives even more implausible.

### *History of Cooperation in American Wheat*

The first instance of significant cooperative-based organization was borne out of the Grange, a fraternal organization that started in 1866 with the goal of educating farmers and restoring “kind feelings between the people of the North and South” (Knapp 1969:4). Initially, it was met with disinterest by farmers. Gradually, the Grange changed its emphasis to economic goals and farmers flocked to the movement in response to decreased demand for wheat, monopolistic practices by railroads, and cricket infestations. In 1871, there were 257 local grange agencies and by 1875 membership had climbed to 858,050 (Knapp 1969, Steen 1923). The Grange attempted to enact cooperative change on a local, state, and nationwide level by lobbying for legislation,

opposing railroad monopolistic practices, and forming purchasing associations, cooperative stores, and elevators. However, it rapidly failed due to the following reasons:

1. Unwieldy and undisciplined membership resulting from the rapid nature of its growth,
2. Involvement in unsuccessful political movements,
3. Failure to secure radical railway legislation, and
4. Economic failure of cooperative business enterprises (Hassinger 1978).

Membership by 1880 had decreased to 150,000, and the organization's greatest victory, *Munn v. Illinois* (1877), was overturned in 1886. The Grange was succeeded by the Farmers Alliance and other lesser movements that had little to no success (Steen 1923). Aside from Grange efforts, cooperative activity among American wheat farmers centered around grain elevators and threshing rings.

Wheat farmers needed a way to ship their product to the market. Grain elevators located next to the railroads would typically store all of a community's grain and charge an artificially high price to the farmers. These grain elevators colluded with each other and the railroads to prevent any new competition. This initial failure of the cooperative movement to regulate these monopolistic practices spurred a new movement of cooperatively owned grain elevators. The first financially successful cooperative elevator, the Farmers' Cooperative Association, opened in Cedar Bluffs, Nebraska, in 1888. The cooperative took 10 years to become profitable and slowly inspired the creation of other cooperatives. With the passage of the Elkins Act in 1903, the discriminatory practices by railroads were prohibited and the number of cooperative elevators grew from less

than 100 in 1904 to over 5,000 by 1921 (Steen 1923). Table 4. is a snapshot of cooperative organization in American wheat.

Table 4. Cooperative Organizations in American Wheat<sup>5</sup>

<b>Name of Organization</b>	<b>Year and Place of Operation</b>	<b>Type of organization</b>
The National Grange of Patrons of Husbandry (The Grange)	Nationwide (1866)	National fraternal organization dedicated to cooperatively organizing farmers.
The Farmers' Alliance	Nationwide (1875)	Lobbied for regulation of railroads and tax reform
Farmers' Cooperative Association	Nebraska (1888)	Cooperative Grain elevator
Farmers' Incorporated Cooperative Society of Rockwell, Iowa	Iowa (1889)	Cooperative Grain elevator
National Farmers' Union	Nationwide (1902)	Created marketing and grain elevator cooperatives
American Society of Equity	Minnesota (1902)	Attempted to collectively market wheat
The Danforth Elevator	Illinois (1908)	Cooperative elevator
Michigan Elevator exchange	Michigan (1922)	Collectively marked cooperative wheat

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<sup>5</sup> Source: Steen 1923

Note on table: This list is not comprehensive, but rather a compilation of some of the most significant organizations in the cooperative wheat movement.

### *Motivation for Cooperative Organization in American Wheat*

The purpose of all cooperative elevator movements was to advance trade interests by seeking to eliminate the alleged waste of the competitive system (Burr 1921). It aimed to eliminate overhead costs by purchasing goods and services as a group and to gain more market power by setting grain prices as a unit. These U.S. cooperatives differed from Danish ones, in that they were born not out of a desire to increase productivity, or increase social capital, but simply to provide farmers with a way to sell their products to the market without being short-changed. This catalyzed formation of cooperatives in extremely diverse ways, both structurally and philosophically, from the Danish model. The first farmers' elevator companies were simply organized as joint-stock corporations and operated similarly to their competitors by buying grain from everyone and selling to the highest bidder. The primary goal of these companies was to increase profit through vertical integration starting with elevators. These institutions eventually managed to purchase their own warehouses and organize joint purchase of supplies. As their number increased, so did the variation between them, with some so-called cooperatives being ultimately beholden to a few elite farmer investors instead of the majority of growers (Steen 1923). However, some cooperatives were structured very similarly to those of Denmark, in that their ownership was decentralized, they operated on a one-man-one-vote principle, and division of profits was in proportion to patronage. However, ironically, these institutions, though cooperative, still competed with each other and ultimately failed to control the wheat market. (Filey 1929).

Threshing rings were the proactive form of cooperative organization in American wheat. These groups were neighborhood collectives organized to provide mutual assistance at each member's

farm during the threshing season. Threshing rings had the following characteristics: (1) a consistent core membership of six to ten families and a total participation of eight to as many as twenty farms, (2) the responsibility of each member was to provide at least one worker at each threshing, (3) the meeting of all labor obligations within the threshing cycle, (4) a “threshing season” that lasted between two and four weeks, and (5) a sense of identity and a set of traditions that set each group apart from other local cooperatives (Rikoon 1988). These reciprocal labor agreements were the norm from the 1870’s to the early 1900’s. However, as the technology shifted from horsepower to steam-powered threshing, cooperation among farmers was substituted by a thresherman who could afford the steam engines, which typically would have been prohibitively expensive for average farmers to even jointly purchase (Isern 1990). These threshermen typically furnished the machinery, the engineer running it, and eventually entire threshing crew, totally supplanting the cooperative based exchange of labor.

### *Social Capital Development in American Wheat*

These cooperative institutions at best placed a marginal emphasis on the creation of social capital. In contrast to Denmark, the American cooperatives did not place a strong emphasis on using education or technology to increase yields, and thus these institutions did not cause the spillover of social capital that was so prevalent in Denmark. As aforementioned in the American Dairy section, the U.S. federal government attempted to increase human capital productivity, passing bills such as the Morrill Act of 1862, Hatch Act of 1887, and the Smith-Lever Act of 1914. However, these institutions were not local and their innovations often took years to reach farmers (Rikoon 32).

*Canada: Wheat*

Canadian wheat cooperatives had a very similar evolution and purpose as compared to those in the United States, which necessarily means that they were very different from cooperatives found in Denmark. Early cooperative action was very local and low impact. Large scale organization occurred in response to predatory practices by railroad and elevator companies. Although there were minor benefits to human and social capital created by the cooperatives' secondary projects in areas such as education and credit, the large Canadian cooperatives were concerned primarily with increasing profits by lobbying and collective marketing and did not focus on improvement of their product.

Table 5. Timeline of Early Developments in the Canadian Grain Trade<sup>6</sup>

<b>Year</b>	<b>Development</b>
<b>1876</b>	First eastern shipment of wheat from Western Canada
<b>1883</b>	Completion of Canadian Pacific Railway between Lake Superior and Winnipeg
<b>1884</b>	First shipment of wheat from Western Canada to Europe
<b>1886</b>	Inauguration of federal grain inspection at Winnipeg and Port Arthur
<b>1887</b>	Organization of Winnipeg Grain and Produce Exchange
<b>1889</b>	Creation of Western Grain Standards Board
<b>1899</b>	Creation of Manitoba Inspection District and Appointment of Royal Commission on Shipment of Grain

As seen in Table 5, despite this rapid development in expanding and regulating the grain trade pre-1900, there was no large-scale formation of cooperatives until 1901. Only the Patrons of

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<sup>6</sup> Source: Patton 1928:415

Husbandry (the Grange) and the Patrons of Industry existed in the late 19th century, and they were primarily concerned with wholesaling (MacPherson 1979). There were also some scattered agricultural societies promoted by the Manitoba and Territorial Departments of Agriculture “concerned primarily with problems and methods of production and with agricultural fairs” (Patton 1928:36). None of these societies were influential enough to be named specifically in the historical record. This is a stark contrast with the substantial number of Canadian farmers’ cooperatives formed in the first half of the 20th century. Table 6. lists the prominent grain cooperatives were established.

Table 6. Timeline of Cooperative Producer Associations in the Prairies (1901-1927)<sup>7</sup>

<b>Cooperative Organization</b>	<b>Year Established</b>
Territorial Grain Growers' Association (later known as Saskatchewan Grain Growers' Association)	1901
Manitoba Grain Growers' Association	1903
Alberta Farmers' Association	1905
Grain Growers' Grain Company	1906
United Farmers of Alberta	1909
Saskatchewan Co-operative Elevator Company	1911
Alberta Farmers' Co-operative Elevator Company	1913
United Grain Growers Limited	1917
Alberta Wheat Pool	1923
Manitoba Cooperative Wheat Producers, Ltd.	1924
Central Selling Agency (Canadian Co-operative Wheat Producers)	1924
Saskatchewan Wheat Pool	1924
Saskatchewan Pool Elevators Ltd.	1925
Manitoba Pool Elevators Ltd.	1925
Alberta Pool Elevators Ltd.	1925
United Farmers of Canada, Saskatchewan Section, Ltd.	1926

*Purpose of Cooperative Organization in Canadian Wheat*

The main enemy of wheat farmers were railroad and elevator companies that made high profits off of them due to high barriers of entry into the market and minimal regulations against

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<sup>7</sup> Source: Patton 1928: 415-418



predatory policies. Some farmers tried to fight back on a local level in the late 19th century, but they did not have the resources to compete.

Here and there discontented farmers formed local companies and erected elevators of their own. [This] ... involved, however, capital investment which limited their number largely to older and more prosperous settlements. ... these local elevators were of little service to the seller of street wheat, and were at a distinct financial disadvantage in competing with the line elevators ... The companies, or elevator pools, were capable, moreover, of putting farmers' elevators out of business by cutting charges at competing points. At the close of the century there were but twenty-six farmers' elevators all in more or less precarious operation, in Manitoba and the Territories (Patton 1928:17).

In response to this frustration, the Canadian Grain Growers' Movement began on December 18, 1901 in Indian Head, Saskatchewan with the formation of the Territorial Grain Growers' Association (Patton 1928). It was a protective organization formed against monopolistic control of grain interests (Patton 1928). Subsequently, the Grain Grower's conventions in 1902 and 1903 resulted in amendments to the Manitoba Grain Act of 1900, which provided farmers fairer access to railroad cars and mandated that railway companies build loading platforms (Patton 1928). The Manitoba Grain Growers' Association was formed from aforementioned agricultural societies in 1903, and the Territorial GGA split into Saskatchewan and Alberta sections in 1905 (Patton 1928; MacPherson 1979). These grain growers' associations were concerned with lobbying and education.

The cooperatives proposed a solution known as the Partridge Plan, which involved the Dominion federal government erecting elevators that farmers would be able to use at a fair price

(MacPherson 1979). Thus, in 1910, the government purchased 163 elevators and built 10 in Manitoba in response to farmer petitions. However, the farmers were not in actuality committed to using the government elevators, so they were unprofitable. In 1912, the government leased the elevators to the cooperative Grain Growers' Grain Company, and they were able to turn a profit after the second year (Patton 1928). In Saskatchewan and Alberta, the government agreed to loan 85% of the money to the Saskatchewan Co-operative Elevator Company and the Alberta Co-operative Elevator Company to erect elevators (Patton 1928).

The purpose of the cooperatives quickly turned to cooperative marketing, culminating in the dominance of the pools in the 1920's. Cooperative marketing of wheat in Canada began with the establishment of the Grain Growers' Grain Company in 1906 in Saskatchewan (Patton 1928). The organization grew rapidly, growing from 1800 members to 27,000 and 2,340,000 bushels to 28,000,000 from 1907 to 1912 and began marketing grain for the Saskatchewan Elevator Company in 1911 (MacPherson 1979; Patton 1928). According to Davisson, a contemporary of the Canadian pooling movement, "The object of the Pool is to merchandise its members' grain in a modern business way--via the most direct route; and, by keeping every unessential hand away from the grain, between farm and mill, to get back to the growers a fair share of the consumer's dollar, without disturbing the cost of bread!" (1927:53-54). This philosophy led to the founding of several huge wheat pools in the 1920s. The Central Selling Agency (Canadian Co-operative Wheat Producers, Ltd.) was formed in 1923 and handled about 40% of Canada's wheat (Currie 1963). The Alberta Wheat Pool was also established in 1923, followed by the Saskatchewan Wheat Pool in 1924 (Patton 1928). The operating theory was that 60% of the commodity had to be controlled by the pool for them to be able to determine price, and Alberta surpassed this

threshold with the 1923 crop, followed by Saskatchewan and Manitoba with the 1924 crop (MacPherson 1979). The pools were extremely successful for some time, but the crashing prices due to the Great Depression devastated them, forcing them to take out loans from the government to be able to pay farmers. From here on, control became almost completely removed from the farmers (MacPherson 1979). Thus, the cooperative organizations in Canadian wheat focused on marketing operations rather than production and were not particularly successful in their goals.

### *Social Capital Development in Canadian Wheat*

Fringe benefits from educational and community-improvement initiatives were not substantial enough to make a real difference on productivity. The cooperative organizations focused on lobbying and collective marketing were large enough that they were able to expand into other domains and provide some services to their members, but to nowhere near the extent that was seen in Denmark. Credit unions were established in large numbers, but not until the 1930's, when the Canadian wheat industry was already extremely well established, so this was clearly not the reason the industry took off (MacPherson 1979). Educational programs also existed, and it is said, for example, that those who did not go to Ontario Agricultural College were able to learn about "agronomy, public affairs, and the co-operative movement through farmers' organizations and an effective agrarian press" (MacPherson 1979:18). However, there is a significant difference between reading pamphlets and attending schools that are intimately ingrained within your community. Schooling was the primary responsibility of the government, not the community.

These cooperatives may well have increased farmers' standard of living as costs were lowered by the elimination of middlemen, lobbying to decrease monopoly rent, and wholesaling, but there is little evidence that cooperatives would have led to an increase in productivity to any significant degree.

#### *Canada: Dairy*

We did not extensively study Canadian dairy, but due to the very brief mentions of it in the cooperative literature, we would conclude that cooperation existed, but was not very widespread (MacPherson 1979).

#### *Summary: Comparison of Cooperatives*

The cooperatives in the U.S. and Canada differ hugely from their Danish counterparts, with the emphasis of American cooperatives being on defensive organization. These American cooperatives differed not only in conception, but also in structure. In many cases, control of cooperative enterprises remained in the hands of a few wealthy farmers who focused on maximizing profit. This differs starkly from Danish cooperatives, in which power remained decentralized and the aim was increase social capital through community-sponsored technical innovation and education. In conclusion, the wheat and dairy industries in the U.S. and Canada do not fit the Senghassian model of growth.

#### **Productivity Comparison**

The analysis of cooperative histories demonstrated drastic differences between the cooperative organization in Denmark, U.S. and Canada. Thus, we conducted a productivity comparison to

further investigate the impact of cooperative organization on agricultural productivity. We conducted this comparison for the dairy industries in each country to determine if countries with successful agricultural cooperatives achieved higher productivity growth than countries without successful cooperatives. The same analysis was also conducted for wheat industries to determine the presence or absence of productivity growth. A reference table of comparison was created. We compared three data points for each case. These data points corresponded to the beginning, middle and end of the census years from which the data was obtained.

Table 7. Dairy Productivity Comparison: U.S.A, Canada and Denmark<sup>8</sup>

<b>Agricultural Case</b>	<b>Year</b>	<b>No. of Cows Kept for Milk Production</b>	<b>Total Production (Pounds of Milk)</b>	<b>Productivity<sup>9</sup> (Milk/Cow in Pounds)</b>
<b>US Dairy</b>				
	1889	16,511,950	44,807,079,876	2,524
	1909	17,125,471	64,211,094,902	3,488
	1929	20,498,955	95,047,418,070	4,313
<b>Canada Dairy</b>				
	1910	2,595,255	9,806,741,348	3,779
	1930	3,232,800	13,071,421,000	4,034
<b>Denmark Dairy</b>				
	1888	954,000	3,891,000,000	4,079
	1909	1,282,000	7,772,000,000	6,063
	1930	1,608,000	11,734,000,000	7,297

Note: As seen in Table 7, the productivity of the Danish dairy industry is far superior to that of the United States in the years 1888 to 1930. For instance, U.S. dairy reaches productivity of 4,313 in 1930 whereas the Danish dairy has productivity of that level as early as 1888. However, both Danish and American dairy industries show productivity growth of 79% and 70% respectively. Moreover, the dairy industry of the United States exhibits immense volumes of

<sup>8</sup> Data Sources: (See references for complete citations)  
 U.S. Dairy: Agricultural Census (Milk and Dairy Products) of 1940  
 Canada Dairy: *Fifth Census of Canada*, Statistics Canada  
 Denmark Dairy: Jensen 1937

<sup>9</sup> Productivity measures are not available in census. This measure was calculated by dividing cows by milk production.

milk production in the years 1889 to 1929 that dwarfs that of the Danish dairy industry. The same analysis remains true for comparison to Canada, but our research primarily examined the differences between the dairy industries of the United States and Denmark because of the minimal census data that exists for the Canadian dairy industry.

The following figure further illustrates the dairy productivity comparison in all three cases for all the years for which data is available. Figure 2. illustrates Denmark’s superior productivity and shows productivity growth in all cases.

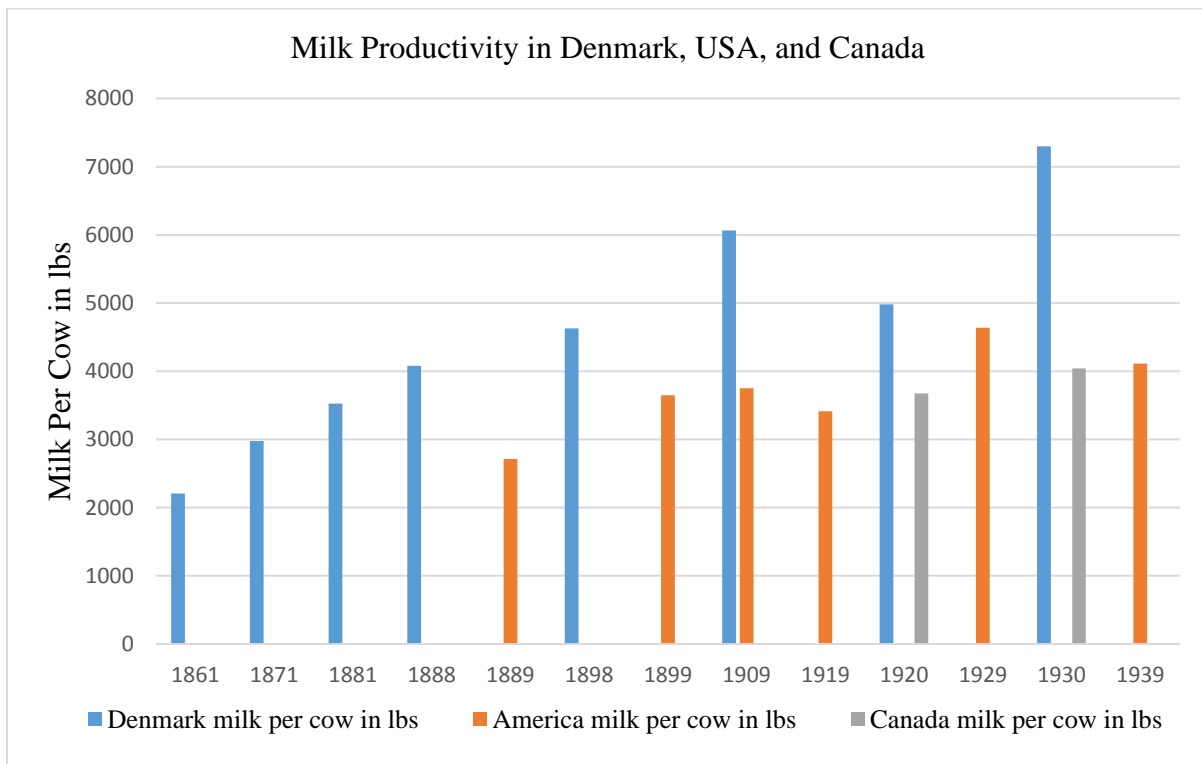


Figure 2. Dairy Productivity Comparison

Table 8. Wheat Productivity Growth Comparison: U.S.A and Canada<sup>10</sup>

<b>Agricultural Case</b>	<b>Year</b>	<b>Acreage</b>	<b>Total Production (Bushels of wheat)</b>	<b>Productivity<sup>11</sup> (Bushels/Acres)</b>
<b>US Wheat</b>				
	1870	30,945,000	254,429,000	12.14
	1910	45,793,000	625,476,000	13.66
	1940	53,273,000	814,646,000	15.29
<b>Canada Wheat</b>				
	1870	1,643,781	25,693,873	15.6
	1910	7,750,000	166,744,000	21.5
	1940	26,756,000	520,623,000	19.5

Note: According to the data in Table 8, the wheat industries in both Canada and USA display modest growth in productivity from 1870 to 1940. There is massive growth in the total volume of production of wheat for both countries. This growth is primarily due to the massive increase of acreage devoted to wheat.

Figure 3. further illustrates the productivity growth in Canadian and American wheat for all the available years. The national data for the Canadian case does not show a positive trend in productivity growth, but several individual provinces do show significant growth in productivity.

<sup>10</sup> Sources for data: (See references for complete citation)

US Wheat: National Agricultural Statistics Service

Canada Wheat: *Census of Canada 1870-1871, Handbook of Agricultural Statistics Part I*

<sup>11</sup> Productivity measure not available in census. This was calculated by dividing acreage by total wheat production



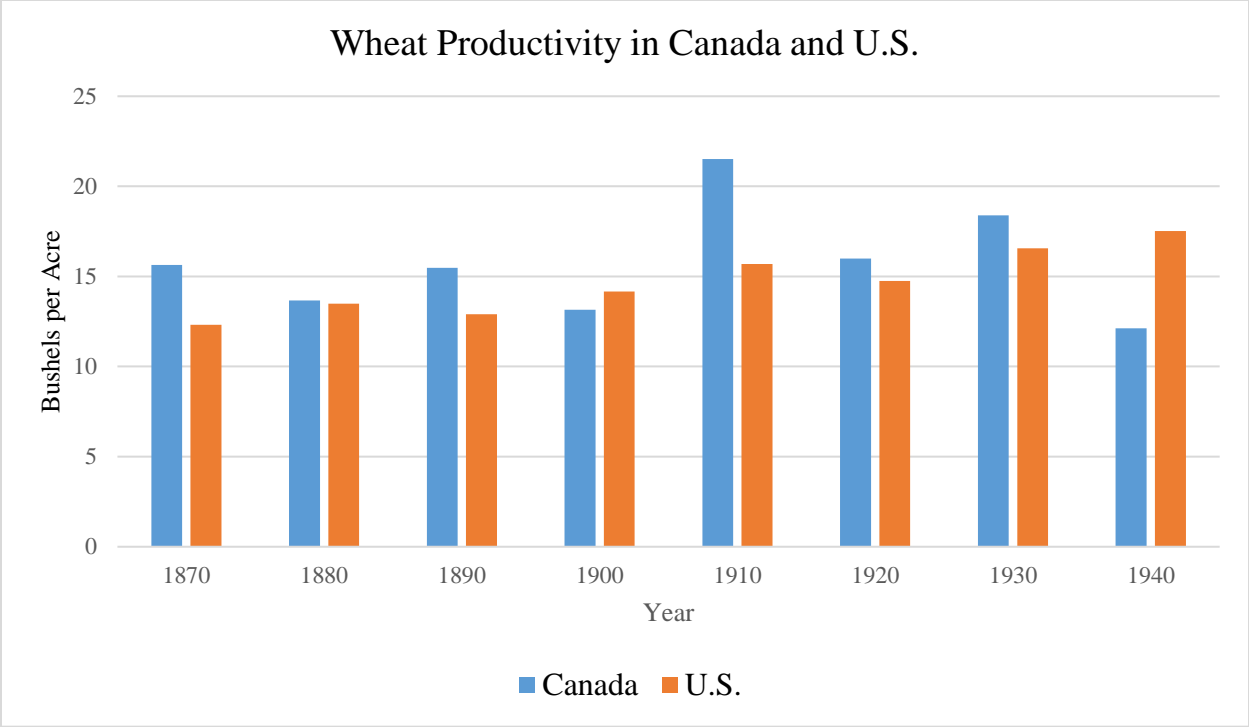


Figure 3. Wheat Productivity Growth Comparison

This comparison demonstrates the enormous impact of cooperatives on the difference in productivity among the three cases. In order to further understand the reason for this dichotomy, we conducted a spatial fix test. This test was motivated by Moore’s explanation of food surplus in the U.S. resulting from ecological expansion into the frontier. Moreover, the cooperative organization analysis led us to believe that cooperative organizations in the U.S. and Canada either resembled corporate ventures or failed to eliminate the centralized control of cooperatives. Thus, this test was principally inspired by Harvey’s theory that focuses on the issue of overaccumulation in capitalist economies. He proposes that this problem is solved by geographic expansion. Clearly, the USA and Canada are geographically huge in comparison to Denmark. Therefore, it would make intuitive sense to hypothesize that larger areas of available land would allow for mobilization from older centers of declining fecundity to new fertile land. Therefore, we tested if the presence of frontier in the USA and Canada substituted for cooperative activity

by allowing farmers to move to new productive land instead of seeking a fix in terms of cooperation.

### **Spatial Fix Test**

Based on the findings of productivity growth in the previous section and the existence of the North American frontier, we decided to determine if expansion of inputs was correlated with productivity or productivity growth in accordance to our interpretation of David Harvey's spatial fix theory. For wheat, it is easy to measure spatial expansion in terms of acreage of wheat farms, and it is intuitive that new land would be inherently more productive than old land. However, for dairy there is no perfect analogy. Thus, we use cows kept for milk production as a measure of expansion of means of production to test if mere scale without obvious ecological depletion leads to higher productivity. Our regressions test our hypothesis that states or provinces that were greatly increasing their number of acres used for wheat production or number of cows used for milk production also experienced high average productivity or high productivity growth.

For each state and province in the U.S. and Canada, we ran two OLS regressions per industry.

For wheat, these took the forms:

$$Acres = \beta_0 + \beta_1 year + \varepsilon \quad (1)$$

$$Productivity_w = \beta_0 + \beta_1 year + \varepsilon, \quad (2)$$

where *Acres* is the total number of acres used for wheat production for the province/state as given by the respective nation's census for the given year, and *Productivity<sub>w</sub>* is the ratio of total number of bushels of wheat produced in the province/state divided by the number of acres employed.

For dairy, the regression models used were as follows:

$$Cows = \beta_0 + \beta_1 year + \varepsilon \quad (3)$$

$$Productivity_d = \beta_0 + \beta_1 year + \varepsilon, \quad (4)$$

where *Cows* is the total number of cows used for milk production for the province/state as given by the respective nation's census for the given year, and *Productivity<sub>d</sub>* is the ratio of total pounds of milk produced in the province/state divided by the number of cows employed.

For each regression model, we used the estimated  $\beta_1$  (slope of the best fit line) as our measure of growth. We also calculated the average productivity for wheat and dairy in each state and province over the years where all regions had production data, for example, 1890 to 1940 for Canadian wheat. This range was different for each sector, but this is not consequential as all comparisons of average productivity were internal and not between nations or between industries.

The results for the U.S. are prohibitively large, so we will provide the results for Canadian wheat in the body of this paper in Table 9 as an example. Table 8 is a sample table that illustrates the statistics calculated for each case of American and Canadian wheat and dairy.

Table 9. Provincial Expansion and Productivity Statistics for Canadian Wheat<sup>12</sup>

<b>Province</b>	<b>Acreage growth</b>	<b>Average productivity 1890 to 1940</b>	<b>Productivity growth</b>
<b>Ontario</b>	-5848.7	22.0	0.154
<b>Quebec</b>	-3085.2	15.0	0.112
<b>PEI</b>	-491.0	17.0	0.059
<b>Nova Scotia</b>	-320.5	17.5	0.147
<b>New Brunswick</b>	-220.6	16.6	0.115
<b>British Columbia</b>	1092.9	23.9	0.031
<b>Manitoba</b>	47351.3	14.9	-0.34
<b>Alberta</b>	195600.0	16.9	-0.096
<b>Saskatchewan</b>	348200.0	15.7	-0.05

The regression analysis conducted for testing the spatial fix theory has its limitations. The historical data from agricultural census was decennial. Thus, limited data points were available for analysis. Moreover, we assumed homogeneity within states or provinces for the purpose of the study. This does not allow us to account for micro-level variation in productivity growth due

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<sup>12</sup> Canadian Wheat: Data is available for select provinces for years 1851, 1860, 1870, 1880, 1890, 1900, 1910, 1920, 1930, and 1940

For similar analysis conducted for U.S wheat, dairy and Canadian dairy, there were certain discrepancies due to the unavailability of data in historical census. More information and data on other cases available on request from authors.

to in-state migration. Thus, this test could be made more robust by using state and county level data and analyze migration and productivity growth at a micro-level. Nevertheless, the analysis of national data provides a starting point for investigation of spatial fix theory. It allows for a simple yet comprehensive analysis of the general national trend.

If spatial expansion works, it would mean that increase in cows/land is positively correlated with productivity growth and absolute productivity. To test our hypothesis if spatial/input expansion leads to higher productivity and/or productivity growth, we calculated the Pearson correlation coefficients for 1) input growth and average productivity and 2) input growth and productivity growth. If our hypothesis were true, we would expect positive values close to one. Positive values closer to one would lead us to conclude that land expansion (wheat) or input expansion (milk) is directly correlated with increase in productivity growth or average productivity. This would provide conclusive evidence for the hypothesis that spatial expansion led to productivity growth. In other words, farmers moved from areas of declining fertility to new productive land. This would also provide a probable explanation for why cooperative activity was not widespread and successful in Canada and USA. Our results are summarized in the following table

Table 10. Results of Spatial Fix Analysis for Dairy

<b>Correlation Measure</b>	<b>U.S. Dairy</b>	<b>Canadian Dairy</b>
Correlation between increase in input (cows) and average productivity	-0.009	-0.091
Correlation between increase in inputs (cows) and productivity growth	-0.06	-0.221

Note: As Table 10. shows, no relationship was significant for dairy. There are no returns to scale for productivity in the dairy industry. Thus, the productivity growth in dairy cannot be explained by spatial fix theory. This is because increase in cows does not correlate with increase in milk productivity. These results do not support our hypothesis.

Table 11. Results of Spatial Fix Analysis for Wheat

<b>Correlation Measure</b>	<b>U.S. Wheat</b>	<b>Canadian Wheat</b>
Correlation between increase in input (acres) and average productivity	-0.235	-0.268
Correlation between increase in inputs (acres) and productivity growth	-0.448	-0.394

Note: As Table 11. shows, for wheat, there is a weak to moderate negative correlation between acreage growth and productivity growth and no correlation with average productivity. These

results lead us to reject our hypothesis that expansion of inputs leads to higher productivity or productivity growth.

Therefore, we conclude that neither cooperative organization nor availability of widespread arable land were causes of increasing agricultural productivity in the U.S. and Canada on a national scale. Their impressive agricultural growth seems instead to be attributed only to their massive scale of production made possible due to the North American frontier. The ramifications of these findings are interesting, as they are contradictory to the historical narrative that capitalistic forces induce farmers to overproduce, causing the soil to degrade, making it unprofitable to farm, so the farmer migrates westward. Our findings support the narrative that this expansion westward was not prompted by a desire of farmers to profit by having more efficient yields, but simply to produce more. This means Moore's and Harvey's theory is not applicable to the U.S. and Canada with regards to dairy and wheat production. However, this does not discount the fact that the volume of production in USA and Canada was incomparable to the case of Denmark. As evident in Table 7. and Table 8., the cases of Canada and the U.S. show evidence of low productivity but massive volume of production. This coupled with the immense arable area of the North American west indicates that the dominance of their agricultural industries was based on sheer scale.

## **CHAPTER IV**

### **CONCLUSION**

This project attempted to understand the contributing factors of agricultural-based growth in developed economies. We tested two theories of agricultural-based economic growth. We analyzed Senhaas' theory of economic development by community organization and Harvey's theory of spatial fix by geographic expansion. To accomplish this, we compared the agricultural experiences of Denmark, Canada and the United States. The U.S and Canada did not experience successful cooperative activity that contributed to enhanced agricultural productivity. It is possible that the presence of a frontier disincentivized cooperative organization. However, according to our regression analysis, availability of widespread arable land also did not lead to better productivity. Thus, the comparison of agricultural histories and results of the spatial fix test reveal that the dominance of U.S and Canada on world agricultural market cannot be attributed to increases in productivity due to cooperative organization or spatial expansion. Instead, it is likely that their agricultural success is due to sheer size of land and production.

This research project begins to understand the complex nature of economic growth via agricultural activity. It successfully furnishes evidence against two proposed theories of development. However, it is important to realize the difficulty of contrasting the agricultural experiences of various nations. For instance, our research highlighted the differences between cooperatives that formed defensively and those that were proactive, despite the shared goal of eliminating inefficiencies associated with capitalism. The failure of these egalitarian institutions to fit the Senhaasian model should not be seen as a criticism of cooperative organization. It



rather places emphasis on the domestic and external forces that shaped their distinct structure and motivations. Moreover, there are many factors that uniquely impact individual economies. This project aims to highlight some of them but there exists wide scope of further viable research. Many other sources of agrarian growth can be looked into. The simultaneous impact of state support to agricultural movement, price volatility from extraneous sources and population growth is worth considering for further research. Also, the analysis can be expanded to other countries in order to build a more robust comparison model with wider geographic diversity.

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