An Economic Analysis of "Local" Production: Is it Efficient or Inefficient

Eugene Jones
The Ohio State University
Columbus, Ohio 43210

Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2014 AAEA Annual Meeting, Minneapolis, MN, July 27-29, 2014.

Abstract

It is well recognized that the production of many farm commodities, especially fruits and vegetables, has become geographically concentrated, with larger but fewer farmers involved in production. This concentration, according to critics, has resulted in the production of less flavorful commodities and added unnecessary costs to marketing. To address these shortcomings, several groups have advocated "local" production of farm commodities, especially fruits and vegetables. According to proponents of "locals", such production is preferred by consumers because these commodities are fresher, more nutritious, better tasting, and grown with fewer pesticides. Further, local commodities provide income opportunities for small farmers and they serve to lower food miles and transportation costs. While acknowledging these described attributes and benefits, this paper uses a specific commodity, potatoes, to illustrate the true costs of "locals". Results show efficiency gains from comparative advantage and other factors that far exceed the most optimistic returns to "locals". In dollars, "local" production of potatoes would add, as a minimum, $3.8 billion of additional cost. Further, it would require an additional 961,000 acres of land. Local production costs for all commodities that make up consumers' diets could possibly rival that of the $90 billion food stamp budget.

Introduction

Economists have long emphasized the importance of efficiency in agricultural production and marketing, recognizing that efficiency leads to lower production and marketing costs (Farrell, 1957). These lower costs are expected to translate into lower consumer prices, unless all gains are captured by firms beyond the farm-gate. With marketing cooperatives in agriculture providing strong competition for private marketing firms, there are obvious constraints on private firms' ability to capture all efficiency gains. Stated differently, the production environment in agriculture suggests a high probability that lower production costs at the farm level will translate into lower food prices at the retail level. Given this environment, this paper examines U.S. potato production to illustrate efficiency gains consumers have realized from specialization and trade, economies of scale and scope, and comparative advantage in production. These gains are contrasted with those that would be realized from "local" production. The overall goal of this paper is to use a specific commodity, potatoes, to illustrate efficiency gains from production specialization and then extrapolate from these gains the cost inefficiencies that would result from production localization.

Although natural resource endowments within a given area are expected to be a major determinant of production costs, this paper focuses on the efficiency gains in production that have resulted from factors such as comparative advantage in production, economies of scale and scope, and specialization and trade. As production has shifted to specific states and/or regions, long-distance shipment of commodities has increased. As such, product quality may have suffered; indeed proponents of "local" foods argue that product quality is inversely related to transport distance. Weber and Matthew (2008) conclude that farm commodities now travel more than 1000 miles from field to table. Using potato production across the U.S. to demonstrate

efficiency gains, this paper highlights the tremendous benefits consumers have received from comparative advantage, economies of scale and scope, and specialization and trade. Further, these benefits are argued to come not at the expense of product quality, but as an enhancement to product quality. While potato production is used to illustrate efficiency gains, it is recognized that the same economic forces underlying potato production are characteristic of many other agricultural commodities. That is, the forces of comparative advantage, economies of scale and scope, specialization, and trade apply to many other commercially produced commodities. Some obvious commodities with highly concentrated production are apples, oranges, strawberries, and tomatoes.

Another argument advanced by proponents of "local" foods is that current production methods lead to excess emissions of greenhouse gases (GHGs) into the environment (Weber and Matthews, 2008). These gases are emitted during both production and distribution, but "local" production is expected to be most effective in reducing gases that emanate from transportation. For example, food that currently travels an average of 1000 miles may travel fewer than 50 miles under a "local" production system, implying less emission of greenhouse gases. Even with a drastic reduction in food miles, a relevant question is whether such reductions are sufficient to compensate for efficiency gains that are derived from specialization and trade. This paper estimates efficiency gains for potatoes and it provides answers to the question as to whether "local" production can overcome the gains from forces such as comparative advantage, economies of scale and scope, specialization, and trade.

The rest of this paper is organized as follows. Section II describes three concepts that are pertinent to understanding efficiency. These concepts of efficiency are allocative, technical, and marketing. Section III describes the roles comparative advantage, economies of scale and scope,

and specialization and trade have played in establishing efficiency gains for potato production. Section IV discusses results from a simple regression model and it highlights the efficiency gains and losses for six regions. Section V provides a discussion of the costs and benefits of "local" production. Finally, Section VI provides a summary and conclusions.

Defining and Understanding Efficiency

A useful approach for understanding the true cost of "local" production is to examine the efficiency of well-known production systems and then evaluate the potential for "local" production to accomplish equivalent results. When economists discuss efficiency at the production level, two types of efficiencies are generally emphasized: technical and allocative. Technical efficiency is achieved when a decision-making-unit achieves the maximum feasible output from a given bundle of inputs; allocative efficiency is achieved when a technically efficient decision-making-unit uses inputs in proportions that minimize production costs for given input prices (Watkins, et al., 2013). To empirically measure these concepts, one would need data for each decision-making-unit, or each field of production. Such detailed data are seldom available to researchers, but a guiding premise of this study is that "good" estimates of efficiency gains at the production level can be derived from historical data. As such, this study uses historical data for potato production to illustrate changes in efficiency across six regions and over fifty-six years, 1950-2006 (Figure 1). Potatoes are used because of readily available production data, but many other commodities, especially fruits and vegetables, are expected to exemplify similar efficiency patterns.

Marketing efficiency, while closely linked to production efficiency, is defined in this study to include production efficiency, plus pricing efficiency. Although pricing efficiency is

sometimes used interchangeably with allocative efficiency, it is used in this paper to refer to the close interrelationship between consumer demands and prices and the ease to which these prices are passed through marketing channels to producers (Cramer, et al., 1997). Measuring this concept also requires detailed data but an approximation of it can be ascertained from everyday observations of retail prices. For example, if local apples from a particular state are offered side-by-side with Washington state apples at comparable prices and consumers do not purchase local apples, then clearly this is an immediate signal to producers that consumer satisfaction is not enhanced with the offering of local apples. In essence, if Washington state apples can be produced at lower costs, then allowing them to replace local apples represents an improvement in marketing efficiency. Stated differently, the ratio of output value (consumer valuation of goods) to input value (costs) has increased. So, this paper presents evidence to show that improvements in production efficiency have not come at the expense of consumer satisfaction but it has indeed elevated consumer satisfaction.

Comparative Advantage and Its Role in Production and Marketing Efficiency

The U.S. potato industry has undergone significant structural changes over the past six decades at both the production and consumption levels. During the 1950s, potatoes were produced commercially in all 48 contiguous states and they were consumed primarily as fresh potatoes. As the fast-food industry developed in the mid-50s and expanded throughout succeeding decades, consumption of processed potatoes grew at the expense of fresh potatoes (ERS/USDA, 2012). Realizing comparative advantage in production costs, lower-cost regions gained production at the expense of other regions. With water comprising 80% of a potato's weight and processing serving to remove water, it is easy to comprehend the economics that

shifted potatoes grown for processing to lower-cost production regions. Fresh potatoes, by contrast, involve much higher transportation costs and minimization of these costs has historically led to production near large population centers. For example, New England's share of total potato production in 1950 was roughly equal to its share of the U.S. population (Figure 2). Yet, one objective of this paper is to show that production efficiencies are often more than sufficient to compensate for perceived transportation disadvantages.

To illustrate comparative advantage in the production of potatoes, the 48 continuous states are segmented into six regions (Figure 1). For easy of reference, these regions are identified as: Midwest, New England, Northwest, Pacific Northwest, South, and Southwest. Two of these regions are most effective in illustrating the changing effects of comparative advantage. In 1950, New England and the Pacific Northwest produced nearly identical shares of raw potatoes. By 2006, the Pacific Northwest's share had climbed from 29.9% to 58.7%; New England's share, by contrast, had fallen from 29.5% to 6.1%. Between these two extremes, other regions experienced smaller gains and/or losses in production. Yet, because of free trade among regions, it is clear that all regions enjoyed adequate supplies of potatoes and, assuming an equal or higher level of quality at lower costs, each region has also realized increased marketing efficiency.

Focusing first on the production shift to the Pacific Northwest, it is well recognized that comparative advantage in production is often derived from natural resource endowments. An area that is resource rich with excellent soil quality, ideal temperature, adequate sunlight, low land costs, and desirable rainfall is sure to have a comparative advantage over areas that are deficient in these ideal resources. Hence, this explains why the Pacific Northwest currently accounts for such a large share of potato production. Production changes throughout the farm

sector occur as regions gain comparative advantage over time. Comparing two regions, the Pacific Northwest had average per acre yields of 245 hundredweights (cwts) during 1950-69, while New England had average per acre yields of 233 cwts for the same period (Table 1). By 1970-89, the Pacific Northwest had experienced a 45% increase in average yields, while New England had realized just a 6.4% increase. Further, the Pacific Northwest realized another 23% increase in average yields per acre by 1990-06, while New England realized just a 7.8% increase for the same period. Coupled with higher yields for the Pacific Northwest was an expansion of potato processing plants in the region, especially plants for processing frozen French fries. These latter changes offer direct evidence as to how economies of scale and scope can interact with comparative advantage to widen the gap between low-cost and high-cost regions.

Drastic changes in production and yields also occurred across the four other regions (Table 1). Measured in hundredweights (cwts), large increases in yields were realized for the Southwest and Midwest. Yields per acre in the Southwest quickly overtook those for New England and, by 1990-06, they were second (372 cwts) only to those for the Pacific Northwest (438 cwts). The south realized large percentage increases in yields for each time period; yet, its yields per acre were the lowest of the six regions in 1950-69, and this bottom ranking remained true for 1990-06. The Midwest realized large increases in yields for each time period and indeed its yields are third highest among the six regions. Based on historical trends, it is likely that the top three producing regions (Pacific Northwest, Midwest, and Southwest) will gain production at the expense of the other three regions, especially at the expense of the South.

Regression Results

Using simple regression with potato production as the dependent variable and a trend variable as the independent variable, it is revealed that production in the Pacific Northwest increased 4179 cwts per year during the 1950-06 period. By contrast, production in New England decreased 910 cwts per year for the same time period. Clearly these changes point to a sizeable comparative advantage for the Pacific Northwest and this advantage explains the shift in production. Although these changes imply lower costs and increased production efficiency, they do not imply increased marketing efficiency because these changes could have come at the expense of consumer satisfaction. As evidence that this has not occurred, Idaho potatoes, a commodity from the largest potato-producing region, has strong consumer preferences. Because of these strong preferences, it seems reasonable to argue that consumer satisfaction has actually increased and that lower costs have led to increased marketing efficiency. In short, a reasonable conclusion is that the ratio of output value to input value has increased from production shifts to the Pacific Northwest.

Although simple trend analyses for other regions do not offer contrasts as sharp as those just discussed, production changes for these regions still support increased marketing efficiency for consumers. For example, the Midwest region gained an average of 830 cwts per year over the 1950-06 period, while the South lost an average of 115 cwts per year. Clearly these changes represent shifts from a higher-cost region to a lower-cost one and there is no evidence to suggest that consumer satisfaction has been diminished because of diminished production in the South. Indeed knowledgeable buyers and sellers of potatoes throughout the U.S. recognize that the shelf life of potatoes, as well as that for many other vegetables, is inversely related to temperatures during growing season. With most mid-western and northern states having cooler nights than

southern states, southern consumers are likely to have realized greater satisfaction from a higher proportion of quality potatoes from other regions. Indeed potatoes from such states as Colorado and Idaho are likely to have longer shelf life than those from the Midwestern region because these two states have almost perfect growing conditions: rich fertile soil, sunny days, and cool-to-cold nights (Sexton, 2011).

Although the Midwest and Northwest regions have maintained fairly constant market shares of potatoes over the 1950-06 period, the one region, besides the Pacific Northwest, that has experienced significant growth is the Southwest (Figure 2). Simple regression analyses with a trend variable show that this region gained an average of 514 cwts per year. Most of this growth is due to one state, Colorado. The San Luis Valley area of this state has ideal growing conditions for potatoes and indeed it is partly this area that gives the state a comparative advantage in the production of potatoes. Yields for the Southwest region have increased from an average of 212 cwts during 1950-69 to an average of 372 cwts during 1990-06, a yield level that is second only to the Pacific Northwest. Just as there is a strong preference for Idaho potatoes, buyers and sellers who seek quality potatoes express a strong preference for Colorado potatoes from the San Luis Valley. These preferences suggest that production efficiency has come not at the expense of consumer satisfaction; rather, this efficiency has enhanced consumer satisfaction and therefore marketing efficiency.

Production of potatoes in the U.S. almost doubled over the 1950-06 period and this production occurred at a much lower cost than what would have been realized if each region had produced shares comparable to its output for 1950. This is evident by the fact that production shifted from higher-cost regions to lower-cost ones. A relevant question is whether these production increases have come at the expense of consumer satisfaction? For potatoes,

production shifts have most likely led to higher-quality commodities because a concentration of potato processing plants in major production areas, such as states in the Pacific Northwest, has facilitated more careful grading and sorting of potatoes for fresh consumption. In short, processing options provide outlets for odd-shaped potatoes that may have previously entered fresh marketing channels; the end result is higher quality potatoes for fresh marketing.

Local Production and Its Costs

Proponents of "local" production often make an argument that local commodities are preferred by consumers because they are fresher, more nutritious, better tasting, grown with fewer pesticides, etc. (Beck, 2011; Weber and Matthews, 2008; Dubner, 2008). Of course, it should be recognized that some areas of Colorado and Idaho use fewer pesticides for potato production than the industry norm because these areas have fields that are isolated from many pests and diseases. Yet, the enumerated attributes for "locals" are sure to differentiate many locally grown commodities from regionally grown ones; indeed "local" commodities have consumer appeals that go beyond these attributes. Many consumers are attracted to "locals" because these commodities have been promoted as: (1) providing income opportunities for small farmers; (2) providing opportunities for the establishment of farmers' markets; (3) helping to lower food miles and transportation costs; (4) serving to diminish the prevalence of food deserts; and (5) offering support for the success of community-supported agriculture (Goland, et al., 2010; Hartman Group, 2008; Onozaka, et al., 2010). Yet, a question that must be asked is whether local commodities can be grown in sufficient quantity to satisfy the food needs of an expanding population. Stated differently, if every local farmer is allowed to produce his or her maximum capacity, could the current supply of food be replicated? If so, what is the price that

society would have to pay? Using potato production across the U.S. as an example, the rest of this paper provides answers to these questions.

With the described efficiency of potatoes serving as a proxy for many other commodities, it seems reasonable to address the expected cost disadvantages and marketing inefficiencies of local production. To do so, we will look at costs that would have been incurred if regions had produced shares of the 2006 potato crop that are identical to their 1950 shares. For example, New England produced 29.5% of the 1950 crop; what additional costs for potato production would New England have incurred in 2006 if it had produced this same 29.5%? Likewise, what if the other regions had produced their 1950 shares in 2006? When production and population shares across the six regions are compared for 1950 and 2006, the distributions are shown to be similar (Figure 3). One major difference is that New England's production share exceeds its population share in 1950; in 2006, it is much less, showing a ratio of .29 percent. Hence, significant shifts in potato production occurred over this period and it seems reasonable to use this time period to assess changes in efficiency.

A production system that is truly "local" would suggest production shares for all commodities in proportion to population shares. This extreme is not considered here because this system has never existed in U.S. history. What is clear from historical data for potatoes is that a large share of production in the early 1950s did occur in or near states with large populations, reflecting the economics of transportation costs. As comparative advantages in production became evident, production shifted to low-cost areas and efficiency gains from this process represent the true cost of "local" production. Relative to acreage, the true cost of producing the 2006 potato crop is 961,000 additional acres of land, assuming 1950 production proportions. That is, allowing for 2006 yields but using 1950 production shares for each region,

it would take an additional 961,000 acres of land for these regions to produce the 2006 potato crop. The relevant question is: what is the economic cost of these 961,000 acres?

A precise measure of costs for an additional 961,000 acres of land would require farmland and potato production costs for a large number of regions within each state. Much of these data do not exist and, even if they existed, extreme variability would exist in costs within and among states. Hence, this study provides conservative estimates of inefficiency costs, using values at the lower end of the distribution. Potato budgets were available from Colorado, Idaho and Pennsylvania and the first two mentioned states are likely to represent the lower end of production costs (budgets were available for various years within 2001-2010). Average 2006 production cost per acre for the three states was $2318. To provide a conservative estimate, this study uses $2000 per acre. Further, farmland costs for 2006 were found to vary from $2000 per acre in Alabama to $8400 per acre in Iowa. To provide the most conservative estimates possible, this study uses $2000 for land cost and, adding both land and production costs, this gives a total cost of $4000 per acre. At this rate, the cost of ignoring efficiency gains for the 2006 potato crop amounts to $3.8 billion ($2000 x 961,000). Holding production costs constant and doubling land cost to $4000 per acre would provide a less conservative estimate of $5.8 billion. If these costs were estimated for a true "local" system -- one in which each region produced potatoes in proportion to its population share -- the cost of inefficiency would be even higher.

To place the aforementioned costs into perspective, total potato production in the U.S. in 2006 amounted to 438.6 million cwts and these potatoes sold for an average farm price of $7.50 per cwt. (NASS/USDA, 2007; ERS/USDA, 2013). The farm value of total production was $3.3 billion, just slightly less than the $3.8 billion estimated for inefficiency costs. In short, shifting potato production from the most productive areas to less productive areas to accommodate

population distributions would result in increased cost of $3.8 billion. Indeed the 2006 potato crop was produced on 1.1 million acres of land and a move toward "local" production would result in an additional 961,000 acres. The largest expansion of acreage would occur in the south, as a 123% increase in acreage is needed just to bring the region up to its 9.5% market share of production in 1950.

The south gained population between 1950 and 2006 and it would take more than a 250% expansion of its potato acreage to reach its 25.2% population share. Stated differently, it would be extremely costly for the south, as well as other areas, to move to "local" production for just one commodity, let alone the hundreds of commodities that make up a consumer's diet. This does not mean that local potato farmers in the south and other areas cannot continue to market their commodities as "local". What it does mean is that any region wishing to promote "local" production must understand the true cost of "local" production and communicate these costs to both farmers and consumers.

Statistics suggest that potato farmers clearly recognize the inefficiencies associated with local production, as 18 of 48 states have cut production below levels needed to qualify as commercial producers (Bosse and Boland, 2011). Yet, potatoes are still produced in these 18 states and this production is generally sold through "local" outlets. This type of marketing provides income opportunities for small farmers and it provides a method by which consumers can identify with local farmers. Simply stated, it serves an unmet need and it does not interfere with the efficiency of the larger marketing system. Indeed in the absence of subsidies for small producers, it is likely that continued efficiency gains from comparative advantage and specialization and trade will drive more and more small, inefficient farmers out of production.

One of the driving forces behind "local" foods is the idea that food miles and food costs can be greatly reduced with "local" production. Yet, researchers at Carnegie-Mellon have concluded that transportation costs account for no more than 11% of greenhouse gases (GHGs) emitted into the atmosphere, while 83% of these GHGs are associated with production. If one makes the most optimistic assumption that "local" production has the potential to reduce transportation costs to zero, then it is appropriate to reduce estimated efficiency gains by 11%. Doing so would reduce the previously estimated values to $3.4 and $5.1 billion respectively. Is it conceivable that "local" production can overcome these large cost disadvantages? As estimated, these costs are for one commodity, potatoes. If you take some fraction of these costs for potatoes and multiply it times 40 to 50 other commodities, then the inefficiency of "local" production becomes staggering. Simply put, local production cannot compete with gains from comparative advantage, economies of scale and scope, and specialization and trade. This does not mean that producers and consumers cannot benefit from "local" production. A tomato harvested vine-ripe locally is likely to have far more juice and taste than one harvested mature-green and transported over a long distance. Yet, if all local consumers were to demand vine-ripened, local tomatoes, it is clear that local producers could not meet their demands. Indeed just two states, California and Florida, produce more than two-thirds of all fresh market tomatoes (ERS/USDA, 2012). Production of processing tomatoes is even more concentrated, with California accounting for more than 94% of total production. Such statistics give a realistic perspective on the inefficiency of "local" production.

Many small farms exist and many consumers have a desire to patronize small farmers, especially those who sell through roadside markets, community supported agriculture, and farmers' markets. These outlets are known for fresh and home-grown commodities and small

farmers are likely to continue to use them to market their commodities. What must be recognized is that these markets appeal to a select group of clientele and that they do not offer an alternative to supermarkets, even for produce. At best, these markets meet the produce needs of fewer than 2% of consumers and these needs are met at very high costs. For example, even after shopping at the aforementioned establishments, consumers still have to make trips to a supermarket to satisfy their total grocery needs. Further, the limited days and hours of operation for some of these direct outlets cause consumers to make larger than optimal purchases. Given the high perishability of produce, it is likely that a greater share of purchases from direct markets end up in garbage cans. Simply stated, there are tradeoffs associated with buying "local" and non-local produce and public policymakers should take these into consideration when promoting the benefits of "local" produce.

Summary and Conclusions

A specific commodity, potatoes, has been analyzed in this paper to illustrate the true costs of "local" production. Potato production, like the production of other commodities such as oranges, apples and tomatoes, is concentrated in a few states that have comparative advantages in yields and costs. This concentration leads to long-distance shipments and, according to proponents of "local" production, excess emissions of greenhouse gases. To ameliorate this environmental damage and simultaneously provide consumers more nutritious food, many food groups have advocated "local" production. Such production is viewed to have advantages over current production and marketing methods because it provides income opportunities for small farmers and improves consumers' health by providing them commodities grown with fewer

pesticides and other undesirable chemicals. This study reveals the shortcomings of "local" production from both a cost and land-use perspective.

Analyses in this study start from the premise that potato production in 1950 reflected the economics of transporting potatoes from farm to plate. In essence, potato production was concentrated around population centers to minimize transportation costs. As modes of transportation improved and states gained comparative advantages in production, potato production shifted away from highly populated areas (semi local) to areas endowed with ideal soil and climate conditions. In short, efficiency gains and cost reductions became far more significant than transportation costs. For potatoes, the ideal soil and climate conditions were found in the Pacific Northwest. For other commodities such as oranges and tomatoes, California and Florida have proven to offer the best soil and climate conditions. Regardless of where produced, commodities have been distributed across the U.S. to meet consumer demands. Yet, advocates of "local foods" suggest that production should shift away from areas of comparative advantage to areas with consumer demand.

If the suggestions of "local" food advocates were followed for potato production, the 2006 level of land use would increase by approximately 961,000 acres and production costs would increase by more than $3.8 billion. Increased costs for "local" production of many other commodities, such as apples, oranges, strawberries, tomatoes, would likely be even higher because these commodities are more geographically concentrated. If the increased costs of "local" production for all commodities that make up a consumer's diet could be calculated and summed, the resulting number would likely rival that of the $90 billion budget for food stamps. Ironically, the food stamp budget has been targeted for a 5.5% cut because many policymakers consider the costs to be excessive and a poor allocation of resources. With current resource

allocation for most commodities being dictated by factors such as comparative advantage, economies of scale and scope, and specialization and trade, it seems reasonable to conclude that most production is organized around the principle of efficient resource allocation. Departing from this system would not only extract unnecessary costs from consumers but it would reinvent the poor allocation of resources that policymakers are seeking to avoid.

Although advocates of "local foods" are not necessarily adverse to the economic logic that local production would lead to higher production costs and food prices, they defend higher costs and prices by noting quality differences between local and non-local commodities. Specifically, they make the argument that product quality is inversely related to transport distance. Yet, as discussed in this paper, there is often a stronger demand for non-local commodities than for local ones. Two examples are Idaho potatoes and Washington apples. Since the quality and shelf life of commodities are a function of growing conditions, potatoes grown in the ideal climate of Idaho are likely to have higher quality and a longer shelf life than "local" potatoes. In short, the advantages of "local" for many fruits and vegetables could be overstated. Relative to Washington apples, the state uses grading standards for its apples that are more stringent than those used by any other state or "local" area. These grading standards lead to the highest quality of apples in marketing channels, far exceeding the quality of many "local" apples. When the higher quality of non-local commodities is coupled with production efficiency, the resource misallocation of "local" production that leads to higher costs becomes glaring and egregious.

Figure 1. US Potato Production Regions Across 48 Contiguous States

Table 1. Changes in Potato Yields by Region

	Pacific Northwest		Northwest	
Date	Yields per Acre	% Change in Yields	Yields per Acre	% Change in Yields
1950-69	245.2	---	132.4	---
1970-89	355.6	45.1	175.3	32.4
1990-06	437.8	23.1	264.1	50.6

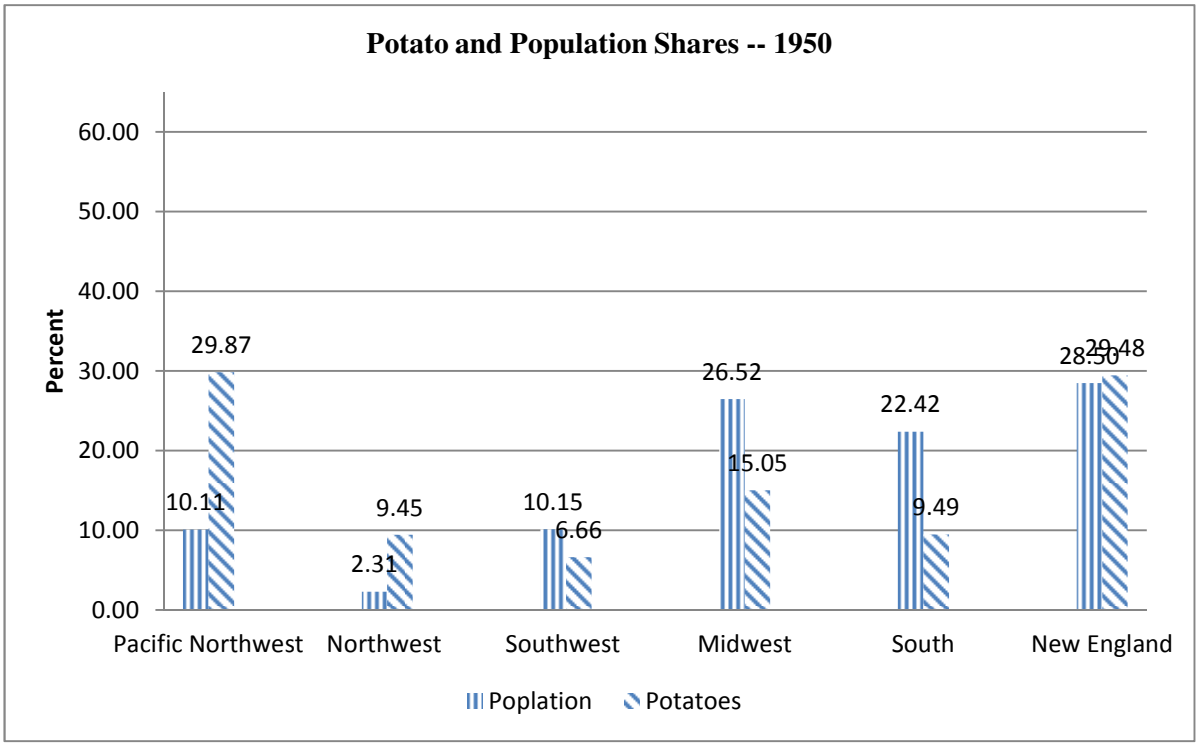
	Southwest		Midwest	
Date	Yields per Acre	% Change in Yields	Yields per Acre	% Change in Yields
1950-69	212.3	---	157.7	---
1970-89	317.9	49.7	252.2	59.9
1990-06	371.7	16.9	334.6	32.7

	South		New England	
Date	Yields per Acre	% Change in Yields	Yields per Acre	% Change in Yields
1950-69	115.5	---	232.6	---
1970-89	165.9	43.7	247.5	6.4
1990-06	222.9	34.4	266.9	7.8

Table 2. Regression Results: A Trend Variable used to Explain Changes in Potato Production for 1950-2006.

Region	Intercept	P-Value	Coefficient	P-Value	Sig. Level of F-Value	R^2
Midwest	25631	0.00001	830	0.00001	0.00001	0.89
New England	73542	0.00001	-910	0.00001	0.00001	0.88
Northwest	13353	0.00001	451	0.00001	0.00001	0.81
Pacific Northwest	55548	0.00001	4179	0.00001	0.00001	0.95
South	19144	0.00001	-115	0.00001	0.00001	0.50
Southwest	10544	0.00001	514	0.00001	0.00001	0.82

Figure 2. Comparisons of Potato and Population Shares by Region



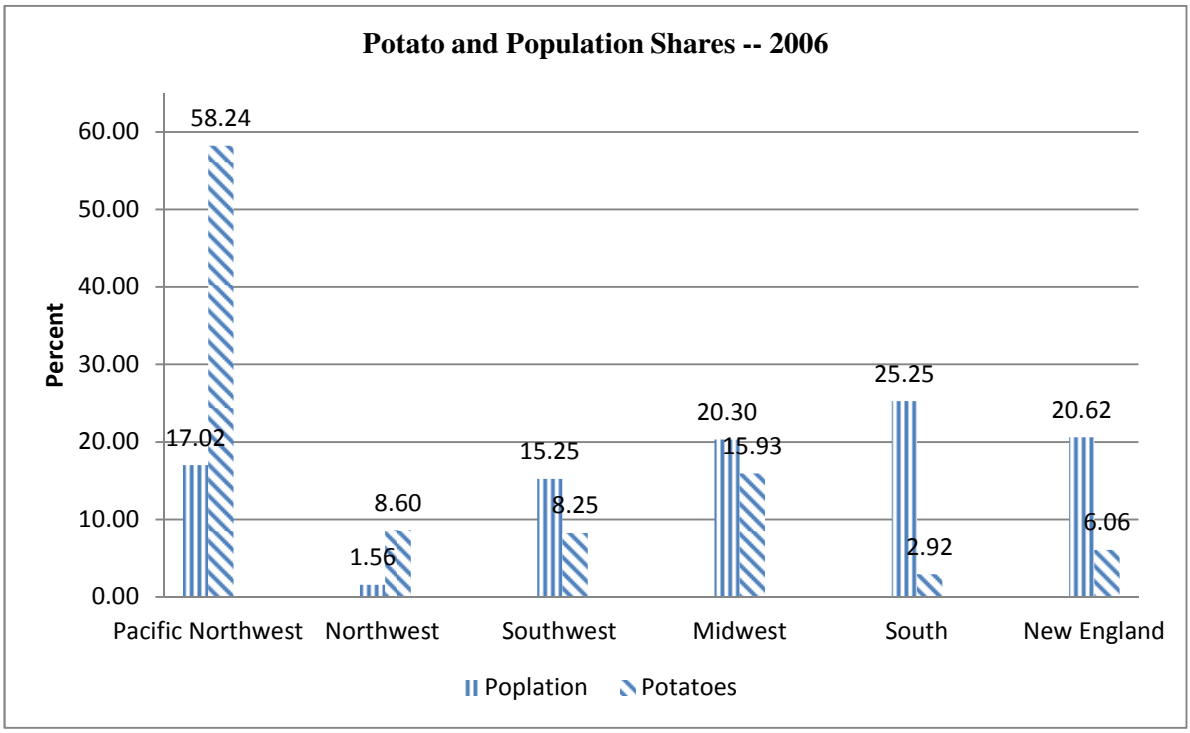
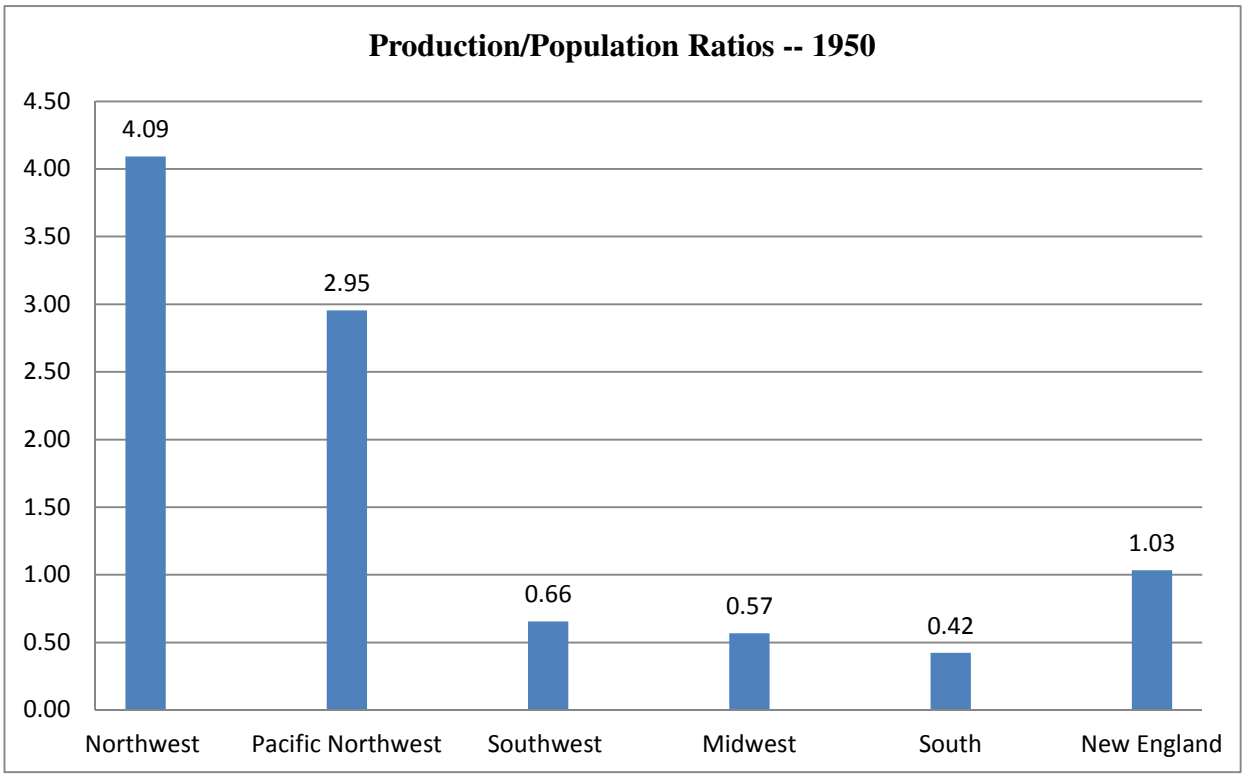
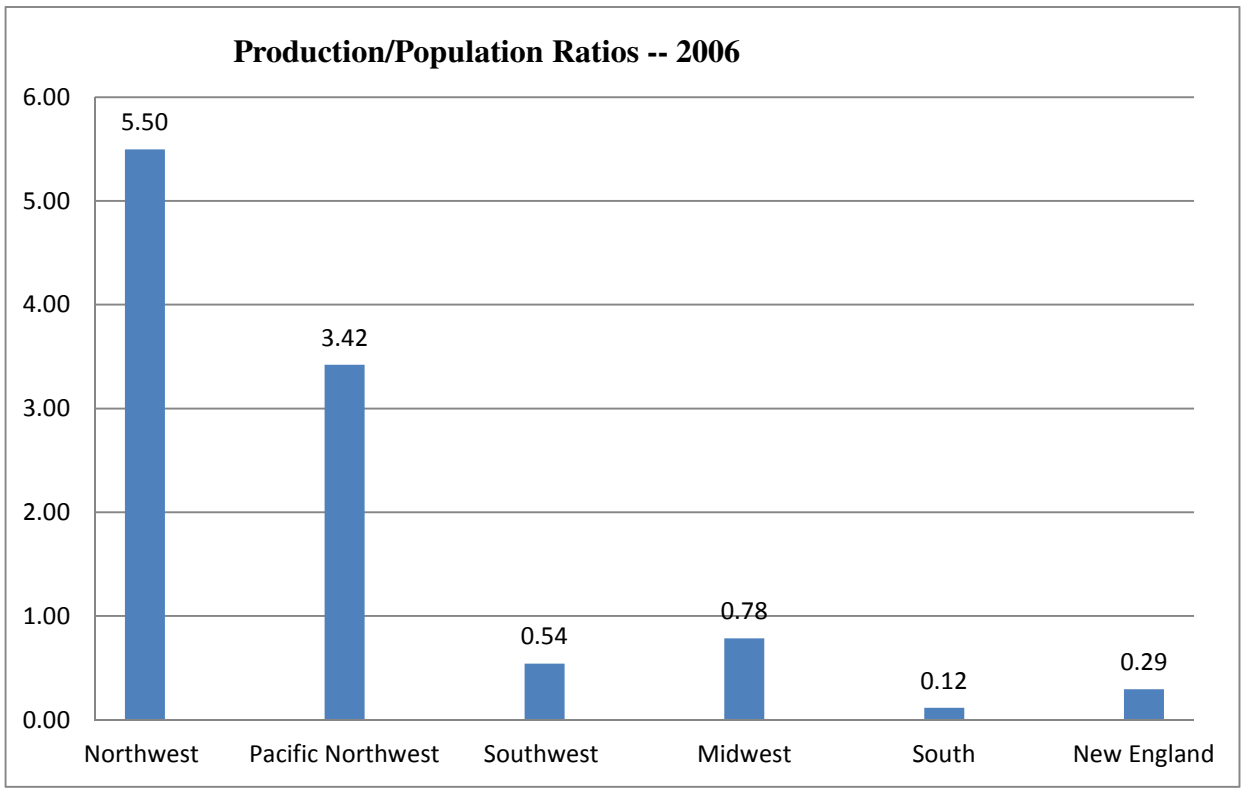


Figure 3. Regional Production Shares as a ratio of Population Shares





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