Understanding the Impacts of Agricultural Commodity Price Volatility on Nebraska's Economy: A Systems Approach
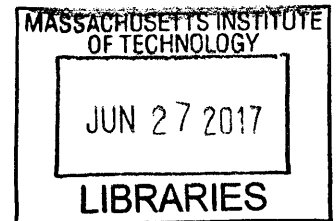
by

Gene S. Scrivner

B.S.B.A. Economics
Creighton University, 2008

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Signature of Author:___

Gene S. Scrivner
System Design and Management Program
May 2017

Certified by:_ **Signature redacted**

James M. Lyneis
Senior Lecturer, System Design and Management Program
Thesis Supervisor

Accepted by:_ **Signature redacted**

Joan S. Rubin
Executive Director, System Design and Management Program

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Submitted to the System Design and Management Program
in Partial Fulfillment of the
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ABSTRACT

Agricultural production is one of the cornerstones of Nebraska's economy and acts as a driver for the state's economy. Nebraska's geography, infrastructure, and industry all support agriculture, and many industries within the state depend on the labor and goods from agricultural producers. In recent years, prices for agricultural commodities have become increasingly volatile, with fluctuations rising and falling much more intensely than in previous years. Global supply and demand for agricultural commodities continues to increase, especially major commodities produced in Nebraska such as corn, soy, and cattle, and it is likely that price volatility will continue to occur. The impacts of this price volatility are being felt across the state, especially as agricultural commodity prices trend downward. Nebraska's agricultural producers are increasingly unable to break even on their operations, and Nebraska lawmakers are facing a budget shortfall caused in large part by the reduced income received from agricultural production and its ancillary effects.

The problem facing Nebraska is incredibly complex, as negative downstream effects are being caused by low commodity prices received by agricultural producers. Policy mechanisms are available to Nebraska lawmakers to manage this problem, but have the ability to exacerbate things if the careful planning and implementation of these policy mechanisms is not conducted. This thesis aims to help define some of the dynamic impacts being felt in the state of Nebraska from global volatility of agricultural commodity prices, and think about these impacts long term. This thesis approaches these issues from a systems thinking perspective, attempting to capture a holistic viewpoint of the major impacts felt in the state now and the potential impacts in the future. An exploratory system dynamics model has been created to explore these dynamic issues and the impacts that different policy mechanisms might have on the state. This thesis by no means provides the "answer" for how to insulate the state of Nebraska from these negative impacts, but offers a first step towards long term systems thinking on the issue.

Thesis Supervisor: James M. Lyneis
Title: Senior Lecturer, System Design and Management Program

Disclaimer

The views expressed are those of the author and do not reflect the official policy or position of the State of Nebraska or any official organization.

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Lastly, on the 150th anniversary of Nebraska's admission as a state into the United States of America, I thank all citizens of Nebraska for helping me become the person I am today. Despite my travels in and out of the state, I have always considered Nebraska home and always will. There truly is no place like Nebraska, and to you I dedicate my thesis.

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Chapter 1 – Introduction

Agricultural production drives the economy of the State of Nebraska. Since its beginnings as a state 150 years ago, farming and ranching have been a key pillar of the state's economy. As William Jennings Bryan, Nebraska native and former Democratic Party Presidential nominee once stated:

"Burn down your cities and leave our farms, and your cities will spring up again as if by magic; but destroy the farms and grass will grow in the streets of every city in the country" – William Jennings Bryan (Arens, 2015).

To put it bluntly, farm production is the driver of many economic activities not only in the state of Nebraska, but across both the United States and the world. Successful production of food is the key to civilization. Without a productive agricultural industry, all other industries would cease, and the world would fall into chaos; such is the importance of agricultural production. Despite agriculture's importance to economies at all levels, it is often overlooked by individuals as the key industry that enables all others to function. While the last century, and especially the years post-World War II, has wrought tremendous advances in food production technology (which continue to boost crop yields to record numbers), the industry faces challenges which threaten its livelihood. In recent years, most notably since the mid-2000's, an increasingly globalized economy has caused major fluctuations in agricultural commodity prices. (Newman & McGroarty, 2017). As more persons worldwide produce and consume food, global prices for major crops such as corn, wheat, and beef will likely continue to fluctuate more intensely.

As mentioned earlier, the state of Nebraska is heavily involved in agriculture. Indeed, more than 25% of the state's Gross State Product is directly credited to agricultural production operations (Thompson, Johnson, & Giri, 2012). As global prices continue to fluctuate, the state of Nebraska has begun to find itself impacted more and more by events outside of its control. An increasingly complex globalized agro-economic system has begun to influence the production and consumption of agricultural goods worldwide, leaving many agricultural producers wondering what can be done to "keep their heads above water", so to speak. In Nebraska, farmers received record prices for their commodities just a few years ago, whereas now prices have dropped to levels not seen in nearly a decade. This sudden and drastic decline in prices is

causing serious problems for many of Nebraska's agricultural producers. Nebraska's state government has also seen regular increases in tax revenues due to the economic growth of its varying sectors, including agriculture. During the "Great Recession" years, Nebraska's tax receipts did not become as negatively impacted as other states due to its strong returns in agriculture. Recently, however, as Nebraska's agricultural economy has endured a sharp decline in prices received for goods produced, state tax revenues have been seriously impacted. In late 2016, Nebraska's economy faced a projected budget shortfall of nearly $1 billion due to the drop in agricultural commodity prices (Stoddard & Nohr, 2016). Recent expenditure reductions have lessened this impact some, but a major budget shortfall looms for the state that can be attributed to the decline in agricultural commodity prices (Nohr, 2017b).

The increasing volatility in agricultural commodity prices has increased the challenges facing Nebraska and its citizens, and due to the complex nature of the problem, the focus of this thesis approaches the problem from a systems thinking perspective. Nebraska's agricultural production system is complex and influenced by many feedbacks. This thesis uses a system dynamics modeling approach to identify the key mechanisms that influence stakeholders within the state, and what levers might be utilized by policymakers to insulate the state from price volatility in agricultural commodities. A review of existing literature on the problem was conducted, and the "Standard Method for System Dynamics Modeling" was used as the primary guideline for conducting research on this topic in order to build a system dynamics model. The following outlines the steps of the "Standard Method":

1) Problem Definition: List of variables, reference modes (hopes and fears), momentum policies, and definition of "success"
2) Dynamic hypothesis (i.e. causal loops linked to reference modes)
3) Simulation model of first loop
4) Analyze first loop & generate insights
5) Simulation model of second loop
6) Analyze second loop & generate insights
7) Simulation model of third loop
8) Analyze third loop & generate insights
... continue until complete model developed

N) Design polices to improve performance (Lyneis & Hines, 2007)

As part of the "Standard Method", key stakeholders directly and indirectly impacted by the problem facing Nebraska constituted a large portion of the research conducted, especially with the formulation of dynamic hypotheses, momentum policies, and key areas for consideration. Overall, this anecdotal analysis helped guide the direction of this thesis, assisted with building the model's structure, and provided key inputs to the model. Initial interviews and follow-up interviews with stakeholders took place between January and April 2017.

Since agricultural production plays such a vital role in Nebraska's economy, it is important to understand Nebraska's unique situation as a producer of agricultural products, the relationship of its citizens to farming and ranching, and why the state is so well-suited for that industry. Nebraska's history as a farming and ranching state is not easily cast away, especially on its 150th anniversary as a state and while facing significant challenges in the industry. An overview of Nebraska's history and development is discussed to provide a benchmark for how the state grew to success in agriculture during the 19th and 20th centuries and how that history might help guide the state forward in dealing with the challenges it faces in the 21st century.

The thesis will also discuss the state's current situation and production capabilities, the resources available to the state for production, the competitive advantages the state has compared to its peers, and how agriculture drives the economy of Nebraska. It will next discuss the key challenges facing the state caused by agricultural commodity volatility. It will outline the key areas being impacted, both by the state's farmers and the budget shortfall being faced, along with other factors, and the policy mechanisms being discussed by key stakeholders and members of government to deal with these problems. The thesis will then cover the interviews conducted and how these interviews helped to drive the problem definition and dynamic hypothesis formulation for the system dynamics model. A discussion of the system dynamics methodology and the overview of the exploratory system dynamics model developed for this thesis will come next, along with a presentation of the model and some of its key findings. Finally, policy recommendations focused on guiding Nebraska stakeholders towards the best possible outcomes, while considering the impacts to both those in government and those impacted by the government's policies while dealing with its complex challenges, will be presented. A brief conclusion will close out this thesis, identifying areas to be explored further and

recommendations for future analysis. This thesis intends to identify key important factors driving this problem, while considering the areas that are currently being affected and may be affected by this problem in the future. The analysis is by no means meant to be a final answer to this issue, but rather guide future research and policy options for managing the issue.

Chapter 2 – Nebraska's Agricultural Heritage and Production Capabilities

Positioned where an ancient seabed once existed, Nebraska is now home to some of the country's most fertile agricultural land, unique wildlife, and hardworking citizens. Shaped by the what is now known as the Western Interior Seaway, the ocean that sat atop Nebraska produced a unique landscape of rolling hills and rock formations that have weathered millions of years of erosion and change ("Western Interior Seaway," 2017). Much of the state's unique features, such as the Sandhills, can be traced back to its former geographic position on the bottom of the ocean floor. From west to east, the state undergoes an elevation change of more than 4,500 feet over the span of 430 miles, resulting in an average annual precipitation change of one inch every 25 miles. This change allows the state to produce a wide variety of agricultural products from one side to the other. Nebraska is also home to the world's largest underground water reservoir, the Ogallala Aquifer, as well as more than 24,000 miles of rivers and streams that provide regular irrigation to 44% of all farmland in the state ("Nebraska Agriculture Fact Card," 2017). This abundance of water resources provides Nebraska with an ideal farming location, and gives the state an advantage over neighboring states that do not have the same access to water.

The state also has a unique combination of topsoil, consisting primarily of clay, silt, and sand. These three types of soil vary in their topsoil mixture throughout the state, with sand being primary in the north and west parts of the state where the Sandhills are located, whereas clay predominates in the east. The differences in topsoil are a primary determinant of where different agricultural products are grown ("Nebraska Agriculture," 2017). Nebraska has a varied weather system which provides the state with all four seasons. While differences in weather do exist in different parts of the state (due to elevation and other factors), Nebraska weather has also been known to change rapidly in the same location. Nebraska's weather changes can go from hot to cold, snowy to sunny in the matter of minutes, regardless of where a person may be located. Indeed, Nebraskans have an old saying that goes, "[i]f you don't like the weather, just wait a minute, it will change" ("Nebraska Agriculture," 2017). The oft changing weather is a source of pride for many Nebraskans, and gives its citizens the chance to enjoy weather of all types.

The fertile soil, temperate climate, and central location in the middle of the United States have attracted people to the state for over 150 years. It is important to understand the history of Nebraska's founding and relationship to agriculture in order to understand the true impact that

any policy mechanisms might have on the state, and prior to developing a model that outlines the options for dealing with volatility from global agricultural commodity prices.

2.1 Nebraska's Founding and Early Agriculture

Nebraska and agricultural production have long been intertwined. Even before Nebraska's founding as a state 150 years ago, agriculture has been the backbone of its economy and its citizens have relied upon the state's vast resources for production. Settled in the early 19th century by European migrants, Nebraska provided a stopover location for trappers and miners on their way to the Rocky Mountains and Pacific Northwest. Many early settlers considered Nebraska "The Great American Desert" and decided against settling within its boundaries (Ireland, 2015). Over time, it became obvious this name was inaccurate and, by the mid-19th century, Nebraska's fertile soils and diverse ecosystem provided settlers with an excellent location for farming and ranching. By 1854, migrants from the eastern U.S. and other countries had begun to reside within the state's future borders ("Nebraska | history - geography - state, United States | Britannica.com," 2017). By the state's founding in 1867, Nebraska had already established itself as a prime location for agriculture production, and the infrastructure and production capacity for agriculture continued to grow into the 20th century.

In the 1870's, Nebraska got tagged with what was first considered an insulting nickname but later became a source of pride for its citizens. The term "bug eaters" was coined as an unofficial nickname of the state, most likely due to the grasshopper incursions during this time. According to legend, a person from the eastern US came to visit relatives in Nebraska and, on his return home, began explaining how "[t]he grasshoppers have eaten the grain up, the potato bugs ate the 'taters all up, and now the inhabitants are eating the bugs to keep alive" (Ireland, 2015). A newspaperman heard the conversation and coined Nebraskans "bug eaters" for the rest of the country (for a time, Nebraska's college football team even called themselves the "bug eaters"). Despite the nickname, Nebraska's agriculture industry became attractive to many by the turn of the 20th century. Farmers in the state, driven by high interest rates for land purchases, assumed less debt than their eastern US counterparts while still being able to produce enough to incrementally grow their farms. A "slowly but regularly rising prosperity" for Nebraska farmers was the result of this, and over time land prices slowly began to close the gap with eastern land

prices (Schlebecker, 1967). From 1870-1890, Nebraska also saw its largest influx of immigrants from places such as Germany, Czechoslovakia, Ireland, Sweden, Denmark, Italy, and many other countries ("Early Settlers," n.d.). These immigrants helped to drive Nebraska's agricultural economy in the late 19th century and during the 20th century. Nebraska's official nickname changed to the "Tree Planter State" around this time (Ireland, 2015). Arbor Day was officially started in Nebraska by local politician J. Sterling Morton in the late 1800's, and later recognized by the US as a national holiday ("Arbor Day," 2017). Thus, Nebraska's new nickname had a more positive connotation.

Nebraska's agricultural economy continued to produce more and more as technological advances became more readily available around the turn of the century. The development of heavy machinery helped to grow the state, as did cheap access to electricity. Nebraska began establishing municipal power systems in order to provide electricity to farmers in hard to reach locations that would otherwise not receive electricity (Williams, 2014). By the 1930's, Nebraska's farm total reached approximately 135,000 individual farms, as the continued proliferation of the railroad and improved technologies allowed for greater productive capacity. While the number of farms has dropped since then, the overall agricultural productive capacity of the state has continued to grow ("Nebraska | history - geography - state, United States | Britannica.com," 2017). Despite the onset of the Great Depression, Nebraska's farms did not get hit as hard, relatively speaking, as many other farmers across the country did. Due to Nebraska's relatively fertile grounds and plentiful dryland, farmers were able to weather the Great Depression relatively better than other areas of the country (Schlebecker, 1967). Even in years when Nebraska's precipitation fell below the minimum for dryland farming, Nebraska farmers still made out better than farmers in other areas. Said one farmer of the Great Depression, "[e]ven so, there never was a time when we could not look out across green hills and see our White Faces grazing in contentment. It was so in '34 too. There is no land I know where the grass grows so well in spite of the elements as in the sandhills of Nebraska" (McKelvie, 1937). The proliferation of farmland during this time confirms the farmer's sentiments, as farmland in western Nebraska grew more than 2,000,000 acres between 1930 and 1940, and farmland in eastern Nebraska also grew (although only by around 450,000 acres) (Schlebecker, 1967). While many farmers did lose their livelihoods in the state during the depression, on the whole Nebraska

came out of the depression stronger than it had been prior to thanks to the state's unique geography and robust agricultural production capacity.

Nebraska's economy began to thrive even more so after the Great Depression, as the onset of World War II required vast amounts of food to feed America's armies overseas. The United States introduced a number of measures meant to support the war effort which included mechanisms to increase agricultural production. These mechanisms included subsidies and price supports that allowed farmers to invest in new farming innovations and generate economies of scale. While the command economy from World War II ceased shortly after the war's end, government involvement in farming and farm subsidies remained (Schlebecker, 1967). Overall, Nebraska continued to grow its agriculture base in the post-war economy and take advantage of the ideal situation for farmers.

2.2 Nebraska's Agricultural Economy Post World War II

After the Great Depression and World War II, Nebraska's economy grew leaps and bounds as new technologies and increased funding boosted efficiencies in agricultural production and grew crop yields (Ganzel, 2017a). From 1945 on, Nebraska became known as "The Cornhusker State", a moniker which aptly described the state's agricultural heritage. Another "unofficial" nickname given to the Nebraska was "The Beef State", a nickname that also appropriately defined Nebraska's agricultural roots (Ireland, 2015). During this time, tractors and other machines came into heavy use on farms across America, including in Nebraska. The shift from using horses and other working animals to machines such as tractors led to an increase in farm size. This shift meant that the land used to provide feed for these animals decreased from approximately 93 million acres in 1915 to less than 4 million acres in 1960. Due to this shift, farmers were able to conduct tasks like plowing fields much easier, but they also relied on more external resources for conducting these tasks (such as fuel and machine components for tractors) (Ganzel, 2017b). This meant that, as farmers continued to grow their farms due to improvements in technology, they also became more dependent on the rest of the world for their production capability, a shift that had not occurred at such a high level before. This would continue throughout the rest of the 20th century, and especially into the 21st century.

Post-World War II, farmers began seeking higher outputs from their farms through the utilization of more and more inputs, such as improved fertilizers, machinery, and pesticides. As farmers used these new production methods, the scale of farms in Nebraska and elsewhere continued to grow, and populations in rural areas started to decline as less labor was needed to maintain levels of production. Also during this time, people from urban areas began going to grocery stores due to an increase of product selection rather than purchasing their foods directly from farmers or farmers markets, leading to a lack of knowledge of food production (Brosnan & Blackwell, 2016). This shift began a "rural/urban gap" between individuals from small towns and those from large metropolitan areas that has only increased over time (and has been brought up by a number of interviewees, which will be covered in a later chapter). Indeed, based on farm data collected from the Agriculture Census Reports from years 1945 (United States Department of Commerce, 1946), 1982 (United States Department of Commerce, 1984), and 2012 (United States Department of Agriculture, 2014), the overall number of farms in the state of Nebraska have decreased quite substantially since this time period while the average farm size has increased, as Figure 1 indicates:
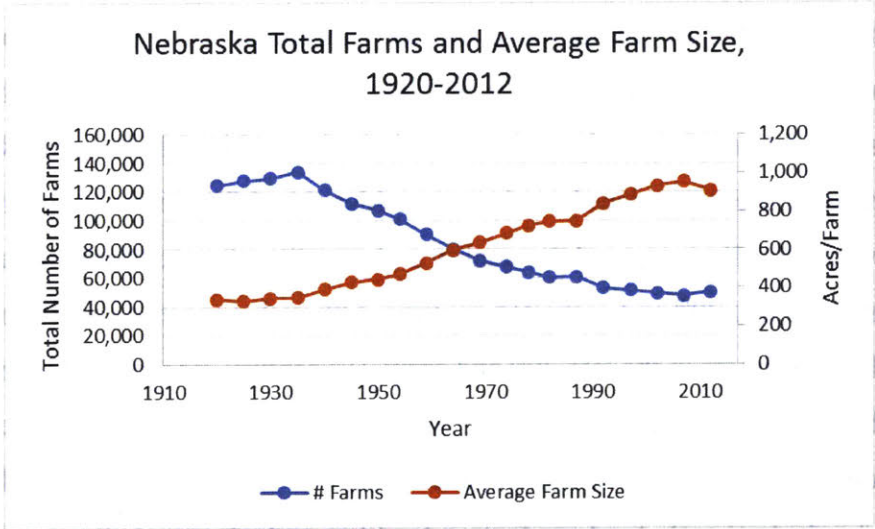
Figure 1 - Nebraska Total Farms and Average Farm Size, 1920-2012

Data Source: US Department of Agriculture and US Department of Commerce

What makes this even more striking is when these figures are compared with the total acres in production in Nebraska, shown in Figure 2:
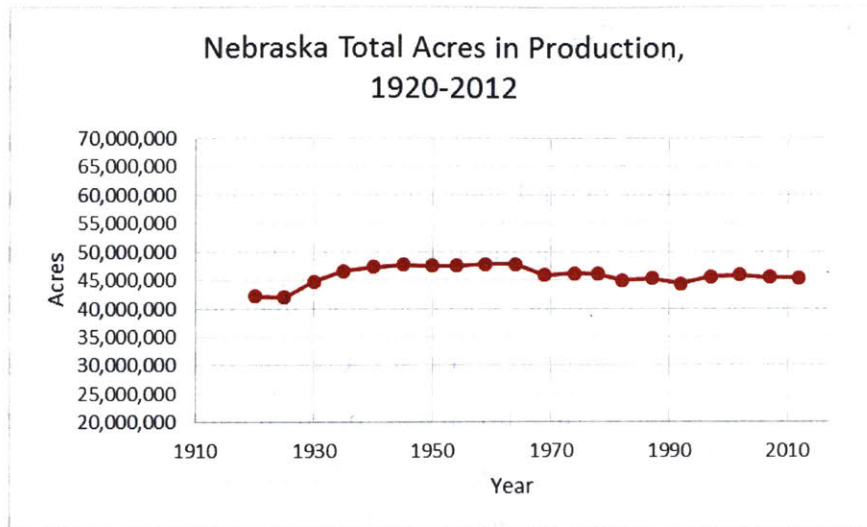
Figure 2 - Nebraska Total Acres in Production, 1920-2012

Data Source: US Department of Agriculture and US Department of Commerce

While Nebraska's total acres under farm production have stayed fairly constant since the end of World War II, the number of total farms in the state have dropped significantly while at the same time the average farm has nearly doubled in size. This data seems to confirm the decline in rural populations and the scaling up of farm operations in the state of Nebraska.

The latter half of the 20th century also saw the widespread use of hybrid crops, the increased use of industrial scale beef, poultry, and hog production operations, and hormone and antibiotic doses added to cattle in order to increase their size and health (Brosnan & Blackwell, 2016). While many of these practices have been considered bad for a person's health by the public, they have drastically improved the quality and quantity of agriculture products for feeding persons in the late 20th and early 21st century. Although concerns about food safety have also increased by consumers in the late 20th and early 21st century, "America's demand for beef cannot be met by free-range, grass-fed cattle…" (Brosnan & Blackwell, 2016). Even though this might create a quandary for some consumers, alternatives do exist for these individuals concerned about industrial scale food production facilities and who want all natural products. Many of Nebraska's farmers produce pasture grown, grass fed cattle that are not injected with hormones and other growth inducing treatments as a way to differentiate themselves (as discussed in a later chapter). Just as Nebraska's farmers adjusted practices in the early and mid-20th century to meet new technological and cultural shifts, so too are farmers adjusting practices

today. However, unlike then, farmers now are faced with new and varied challenges. Despite these challenges, Nebraska's agriculture production is diverse and remains a major pillar of the state's economy.

2.3 Nebraska's Current Agricultural Production

Due to Nebraska's diverse geography, abundant natural resources, favorable climate, and adoption of new production technologies, the state is home to a wide variety of agricultural products. For many of these products, Nebraska is among the nation's top producers, as discussed in this section.

2.3.1 Nebraska Livestock and Poultry Production

Nebraska's livestock production capabilities are among the nation's largest. Of these, Nebraska's beef production is the largest of the state's agricultural production sectors, and is among the national leaders in all sectors of beef production. Nebraska has nearly 19,000 cattle farms and ranches, where cows primarily feed on grass and crop field remains after harvest, and before being moved to feedlots, where their diets change in order to produce better quality of beef ("Nebraska Agriculture," 2017). From Angus to Herefords, a wide variety of cattle types are produced in the state. Nebraska beef is among the world's best quality due to cattle diet and finishing operations at feedlots. Cattle in Nebraska outnumber citizens by over three to one, and Nebraska's beef sector generates over $7 billion annually on average. Nebraska's dairy operations are not nearly as large as their beef production operations, but do generate approximately $300 million in annual revenues ("Nebraska Agriculture," 2017).

Pork production is a large sector in its livestock production. While pork production in Nebraska saw a 60% decline in total number of hog farms from 1997 to 2007, a recent legislative bill saw passage in the Nebraska Unicameral in 2016 that will help reverse the trend. Nebraska legislative bill 176, passed by a 34-14 vote, allows swine producers to enter into contracts with packers for their pigs. The state had banned this activity prior to the bill's passage, while Nebraska's surrounding states did not, making these surrounding states more attractive to packers for hogs down the production chain. Nebraska State Senator John Stinner called the bill's passage an "economic development tool", and "a way of reversing some of the adverse

trends we're seeing in rural Nebraska" ("Pork production bill passes," 2016). Despite this change, Nebraska still ranks as the country's 6th largest producer of hogs, and generates more than $1 billion in annual receipts on average ("Nebraska Agriculture," 2017).

Nebraska's poultry and egg production sector is also key to its overall livestock production. With more than 9 billion birds within the state, the poultry in Nebraska (consisting primarily of chickens and turkeys) are produced for two primary purposes: egg production and meat production. Most of the poultry in Nebraska are hens for egg production, however. Nebraska's overall egg production operations generate nearly 3 billion eggs annually on average. Overall, Nebraska ranks as the 10th biggest egg producing state ("Nebraska Agriculture," 2017). While Nebraska's egg operations are significant, recent backlash to the growth of poultry facilities within the state have potentially limited this sector's growth. Concerns among some of Nebraska's citizens regarding the building of a large chicken plant by Costco have generated backlash for the project. Farmers state that building the plant will mean "dangerously raising the nitrogen levels in the water" due to runoff from the plant. Other opponents are concerned the plant will "bring potentially illegal immigration". Proponents argue that this type of facility is necessary for Nebraska, and will bring "a projected $1.3 billion per year impact to the area" (Cadotte, 2016). This project has brought lawsuits and a large amount of backlash from local citizens and farmers worried about the chicken plant, leading to delays of the project (Liesveld, 2016).

While Nebraska's three largest livestock sectors are cattle, pork, and poultry, Nebraska also maintains around 80,000 head of sheep and lambs in the state. Although much smaller than the other livestock sectors, Nebraska's sheep production generates nearly 450,000 pounds of wool annually. Of the 80,000 head of sheep and goats, more than 20,000 of these are used for meat production, while another approximately 4,000 are used for milk ("Nebraska Agriculture," 2017). Other livestock is produced in the state, but these primary sectors make up the bulk of Nebraska's livestock production operations.

2.3.2 Nebraska Crop Production

Like livestock production, Nebraska's crop production ranks among the nation's leaders in many sectors. Nebraska's crops, however, are much more diverse than its livestock. Known as

"The Cornhusker State", it should come as no surprise that corn is Nebraska's most widely grown crop. Nebraskans produce corn for a variety of uses, including feed for livestock, ethanol production, food for consumers, etc. According to the Nebraska Department of Agriculture, Nebraska is located in what is called the "Golden Triangle", a lucrative spot where corn, livestock, and ethanol production within the region combine to provide increased value along the production chain ("Nebraska Agriculture," 2017). In 2016, Nebraska produced nearly 1.7 billion bushels of corn, and in 2015 exported nearly $1 billion in corn. Nebraska is also home to approximately 25 ethanol plants producing nearly 2 billion gallons of ethanol annually. Overall, Nebraska is the third largest corn producing state in the country ("Nebraska Agriculture Fact Card," 2017).

Soybeans rank as Nebraska's second largest crop, and are often rotated with corn as a way to conserve the soil in the state. Soybeans are robust crops, and can be grown in many different types of soils and climates. Soybeans are used for many purposes, including food for humans and animals, renewable fuels, and other purposes. Nebraska produces approximately 24 million bushels of soybeans annually, placing the state as the 5th largest soybean producer in the country ("Nebraska Agriculture," 2017). Soybeans also ranked as Nebraska's top agricultural export in 2015 ("Nebraska Agriculture Fact Card," 2017).

Nebraska produces wheat, but finds itself outside of the country's top ten wheat producing states (coming in at #12). Although not among the top ten, Nebraska still produces between 55-70 million bushels of red and white winter wheat (the two types of wheat grown in Nebraska) annually, and exports approximately 50% of its total production ("Nebraska Agriculture," 2017). Due to the financial outlook for many farmers in the state, wheat production has decreased significantly, dropping 20% from the year prior and down approximately 50% from 2007. Worldwide production, along with the strong US dollar, are just two key factors contributing to this decrease in production (Bergin, 2017c).

Nebraska ranks in the top 3 of all states for dry edible bean production (as well as first for Great Northern bean production and second for pinto bean production). Other bean types include black beans, light red kidney beans, navy beans, pink beans and garbanzo beans. Beans are primarily grown in the western portion of the state thanks to the drier climate, and Nebraska produces the equivalent of approximately 1 billion servings of dry beans annually ("Nebraska Agriculture," 2017). Nebraska farmers continue to experiment with new ways to grow and

harvest dry beans in order to increase yields and lower costs. Recently, farmers in Nebraska got introduced to a new method called "direct harvest." This method allows farmers to leave beans in fields longer until farmers are ready to harvest, as the beans are anchored in the ground. This means the beans remain safer than in previous harvests. However, the new technique requires learning and, if done incorrectly, can lead to loss of product (Garcia, 2017). This is one example of farmers in Nebraska attempting new techniques to improve crop yields and lower production costs.

Nebraska produces nearly 1.3 million tons of sugar beets annually, ranking 5th in the country, and also ranks 10th in the country for potato production (producing an average of 8.4 million hundredweight). These crops are grown primarily in the western panhandle of the state, and in some areas in central Nebraska (especially in the sandy soils near the Sandhills). While beets require specific growing conditions and a long growing season, potatoes can be planted at different times in order to coincide with farmers' harvesting plans. About one-third of potatoes in Nebraska are used for making potato chips, and the remaining are used for sale in grocery stores or stored in facilities for future uses. Sugar beets are used mainly for sugar production ("Nebraska Agriculture," 2017).

Nebraska produces two lesser known grains, called grain sorghum (also known as milo) and proso millet. These crops are primarily found in dryland, low moisture areas of the state. Milo is a gluten free grain that is in demand in many countries across the globe, and proso millet has found uses in a variety of products, including cereals, bird seed, and even beer brewing. Nebraska's Milo production ranks 8th in the country, and the market for proso millet is growing due to its short growing length (60-90 days), limited moisture needs, and favorable use in crop rotation ("Nebraska Agriculture," 2017). Milo may see an increase in production as a substitute for corn in coming years, as due to corn's abundance on global markets, milo may become a niche product for farmers. Milo's input costs are lower than corn, and the grain is more robust during droughts and dry years. Wildlife tend to like milo better than corn, as well (Bergin, 2014). This may help improve Nebraska's agri-tourism industry for activities like hunting and sight-seeing, and could provide farmers with an alternative crop in the future.

2.3.3 Nebraska's Additional Agricultural Products

Aside from Nebraska's primary agriculture products like livestock and large scale crop production, Nebraska also grows a variety of products used for both farm production, as well as other uses.

In order to feed the millions of cattle growing in Nebraska, farmers and ranchers need more than just corn and other grain for feed. Thus, hay and alfalfa are grown in every county in the state. These products are either grown for cattle grazing in fields, or cut and baled to be used for feed during winter months or sold to other locations. These two products are necessary for the state's success as a beef producing state, and overall Nebraska ranks as the 6th largest producer of hay and alfalfa in the country ("Nebraska Agriculture," 2017). Hay bales are often stored during winter and early spring for use as feed for cattle and other livestock. Figure 3 shows rows of hay bales for use as feed:

Figure 3 - Rows of Hay Bales, Greeley, NE

Photo by: Gene Scrivner, 2017

Nebraska is home to a number of niche products as well, including honey from honey bees, wine, a variety of small production fruits and vegetables, and Christmas trees. While much smaller than Nebraska's other production sectors, these unique products offer consumers a variety of products that can be produced in the state. More than 3.75 million pounds of honey is produced in Nebraska annually from about 50,000 bee colonies. Over 40 different wineries are in

operation in the state, producing wines from hybrid grapes chosen to withstand Nebraska's climate. Dozens of roadside stands, farmers markets, and single family operations within the state produce products like tomatoes, cucumbers, melons, pumpkins, berries, and other edible fruits and vegetables. Finally, over a dozen Christmas tree farms in Nebraska allow individuals to choose their own trees (the most standard types are varying fir and pine trees, such as Douglas Fir and Scotch Pine, among others) ("Nebraska Agriculture," 2017). Ultimately, these smaller operations add to the unique offerings produced in Nebraska and help to diversify the state's overall agricultural production.

2.4 Nebraska's Supporting Agricultural Production Resources

Nebraska is fortunate to have a number of value-added resources that help support the agricultural production operations within the state.

2.4.1 Nebraska's Transportation Infrastructure

Nebraska's transportation infrastructure is a robust transportation system that allows agricultural products to be transported relatively easily throughout the state and to locations outside of Nebraska. Nebraska's central location in the United States makes it an ideal location to produce agricultural products, and with Nebraska's network of highways and Interstate 80 running through the middle of the state, this critical infrastructure provides ease of product transport to Nebraska's farmers ("Nebraska Agriculture," 2017). Nebraska also is home to Union Pacific Railroad, whose headquarters is located in Omaha and whose largest train yard is located in North Platte, Nebraska, about halfway between the state's east and west borders ("Bailey Yard," 2017). Burlington Northern Santa Fe Railroad also operates within the state's borders; both of these railroads have strong infrastructure built to transport agricultural products within and outside the state. Nebraska also sits next to the Missouri River, with barge transportation available to many farmers ("Nebraska Agriculture," 2017).

Many farmers in Nebraska haul their own products from fields to buyers, but many farmers also outsource this work, providing Nebraskans with additional work. Companies such as Werner Enterprises, a Fortune 1000 company headquartered in Omaha, NE, help transport agricultural commodities both throughout Nebraska and to locations across the globe. Werner

transports food, especially on a seasonal supply and demand basis as needed, which provides farmers with a local option for moving their products ("Our Customers," n.d.).

2.4.2 Nebraska's Irrigation Resources

Nebraska's proximity to ground water for irrigation has allowed for the development of irrigation systems, such as the center pivot irrigation system, for more efficient delivery of water to crops. A center pivot irrigation system can be seen in Figure 4:

Figure 4 - Center Pivot Irrigation Well, Greeley, NE

Photo by: Gene Scrivner, 2017

According to the Nebraska Department of Agriculture, four of the biggest irrigation manufacturers are located within Nebraska ("Nebraska Agriculture," 2017). These companies, such as Valmont Industries, a Fortune 1000 company, provide Nebraska with production jobs and resources within the state to improve the operations of farmers and ranchers (Cordes, 2013). Center pivot systems are powered primarily by electricity, although many farmers use diesel fuel, natural gas, and other sources to power their pivots. By using center pivot systems, especially of the low pressure type, Nebraska farmers are able to increase their efficiency of energy and water usage, and reduce costs (B. B. Johnson, Thompson, Giri, & Van NewKirk,

2011). Having the manufacturers of these systems so close also helps provide Nebraska farmers with an advantage. While maintaining these systems can be costly, it benefits production operations from having efficient irrigation systems.

2.4.3 Nebraska's Ethanol Production Capabilities

Nebraska has an estimated 25 ethanol plants within the state's borders that provide farmers with another option for selling grain. Of these 25 plants, Nebraska total capacity for ethanol production is more than 2.1 billion gallons annually, of which Nebraska ethanol plants produced 2.06 billion gallons in 2016, or just over 98% of their total production capacity. This constituted 14% of the entire production for the United States in 2016 ("Ethanol Production Capacity by Plant," 2016). Green Plains Renewable Energy, another Fortune 1000 company headquartered in Nebraska, is one of the largest producers in the state and has locations in a number of towns for both ethanol production and grain storage. While the ethanol itself is the main product of these plants, a highly beneficial by-product called "distillers grain" is produced at these plants, which is among the best feed for animals due to its high protein, high energy makeup. Green Plains produces approximately 4 million tons of this by-product annually, which is then used by Nebraska's farmers and ranchers as animal feed ("About | Green Plains Inc.," 2017). This is what is known as Nebraska's "Golden Triangle". The "Golden Triangle" in Nebraska allows farmers to sell corn to ethanol plants, which then use the corn to produce ethanol and the by-product, distiller's grain, which is then used by farmers for feeding livestock that provides Nebraska farmers with "more feed options and an advantage over feeders in other states" ("Nebraska's Golden Triangle," 2017). This "Golden Triangle" "creates a closed loop that benefits all three industries" as the corn, ethanol, and high quality feed for livestock are all produced in the state and are able to be shipped elsewhere at much higher prices (S. Hansen, 2016). While Nebraska's 25 ethanol plants provide value added benefit to much of Nebraska's farmers, there are currently no plans to build any new plants or expand on existing facilities. The reasons why there are no plans for growth in ethanol plants in Nebraska is uncertain; however, Nebraska's neighbor to the east, the state of Iowa, has nearly double the amount of ethanol plants, and nearly double the production capacity of Nebraska ("Ethanol Production Capacity by Plant," 2016).

Ethanol production provides farmers with an additional buyer of corn in the state, but some people argue that the benefits of (and subsidies for) ethanol production are not worth it. A common argument made against ethanol is that the energy needs and greenhouse gas emissions required to produce the ethanol are not worth the effort to produce, as minimal cost savings and greenhouse gas emission reductions occur from using the product in vehicles. The price for corn is believed by many to have increased substantially due to the demand by ethanol plants for the product, which is driven by subsidies, tax credits, and tariffs from the federal government, and without which ethanol proliferation would not occur. Claims are also made that the increased production of ethanol has other unintended consequences such as increased irrigation leading to the depletion of aquifers, chemical runoff, and deforestation, among others (Conca, 2014). While some of these claims may prove true, ethanol plants in Nebraska provide farmers with an additional customer that also produces a valuable by-product from corn that cannot be made by farmers themselves. As the price of corn drops, ethanol plants in the state have helped to sustain the agricultural economy of the state.

2.4.4 Agri-tourism in Nebraska

Agri-tourism is a growing industry in the state, as well. Today, Sandhill Cranes and other migratory birds make their way through Nebraska and get their name from the unique sandy hills in the central and western part of the state. Tourists come from all over the planet to view these birds each year (Suri, 2015). These birds and the other features of the state provide its citizens with a source of pride for their state, as do many other features of Nebraska, such as the state's friendly nature and agricultural heritage. Aside from watching bird migrations, Nebraska encourages agri-tourism through its outdoornebraska.gov website, specifically giving tourists information and contacts for places to hunt, fish, and do other activities near and around agricultural areas. In Nebraska, most hunting is done on private farmland and focuses on game such as deer, and birds such as pheasants and ducks. The state does offer public areas, but for many hunters and trappers, it means getting in touch with individual farmers themselves ("Where to Hunt," 2015). Another opportunity for agri-tourists is spending time on a farm or ranch and helping to work the land. In 2016, Nebraska Senator Ben Sasse's daughter spent time working on a ranch to learn about what it takes to own and operate an agricultural operation in Nebraska. To

many, this type of tourism is extremely attractive, as it allows a person to see firsthand where their food comes from and what it requires to grow that food for the rest of the country. There is no "placement program" for tourists to sign up and spend a week on the farm or ranch, says Sen. Sasse (Peterson, 2016). While no program exists at present to place agri-tourists with farmers and ranchers throughout the state, there is a fast growing interest in this type of tourism, and Nebraska is well suited to grow this industry in the state, while also improving its hunting and trapping industries, along with its agrarian heritage, natural wildlife tourism (such as Sandhill Cranes), and many other types of tourism in the state. This type of industry helps add to Nebraska's overall agricultural economy.

2.4.5 Other Resources Available to Nebraska

Nebraska has a wide variety of additional resources for supporting farm production. National and local banks in the state, such as First National Bank of Omaha, the largest private bank in the country and headquartered in Omaha, NE, help to provide farmers and ranchers with options for financing their operations ("About Us, First National Bank," 2017). A number of smaller banks located in towns throughout Nebraska also provide farmers with options for operating loans and funding for farm equipment. Nebraska also has credit services dedicated to serving the agricultural production needs of the state. Farm Credit Services of America, headquartered in Omaha, NE, is one of the main service providers to farmers and ranchers in Nebraska for credit access, risk management, and other financial resources ("About Us," 2017). Aside from banking organizations, a number of farming equipment sales companies are spread across the state. These retail locations provide farmers with the equipment needed to run their farming and ranching operations effectively. Items sold at these locations include tractors, combines, row-headers for planting and harvesting, and other heavy farming equipment. Other stores also specialize in seed for planting, fertilizers, and other production inputs. Specialty support operations are also widely available, and include operations such as fence layers, irrigation repair (as seen in the photograph above), and veterinary services. These are just some of the types of non-production agricultural retail operations that exist throughout Nebraska that provide farmers with the resources to run effectively.

A number of farm production organizations operate throughout the state of Nebraska with the purpose of improving the livelihood of Nebraska farmers. Farmer coops (pronounced "co – ops", short for cooperatives) are located in many small towns throughout the state, are owned and operated by their members, and differ from other businesses because they operate solely for the mutual benefits of the farmers and ranchers that belong to them. These coops are generally overseen by a board of directors elected by the members. These benefits include increased bargaining power, better access to markets, increased opportunities, access to goods and services, and a number of others ("About Co-ops," 2017). In Nebraska, the Nebraska Cooperative Council, which counts over 90% of all Nebraska agricultural cooperatives as members, acts as a non-profit, non-partisan trade association for its member coops. The range of services offered by the Nebraska Cooperative Council adds to the services offered by local cooperatives, including greater legislation and governmental affairs influence, communications, and regulatory issues ("Nebraska Cooperative Council," n.d.). Nebraska is home to seven of the top 100 agricultural coops in the country, including Ag Processing, Inc., an Omaha based agricultural cooperative with revenues of more than $4.3 billion that ranks as the tenth largest coop in the country ("Fewer Nebraska co-ops among nation's largest," 2016). These cooperatives provide many farmers in the state with a support system that can help improve operations and assist in tackling problems when they arise. While coops cannot help in all situations, they are available to farmers when needed.

The Nebraska Department of Agriculture provides farmers with a variety of resources for managing and operating farms and ranches, and strives to develop and promote agriculture in the state. Some of the programs run by the Nebraska Department of Agriculture include livestock disease tracking and management in order to minimize the impacts of disease spread among livestock in the state and crop growing and soil conservation programs, among many other programs ("Nebraska Department of Agriculture," 2017). The Nebraska Department of Agriculture is also involved in the "NextGen" program for beginning farmers. This program provides farmers that are just starting out and are qualified with the opportunity to waive a percentage of their total property tax for up to three years (after receiving approval from the local county assessor), and also claim a one-time state income tax credit for up to $500. Asset owners are also eligible for a tax benefit for providing new farmers with opportunities to work their land. This benefit includes a refundable tax credit based on the type of relationship entered into with

the new farmer, whether a cash rent or a share of crops or livestock ("NextGen : Eligibility & Benefits," 2017).

Organizations such as the Nebraska Farm Bureau, the Nebraska Farmers Union, and other Nebraska commodity boards, such as the Nebraska Corn Growers Association, work to represent agricultural interests for farmers and ranchers in the state of Nebraska. Other advocacy groups include the Nebraska based Center for Rural Affairs, a left leaning organization whose mission statement is to "[e]stablish strong rural communities, social and economic justice, environmental stewardship, and genuine opportunity for all while engaging people in decisions that affect the quality of their lives and the future of their communities" ("Our Mission and Our Values," 2017), the Open Sky Institute, a non-partisan group focused on budget, revenue, and education policy in Nebraska that has a direct impact on farming and ranching operations ("OpenSky Policy Institute - Nebraska," 2017), and the Platte Institute, a right leaning think tank focused on Nebraska's tax and spending policies, labor and regulations, and education measures ("Issues : Platte Institute," 2017).

Aside from the Nebraska Department of Agriculture, other non-governmental organizations, and policy think tanks, a number of academic research institutes and non-government organizations help support Nebraska farmers and conduct research that helps drive farm policy. Creighton University in Omaha, NE is home to Dr. Ernie Goss, the MacAllister Chair and Professor of Economics. Dr. Goss produces a monthly survey focused on economic trends and conditions of rural areas throughout the state and Midwest region. This survey is cited regularly and used by many farmers and ranchers in the state to help make decisions for their operations ("Ernest Goss," 2015). The University of Nebraska – Lincoln (UNL) has departments focused on the study, analysis, and improvement of agriculture. One area, the Institute of Agriculture and Natural Resources, is "committed to growing the future of Nebraska's people, businesses, and communities" by collaborating with other departments throughout UNL (such as the Agricultural Resources Division) in order to make informed, long term recommendations for strengthening agriculture in Nebraska ("Institute of Agriculture and Natural Resources | University of Nebraska–Lincoln," 2017). UNL's Department of Agricultural Economics has also contributed immensely to the understanding of agriculture's impact in the state of Nebraska. Among some of the most impactful work done, an analysis conducted on the economic impact of agriculture on the state was conducted for the year 2010. Released in 2012, this report outlined

the key economic factors that are driven by agricultural production operations, and how the "agricultural production complex" in the state of Nebraska plays one of the biggest roles in the state's economic health (Thompson et al., 2012).

2.5 Nebraska's "Agricultural Production Complex"

The 2010 Economic Impact of the Nebraska Agricultural Production Complex study remains the "go-to" study for assessing the sector's economic presence on the state of Nebraska. The study defines Nebraska's agricultural production complex as "remarkable in both its sheer volume of production and its diversity", and includes "major input industries tied to agriculture as well as sectors processing agricultural production into value-added products, all of which contribute to its economic significance" (Thompson et al., 2012). Based on the factors discussed earlier in the chapter, this statement is certainly true. This agricultural production complex includes much more than just agricultural production operations, but rather the entire set of operations involved with the production and processing of agricultural products. The agricultural production complex includes the portions of Nebraska's agriculture economy mentioned above, such as food processors, agricultural cooperatives, farm equipment manufacturers, wholesalers, transportation operations, educational and research organizations, public agencies and non-profits, as well as the agri-tourism industry (Thompson et al., 2012). The agricultural production complex consists of what the authors call "backwards" and "forwards" linkages between these supporting industries and agricultural production itself. This includes the inputs to production, such as machinery, seeds, fertilizer, and others, as well as the transportation of livestock and crops from farms to feedlots, ethanol plants, and other value-added activities dependent on agricultural production. The authors break down the agricultural production complex into six primary components: crop production (both irrigated and non-irrigated), livestock production, agricultural-related manufacturing (durable and non-durable), agricultural-related transportation and wholesaling, agricultural-related research and education, and agri-tourism (Thompson et al., 2012). Of these six components, two of them, crop production and livestock production, represent agricultural production itself. The four other components, agricultural-related manufacturing (durable and non-durable), agricultural-related transportation and wholesaling, agricultural-related research and education, and agri-tourism, make up the additional non-

production activities within the state of Nebraska that generate value for the state and its citizens as a result of agricultural production.

These activities constitute an enormous amount of revenues for the state and its citizens. For 2010, the year economic impact study was conducted, Nebraska's agricultural production complex generated 40.7% of the state's total dollar output, and nearly 27% of the state's gross state product. This means that over $1/4^{th}$ of the state's economy is generated from agriculture production and its supporting activities (Thompson et al., 2012). Nebraska's agricultural production complex was also responsible for 1 out of every 4 jobs in the state ("Nebraska Agriculture Fact Card," 2017). It is clear that Nebraska's agricultural production complex is key to the state's overall economic health, and that agricultural production is the main driver of the agricultural production complex as a whole. The state of Nebraska has tremendous resources which support the agricultural production complex, both natural and man-made. Due to its proximity to key natural resources, ancillary value-added production capabilities found in the state, agrarian history and support structure, and location in the country, Nebraska is uniquely positioned to lead the agricultural production complex of not just the Midwest, but the entire country in the future.

2.6 Conclusion

While not comprehensive, this chapter outlines Nebraska's history with agriculture, the abundance of resources Nebraska contains that promote the production of agriculture (both natural and man-made), the main types of agricultural production that occur within the state, and an overview of the state's agricultural production complex. While Nebraska's resources and variety of growing options make Nebraska an ideal producer of agricultural products, dynamic forces play a major factor on the ability of Nebraska farmers to continue to produce each year. Falling agricultural commodity prices, driven by an increased global supply, make agricultural production difficult for many of the state's farmers and ranchers.

Chapter 3 – The Problem Facing Nebraska

3.1 – Introduction

This chapter outlines the key dynamics impacting the state of Nebraska due to falling agricultural commodity prices. While Nebraska has been impacted by fluctuating agricultural commodity prices in the past, the current situation is unique in that prices are primarily being driven not by production and consumption in the United States, but rather by the production and consumption of the global economy. As global production and consumption increases worldwide, the United States is left with less power to manage global agricultural commodity prices. Since the mid-2000s, Nebraska's top five agricultural commodities have undergone an increase in volatility, seeing record highs reached and large swings in price (see Appendix A1). According to the Wall Street Journal, "American farmers' share of the global grain trade has fallen from 65% in the mid-1970s to 30% today, giving them less sway over prices. More producers and more buyers around the world also mean more potential disruptions from bad weather, famine or political crisis" (Newman & McGroarty, 2017). This inability to control commodity price fluctuations has created a situation not faced by U.S. farmers before. Comprised of data collected from the USDA ("USDA ERS - International Agricultural Productivity," 2017), the rise in global production can be seen in Figure 5:
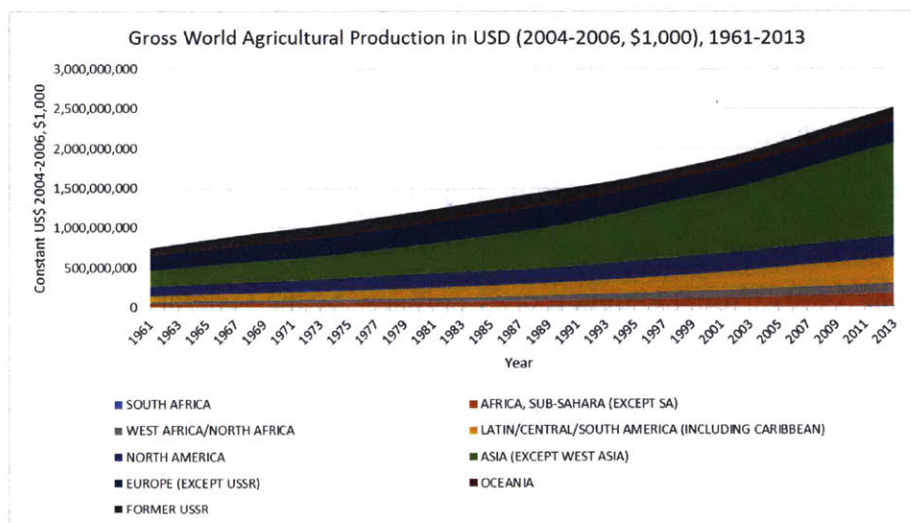
Figure 5 - Gross World Agricultural Production, 1961-2013

Data Source: ers.usda.gov

Based on the data above, global agricultural production has moved from below, $1 trillion in 1961 to more than $2.5 trillion in 2013.

For the state of Nebraska, agriculture is one of the pillars of the overall economy, as it accounts for more than one quarter of its total Gross State Product (Thompson et al., 2012). A downturn in the agricultural sector has led to a drop in incomes, impacting the state's overall tax revenue collection. As farmers' margins shrink, less and less money is spent on equipment and supporting activities, or purchases originally planned for now have been put off for later. When this occurs, it further impacts the ability of Nebraska to collect tax revenues that had already been earmarked for spending. Due to this fact, Nebraska is facing a budget shortfall of nearly $760 million by the start of the next biennial budget, down from over $900 million earlier in 2017 (Nohr, 2017b). In Nebraska, despite the state's vast natural resources and ideal geography for agricultural production, this pillar of the state's economy is being negatively impacted by forces that are outside of the state's ability to control. It is important to explore what is occurring now, what the state and its farmers and ranchers have done during previous downturns of the state economy's agricultural sector, and what options are currently being considered by stakeholders for dealing with the problem.

3.1.1 – A New Cause for Commodity Price Volatility

Farmers in Nebraska are not unfamiliar with swings in commodity prices and the effects that those swings have on individual operations. Over the past few decades, Nebraska's farmers have endured swings during all types of economic conditions. In the 1970s, oil price increases raised the price of production for farmers. These increases also drove fears of declining natural resources, drove prices for agricultural commodities and land prices upward, and sparked a massive investment in machinery and land in the agricultural industry (Lotterman, 1996). High interest rates in the 1980s wrought "tight money policies" by the Federal Reserve (designed to bring down the high interest rates and combat "stagflation") and record production (for that time) in the U.S. along with an export embargo on the Soviet Union by the U.S. agricultural products caused major issues for farmers. After climbing farm land prices and availability of capital for new machinery and production inputs in the 1970s, the combination of low commodity prices, falling land values (upwards of 60% loss of value in some areas), high debt, high interest rates,

and loss of export partners in the 1980s caused a major increase in farm foreclosures nationwide, with more than one-third of U.S. farmers facing foreclosure (Lawton, 2016). Changes in consumer diets and food options impacted farmers in the 1990s and 2000s, as Americans shifted from high grain diets such as wheat to more low carb diets, impacting the demand for agricultural commodities ("A circular tale of changing food preferences," 2017). Economic recessions have occurred throughout all of these trends as well, which also impacted Nebraska's farmers. Recently, downturns in the agricultural economy have followed periods of overall economic downturns. These have occurred after the "dot com" bubble of the early 2000s and the "Great Recession" in the late 2000s (Brown, 2017). However, the current situation facing Nebraska's farmers and ranchers, and indeed farmers and ranchers throughout the entire country, is not being caused due to a downturn in the overall economy that will correct itself over time, but by new dynamics not faced by farmers before.

Never before has the world had as many people to feed as it does right now. Not only has the world's population continued to increase, but diets worldwide have begun to change and more and more people from all across the globe have begun to add more robust options (such as wheat, red meat, etc.) to their diets ("A circular tale of changing food preferences," 2017). In the last decade, approximately 180 million acres of farm land have been added to the world's total cultivated land, adding what essentially equals another "U.S. Grain Belt" to existing farm acres worldwide (Gee & Newman, 2016). Aside from cultivating more land, farmers worldwide have begun adopting farming practices used by farmers in America and other industrialized nations to increase the production of desired crops and agricultural products, including using heavy machinery such as tractors and combines, as well as fertilizers, seed, and irrigation practices. While America and other industrialized nations continue to be world leaders in agricultural production, emerging economies such as China and Brazil are catching up quickly (Fugile & Wang, 2013). This overall increase in the global production of agricultural commodities, driven by the increase in global supply, along with the decrease in certain production costs (such as fuel for operating machinery) has caused these emerging economies to begin producing agricultural commodities in greater amounts than at any previous point in history. The causal loop diagram (CLD) in Figure 6 illustrates these dynamics, and how the decline in production costs, coupled with an increase in production resources is driving the global commodity price down:
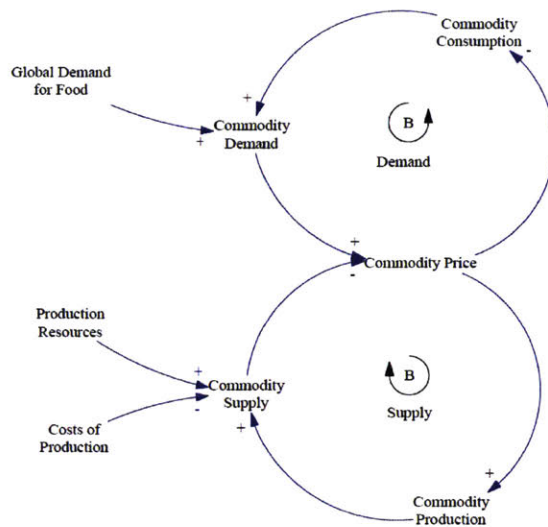
Figure 6 – Global Commodity Price Causal Loop Diagram

Overall yields have improved worldwide as these advances in production capabilities improved, meaning that more crops can be grown on the same amount of land than had been produced in previous years (Fugile & Wang, 2013). In Nebraska, this trend can be seen from data collected from the USDA ("USDA/NASS QuickStats Ad-hoc Query Tool," n.d.) regarding the state's overall increase in corn yields from 1960 to 2016 (this is the state's overall average, including both dryland and irrigated acres), shown in Figure 7:
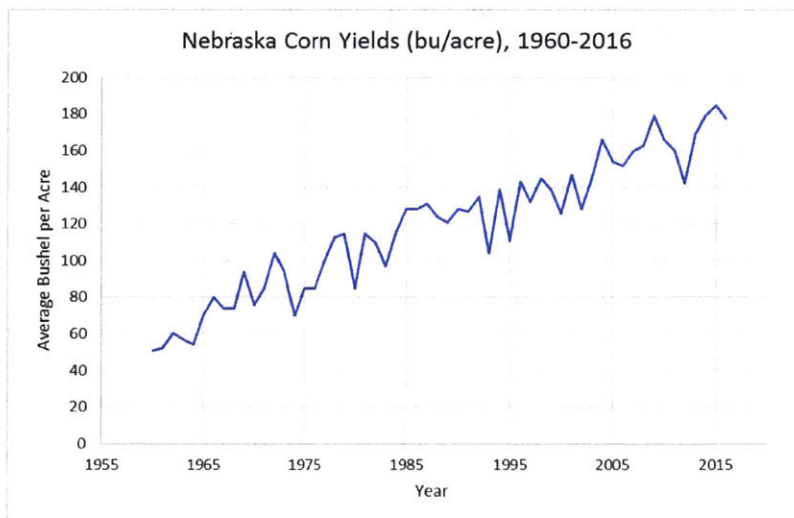
Figure 7 - Nebraska Corn Yields, 1960-2016

Data Source: quickstats.nass.usda.gov

Even though fluctuations in average corn yields exist, the overall trend shows increasing growth in crop yields, confirming the impact that improved technologies have had on crop production overall. As the global supply and demand for major crops has increased in recent years, there has been increased volatility for agricultural products. Farming has always been a "boom-and-bust enterprise", but these recent changes have made swings "sharper and less predictable now that the farm economy has become more international, with more countries growing food for export as well as for their own populations." American farmers' influence over the global grain trade "has fallen from 65% in the mid-1970s to 30% today, giving them less sway over prices", and "[m]ore producers and more buyers around the world also mean more potential disruptions from bad weather, famine or political crisis." This trend has happened relatively recently, and the volatility can be seen once again with corn, as "prices once varied year-to-year by less than $1 a bushel" but since the mid-2000s, "they have shot up and dropped more than $4 a bushel" (Newman & McGroarty, 2017). This trend can be seen with corn price data from 1950-2016, collected from the USDA ("USDA/NASS QuickStats Ad-hoc Query Tool," n.d.), as seen in Figure 8:
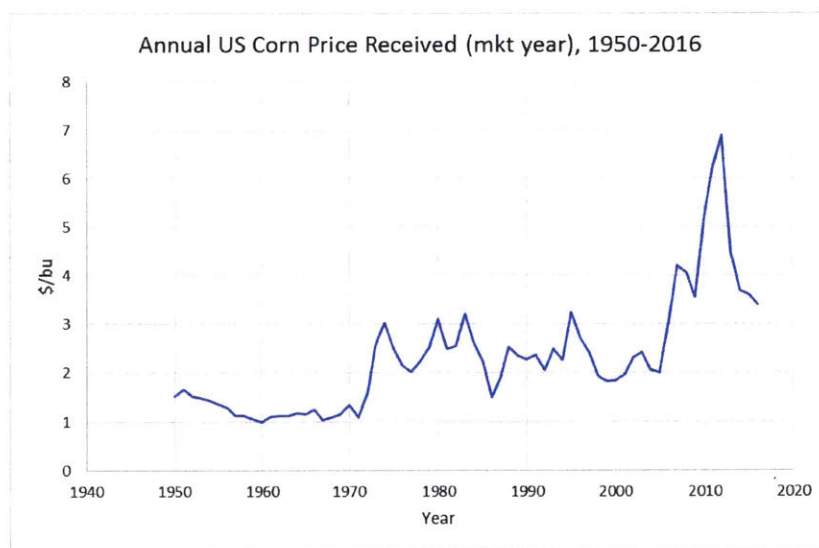
Figure 8 - Average US Corn Price, 1950-2016

Data Source: quickstats.nass.usda.gov

Farmers in Nebraska and throughout the United States continue to revolutionize the production of major crops, but the control over prices and supply once held by these farmers has eroded as more and more farmers worldwide adopt western farming practices for the purpose of feeding

their populations and growing their economies. These activities are surely necessary for continuing to feed the world's growing population and defending "against a recurring Malthusian crisis—where the needs of a growing population outstrip the ability of man and resources to supply food" (Fugile & Wang, 2013). However, as the global production of agricultural commodities continues to improve, farmers in Nebraska and across the United States will be more and more impacted by global fluctuations in supply and demand for their products.

3.2 – Impacts to Nebraska's Government

As the fall in agricultural commodity prices begins to impact the state's farmers and ranchers and ancillary non-production businesses, it has also started to have an impact on the state government itself, with Nebraska facing a multi-million dollar revenue shortfall by mid-2019. This section explores the impacts this problem is having on Nebraska's government and identifies the major policy mechanisms that may be used for combating the state's budget shortfall, along with their drawbacks.

3.2.1 – Nebraska's Budget Crisis

The State of Nebraska is facing an approximately $760 million budget shortfall to occur by the end of the fiscal year ending June 30th, 2019. This shortfall is down over $130 million from earlier this year, when the state faced a budget shortfall nearing $900 million by the end of the same period (Nohr, 2017b). Further, Nebraska State Senators have worked to outline a plan to reduce the overall budget shortfall to just under $300 million projected by the end of the budget period through expenditure reductions this year and proposed cuts in the future (Nohr, 2017d). Nebraska Governor Pete Ricketts has said that the impact of declining farm revenues is the driving force behind this shortfall, and the state government will need to lower spending, slow the growth of government, and relax regulatory burdens required for starting new business as a way to combat this issue (Curtin, 2017). This budget shortfall is occurring as the state projects expenditures to exceed revenues during the next two year budget period, largely due to the drop in agricultural commodities. Planned expenses are largely due to the expected spending of the budget under current operating conditions and normal budget growth. This funding goes to pay for many of the services the state of Nebraska provides to its citizens, and worries about the

ability to continue to operate without this funding have begun to increase. While this budget shortfall is worrisome, many in the Nebraska legislature believe the problem will be overcome without too many negative consequences. Nebraska State Senator John Stinner has stated that "Nebraska's overall conservatism has really put us in good shape to take this task on" and that finding a solution to this budget shortfall is "a doable deal" (Nohr, 2017a). Many in Nebraska's state legislature believe this budget shortfall can be solved through expenditure cuts alone, but others believe the end solution needs to be a mixture of expenditure cuts, fund transfers, and using money from Nebraska's almost $630 million cash reserve fund. There is a strong resistance to raising taxes by many. Others, however, argue that this problem will not be solved through expenditure cuts alone and tax increases are necessary (Nohr, 2017a). At present, the reduction of state expenditures seems to be the most palatable policy mechanism for state lawmakers to use for reducing the looming budget shortfall. Reducing the state's requirements for starting new businesses in the state is also another policy mechanism available to lawmakers, and must also be explored.

3.2.2 – Raising Taxes Policy Mechanism

As tax revenues fall due to the decline in global agricultural commodity prices, Nebraska faces reduced tax revenues as a result. One way to reduce the impact from falling agricultural commodity prices is through the increase in taxes. This dynamic can be seen in Figure 9:
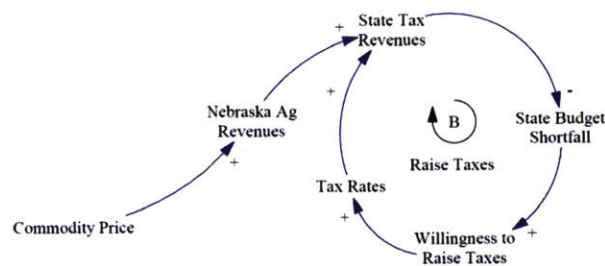
Figure 9 - Raise Taxes Causal Loop Diagram

Previous budget shortfalls faced by the state of Nebraska have come on the heels of economic recessions, unlike the current shortfall faced by the state due to falling agricultural commodity

prices. Nebraska legislatures in the past addressed budget shortfalls through a combination of expenditure cuts, fund transfers, and new revenues from targeted excise taxes on items like cigarettes and alcohol, increasing the sales tax rate, and expanding the sales tax to more and more items and services. The most recent cuts came during the shortfall caused by the Great Recession, and impacted funding for K-12 education, corrections, and other state services. These cuts have not been rolled back since the last budget shortfall, and cannot be made again to help close the budget gap (Brown, 2017). Some have argued that these spending cuts, as well as recent tax credits and bills aimed at reducing the tax burden on many throughout the state of Nebraska have had a significant impact on the state's revenue collecting abilities. One Nebraska State Senator has introduced legislation hoping to repeal these bills.

Nebraska Legislative Bill 373 (2017), introduced by State Senator Paul Schumacher of Nebraska's 22nd district, aims to repeal an array of revenue bills passed since 2005, and is intended to restore revenue collecting power of the state. While some of these exemptions might seem trivial, the bill would repeal a number of tax cuts and exemptions that directly impact Nebraska's farmers and ranchers, those being hit hardest by the decline in agricultural commodity prices. The most notable impacts to farmers and ranchers include repealing Legislative Bill 968 (2006), which would return taxable agricultural and horticultural land valuations to 80% of market value from its current percentage of 75%, repealing Legislative Bill 96 (2014), which provides a sales tax exemption on repair and replacement parts for agricultural machinery, and repealing Legislative Bill 968 (2006) and Legislative Bill 367 (2007), which expanded the sales tax exemptions on contracted labor in Nebraska ("Legislative Bill 373," 2017). While this bill would repeal a number of other revenue reducing bills if passed, these three in particular impact Nebraska's farmers and ranchers directly. If passed, this bill might increase revenues in the short term, but given current economic conditions for farmers and ranchers, it would almost assuredly have a negative impact on the state's agricultural production, as any more costs added onto farmers and ranchers in the midst of this downturn would reduce the already limited budgets of the state's agricultural producers, causing further production problems and likely expediting farm quits across the state. It would also provide a disincentive for producers in the state overall, likely impacting the state's ability to generate revenues. Further, Nebraska's Governor has stated Nebraska will not seek to increase revenues by raising taxes, citing a Bloomberg report labeling Nebraska a "high tax state", coming in at number 16

out of 50 in income taxes, and a USA Today article labeling Nebraska the 5th highest in property taxes (which are not levied by the state, however) (Curtin, 2017). While the current sentiment in the state for raising taxes is low, due to the scope of the problem facing Nebraska, the ability of the state to raise taxes, either through rate increases, through the repeal of existing tax credits and exemptions, or applying taxes on new goods and services, is a policy mechanism that should be explored in order to determine its effectiveness at reducing the budget deficit over a long term period.

3.2.3 – Expenditure Reduction Policy Mechanism

Nebraska's State Senators are rightly concerned with the immediate problem of reducing the budget shortfall projected for the end of the upcoming budget period. In their attempt to reduce the shortfall, expenditure reductions have been the primary policy mechanism used for narrowing the budget gap. The effect of expenditure cuts can be seen in the causal loop diagram shown in Figure 10:
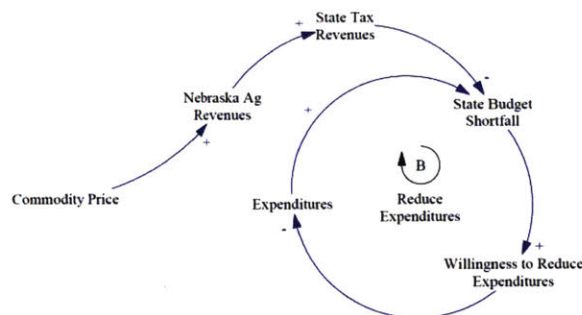
Figure 10 - Reduce Expenditures Causal Loop Diagram

However, the problem facing Nebraska is likely to be more long term than just one budget period. It seems that agricultural commodity prices could remain depressed for the foreseeable future before any recovery occurs (O'Donoghue, Hansen, & Stallings, 2017). Current plans in the Nebraska Legislature are focused on the current budget shortfall, but State Senator Stinner stated that "if [the gloomy agricultural economy] goes for another biennium, we're going to have to really adjust our thinking about what our priorities are" for the state's budget. After the budget period ending in 2019, the following budget period ending in 2021 is projected to see a budget

shortfall of $1.2 billion, assuming the state's budget grows at a rate of 4% annually during the next 4 years. Nebraska Governor Pete Ricketts has been able to reduce expenditure growth down to 3.7% annually, and is pushing for future spending growth to be reduced to at least 3% and maybe lower, which would reduce this figure (Nohr, 2017a). Thus far, Governor Ricketts has even been able to reduce the growth in government spending from an average annual rate of 6.5% down to 1.7% in his first full year in office. Governor Ricketts stated that "[b]y aiming for 1.7 percent, you can see that we are tightening our belts, just like our farming and ranching families are having to do. They see their income go down. They're tightening their belts. They expect us to do the same" in government (Curtin, 2017). Although the reduction in expenditure growth will help to curb the budget shortfall problem, it is likely that even this decrease in spending will result in future budget shortfalls should agricultural commodity prices remain depressed for any greater length of time in the future and these cuts are not permanent. In fact, some are even estimating the budget shortfall to widen during the upcoming budget period by as much as $200 million (Nohr, 2017b). Keeping the impacts of budget cuts and any potential tax increases on Nebraska's citizens in mind is key as lawmakers work to solve the problems facing the state. Further, if the state cuts spending too much, there will likely be major negative impacts to existing services for Nebraskans.

Current cuts to Nebraska's expenditures over the budget period have included primarily across the board cuts to most government agencies, with exceptions to a few key agencies. The most recent bill passed by the Nebraska Unicameral and signed into law by Nebraska Governor Pete Ricketts, Legislative Bill 22 (2017), helps to narrow the budget shortfall by approximately $137 million through expenditure cuts and the reclamation of unspent dollars during the current budget period that ends on June 30th, 2017 (Nohr, 2017b). Although expenditure cuts are necessary as a way to reduce the state's looming budget shortfall, the cuts have already stirred up backlash across the state. Among the most notable conflicts of the state's proposed budget cuts involves the Department of Health and Human Services. Not only do many citizens argue that cuts to the HHS budget would create major issues, but the Nebraska Unicameral and Governor are in disagreement over agency cuts. Nebraska's Governor is proposing a $31.5 million budget cut for the fiscal year beginning July 1st, and a $9.8 million cut the following year, while the Nebraska Unicameral is proposing an increase of $4 million for the fiscal year beginning July 1st, and a $29.5 million increase the following year. The Governor and Unicameral are also in

disagreement in rate cuts to providers for child welfare and disabilities (Nohr, 2017c). Nebraska's subsidy program serves approximately 30,000 children statewide, and State Senator Sara Howard and other senators argue that the state should not seek to balance the budget by defunding support for children (Stoddard, 2017). For many, it seems, a real life "taking candy from a baby" situation is playing out over Nebraska's budget woes. While unpopular, the problem is real and cuts may occur out of necessity. State Senator Mark Kolterman reminded constituents that these aren't cuts directed solely at one state agency, stating "[w]e're asking everybody to take cuts". State Senator and Appropriations Committee Chairman John Stinner recently stated that "[w]e just don't have any more money" (Stoddard, 2017). Other impacts are being felt by Nebraska's judicial branch, as the legislature looks to re-appropriate money from the state's "attorney services fund", used to help fund some of the activities of Nebraska's Supreme Court and judicial branch. Arguments have developed regarding the legality of this re-appropriation, with many stakeholders of the judicial branch claiming the legislative branch is over-reaching their authority by taking this money, which contains no funds provided by taxpayers (Duggan, 2017). The University of Nebraska is also facing cuts to its budget due to the looming state budget shortfall, and is unsure of its ability to maintain affordable tuition rates for its students as a result. University of Nebraska President Hank Bounds stated that the cuts the university will have to make, which may likely be more than $50 million over the next two years, "will not be short term reductions" (Ruggles, 2017). These are just a few examples of the pushback caused by expenditure cuts proposed and already undertaken by the state of Nebraska. Despite the current backlash facing Nebraska's legislators, reducing the state's expenditures in order to manage its budget is necessary. While some cuts might be unpopular, cutting back on expenses will likely have the biggest short term impact in reducing the state's budget shortfall, and may result in cutting some areas of government spending that may not be needed. This policy mechanism's effectiveness and ability to reduce the budget shortfall relatively quickly need to be explored.

3.2.4 – Economic Growth Policy Option

Although not discussed near as often as expenditure reductions or tax increases, Nebraska has another policy option that might be used for spurring long term economic growth for the

state. This mechanism, mentioned by Governor Ricketts, is the ability to relax regulatory burdens on new ventures as a way to attract more businesses to the state and thereby generate more revenues. This might also include the state's willingness to attract large-scale businesses to the state by reducing the regulatory "red tape", such as licensing regulations, often involved in starting up large operations, and reducing the levels of bureaucracy that businesses must engage with prior to starting. This policy mechanism might even involve tax burden reductions on new large-scale operations when first starting out as a way to attract these businesses to the state. Some examples of this type of regulatory red tape that businesses must currently stumble through in order to start operating in Nebraska include a requirement for hundreds of more hours of training prior to becoming licensed in the state for operating a barber shop, massage therapy service, and other service type businesses. Nebraska currently requires over 25% of the state's workers to have some sort of an occupational license, which poses a very high barrier to entry for many workers and businesses when compared to other surrounding states, most notably the states of Iowa and Missouri (Curtin, 2017).

In the agricultural sector of Nebraska's economy, this type of policy mechanism might also be useful for generating economic growth. As discussed in a previous chapter, Nebraska has recently been dealing with these red tape issues in the agricultural sector with regards to a Costco chicken processing plant near Fremont, Nebraska. Announced in the spring of 2016, Costco planned on opening a chicken processing plant in eastern Nebraska, designated a "preferred site" by the company, as a way to gain greater control over the company's supply chain and to take advantage of Nebraska's quality workforce, available land, partnerships with farmers that raise chickens, and closeness to suppliers (Layne & Hirtzer, 2016). While this operation has an expected annual revenue windfall in the state of approximately $1.3 billion, resistance to the operation and bureaucratic red tape have slowed the construction of the facility (Cadotte, 2016). The first plant location at a town near Fremont was rejected due to lack of zoning and incentive approval in April 2016. The current zoning situation in Fremont caused delays in the project start for a number of reasons, including concerns over the environment and over an expected influx of immigrant labor (Dayton, 2016). Lawsuits over the construction of the plant were soon filed to stop the project from continuing, and a lengthy debate began over the plant's construction. While lawsuits continued, Costco also sought to increase the size of its plant, which prompted lawmakers in and around Fremont to approve the larger operation and annexation of more land.

By the end of 2016, the plant finally gained official approval for expansion and operation ("Council unanimously votes to expand Costco Poultry Complex," 2016).

Concerns over negative impacts to the state are valid and must be considered, but operations such as the Costco chicken processing facility are largely beneficial for Nebraska, as the state's "golden triangle" provides an ideal location for plants like the one being built near Fremont. Nebraska should work to attract businesses to build facilities such as these in the state, and work with local and municipal governments to alleviate concerns and expedite operations in order to increase the economic strength of the state, specifically in its agricultural sector. While this type of policy mechanism is likely the most difficult to pursue, as businesses are not often available for capital investments and Nebraska's citizens and local governments are not always willing to allow major operations to occur near their municipalities, these operations help to grow Nebraska's agricultural production complex and decrease the state's reliance on agricultural production operations for revenue. As agricultural commodity prices fall, adding more operations such as the Costco chicken production facility in the state helps to buoy the state's revenue collection capability, and also provides farmers and ranchers with more opportunities to sell crops and livestock in the state. This policy mechanism should be explored as a means to reduce the state's budget shortfall long term.

3.3 – Impacts to Nebraska's Farmers and Ranchers

3.3.1 – Impacts to Farmers Facing New Dynamics in Agricultural Production

Nebraska's farmers are facing a dynamic situation that has increased the volatility of their industry unlike any previous occurrence before. Global gluts in commodity supplies, leading to lower commodity prices, have occurred in the past (most notably during the 1980's); however, there has always been a balancing effect that occurred for farmers within a few years. The volatility in these previous situations had been relatively short-lived. The current situation faced by farmers is unique in that it is unclear when, or more likely if, the increased volatility in agricultural commodity production and consumption (and thus, price) will return to a "pre-mid 2000's" state.

Farmers in Nebraska have begun to feel the impacts of the recent drop in agricultural commodity prices, but have not yet been impacted at the same levels as farmers were in the 1980's. Despite this, there have been many difficult decisions made by Nebraska's farmers, and adverse effects have already impacted farming and ranching operations throughout the state. Since 2013, Nebraska farmers have been struggling to break even on their farming operations as commodity prices fall. As this has occurred, farm debt has begun to creep up on many operations with farmers struggling to pay off their loans, and land values have recently started to decline after years of growth (Gerlock, 2017). Nebraska's average farm valuation fell 10% in early 2017, meaning the value of overall farm land is worth less than in previous years. The impact of this drop in land valuations is due directly to the drop in agricultural commodity prices, as well as concerns over the impact that high valuations have on property tax collections at county levels (Bergin, 2017b). As discussed later in this chapter, this will have an impact on school funding.

As Nebraska's farmers and ranchers look to weather the depressed agricultural economy, it is important that funds, such as operating loans, are available to producers in order to pay for expenses for the upcoming production season. However, the number of new loans issued to farmers during the 4th quarter of 2016 dropped 40% from the previous year, according to the Federal Reserve Bank of Kansas City. This drop is likely caused by the decline in production inputs, such as fuel, feed, and cash rents, but is still alarming (Bergin, 2017a). Should this trend continue, farmers may not have access to capital needed to continue operations, or may be subject to higher interest rates than in previous years. There has not yet been a significant number of delinquent payments seen in the agricultural sector (Bergin, 2017a). However, should commodity prices stay low for the foreseeable future, delinquencies are likely to rise. For some farmers in Nebraska, this has already started to occur. One young farmer (25 years old) from western Nebraska began his own operation, farming corn, alfalfa, and beans, shortly after the peak of agricultural prices in 2013. After investing nearly $100,000 in necessary equipment and supplies, some of which was approaching 30 years old, the young farmer began his own operation just as commodity prices began their drastic fall. In just a few years' time, the farmer was told he no longer qualified for credit, meaning he would not be receiving necessary funds to continue his farming operation, even after having planted that years' crops. While the farmer was able to save his land, he had to find another job in order to pay bills and support his family (Gerlock, 2017). For many farmers, especially young farmers just starting out, the impact of low

agricultural commodity prices are likely to create similar situations across the state should prices stay low into the mid and long term.

With the continued fall of agricultural commodity prices, farmers and ranchers across Nebraska have been forced to cut expenditures and spend as little as possible while still managing multi-million dollar operations. This trend is likely to continue as farmers' incomes are expected to drop approximately 9% in 2017, making the current situation the biggest drop seen in agriculture since the Great Depression (Newman & McGroarty, 2017). Farmers continue to cut expenses wherever possible, but this is often not enough to make ends meet for many families. In nearby Kansas, farmers work side jobs just to stay solvent. As reported in the Wall Street Journal, one farmer in Kansas stated "[n]o one just grain farms anymore", and that "[h]aving a side job seems like the only way to make it work" (Newman & McGroarty, 2017). Indeed, many farmers work side jobs in order to bring in additional revenue to keep their families above water.

Farmers in Nebraska, and indeed across the United States, are beginning to feel negative impacts due to the multi-year drop in agricultural commodity prices. As these prices become more volatile, it will become more and more important for farmers and ranchers to be able to adapt to changing conditions in the future, even during multiyear upswings in agricultural commodity prices. The ways farmers and other stakeholders throughout Nebraska are being impacted by falling commodity prices are similar but unique, and more on this topic will be discussed in a later chapter. However, farmers and ranchers in the state will all be impacted in some way by how the state of Nebraska responds in dealing with the budget shortfall. As the state's agricultural producers, how Nebraska's farmers and ranchers are impacted, and the strain this puts on their operations is key to how the state fares long term.

3.4 – Other Impacts to the State of Nebraska

3.4.1 – State School Funding

The drop in land valuations will certainly help farmers reduce their property tax burden, but will have consequences for other areas, especially at the county level. As land values fall, less money will be paid out to counties on property taxes throughout the state of Nebraska,

impacting the ability of counties to maintain services for citizens, especially for schools. Nebraska's public schools are funded from a combination of state and local funds, collected primarily through property taxes. The formula that determines this combination, established as part of the Tax Equity and Educational Opportunities Support Act passed in 1990, commonly referred to as TEEOSA (commonly pronounced as "TEE-OH-SA"), established "the principle of 'Equalization Aid' paid by the state to individual school districts." The bill is meant to help make up costs for educating students that local school districts in Nebraska might not be able to afford. The bill has been changed and expanded many times since its inception in 1990, and is incredibly complex. It contains more than 26,000 words and is more than 50 pages long, with dozens of components that need to be included into the overall calculation of state aid to a particular school district (Kuehn, 2016). For rural communities, the biggest impact that TEEOSA has had involves how the agricultural land value factor of the TEEOSA state aid formulation has impacted local communities. Due to the regularly increasing rate of agricultural land values over the last decade, the TEEOSA formula regularly determines that the local district's ability to fund its schools are greater than their needs, and thus little to no state funds had been provided to many rural school districts (Kuehn, 2016). The formula is set up to mean that high agricultural property valuations falsely indicate high levels of wealth for a school district, which means that the burden to fund schools in rural areas is increasingly placed on farmers and ranchers, many of whom may not have children attending local schools, and whose wealth is not liquid, but rather real property that cannot be split up easily. Thus, the money owed to counties to be used for school funding must come from the property taxes paid by farmers, further adding to their costs.

Nebraska's property tax valuations are not based on an income earning potential, but rather is valued on its current use as dictated by comparing with similar properties and assessed based on the type of property it is (such as the difference between dryland and irrigated land, the soil content, etc.). Further, land valuations are often assessed earlier than the actual value of the land might be, meaning farmers and ranchers would be required to pay property taxes on land that is no longer worth what it was once assessed at, especially as commodity prices fall (Patent & Seacrest, 2015). The way Nebraska values its agricultural land differs from surrounding states. In neighboring Iowa, for instance, agricultural land is valued at 100% of its "productivity and net earning capacity value" every two years, and income is assessed with "production, prices, expenses, and various local conditions" taken into account ("Iowa Property Tax Overview | Iowa

Department of Revenue," 2017). This property assessment technique takes into consideration the production and income generating capabilities of a particular piece of property rather than assessing property on potentially outdated market conditions, as in Nebraska. While the way Nebraska values its agricultural land would certainly help, an even bigger problem faces Nebraska's farmers, counties, school districts, and state government. As commodity prices drop, land valuations have begun to follow, meaning the property valuation factor in the TEEOSA formula may require the state to provide funds for more school districts as rural areas lose value on their properties that once reduced the state's share of public school funding. Further, with the state of Nebraska already facing a significant budget shortfall, this additional funding responsibility may potentially increase Nebraska's budget woes in the future. What might ultimately occur is that the fiscal condition of the state determines the amount of money that can go to school districts, and thus the state school aid formula is adjusted to reflect the situation. This occurred in 2009, as the formula was adjusted to reduce the growth of state aid to school districts (Gottlob, 2010). Should this occur, it places an increased burden on local school districts to cut expenditures or school programs to remain solvent. The effect that falling commodity prices continue to have on the state of Nebraska's economy will directly impact the way that school districts are funded, should no changes to the structure of school funding occur. Thus, policy mechanisms designed to promote healthy state revenues are critical in maintaining adequate funds for school districts.

3.4.2 – The Rural/Urban Gap

As seen in the previous chapter, Nebraska's average farm size has continued to increase since the early 20th century while the total number of farms in operation in the state has fallen. This has meant that an increasing number of people have left rural, agricultural regions in the state and moved to urban areas. While farm and ranch operations can now produce on many more acres while requiring less people due to advances in technology, this loss of population from rural to urban areas has its own consequences. As populations shift from rural areas to urban ones, the priorities of individuals from rural and urban areas become more and more distinct from one another. In rural areas, national level issues for residents "are seen as magnified versions of personal considerations: Does the country have enough food, fuel and minerals? Can

America defend itself, protect its friends and punish its enemies?" However, rural residents' concerns "differ markedly from the urbanite's [worries]" of issues like government services and relationships between people of different backgrounds and beliefs (Hanson, 2015). Thus, hot button issues such as "deficit spending, defense... gun control, abortion – break along rural or urban lines" (Hanson, 2015). While these differences in viewpoint touch on political issues, political issues often reflect one's own view of daily life.

As more and more people shift from rural areas to urban areas in Nebraska, one might logically expect more policy and decision makers of the state to come from metropolitan areas. The policy makers from urban areas have different priorities and ways of viewing the world than do those from more rural areas. These differences can cause friction between populations. According to Victor Davis Hanson, "[t]hese differences [between rural and urban populations] wouldn't matter so much if it weren't for the fact that the nation's urbanites increasingly govern those living in the hinterlands, even as vanishing rural Americans still feed and fuel the nation" (Hanson, 2015). Indeed, a shift towards urban priorities would likely bring increased animosity between rural and urban areas, especially when laws and policies are enacted by urban lawmakers to the detriment of those from rural areas. It seems important, then, for the state's policymakers, both now and in the future, to keep in front of mind the critical role that Nebraska's agricultural producers play in enabling the other sectors of the state's economy to function, and to create policies that don't overly favor urban populations over rural ones (and vice-versa). America's founders discussed the importance of an interdependent relationship between rural and urban areas in the country as key for the country's long term success as a democracy. Thomas Jefferson stated, "I think our governments will remain virtuous for many centuries; as long as they are chiefly agricultural; and this will be as long as there shall be vacant lands in any part of America. When they get piled upon one another in large cities, as in Europe, they will become corrupt as in Europe" (Hanson, 2015). As the shift to urban areas and away from rural areas continues, this relationship will continue to erode. Should the rural/urban gap continue to grow and policy makers favor urban priorities over rural ones, it will likely impact the ability of the state to govern itself effectively and erode the bonds between fellow Nebraskans.

According to a study conducted by researchers at the University of Nebraska – Omaha in 2013, the major impacts of this "rural/urban gap" are most seen in population shifts, age of

populations in rural and urban areas, diversity between these areas, and gaps in education. Population shifts from rural to urban areas, as can be seen from the shrinking number of farms in the state, have been occurring in Nebraska for some time. The study indicates that nearly two-thirds of Nebraska's population live in metropolitan areas. The report also indicates that the average age of persons living in rural areas is higher than in urban areas. Nebraska's median age, 36.2, is younger than the national average. However, when comparing the difference in population between rural and urban areas, a stark contrast exists, as Nebraska's metropolitan areas have a median age of 33.6, whereas its non-metropolitan areas jump to 40.5. This gap of almost 7 years is nearly twice the national average. The study indicates that a gap in population diversity exists between Nebraska's three most populous metropolitan areas and its 51 most rural counties. Finally, the percentage of Nebraskans in metropolitan areas with a bachelor's degree is 34%, whereas in non-metropolitan areas this drops to 19%, a gap of 15 percentage points. This gap represents the highest gap for all the plains states ("Study Unveils Urban-Rural Split in Nebraska," 2013).

Taken at face value, these metrics represent a troubling trend. Since much of Nebraska's economy is driven by agriculture, the long term trends of Nebraska's population shifting away from this industry, despite Nebraska's vast resources for supporting agriculture, are alarming. Should Nebraska's rural populations continue to decline either through people moving to more metropolitan areas or through existing populations dying or no longer being able to farm, much of Nebraska's agricultural knowledge, and heritage, will be lost. This will surely have negative consequences for Nebraska's economy as a whole. The agricultural sector enables the rest of the state's, and indeed the country's, other economic sectors to function. Should Nebraskans lose their heritage for agriculture and that sector of the state's economy falters, less production will occur in this state and in the United States overall. Long term, this could mean that, despite the natural resources and infrastructure in the state that enable agricultural production to occur, should the rural/urban gap continue to increase and the state's population continue to shift away from rural areas, Nebraska and the country as a whole might become increasing importers of agricultural products rather than world leaders in the industry. Despite the alarmist tone, this scenario would not likely occur for decades, but is one that should at least be thought about for Nebraska's long term economic health. The rural/urban gap will be discussed more in a future chapter.

Maintaining the balance between rural and urban influence in the state of Nebraska is important for economic, political, and cultural reasons. Both rural and urban regions play critical roles in maintaining the unique character of the state of Nebraska, and as one diminishes, so too does the state. Policymakers in the state must be mindful of the interdependent relationship between the rural and urban components of the state and be careful not to overly favor one over the other, or risk increasing the rural/urban gap. Generating policies that promote the general well-being of all Nebraskans while remaining cognizant of the impacts of policy mechanisms on constituents is key. While not every solution to a problem is easy, it remains an important responsibility of Nebraska's lawmakers, both now and in the future.

3.5 – Conclusion

The impacts that falling agricultural commodity prices are having on the state of Nebraska are broad and affect the state in a varied, multi-dimensional way. While the primary issue is economic in nature, the impact this plays trickles down to other areas, including the political/regulatory and cultural domains. Finding ways to maintain a healthy state economy that promotes the well-being of both rural and urban areas within the state is vital to policymakers and for the long term health of the state. Nebraska is blessed with an abundance of resources for maintaining strong rural areas with an agricultural focus, as well as urban areas that help drive other sectors of the state's economy. However, in order to gain a better understanding of the problems facing Nebraskans caused by falling agricultural commodity prices, it is important to explore these impacts firsthand. The following chapter is an analysis on the anecdotal evidence collected on the problem facing the state of Nebraska, and helps to reinforce and shed light on many of the concepts discussed already.

Chapter 4 – Anecdotal Analysis of the Impacts on Nebraska

4.1 – Introduction

The impacts of falling agricultural commodity prices are being felt in many areas across the state of Nebraska. Although the data collected and research conducted helps to provide a picture of what is happening in the state, talking with key stakeholders is important to gain a better understanding of these impacts. Further, interviews with stakeholders is part of the "Standard Process" for building system dynamics models. Interviews with key stakeholders from across the state took place between January and April 2017, and subjects all provided a unique perspective on the problem. These interviews helped guide the development of the problem definition and provide clarity and focus for the modeling portion of this analysis. In conducting these interviews, a number of key variables were identified as important to the creating of the dynamic hypothesis and development of the system dynamics model created. Some of the material mentioned by stakeholders had already been uncovered during research. However, the personal impacts that are being felt by these stakeholders are important to identify, and confirm much of the prior research outlined in earlier chapters.

Stakeholders identified their hopes and fears for the current problem facing the state, and reference modes were generated based on these hopes and fears. Also, momentum policies were identified and later explored, and "success" was defined by a number of stakeholders, as well. While the interviews conducted included a great mixture of stakeholders from across Nebraska, no stakeholders from the CURRENT Nebraska Legislature were available for interviews, as the state legislature's governing session coincided with the interview period. However, a Senator who recently left office in January after reaching term limits was interviewed. Additional information gathered on the Nebraska legislature's views on the topic came from news articles and editorials written by senators themselves. This chapter focuses primarily on the stakeholder analysis conducted, and the anecdotal analysis received from stakeholders during interviews. Overall, the anecdotal evidence gathered during the interview process provided a wealth of knowledge that would not have been gained without discussing the impacts of agricultural commodity price volatility on the state of Nebraska with those stakeholders that are impacted by it on a daily basis.

4.1.1 – Stakeholder Analysis and Interviewee Background

In order to identify the interviews to conduct, a stakeholder analysis was conducted outlining the needs of major stakeholders and a stakeholder map produced showing the key interactions and relationships between stakeholders impacted by the state's revenue shortfall due to falling agricultural commodity prices. The stakeholder map can be seen in Figure 11:
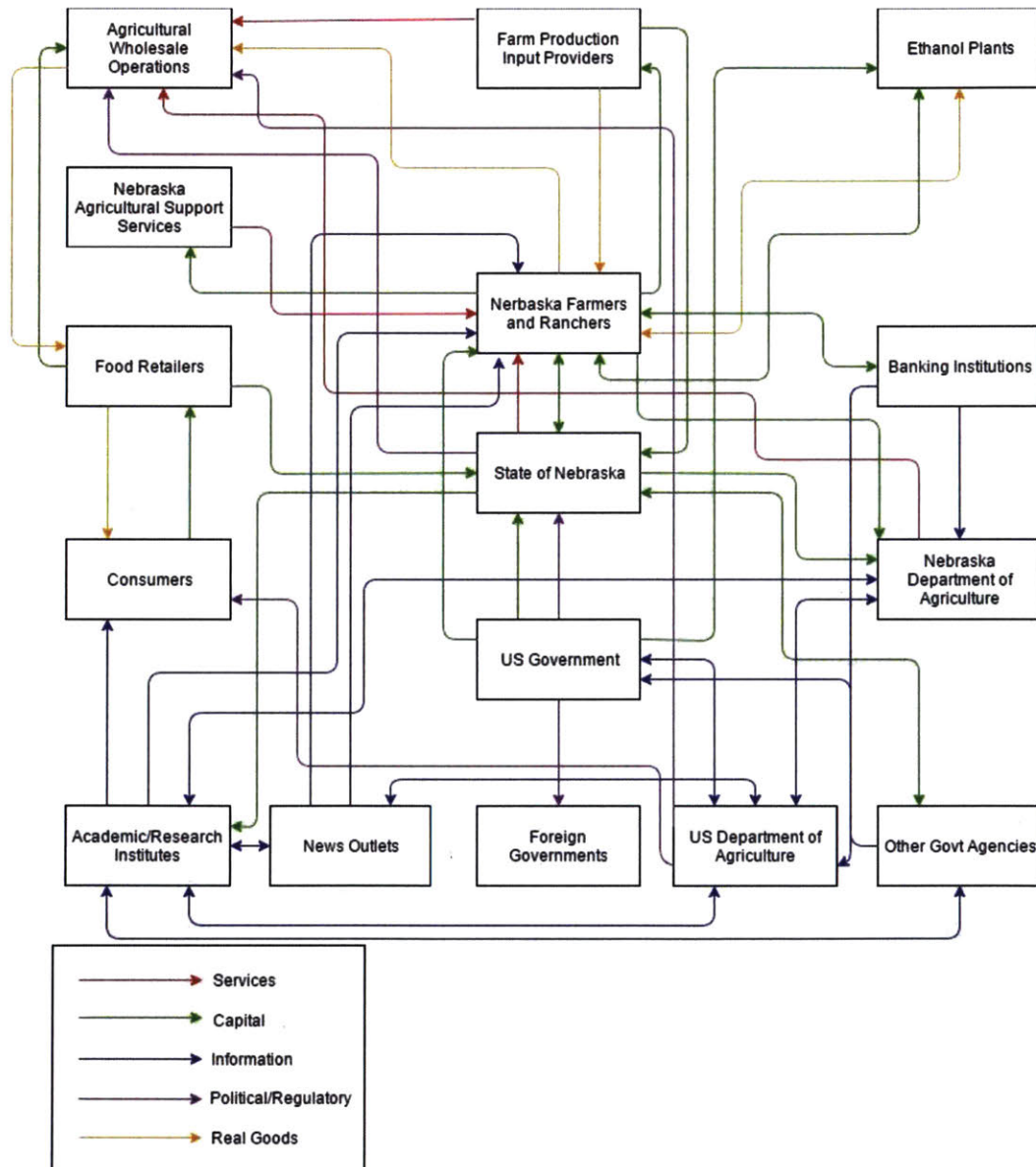
Figure 11 - Stakeholder Analysis Map

Although not comprehensive, the diagram outlines major interactions and types of flows between stakeholders regarding this problem. This stakeholder analysis helped to guide interview candidates and research on the subject.

The interviews conducted offered unique insights into the problems facing the state of Nebraska and revealed the key issues on the forefront of the minds of the interviewees. These perspectives helped to provide a broad lens from which to view the impacts that falling agricultural commodity prices are having on the state, and help to "tell the story" from all sides. Also, these interviews provided specific data and striking revelations regarding the nature of the problem. Table 1 shows the background and experiences of the interviewees:

Table 1 - Interviewee Background

Name	Title	Business	Area of Focus
Alex Straatmann	Counsel for Constituent Services	United States Congress	Government (Federal)
Johnathan Hladik	Policy Program Director	Center for Rural Affairs	Research (think tank)
Dr. Ernest Goss	MacAllister Chair and Professor of Economics	Creighton University	Academia (university)
John Hansen	President	Nebraska Farmer's Union	Advocacy (union)
Jay Rempe	Senior Economist	Nebraska Farm Bureau	Advocacy
Dr. Bruce Johnson	Professor (retired) of Agricultural Economics	University of Nebraska - Lincoln	Academia (university)
Montgomery Escue	Freelancer	Commodities	Ag Relations/Oil and Gas
Steve Rome	Owner/Operator	Farming (located in Kansas)	Ag Production
Dr. Ed Kanne	Retired	Retired	Academia
Don Dugan	Owner/Operator	Farming	Ag Production

		Greeley First National Bank	Banking
Mike McQuillan	Branch Manager		
Denny Stromp	Owner/Operator	Farming	Ag Production
John Nordhues	Owner/Operator	Farming	Ag Production
Mike Stillmock	Former Sales / Use / Corporate Auditor	Nebraska Department of Revenue	Government (State)
Kathleen Sullivan	Former Nebraska State Senator, District 41	Nebraska Unicameral	Government (State)

Interviewees were gracious enough to provide their time in order to explain their personal perspectives on the problems facing Nebraska. The author is personally grateful to all interviewees who took time out to assist with this project and share their experiences regarding the impacts that agricultural commodity price fluctuations are having on them and others.

4.2 – Identifying the Problem

"A third of the state's budget goes to Medicaid, a third of the state's budget goes to education, and a third of the state's budget goes to general day to day operations. We had tax revenues around $7 billion in 2010, and we're down to around $4.5 billion in 2016 because of falling ag prices." - (Straatmann, 2017)

"Ag prices are only part of the story. Bills passed by the legislature for tax reductions are impacting the ability to collect revenue. There's less money coming in now." - (Hladik, 2017)

"As the saying goes, 'If your neighbor lost his job it was a recession; if you lost your job, it's a depression.'" - (J. Hansen, 2017)

The problem of agricultural commodity price volatility and its impact on the state was selected after consultation with Alex Straatmann, a peer and colleague of the author. His experience working with the United States Congress for a Congressional Representative from

Nebraska's Third Legislative district (which largely represents rural constituents of the state) provided him with a unique insight into the biggest problems facing the state. While not working directly with policymakers at the state level, constituents of the third district had been feeling the impacts of falling commodity prices for more than two years. His forethought helped guide the author towards a topic worth exploring using a systems approach.

Interviews with stakeholders indicated that the impacts that falling agricultural commodity prices are having on the state are not insignificant, and are largely driving the revenue problems in the state. Among all stakeholders consulted, not one disputed this fact, and all recognized the immediate problems this has been causing the state and its citizens. The degree to which agricultural commodity prices are causing revenue problems for the state government, however, is a matter of debate among some stakeholders. One stakeholder stated that Nebraska's Unicameral has passed bills authorizing tax breaks for constituents over the last ten years that are just now starting to come into effect, meaning less money is coming in to the state. This, along with the drop in agricultural commodity prices, are causing the revenue issues for Nebraska. In nearby Kansas, this has caused major headaches for stakeholders. As a matter of perspective, one agricultural producer was interviewed in order to understand the impacts that falling commodity prices have been having in other states. According to this person, Kansas' shortfall has been more pronounced as the state has recently eliminated the income tax as a means for spurring economic growth. This occurred around the same time as the fall in commodity prices, leading to a severe budget impact on that state.

On the other hand, one interviewee voiced concerns over the current global economic environment for agricultural products as the primary driver of problems facing Nebraska, with state tax breaks having largely minimal impact. Three factors are primarily driving the drop in price for Nebraska's farmers: high yields leading to record supply worldwide, a strong U.S. dollar, and overall drop in demand from U.S. trade partners. The dollar's strength relative to many other countries that have, in recent years, begun to improve their farming practices has led to less demand from U.S. farmers. Further, countries have begun to impose restrictions on U.S. agricultural products that used Genetically Modified Organisms, or GMOs, in the name of "safety". In reality, these restrictions act as trade barriers for farmers in these countries so as not to compete with U.S. agricultural products. One farmer interviewed has moved completely away from GMOs and hormone treatments for cattle as a way to separate from other farmers in the

state and provide a niche market, while also producing higher quality products. The volatility of international markets has been noticed by interviewees, as well, as one commented on the substantial increase in price volatility around this time. The two positions discussed in interviews seem to mimic the general consensus among most of the interviewees: in short, global shifts in the agricultural markets have caused the primary problems being felt in Nebraska's agricultural industry is one feeling, whereas the other seems to be that the state has begun to increase its tax cuts as a way to spur growth, but it's not happening and is acting as a catalyst for the budget shortfall problems facing the state.

4.3 – Feedback on the Effects to the State and Population

"Farm income levels have dropped 50% from highs seen in 2013. That means less income taxes for the state, it means farmers begin pulling back on purchases, they stop buying equipment, and other parts of the economy begin to suffer" - (Rempe, 2017)

The impacts of falling agricultural commodity prices on the state of Nebraska have been varied and impactful. Producers, providers of production inputs to farmers, and main streets of small towns have been the first to feel the brunt of the downswing in commodity prices. However, the state's budget shortfall has begun to impact funding in other areas of the economy, and over time the impacts will become more pronounced. This section examines some of the feedback received on the impacts felt thus far by interviewees, and what might be expected moving forward.

4.3.1 – Comments from Agricultural Producers

"All we can do is try to keep costs down as much as possible" - (Dugan, 2017)

"There's no such thing as a dumb farmer. Nowadays they don't exist, and if they do they aren't in business long. Technology runs planting, finances... everything" - (Stromp, 2017)

The interviews conducted with agricultural producers, or farmers and ranchers, provided a wealth of knowledge. Interviews took place during the month of March 2017 on site in Nebraska, as well as via phone call. The on-site interviews provided a firsthand look at the agricultural production operations and the impacts being felt by farmers. As the impacts of volatile commodity prices have direct consequences on producers, these individuals are impacted more than any other stakeholder from price changes of agricultural commodities. They follow changes in price on an almost hourly basis. Further, the operations run by farmers are nothing short of extraordinary. These multi-million dollar operations include hundreds of head of livestock (such as cattle), all with their own specific requirements for feeding and care, machinery that costs hundreds of thousands of dollars to purchase and additional costs for operating and maintaining the equipment, an ever increasing understanding of technological advances in agricultural production, and a plethora of other requirements. The work done by these agricultural producers is a labor of love, and is by no means easy. While conducting interviews, nearly all farmers and ranchers spoken with had been getting minimal sleep, as interviews fell during calving season when new calves are born. This requires farmers to be up at all hours of the day and night to care for these new calves, document their births, and keep them warm during cold nights. Having experienced only a portion of the work required for being successful in farming, it is clear that this is not an easy industry to operate in and it takes a vast knowledge-set (not just in agriculture, but also finances, financial and commodity markets, etc.), physical stamina, forethought and planning, and many other skills to be successful. In fact, without years of experience and an intimate knowledge of what it takes to succeed in farming, a person would almost assuredly fail to make it in this industry.

Every agricultural producer is intimately aware of the landscape in which they operate, not just on a local or national level, but on a global level. The amount of knowledge shown in regards to international agricultural commodity markets in places like Europe and Brazil was apparent. As mentioned before, these producers check the markets for their commodities numerous times each day. If commodities can be sold during a brief upswing in prices, it likely means additional revenues for their operations. Other producers have pre-established contracts on their commodities even before crops or livestock have been grown/raised. This helps to alleviate concerns for price decreases in the short term, but also means that an upswing in prices cannot be capitalized on. Discussions with producers revealed a deep realization of market

conditions that have caused the current downswing in agricultural commodity prices. During the agricultural commodity price upswing from the late 2000's to 2013, agricultural producers had the ability to expand their operations, make new purchases on equipment, and pay down debt from previous years. Many did this as a way to reduce the burden on their income taxes. One farmer stated that in 2012, taxes that farmers would have to pay drove the purchases of new equipment, and that at one point farmers had to stand in line just to see a sales representative at many equipment stores. Now, however, there is almost no one buying new equipment because agricultural producers just can't afford it. Almost to a person, "over-production" was mentioned as a cause for falling prices. However, agricultural producers are not able to cut back on their production, as any drop in production means less income received. Each producer knew the impacts that improved farming practices in other countries had started to have on global prices. They also mentioned factors such as improved crop seeds and planting practices, targeted planting so that the best land for specific crops can be planted on, and other factors causing rises in production. While aware of these factors contributing to overproduction (and thus falling agricultural commodity prices), they have no options but to continue to produce as much as they can in order to capture as much income as possible. One concern mentioned regarded the length of the current downturn, and what might occur should the current situation remain as is. Interviewees referred to the 1980's as the last major example of a prolonged downturn in farming, and indicated the current downturn hasn't reached the level of the 1980's yet, but should prices remain low for the foreseeable future, it is likely that the situation will rival that period as far as the negative impacts on farmers go.

In order to offset the effects of low agricultural commodity prices, farmers and ranchers have in recent years started to cut costs of their operations as much as possible. This has meant that new purchases on equipment and production are not made or the equipment schedules followed in the past have increased in length (i.e., equipment trade-ins occurring on later model items rather than newer model items), or that producers have resorted to used equipment instead. Part of the problem for farmers and ranchers mentioned during these interviews is that, while prices on commodities have begun to fall drastically in recent years, production input prices have not begun to fall at the same rate (and in some cases haven't dropped at all) for farmers in Nebraska. This is especially the case in seeds for planting crops and cash-rents for producing on someone else's fields. In Nebraska, the fall in commodity prices have only recently begun to

impact agricultural land valuations in the state, meaning the rent on these fields is still very high due to the income taxes the owners are required to pay on them, while the income that can be earned on these lands is much lower than it was when the land valuations occurred. In most cases, farmers had produced on these lands for many years, and relationships with the land owners had been established in prior years. If farmers continue to farm on this land, they would owe high cash-rents to land owners or cause friction to relationships by asking for lower rents; if they forego farming on these lands, they might strain relationships or risk losing the land to another operation. Neither choice is easy or ideal, but producers are faced with these options nonetheless. Hiring additional labor is resisted as much as possible, meaning less people are able to work in rural communities. Land purchases by agricultural producers have begun to slow. Also, in some cases, agricultural production operations have started to "go under." In one farmer's situation, two agricultural producers next to him had begun the process of going out of business and liquidating their assets. He also stated that since the price peak in 2013, the equity lost had been over $2 million on his operation alone. Many agricultural producers are taking on additional jobs as a way to survive the current situation. This includes work as a farmhand, in a cooperative, or any other business in the rural community that might provide additional income. Some farmers and their family members have started to take on more than one extra job to make ends meet. Unfortunately for many families looking for extra work, as other agricultural producers cut back on their labor, it reduces the number of jobs available for a community. One particular example outlined dealt with fence installers; during boom years, not only did fence installers have a booming business, but the hardware used to put up new farm fences such as fence posts was in such high demand that agricultural producers had no option but to place it on back order when planning to install new fences. However, now that agricultural commodity prices have fallen, fence posts are no longer in demand and are just stored in semi-trailers waiting to be used. This only increases the pain points already felt in these communities, and causes the problem to worsen.

As agricultural producers in the state have begun to utilize a variety of new techniques as a way of keeping costs down while improving output. One farmer has begun a "niche" non-hormone injection operation with approximately 500 Black Angus cattle in Nebraska. Black Angus cattle are among some of the most desired cattle raised by agricultural producers and provide a sizeable portion of the "prime" cuts of beef in supermarkets and restaurants across the

world. Simply put, the demand for Black Angus is high. By producing these cattle without hormone injections, the agricultural producer has access to markets most other farmers in the state (and across the world) do not have access to. However, this comes at a cost, as the documentation required to prove that the cattle have been non-hormone injected since birth is staggering. A detailed record of each animal is required from birth to sale, and regular tests are done on "non-hormone added" cattle to ensure no animals have been exposed to hormones. This type of operation also increases the length of time it takes for cattle to grow; one of the benefits of hormone injections is that it increases the cattle's size in preparation for final feedings and slaughter. With non-hormone injected cattle, the length of time it takes to raise cattle to sale weight is often a few months longer than cattle with hormone injections, increasing the time it takes to bring in revenue on these animals. However, the extra effort tends to pay off in quality, as this producer's beef is 75% prime quality on average, and the top cattle produced have been identified as in the top 7% of all beef quality in the state of Nebraska. Because of the extra time and effort and the quality of beef, this producer generally receives higher prices for cattle than other producers in the state.

Other ways agricultural producers have tried to make ends meet is through increased use of farming services that offer information not often shared amongst producers. Although interviews revealed that farmers generally don't like to share detailed information on their operations, in recent years a number of services have begun to pop up which provide information on local prices for production inputs offered across various geographic areas, with the information freely offered by farmers themselves. In one case, a farmer who had begun using one service realized he had overspent on fertilizer by over 20% by not consulting this service. One service mentioned, the Farmer Business Network, is a subscription service that provides tailored information about farming input prices and other market information specific to its customers. Its popularity has grown in recent years, and the number of farmers utilizing it has helped to level the playing field for some producers. Aside from services like these, farmers have also begun turning to things such as leasing out land for the development of wind farms. One major complaint made for installing wind turbines is that it pollutes the landscape and takes away from the natural beauty of rural areas. Farmers have decided to store their grain rather than sell it now and wait for prices to rise. This is a risky proposition, however, and requires time and money to ensure the crops don't spoil. Other farmers have looked into switching up their crop

production and raising vegetables and other non-grain crops. One story shared, however, details a farmer known locally as "Pickle" Joe. "Pickle" Joe produced vegetables instead of the traditional crops grown in Nebraska as a way to distinguish himself from other farmers in the area. While the production of these crops turned out okay, the infrastructure for these crops in Nebraska was lacking, so "Pickle" Joe was forced to drive to the Denver area in order to sell these crops to a cannery there. After hauling his first load in a non-refrigerated truck for an entire day, the vegetables had gone bad, and the cucumbers had turned to pickles (thus how "Pickle" Joe got his nickname). "Pickle" Joe went out of business shortly thereafter. This story outlines risks for deviating from the norm for farmers, but also outlines a potential opportunity for farmers, as well as the state, as additional canneries for vegetables and comparable facilities could help to diversify the state's major crop production.

One fear many agricultural producers named regarded the ease of which young farmers can enter and remain in the agricultural production sector. This fear, outlined previously, was confirmed through interviews. To begin, the industry is difficult and requires a significant investment not only in money, but also time and energy. Farmers and ranchers work longer hours than most people in urban areas do. To a lot of people, this type of lifestyle just isn't attractive. Additionally, current conditions for starting farm operations are incredibly difficult. According to one farmer, there still remains "older money" in many rural areas that makes it difficult for young farmers to purchase land at a reasonable price. Banks have also increased the capital requirements for many young farmers before any money will be lended for a farming or ranching operation. Young farmers also generally need to start off with smaller operations, and since the scale of the operation is important for the overall productivity of the operation, smaller farms tend to be hit hardest during industry downturns, as is happening now. One farmer stated that the "custom farming, custom feeding" route might be a good option for these young farmers starting out, but that requires additional effort and costs. The sentiment that rural America needs farmers was generally shared, as well, but the ability to make a living as a farmer right now is difficult. This fact really bothered some of the interviewees.

The reliance on ethanol plants by Nebraska's farmers also came up in interviews. Farmers all stated that ethanol plants in the state provide the best price for corn of any market available to farmers. Farmers mentioned this was likely the case because of the subsidies being given to the ethanol plants for production. These plants take in so much corn on a weekly basis,

however, that they can often only receive corn shipments from farmers for a few days out of the week before they reach capacity. Although these plants reach capacity quickly, farmers have come to rely on these plants, especially during downswings in the agricultural sector. Said one farmer, "thank God for the ethanol plants right now" (Nordhues, 2017). Farmers touted the ethanol plants' ability to provide environmentally friendly fuel, along with distiller's grain as a by-product, but maintained a fear of the impact they have on the economy. One farmer mentioned the practice of some ethanol plants for selling distiller's grain to buyers in China as a way to get better prices locally, even though they already receive subsidies to operate. This seemed like a slap in the face to the farmers who provided the initial corn for those plants. The sentiment made clear that many farmers see ethanol plants as a "necessary evil" right now. Should ethanol plants begin to lose subsidies and shut down, it would leave farmers with even lower prices, and leave them without distiller's grain, the best feed for livestock and poultry. At present, however, there is a reliance on these plants by Nebraska farmers.

One final concern voiced by agricultural producers had to do with the impact that shifting U.S. trade policies might have on producers' ability to export their goods. Much of Nebraska's agricultural production stays in the state for use as feed or ethanol production, but Nebraska agricultural producers still export a significant portion. Should trade agreements such as NAFTA be ended, it would have a significant impact on Nebraska's farmers and their ability to ship goods to international markets. Some farmers remain wary of these agreements and stated in interviews that it seems like farmers still get the short end of these trade deals (a reluctance towards accepting the Trans-Pacific Partnership did get brought up). The impact that free trade has had for Nebraska's farmers cannot be understated, though, and to a person each farmer mentioned the devastating impact to Nebraska's economy if tariffs get imposed on their goods overseas.

4.3.2 – Comments on Government's Role

"As a country, we need to make sure we have a viable agricultural production sector. Look at history, production can change in a heartbeat. From a public policy perspective, we need to maintain a healthy farm economy, but we often tend to lose sight of that" - (Escue, 2017)

"In order to reverse these trends, we need to rethink our farm policies. We should consider a price floor on commodities.. it's really cheap food versus farming being the primary economic driver" - (J. Hansen, 2017)

"There are no statesmen left; in today's world, everyone wants to be a politician" - (Nordhues, 2017)

The role that government must play in solving or alleviating this problem has been perhaps the biggest question up for debate among stakeholders interviewed. Certainly, the rural/urban gap plays a role in this, but so do personal beliefs regarding the role of government in solving market problems and the level of control government should have in setting policy for personal businesses and industries. Some interviewees feel that the state government overly favors urban areas and corporations, and these policies continue to degrade the livelihoods of rural communities. Examples cited include the removal of funding requirements to distressed rural communities that have been passed by the state legislature, the removing of restrictions on companies to build hog feedlots in the state, and issues with school funding regarding the state's TEEOSA formula and lack of funds being allocated to rural areas. Others find the problem to be a market problem primarily, and the state must respond to market conditions in kind by reducing expenditures while trying to limit the impacts to citizens from government as much as possible (including implementing tax increases on citizens). There is also a feeling among many, both in government, policy, and from agricultural producers, that government spending, both at the state and local levels, needs to be constrained. It was mentioned by a number of interviewees that part of the problem is local government spending and state spending has increased a lot, causing half the problem. These sentiments seem to be driving the support of particular policy mechanisms in the state, whether it be tax increases, expenditure cuts, or revenue growth policies. The state of Nebraska absolutely needs to balance its budget, but what mechanisms are the right ones? Suggestions mentioned by stakeholders included ideas ranging from the "doing nothing" option to the implementation of a price floor on all agricultural commodities, imposed on all purchasers in the country. The real question towards implementing a realistic solution on the problem must be "what mechanisms will best support the citizens of the state without burdening one group of citizens over another?" One interviewee stated that the real issue came down to who will use the

money better, citizens or government? This is an interesting question to keep in mind when considering this problem.

At the state legislature, a number of interesting dynamics are in play regarding the role government should play in working to alleviate the problems faced by Nebraska. The interview conducted with former State Senator Kate Sullivan provided a unique perspective of the problems facing Nebraska, and how difficult it might be to demonstrate these problems to other members of the legislature. To start, term limits had been enacted on state senators in Nebraska beginning in the mid 2000's, meaning senators can only serve two consecutive four year terms before being required to leave office. This leaves a major learning gap for incoming senators, and makes those in office generally more short term thinkers. For a problem like the one facing Nebraska, where agricultural commodity prices may remain depressed well into the future, term limits can negatively impact the way the state plans for long term revenue losses. Nebraska's legislature does have a legislative planning committee, whose goal is to be forward looking and project long term impacts to the state. While this seems to be helpful, Senator Sullivan did not see it having the impact it could have in the legislature, as other motivations of state senators factored into this committee's ability to impact decision making. Other stakeholders commented on the need for Nebraska to adopt visionary leadership for the future. This was explained as getting ahead of crises and working to prevent or alleviate their impacts rather than being reactionary each time a new crisis occurs. Especially for the problems facing agriculture, many opportunities exist for taking a proactive approach; however, visionary leadership will be required for making a positive impact for the future.

One area not being considered as a good policy mechanism in recent years has been additional revenue growth policies. There just hasn't been a big focus on adding revenue recently; raising revenue has been considered (i.e. raising taxes), as have expenditure cuts, but there hasn't been as big a focus on adding new revenues. The ability to add more value added operations downstream from agricultural producers is one option mentioned to do this. However, this is a double edged sword, as these activities will likely change the community dynamics wherever they start up. This shift in dynamics won't necessarily be bad, but will bring new considerations for communities and likely new costs. They can be offset if the economic impact makes it worth it to a community, but negative externalities from these operations may occur, such as smell from hog plants for instance. Another option mentioned by Senator Sullivan for

additional state revenues was to look at legalizing gambling in the state. Although this option was not being explicitly advocated by the former State Senator, it was offered as an intriguing option for the state. Again, the negative externalities from taking this approach may occur, but gambling is legal in many of the states surrounding Nebraska. It may be worth looking into as a viable source of additional income. Adding additional revenue to the state's coffers might be necessary moving forward, especially as the state's population continues to age and more stress is added to the state government to fund the needs of an increasingly aging population. It is likely that the state's baseline funding could continue to rise dramatically as the baby boomer generation begins to retire, and their health needs continue to grow.

Further, the shift in power in the legislature from rural senators to urban senators is real; rural senators used to be able to bring rural issues to the legislature with more force than they are able to now. This trend could continue if population shifts continue to occur in the state. As this trend continues, it becomes increasingly difficult for urban senators to be sympathetic to rural issues. This played out in the legislature in regards to the impact property taxes were having on rural areas. Because property taxes in Nebraska are imposed locally, state senators from urban areas considered property tax issues to be a local problem. Therefore, in recent years attempts to provide property tax relief to rural areas from the state level also meant senators from urban areas wanted income tax relief to accompany it. These arguments ultimately went nowhere. Senator Sullivan believes that, as these problems continue to impact Nebraska, they will continue to get bigger until the state reaches a tipping point. Many in government are so focused on cutting taxes and expenditures as a way to improve the state instead of looking at the bigger picture. "Look at Kansas", Senator Sullivan stated. "We see what's happening there. We are setting ourselves up for failure" (Sullivan, 2017).

4.3.3 – Kansas: Nebraska's Neighbor to the South

"There are just no good options on what you can do to bring profitability back to producers. What are your options?" - (Rome, 2017)

Kansas, Nebraska's neighbor to the south, is currently feeling many of the same impacts to its economy that are being felt in Nebraska. Interviews relating to the impacts to Kansas were

conducted with a large agricultural producer from the southwest corner of the state and a commodity manager specializing in oil and natural gas whose familiarity with Kansas' current economic situation offered insight into the problem. By comparing Nebraska's impacts with those of a similar state, it helps to see what policy mechanisms might work best and what might need to be reconsidered in order to implement effective policy mechanisms.

In Kansas, the impacts to their economy are perhaps being felt more intensely than in Nebraska, as the state implemented major tax and expenditure overhauls in recent years and these impacts seem, at least on the surface, to be exacerbating the problem for that state. Further, Kansas' economy relies heavily on the oil and gas markets, along with agriculture and manufacturing (particularly aerospace). All three of those markets are down from where they were just a few years ago (especially as fracking has dropped global oil and gas prices significantly). A few years prior, Kansas removed the income tax as a way to collect taxes and raise revenues. Unfortunately, this came right when oil and gas and agricultural commodity prices began to fall, which seemingly intensified the problem for that state. At the same time, land valuations have started to fall which, like Nebraska, has begun to impact the amount of money collected in property taxes. According to interviewees, the state has discussed significantly raising taxes as a way to combat the loss of revenues. This includes property tax increases, implementing a value added tax, a severance tax, and other options, none of which are popular with the citizens of the state and have increased the discord in that state. The state has also attempted to cut back significantly on its spending, but this has also caused uproar in the state and much of the blame to fall on the state's decisions to remove the income tax. While the debate in Kansas continues, the problem of a budget shortfall still exists, and difficult decisions will need to be made by lawmakers and citizens.

Kansas also doesn't have the same resources for farming that Nebraska does, most notably in regards to water resources. For farmers, this problem is significant. When droughts occur, water is not always available from aquifers like it is in Nebraska. One plan discussed by the state of Kansas involved building aqueducts from the Missouri River to farmers in western Kansas. This project, with an estimated price tag of around $18 billion, has little chance of happening in the recent future due to the state's lack of funds to finance it. Further, many in the state don't realize why this project is even necessary. This insight highlights the rural/urban gap issue in Kansas, as well, and indicates it is part of a broader trend in the country. As stated by

Steve Rome, the farmer interviewed from Kansas, stated "you end up in a situation where you can't move, and can't afford to do anything else. The [Kansas] legislature needs to make sure these [rural] locations don't get stagnant and allow this problem to get worse. Many people just don't have a basic understanding of the economy of the state, unfortunately" (Rome, 2017).

4.4 – Other Considerations

"The environmental sustainability factor of the state is an important one. Thus far, Nebraska is doing a really good job of this, especially with managing the Ogallala Aquifer. We need to make sure we keep doing so." - (B. Johnson, 2017)

Stakeholders mentioned other considerations that need to be taken into account regarding the impact of falling agricultural commodity prices. One main consideration is the proper stewardship of Nebraska's natural resources. Maintaining the Ogallala Aquifer for future use is vital to Nebraska's long term agricultural production capacity, and must be kept in mind while implementing policies. This also includes ensuring Nebraska's wildlife is not significantly impacted by any policy mechanisms implemented, and steps are taken to ensure natural habitats are maintained. Should these habitats erode, it would likely have an effect on Nebraska's ecosystem, not to mention its ability to attract tourists for events like the annual Sandhill Crane migrations.

Another consideration that isn't directly related to agriculture but will certainly impact Nebraska's agricultural production capacity and future expenses of the state is the continued aging of Nebraska's population, especially in rural areas. The rise of Nebraska's aging population means more of Nebraska's workforce will stop producing, and will instead begin requiring resources for retirement and old age. This means that Nebraska's funding of health services to these individuals will have to increase while the state will also begin losing tax revenues collected from these individuals. These dynamics are very important, and it will increase the baseline expenditures of the state under current conditions. Future lawmakers and state leaders must consider the impacts that an aging population is having on the state.

One final area of consideration is the impact that tax collection policies are having on the state. While likely minor in overall impact, Nebraska's agricultural producers often have additional

paperwork to fill out for receiving a sales tax exemption when making a major purchase. Further, companies selling this equipment to farmers are required to file this paperwork and maintain it for Nebraska's auditors to prove compliance with state law. This process, and many like it, could be reconsidered in order to improve the efficiency of sales tax exemptions (and other exemptions) while costing the state and taxpayers less money overall.

4.5 – "Success" as Defined by Stakeholders

A general consensus was found among stakeholders interviewed regarding what future "success" would look like in solving the current problem facing Nebraska caused by falling agricultural commodity prices. Most stakeholders did not try to forcibly adjust the price of commodities, but instead looked at the long term results of what a successful policy should contain. Chief among these results included two primary items: eliminating the budget shortfall and keeping the budget balanced at the state level, and ensuring farm quits across the state did not increase in intensity. "Keeping farmers farming" was a major point among stakeholders. While the policies needed to do both of these items differed, the end results among stakeholders were similar overall. Other items of note included better money management by the state and local governments. As mentioned earlier, both ag producers, policy experts, and economists mentioned this as a concern. Improving the relationship between rural and urban areas of the state, especially in regards to the importance of rural production to Nebraska's economy and between Nebraska's rural and urban legislators. Primarily, however, solving the budget shortfall problems long term while maintaining Nebraska's strong agricultural economy equate to "success" for stakeholders.

4.6 – Conclusion

The anecdotal evidence captured during interviews with stakeholders includes a number of additional considerations when thinking about the impacts to Nebraska. The stakeholders interviewed all provided key insights into the problems facing the state, as well as impacts that must be considered in the future. These considerations helped to develop an exploratory system dynamics model for examining the various policy mechanisms available to Nebraska's

lawmakers, as well as future conditions that might place additional strain on the state of Nebraska and its ability to manage its budget. The next chapter will outline the exploratory system dynamics model developed for this analysis.

Chapter 5 – An Exploratory Model Examining Nebraska's Budget Shortfall

5.1 – Introduction

The problem facing Nebraska, outlined in previous chapters, is a complex one. The impacts that falling agricultural commodity prices are having on the state of Nebraska impact a many areas and stakeholders, and the levels of severity from these impacts vary, as well. This problem offered a number of areas from which to design, build, and test a model. However, due to the scope of the problem and time constraints, the model's focus has been narrowed towards a specific issue of Nebraska's larger problem: the state budget shortfall. This model focuses primarily on the budget shortfall issue facing the state, and the policy mechanisms (and their unintended consequences) available to the state for managing this problem. This is intended to provide a starting point for future research into the overall problem facing the state of Nebraska, and further research into the impacts that falling agricultural commodity prices are having at the state level.

Multiple policy mechanisms are available to lawmakers to combat the decline of tax revenues collected at the state level caused by falling agricultural commodity prices. However, these policy mechanisms all have second and third-order effects that are not often considered by policymakers which, over time, can intensify the problem. These effects are not immediate and will play out over the course of decades. Further, the likelihood that agricultural commodity prices will stay low for the immediate future and be impacted more intensely by swings in price is high. Projections for future agricultural prices are based in large part on normalized conditions. According to the "USDA Agricultural Projections to 2026" Long Term Projections Report, the projections offered in this report are based on largely normalized conditions. The report states that it:

"is a conditional, longrun scenario about what would be expected to happen under a continuation of current farm legislation and other specific assumptions. Critical long-term assumptions are made for U.S. and international macroeconomic conditions, U.S. and foreign agricultural and trade policies, and growth rates of agricultural productivity in the United States

and abroad. The report assumes that there are no domestic or external shocks that would affect global agricultural supply and demand" – (O'Donoghue et al., 2017).

Appendix A2 offers a comparison of previous USDA Long Term Projections from previous years against actual price data for Nebraska's top agricultural commodities. These "porcupine charts" are not meant as a criticism of projection methods; indeed, there is no way to predict the future, so using existing conditions as a way to provide an idea of future price expectation sans shocks to the system is a conventional method for offering projections. These charts are offered as a way to demonstrate the value of considering system shocks and likely dynamic future behaviors for modeling a systems problem, however. Thus, a system dynamics modeling approach has been used to provide considerations of what the impacts of various policy mechanisms implemented at the state level as a way to combat the impacts of falling agricultural commodity prices might look like for Nebraska and its populace long term.

The system dynamics model created for this problem is largely exploratory and meant to offer general ideas about the best policy mechanisms to be used by the state for combating the decline of tax revenues from falling agricultural commodity prices. It is not meant to be used as a "crystal ball" for predicting the future, and in fact liberties have been taken for generating parts of the model's structure based on the modeler's beliefs regarding future impacts affecting the state. The model is a first step towards analyzing the long term impacts to Nebraska's budget and overall economy using system dynamics. It is therefore recommended that future studies build upon the work done with this model, and more detailed models are generated for more in depth analyses of the problem. Recommendations for future research on this problem will be provided later on.

5.2 – Model Overview

The model developed for this analysis was created using the "Standard Process" for system dynamics model development by Lyneis and Hines, as mentioned in Chapter 1. A number of existing models helped to shape the general idea of how to approach this model, including the "Grain 1" model by Brzozowski (Brzozowski, 1979) and other farming models for system dynamics, such as the model developed by Turner, et al (Turner et al., 2016). Existing

commodity management models from John Sterman (Sterman, 2000) and Dennis Meadows (Meadows, 1970) were also studied. However, as mentioned earlier in the chapter, due to the size of the problem and time constraints, the final model developed focuses on one primary aspect of the overarching problem impacting Nebraska. Therefore, this model was developed with a focus on Nebraska's budget shortfall problem rather than production or other aspects of the issue. In order to outline policy mechanisms available to the state of Nebraska for solving the problem, the dynamic hypothesis of the model was developed using the generic "Work Harder, Not Smarter" model construct. The dynamic hypothesis developed for this thesis can be seen in Figure 12:
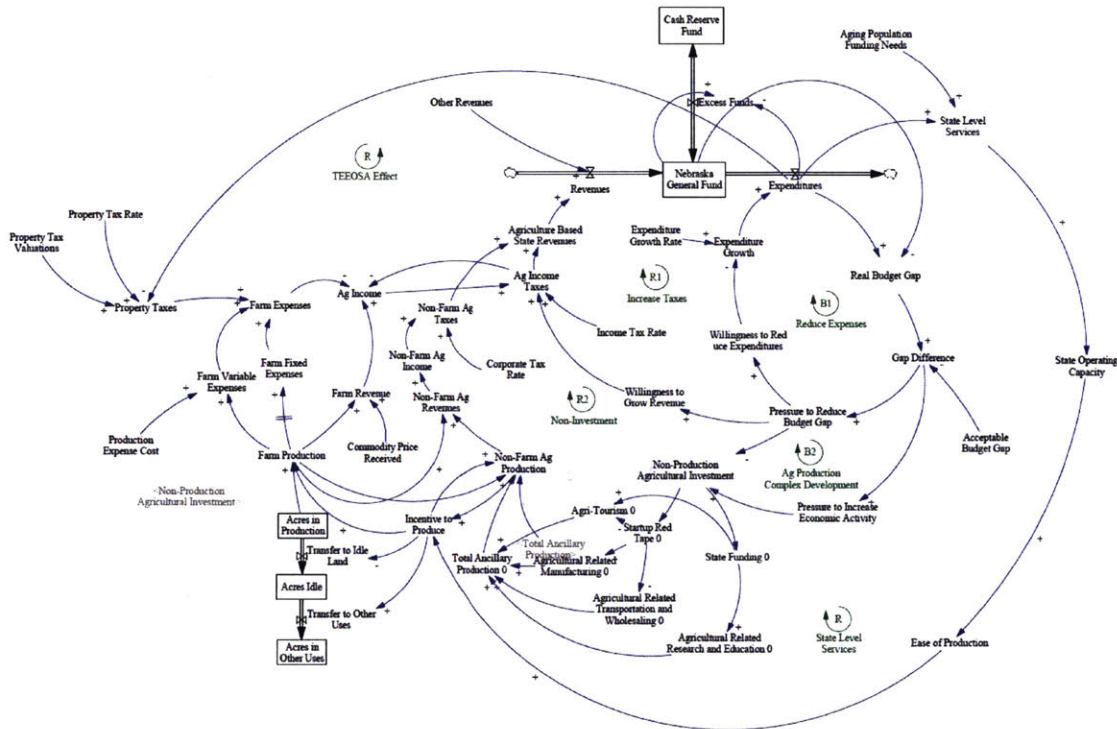

Figure 12 - Dynamic Hypothesis

When developing this model, the problem of low and increasingly volatile global prices for agricultural commodities, and how to best manage that problem over a long time horizon, became the focus of the model. Thus, the model developed focuses primarily on the state tax revenue shortfall problems associated with the decline of agricultural commodity prices rather than any production effects. While not directly modeling production activities, the model developed does provide insights into the policy mechanisms available to lawmakers and the

effects that these policy mechanisms might have on Nebraska's populace. After developing reference modes for the different aspects of the problem, analyzing existing literature, and conducting interviews with stakeholders, it became apparent that, should low prices or increasingly volatile prices for agricultural commodities continue for longer than 2-3 years into the future, the state of Nebraska will be strongly impacted, both at the state government level and for Nebraska's farmers and ranchers. This model therefore looks at the effects, both positive and negative, that policy mechanisms might have on the state's ability to increase taxes or reduce expenditures over time. The effects of increasing value added activities will also be considered. In order to analyze these effects with a long enough timeline, the time horizon for this model has been set to 30 years. This model was created using VensimDSS, a system dynamics modeling software. Full variable descriptions and initial model values can be found in Appendix B.

5.3 – Model Description

The main policy mechanisms discussed for solving Nebraska's budget shortfall are the state's ability to cut expenditures or raise taxes. These two mechanisms each have their share of benefits and pitfalls associated with them (as discussed in previous chapters). The model developed considers these two methods for managing the state's budget shortfall as the primary tools for this task. Therefore, the model is built around a stock identified as Nebraska's General Fund, which is made up of "activities funded by general tax dollars, primarily sales and income taxes, and related expenditures and transfers", and inflows of "Revenues" and outflows of "Expenditures". The primary stock and flow structure also contains an additional stock and flows from the General Fund to the Cash Reserve Fund, which "is used to account for cash held as a reserve ("rainy day" fund) for the General Fund, should the General Fund balance become insufficient to meet current obligations" ("www.StateSpending.Nebraska.gov • Glossary of Terms," n.d.). These transfers are important in capturing the impacts that the Cash Reserve Fund have on Nebraska's budget shortfall problem. Figure 13 displays the model's main stock and flow structure:
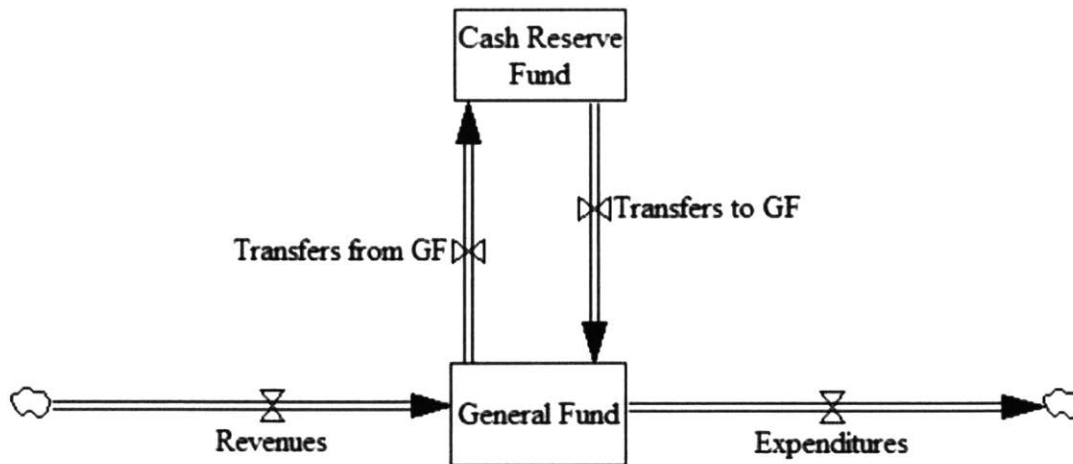
Figure 13 - General Fund Stock and Flow Structure

The model's main stock and flow structure is acted upon by two main factors: revenues, generated by the overall revenues generated by the state and the taxes collected on those revenues, as well as the expenditures of the state. Revenues are generated from two sources in this model: agricultural revenues and non-agricultural revenues. These revenues are each acted upon by an effective tax rate (a proxy used for all state taxes collected by producers), which generates the tax revenues for the state of Nebraska. Revenue collections are determined by either the amount of revenues generated each year, or by adjustments to the tax rate. Expenditures are a product of the state's baseline expenditures and the expenditure multiplier, which determines the adjustments for the state's expenditures. Expenditures are adjusted based on changes to the expenditure multiplier, which determines actual expenditures. The Cash Reserve Fund, or "Rainy Day" Fund, acts as a buffer for the state anytime the General Fund cannot meet its expenditures from tax revenues collected, and is added to when surpluses occur. This structure will help to prevent significant oscillations in the model moving forward, as the Cash Reserve Fund will be able to add cash to the General Fund rather than force the model to raise and lower tax rates or expenditures as a way to manage the General Fund stock. A general overview feedback diagram of these basic functions can be seen in Figure 14:
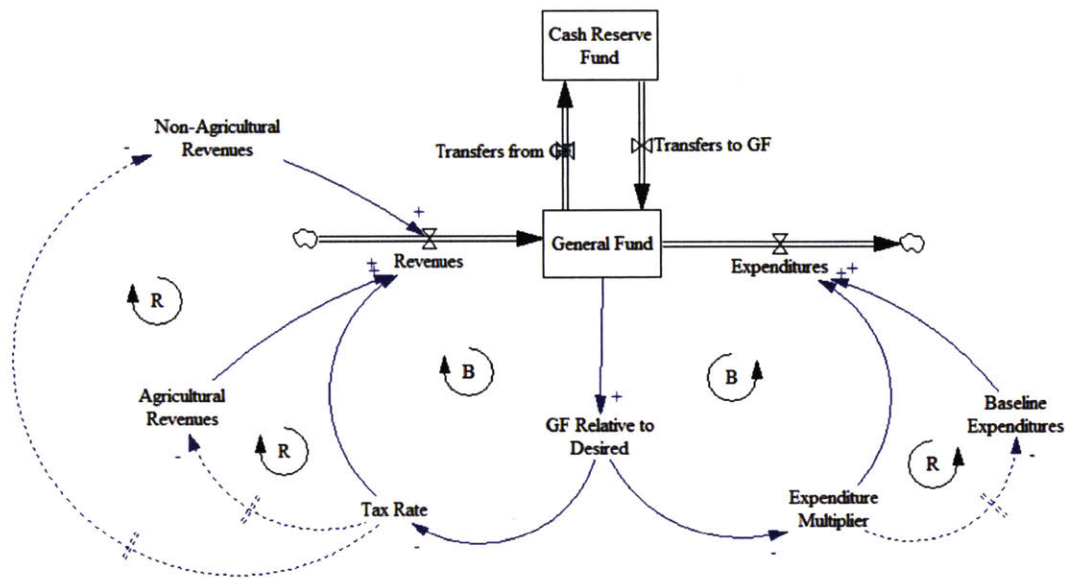
Figure 14 - Overview Feedback Diagram

Using this model architecture as a guide for thinking about the problem, the first model feedback loops have been created with the general overview model in mind. Two balancing loops work to either increase the tax rate or decrease expenditures any time the General Fund drops below the desired amount. The model also has reinforcing side effect loops that cause adverse effects on the model when the tax rate is increased above its original level, meant to simulate a production disincentive effect, and also when expenditures drop below the model's baseline expenditures, meant to simulate the effects that significant budget cuts have on the state's level services. These are the primary feedback loops in the model; the balancing loops have been created using two different methods of adjusting the model. The first set of loops, displayed in Figure 15, shows the model structure built for the initial tax and expenditure feedback loops using sensitivity adjustments as a means for bringing the General Fund stock back into balance anytime a gap occurs:
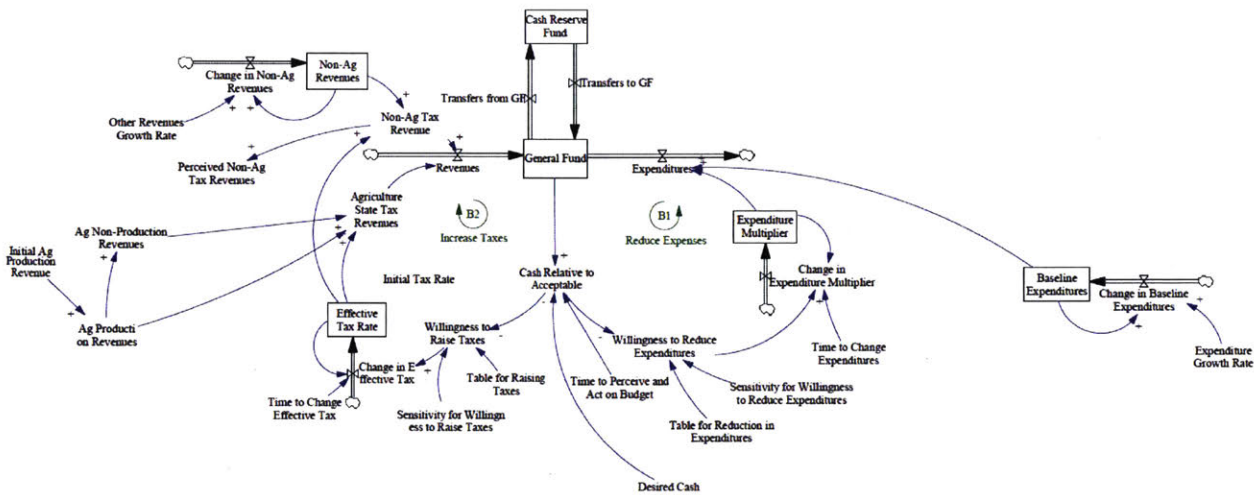
Figure 15 - Initial Model Tax and Expenditure Feedback Loops

The stock and flow structure shown in Figure 15 outlines the model's primary concern: the Nebraska General Fund. The General Fund and maintaining its balance drive the dynamics of the model. As the General Fund's balance adjusts according to increasing or decreasing revenues, the model's feedback loops can be adjusted to bring the General Fund back to an acceptable level. Figure 15 outlines this process using manual sensitivities for raising taxes and reducing expenditures as a way to adjust the model's effective tax rate and expenditure multipliers. As the sensitivities increase for the Willingness to Raise Taxes and Willingness to Reduce Expenditures variables, the model will increase taxes or reduce expenditures according to that adjustment. Likewise, as sensitivities for these two variables are reduced, the model will not make adjustments as drastically. Thus, the strength of these loops will be manually determined. Some key equations for and descriptions of variables for these initial loops can be seen in Table 2:

Table 2 - Initial Tax and Expenditure Loop Key Variable Equations

General Fund
= INTEG(Revenues + Transfers to GF - Expenditures - Transfers from GF, Smoothed State Revenues * Desired Cash Fraction of Revenues)
Units: Billion Dollars
The amount of money held by the State of Nebraska in the General Fund. This figure comes from collection of income, sales, corporate, and other taxes imposed by the State of Nebraska. This is the primary fund used by the state for allocating monies to pay for the regular business of the state government. Initialized to the smoothed state revenues multiplied by the fraction of desired cash revenues on hand.
Revenues
= Agriculture State Tax Revenues + "Non-Ag Tax Revenue"

Units: Billion Dollars/Year The revenues collected by the State of Nebraska each year that feed the Nebraska General Fund.
Expenditures = Baseline Expenditures * Expenditure Multiplier Units: Billion Dollars/Year The annual expenditures of the Nebraska General Fund for the general operations of the state.
Cash Relative to Acceptable = SMOOTH (((General Fund - Desired Cash) / Desired Cash, Time to Perceive and Act on Budget) Units: Dmnl The difference between the amount of money desired on hand by the state of Nebraska compared to how much is actually on hand. This variable is smoothed in order to simulate the time it takes to realize this difference.
Effective Tax Rate = INTEG(Change in Effective Tax , Initial Tax Rate) Units: Fraction The effective rate at which agricultural revenues are taxed annually. Due to the varied ways in which taxes are collected for agriculture in Nebraska, this rate is an aggregate representation of the income, sales, use, corporate, and other tax rates, and meant to be used for testing purposes with the model.
Expenditure Multiplier = INTEG(Change in Expenditure Multiplier , 1) Units: Dmnl The multiplier by which the expenditures are increased or decreased. This is adjusted by the Change in Expenditure Multiplier inflow.
Agriculture State Tax Revenues = (Ag Production Revenues + "Ag Non-Production Revenues") * Effective Tax Rate Units: Billion Dollars/Year Tax revenues collected by the state from agriculture. This includes production and non-production activities.
Willingness to Raise Taxes = Table for Raising Taxes (Cash Relative to Acceptable) * Sensitivity for Willingness to Raise Taxes Units: Dmnl A manual adjustment of tax rates by policymakers, and determined by the sensitivity of policymakers for raising tax revenues against the table for willingness to raise taxes.
Willingness to Reduce Expenditures = Table for Reduction in Expenditures (Cash Relative to Acceptable) * Sensitivity for Willingness to Reduce Expenditures Units: Dmnl A manual adjustment of expenditures by policymakers, and determined by the sensitivity of policymakers for reducing expenditures against the table for reduction in expenditures.

These adjustments to sensitivity for either raising taxes or reducing expenditures allow the model's dynamics to be driven by the willingness of stakeholders rather than allow the model to adjust endogenously. Instead of using these manual adjustments to sensitivity variables as the primary means for adjusting the model, additional structure was added for the model to change the Effective Tax Rate and Expenditure Multipliers endogenously. This structure is based on different information that what the previous balancing loops use for adjusting the Effective Tax Rate and Expenditure Multiplier, such as Desired Revenues and Desired Expenditures, and smoothed values based on the time it takes to collect information on desired values, projected revenues, and other considerations. The equations for some of these key variables can be seen in

Table 3. Figure 16 shows the computed multiplier loops for the Effective Tax Rate and
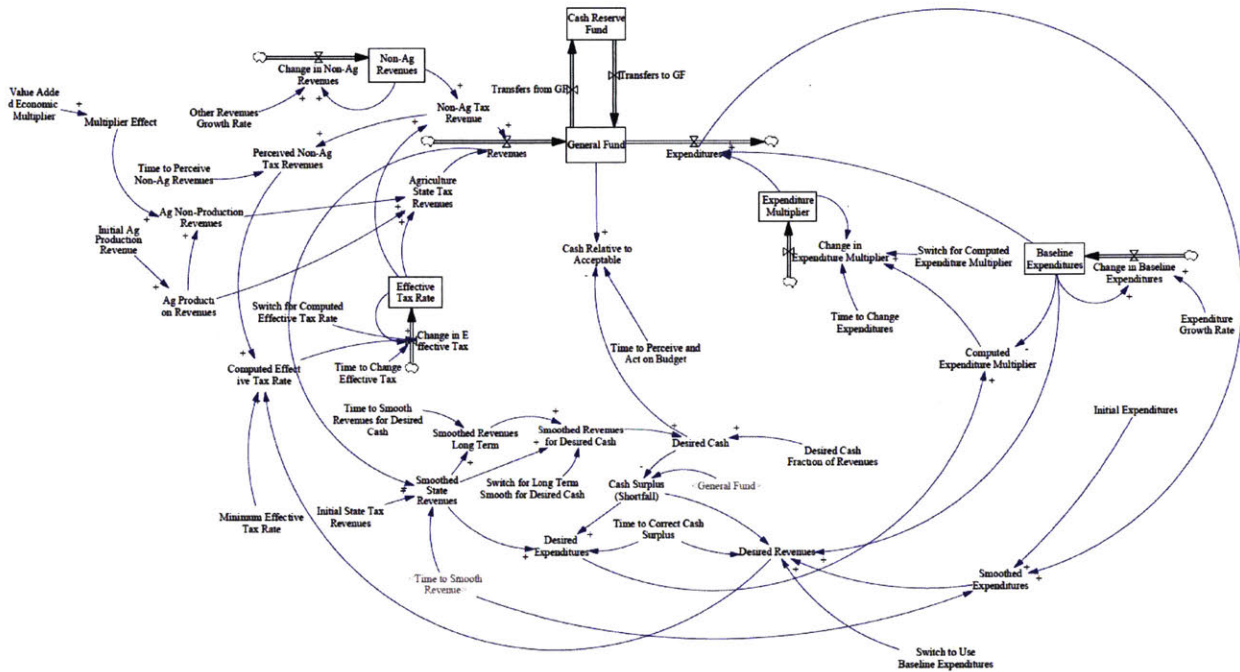Expenditure multiplier:

Figure 16 - Computed Multiplier Loops

Table 3 - Computed Multiplier Key Variable Equations

Cash Surplus (Shortfall) = General Fund - Desired Cash Units: Billion Dollars The difference between the general fund balance and the desired cash on hand by policymakers.
Computed Effective Tax Rate = MAX (Minimum Effective Tax Rate , (Desired Revenues - "Perceived Non-Ag Tax Revenues") / Projected Revenue) Units: Fraction The computed effective tax rate based on the revenues desired less the perceived non-agriculture tax revenues over the total projected revenue. The effective tax rate adjusts according to expected revenues needed.
Computed Expenditure Multiplier = Desired Expenditures / Baseline Expenditures Units: Dmnl The endogenous computation for determining the expenditure multiplier. Equal to desired expenditures over baseline expenditures.
Desired Cash = Desired Cash Fraction of Revenues * Smoothed Revenues for Desired Cash Units: Billion Dollars The amount of cash desired by policy makers based on known previous revenues received and the desired fraction of cash on hand.
Desired Expenditures = Smoothed State Revenues + ("Cash Surplus (Shortfall)" / Time to Correct Cash Surplus)

Units: Billion Dollars/Year The desired level of expenditures based on the determined revenues collected and the revenue surplus or shortfall.
Desired Revenues = (Switch to Use Baseline Expenditures * Baseline Expenditures + (1 - Switch to Use Baseline Expenditures) * Smoothed Expenditures) - ("Cash Surplus (Shortfall)" / Time to Correct Cash Surplus) Units: Billion Dollars/Year The desired level of revenues based on the determined expenditure levels (either using baseline or smoothed expenditure values) and the revenue surplus or shortfall.
Smoothed State Revenues = SMOOTH3I (Revenues , Time to Smooth Revenue , Initial State Tax Revenues) Units: Billion Dollars/Year The revenue value determined after the delay in information gathering for determining total revenues.
Smoothed Expenditures = SMOOTH3I (Expenditures , Time to Smooth Revenue ,Initial Expenditures) Units: Billion Dollars/Year The expenditures determined after delays in capturing real expenditure information, with an initial value equal to initial expenditures.
Perceived Non-Ag Tax Revenues = SMOOTH3 ("Non-Ag Tax Revenue" , "Time to Perceive Non-Ag Revenues") Units: Billion Dollars/Year The perceived value of non-agricultural tax revenues received by the state of Nebraska.

This figure shows an increasingly complex diagram aimed at controlling revenues and expenditures based on the perceived revenues and expenditures brought in through tax collections and the perceived expenditures by the state government. The causes tree diagrams for both multipliers are shown in Figure 17 and Figure 18:
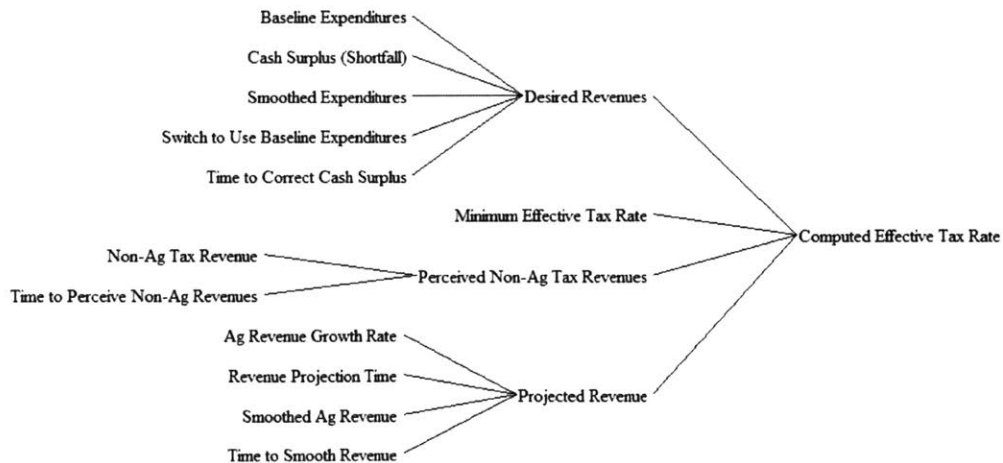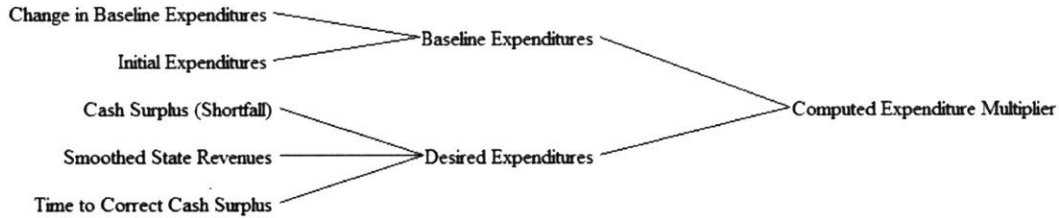

Figure 17 - Computed Effective Tax Rate Causes Tree

Figure 18 - Computed Expenditure Multiplier Causes Tree

These figures outline how the model's Computed Effective Tax Rate and Computed Expenditure Multiplier are dependent on the data collected regarding the state's expenditures and revenues. In effect, the effective tax rate adjusts according to the projected revenues of both agriculture and non-agriculture activities, as well as the desired revenues of the state, which itself is a product of the baseline expenditures, perceived expenditure data, and current cash surplus (or shortfalls). The Computed Expenditure Multiplier adjusts according to the state's Baseline Expenditures along with the desired expenditures, which is derived from data gathered regarding tax revenues collected and existing cash surplus (or shortfall). As revenues from farming activities increase or decrease, these computed feedback loops will begin to adjust when switched on in order to maintain desired levels of the General Fund. Changes to revenues in this model drive these feedback loops. The model makes adjustments based on these changes to revenues compared to the inputted value for baseline expenditures. The revenue structure that drives changes in the model can be seen in Figure 19:
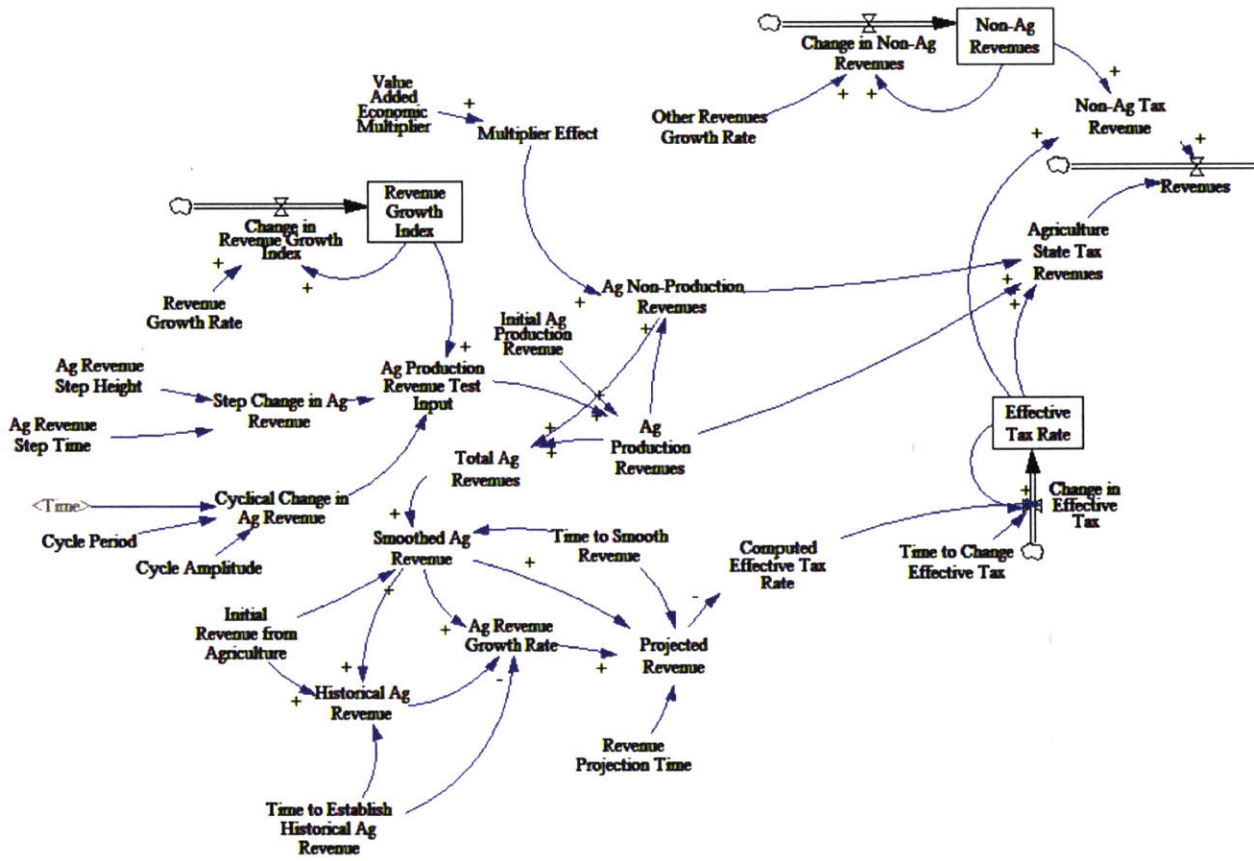
Figure 19 - Revenue Structure of Model

The revenue structure created for the model shows how revenues from agricultural production drives agricultural non-production revenues. As agricultural production revenues increase, the multiplier effect acts on Ag Non-Production Revenues. This structure imitates the effect that agricultural production has on non-production agricultural activities, and how these two add to the state's ag revenue generation, as per research conducted by Thompson, et al (Thompson et al., 2012) Ag production revenues are also influenced by the Revenue Growth Index, which drives ag production revenue growth. Test inputs have been added to the model to display the impacts that shocks to agricultural revenue production will have on the overall revenue collecting ability of the state. This is important for determining the impacts that the policy mechanisms discussed earlier will have on Nebraska's populace, and whether or not these mechanisms are viable for Nebraska. Some key variable equations can be seen in Table 4:

Table 4 - Revenue Key Variable Equations

Total Ag Revenues = Ag Production Revenues + "Ag Non-Production Revenues" Units: Billion Dollars/Year The total amount of revenue produced by agriculture in a given year.
Smoothed Ag Revenue = SMOOTH3I (Total Ag Revenues , Time to Smooth Revenue, Initial Revenue from Agriculture) Units: Billion Dollars/Year The revenues from agriculture determined after a delay in the time it takes to capture this information. Initial value set to initial revenue from agriculture.
Revenue Growth Index = INTEG(Change in Revenue Growth Index , 1) Units: Dmnl Index for indicating the level of agricultural production in the model.
Projected Revenue = (1 + Ag Revenue Growth Rate * (Time to Smooth Revenue + Revenue Projection Time)) * Smoothed Ag Revenue Units: Billion Dollars/Year The projected revenues for determining the endogenous computed effective tax rate in the model.
Value Added Economic Multiplier = 2 Units: Dmnl Based on 2010 UNL Study of Agricultural Production Complex in the State of Nebraska. For every dollar of ag production, there are 2 dollars of non-production value added services added to the economy, thus this is initialized to 2. This value is adjusted for testing purposes in the model.
Ag Production Revenue Test Input = Revenue Growth Index + Step Change in Ag Revenue + Cyclical Change in Ag Revenue Units: Dmnl Input that determines the growth of ag production each year, as well allows the use of test inputs on the system.

The model's Cash Reserve Fund acts as a buffer for the General Fund in the event of a downturn in the economy or some other factor impacting the state's ability to collect revenues. Likewise, in the event of an economic boon, the Cash Reserve Fund is added to from the General Fund. This has been designed to mimic the Cash Reserve Fund used by the state of Nebraska for similar events. In this model, this additional structure acts as a way to minimize oscillations in the model. The Cash Reserve Fund acts endogenously in regards to fund transfers in order to prevent the General Fund from dropping below its desired level; in practice, this is not always the case as lawmakers and state leaders are required to approve such transfers prior to any transfers occurring. The transfers from each fund do provide interesting dynamics, however, and as different system shocks occur, where a variety of policy mechanisms are tested, this becomes more apparent. Regardless, it is assumed that these endogenous transfers would occur in practice as Nebraska tries to manage its budget shortfall problem in the future. Testing with this structure will be covered later in the chapter. The Cash Reserve Fund structure can be seen in Figure 20:
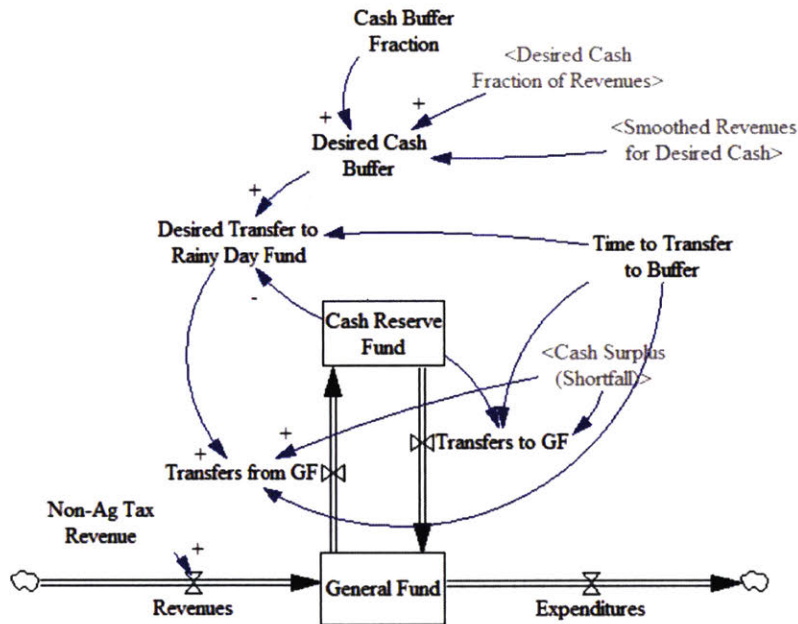
Figure 20 - Cash Reserve Fund Model Structure

Some key variable equations for this structure can be seen in Table 5:

Table 5 - Cash Reserve Fund Key Variable Equations

Cash Reserve Fund = INTEG(Transfers from GF - Transfers to GF , Desired Cash Buffer) Units: Billion Dollars The fund used by the state to assist with paying off expenditures during downturns in the economy. This is initialized to equal the desired cash buffer, and is a product of the inflows and outflows of funds to and from the general fund.
Transfers from GF = Min (Desired Transfer to Rainy Day Fund , MAX (0, "Cash Surplus (Shortfall)") / Time to Transfer to Buffer) Units: Billion Dollars/Year The rate at which funds transfer from the general fund to the rainy day fund. Transfers only occur during years when the general fund exceeds the desired fraction of cash on hand.
Transfers to GF = Min (Cash Reserve Fund , MAX (0, - "Cash Surplus (Shortfall)")) / Time to Transfer to Buffer Units: Billion Dollars/Year The rate at which funds transfer from the rainy day fund to the general fund. This occurs when expenditures exceed revenues and rainy day funds are used to cushion the general fund.
Desired Transfer to Rainy Day Fund = (Desired Cash Buffer - Cash Reserve Fund) / Time to Transfer to Buffer Units: Billion Dollars/Year The desired amount of money to be transferred to the rainy day fund, when possible.
Desired Cash Buffer = Smoothed Revenues for Desired Cash * Desired Cash Fraction of Revenues * Cash Buffer Fraction Units: Billion Dollars

The total amount of money desired in the rainy day fund. Equal to the total smoothed revenues for desired cash multiplied by the desired cash

The model's structure includes two components designed to mimic real world effects from excessive expenditure cuts and tax increases imposed by lawmakers. In effect, when tax increases become excessive, a production disincentive is applied that reduces the amount of revenue generated by the model from agricultural and non-agricultural activities. Similarly, if expenditures get cut below the determined Baseline Expenditures level, additional expenditures are imposed on the model as a way to mimic future costs needed for making deep cuts in the present. The structure built is a very simple representation of possible consequences faced by the state for excessive expenditure cuts to level services over time and increasing taxes on citizens over time. This structure contains two key components: the average length of delay before these impacts are felt, and the strength of each impact. The effective tax rate and expenditure multiplier parameters for each of these functions have initial values based on reasonable assumptions of long term effects, but can certainly be adjusted based on further research. Sensitivity testing of these parameters in a later section illustrates their power and why further research of these values might be warranted. Figure 21 displays the structure developed for imposing the production disincentive from tax increases on the model:
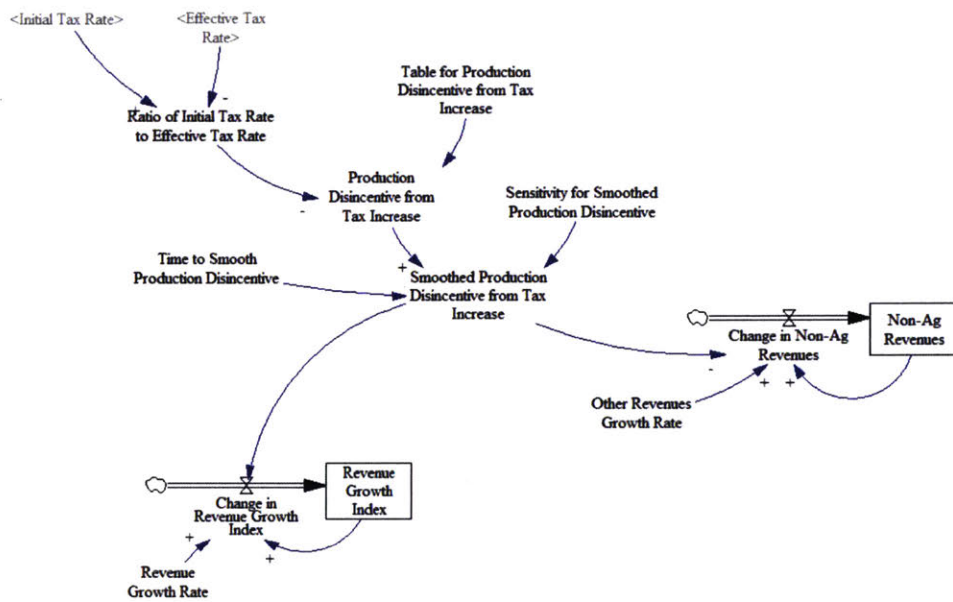

Figure 21 - Production Disincentive from Tax Increase Structure

The structure created for imposing additional costs on the model caused by long term expenditure cuts can be seen in Figure 22:
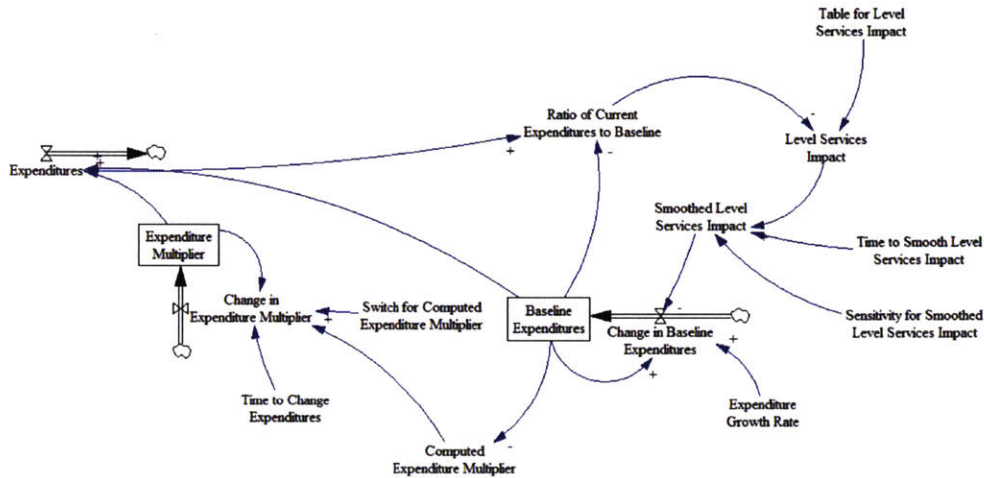

Figure 22 - Structure for Level Services Impact

Key equations from the Production Disincentive structure and Level Services Impact structure can be seen in Table 6:

Table 6 - Production Disincentive and Level Services Impact Key Variable Equations

Production Disincentive from Tax Increase   = 1 - Table for Production Disincentive from Tax Increase   (Ratio of Initial Tax Rate to Effective Tax Rate)   Units: Dmnl   The effect that raising taxes has on discouraging production in the state.
Smoothed Production Disincentive from Tax Increase   = SMOOTH3 (Production Disincentive from Tax Increase, Time to Smooth Production Disincentive) *   Sensitivity for Smoothed Production Disincentive   Units: Dmnl   The overall production disincentive factored into the model after time delays and sensitivities have been considered.
Level Services Impact   = Table for Level Services Impact (Ratio of Current Expenditures to Baseline)   Units: Dmnl   The impact felt from reducing expenditures below the baseline expenditure level.
Smoothed Level Services Impact   = SMOOTH3 (Level Services Impact , Time to Smooth Level Services Impact) * Sensitivity for Smoothed Level Services Impact   Units: Dmnl   The impact felt from expenditure reductions below baseline levels over time, and amplified or reduced based on the sensitivity level.
Ratio of Current Expenditures to Baseline

= Expenditures / Baseline Expenditures Units: Dmnl The ratio between the actual annual expenditures of the state of Nebraska compared to the baseline expenditures for maintaining level services for the state.

Should there be any confusion regarding variable information not described in this section, all of the model's units, equations, and descriptions can be seen in Appendix B – Model Documentation.
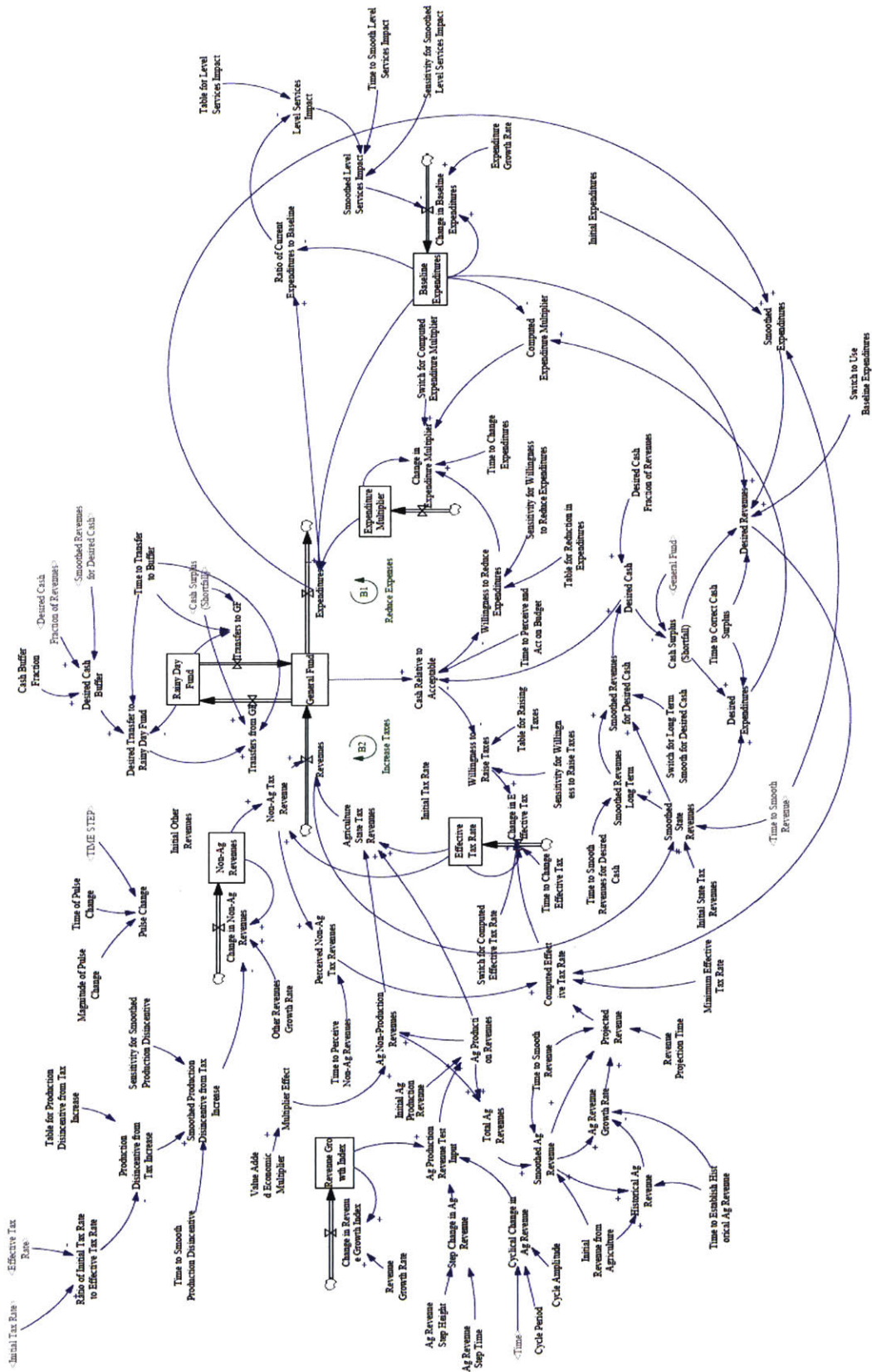
The full model can be seen in Figure 23:

Figure 23 - Nebraska Budget Shortfall Full Model Diagram

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5.4 – Model Testing

This section outlines the results produced from testing the model developed for understanding Nebraska's budget shortfall problem. These results are based on the model created, and should be understood as exploratory in nature rather than predictions of future events. The first tests conducted on the model occurred during model equilibrium. All model variables are initialized for equilibrium, all growth rates have been set to zero, and all switches and testing inputs have been turned off.

5.4.1 – Equilibrium Testing

Equilibrium testing begins with a system shock imposed on the model. A step function occurs on agricultural production revenues (both up and down) in year 5 with a height of 0.5, which acts to increase revenues 50% and decrease revenues 50%. This input's effect on agricultural revenues can be seen in Figure 24:
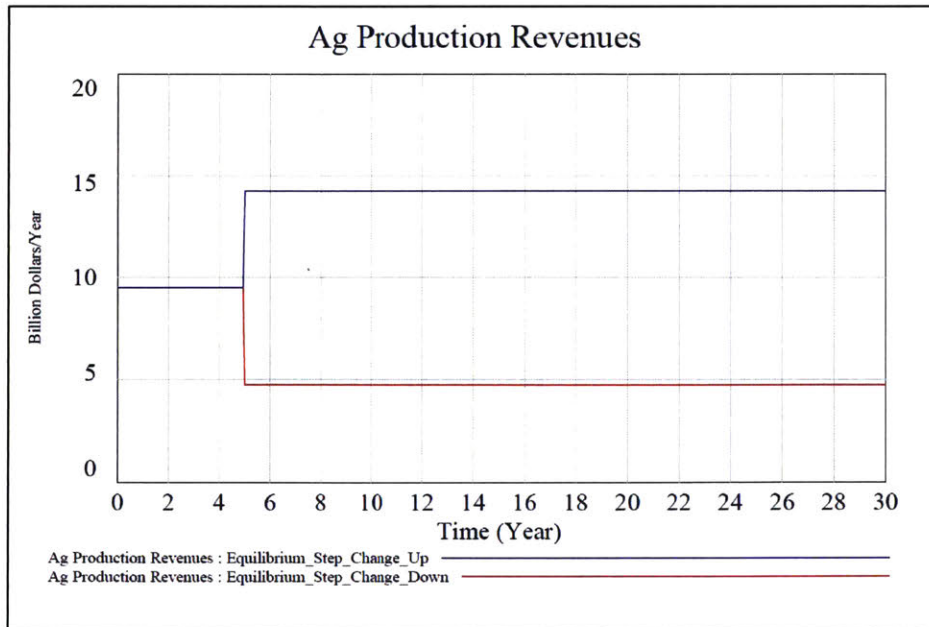

Figure 24 - Step Test Input
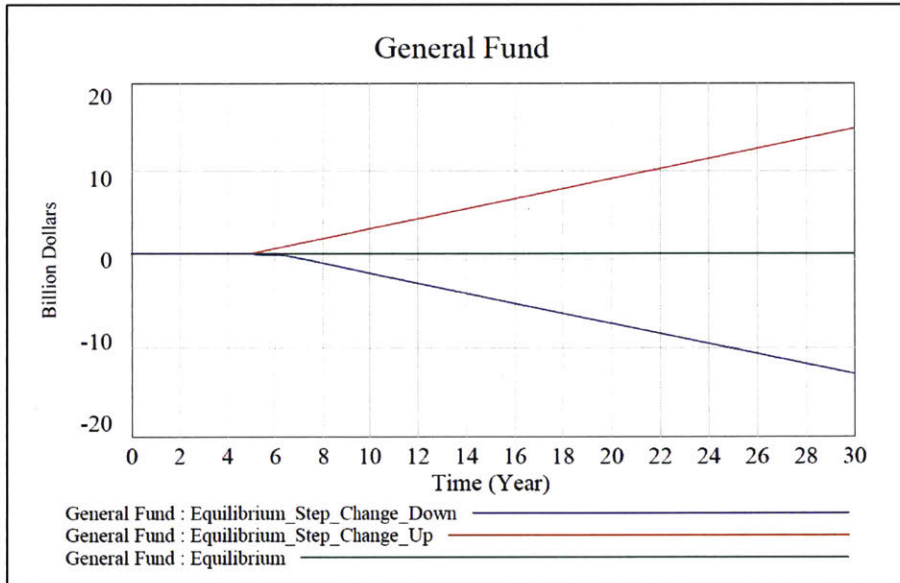
Figure 25 shows the impact to the General Fund:

Figure 25 - General Fund, Step Function in Equilibrium

The results of the shock to the model from an increase and decrease in agricultural revenues are interesting. The increase in revenues yields an automatic rise in the General Fund, whereas the 50% decrease does not have an immediate impact on the General Fund. This is because the Cash Reserve Fund works to buffer the General Fund from the significant loss of revenues, resulting in a delay of almost two years before the General Fund starts to lose money. Impacts to the Cash Reserve Fund are seen in Figure 26:
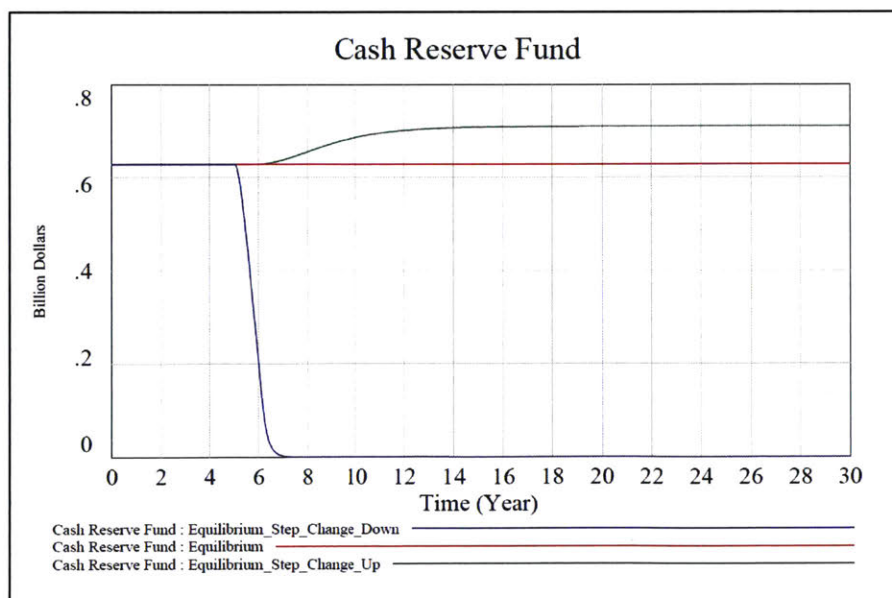

Figure 26 - Cash Reserve Fund, Step Function in Equilibrium

By introducing a cycle shock to the system with an amplitude of 0.5 and a cycle period of 5 years, we get a different result. The test input's impact on agricultural production revenues can be seen in Figure 27:
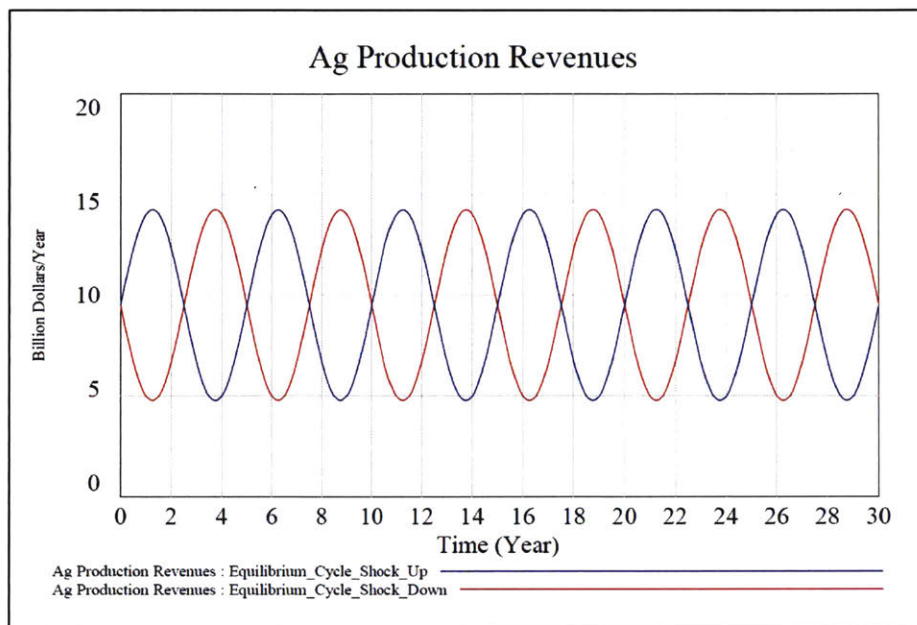

Figure 27 - Cycle Test Input

As seen in Figure 27, the behavior of a down cycle shock compared to an up cycle shock are very different. When the cycle shock is positive, agricultural production revenues increase above their equilibrium value before peaking at 2.5 years, and then swinging downward for another 2.5 years before increasing its value again. When the cycle shock is negative, agricultural production revenues become negative during the first 2.5 years before hitting the cycle trough and increasing in value. This behavior has a much different impact on the General Fund and Cash Reserve Fund than when the cycle shock is positive. The impact to the General Fund of a cycle shock to agricultural production revenues can be seen in Figure 28:
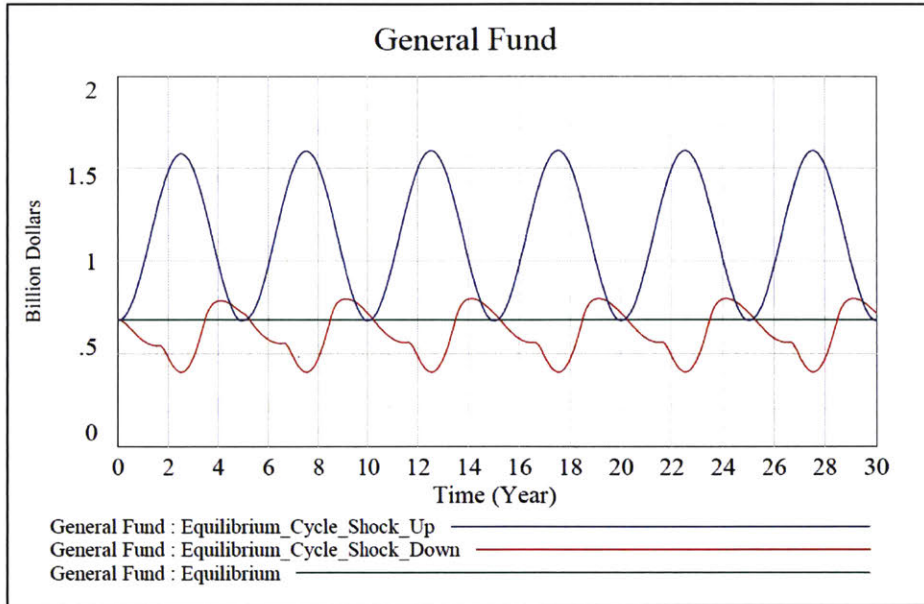
Figure 28 - General Fund, Cycle Function in Equilibrium

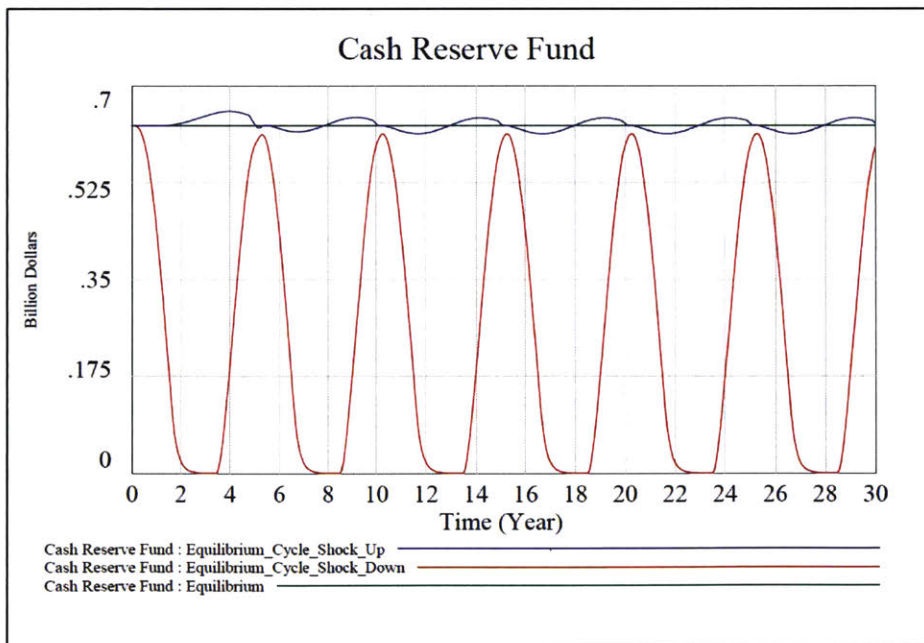The impact to the Cash Reserve Fund is seen in Figure 29:

Figure 29 - Cash Reserve Fund, Cycle Function in Equilibrium

The results of a positive and negative cycle function on the two funds show very different results from the step function. In either scenario, the Cash Reserve Fund will take on additional

revenues during boom times and during times of declining revenues, will support the General Fund in order to prevent a significant drop in that fund's balance. However, with the cycle shock, the Cash Reserve Fund will replenish itself during up years and feed the General Fund during declining years. The step shock remains low during a Step down and thus does not have a chance for the Cash Reserve Fund to replenish itself. In comparing a negative cycle shock to a positive cycle shock, the General Fund can build up additional revenues to start when a positive cycle shock is introduced, which means that when the downturn in the test input occurs, it has built up 2.5 years' worth of additional funds to buffer against a downturn. The negative cycle shock is the exact opposite, in that the General Fund loses money for 2.5 years before having to build back its desired funds. Also, the Cash Reserve Fund's balance reaches zero dollars multiple times while working to keep the General Fund at its desired balance, but is able to build itself back up later in the model simulation. The negative cycle shock creates a situation where the General Fund is constantly having to "make up" lost funds, whereas a positive cycle shock handles downturns in agricultural production revenues much better. The General Fund is therefore not subjected to as large of swings from a negative cycle function as it is when the cycle function is positive.

In order to counteract the impacts of declining agricultural revenues, the Cash Reserve Fund acts as a buffer to these effects. However, should a long term decline occur as in the case of a negative step function, the Cash Reserve Fund only provides two years of a buffer to a significant drop in revenues. Thus, it is important to test policy mechanisms available to lawmakers for managing a long term loss in revenues. The primary mechanisms available to lawmakers are to either increase taxes or decrease expenditures. Two loops are available in the model to adjust the sensitivities of each mechanism after a shock to the system from a step function. The results from adjusting the sensitivity of the Willingness to Raise Taxes an increment of 0.1 after a step decrease of 50% to agricultural revenues is shown in Figure 30:
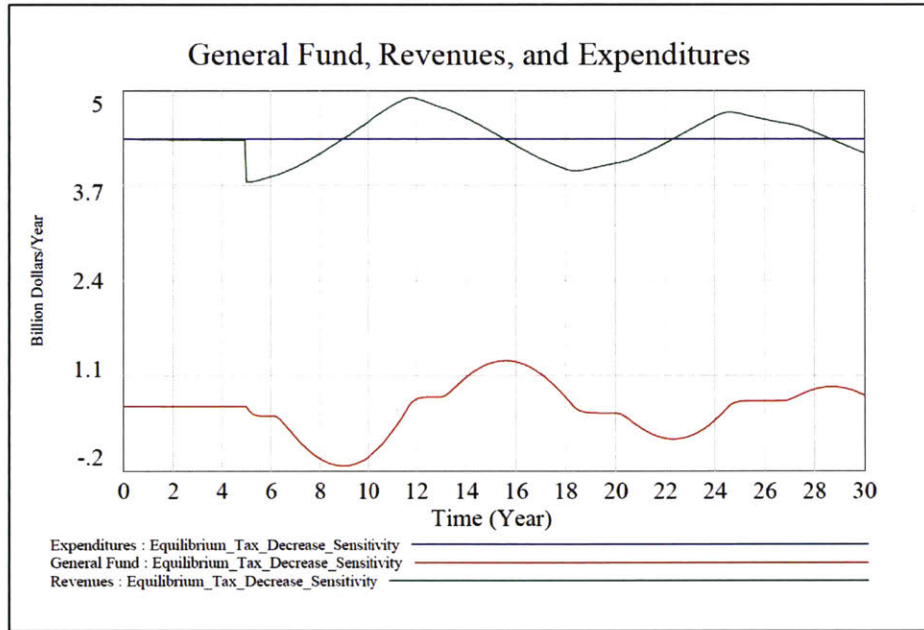
Figure 30 - General Fund, Revenues, and Expenditures after Step Decrease and Tax Sensitivity Adjustment 10%

With an incremental adjustment of 0.5, the following results are seen in Figure 31:
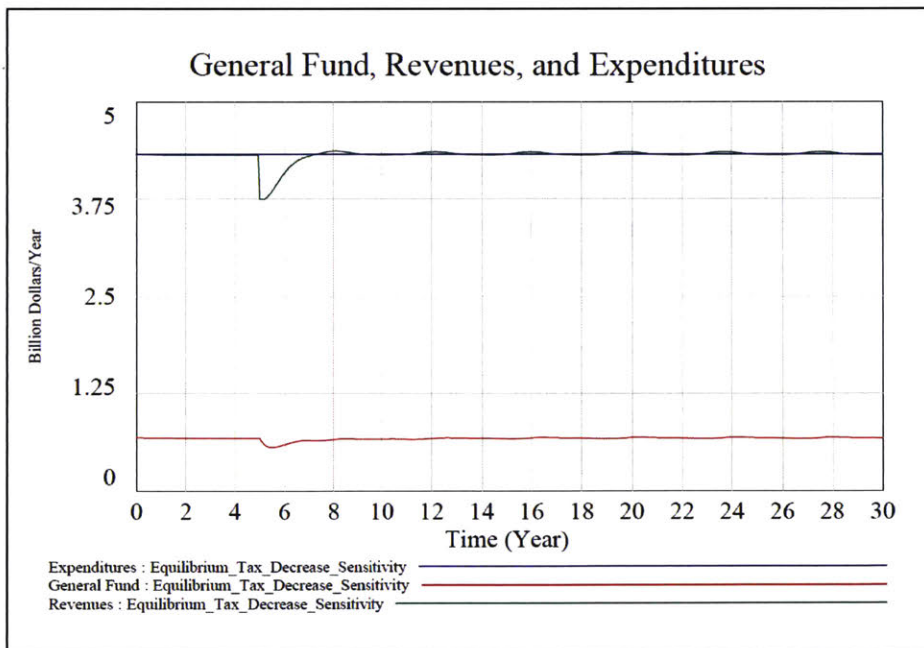

Figure 31 - General Fund, Revenues, and Expenditures after Step Decrease and Tax Sensitivity Adjustment 20%

The results show that a higher sensitivity keeps the General Fund from dropping to a negative balance even after the effective tax rate rose. However, the tax rate continues to adjust up and

down. Also, the Cash Reserve Fund becomes depleted entirely just to maintain the General Fund at desired levels. The results from adjusting the sensitivity for Willingness to Reduce Expenditures in a similar fashion (this time with the sensitivity set to 0.1), can be seen in Figure 32:
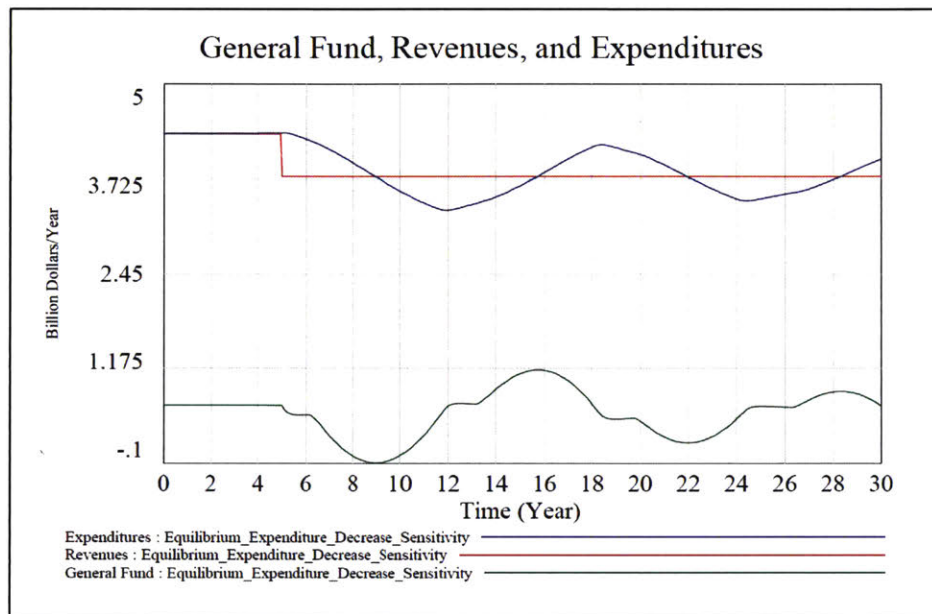

Figure 32 - General Fund after Step Decrease and Expenditure Sensitivity Adjustment 10%

The General Fund drops below zero in this simulation, although not quite as much as when adjusting the sensitivity for Willingness to Increase Taxes. The adjustment at 50% can be seen in Figure 33:
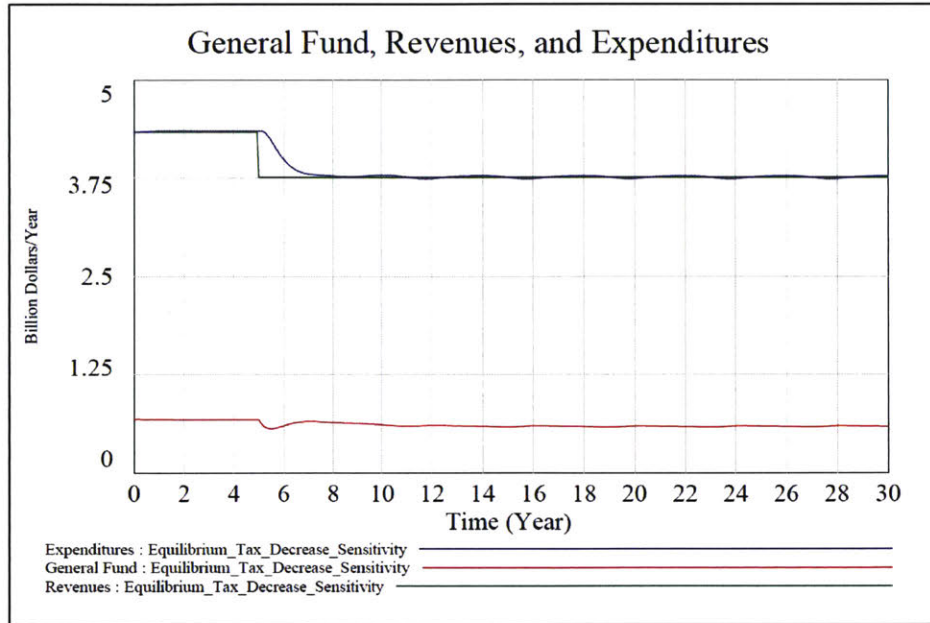
Figure 33 - General Fund, Revenues, and Expenditures after Step Decrease and Tax Sensitivity Adjustment 50%

Like the results from the adjustment of the sensitivity for Willingness to Raise Taxes, the sensitivity adjustment for Willingness to Reduce Expenditures yields similar discouraging results. At 0.1, the General Fund still accrues a negative balance, although not quite as much as the previous sensitivity adjustment. The Cash Reserve Fund also becomes depleted for multiple years at a time with barely any increase in its stock occurring. Also, without the Cash Reserve Fund, the model would undergo significant oscillatory behavior, as will be discussed later. Neither of these loops seem to be a good control structure for adjusting the General Fund after falling agricultural production revenues. Testing at various sensitivities offer interesting results, but how does a policymaker know what each increase or decrease in sensitivity means in real life? How would this translate to an effective policy for the state of Nebraska? Thus, another way to adjust expenditures and revenues in the model is needed.

A computed endogenous response based on desired and actual expenditures and revenues (outlined previously in this chapter) has been developed to provide a more realistic adjustment for the model's Effective Tax Rate and Expenditure Multipliers. Using the same shock to the system while in equilibrium (step down of 50% starting in year five), the following results can be seen to the General Fund after turning on the Switch for Computed Effective Tax Rate in Figure 34:
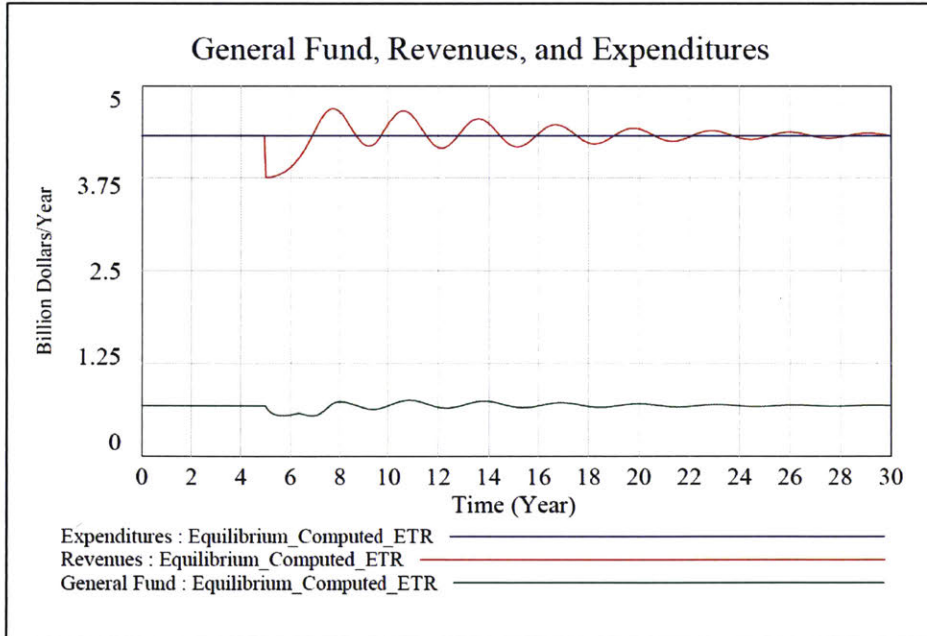
Figure 34 - General Fund, Revenues, and Expenses after Step Decrease and Computed Effective Tax Rate On

These results indicate a more realistic scenario. While oscillations do occur, the impact of the Computed Effective Tax Rate being turned on show the model working towards moving the General Fund back to equilibrium after the 50% drop of agricultural revenues in year five. The General Fund itself never reaches a negative balance and, while the Cash Reserve Fund does, it only happens briefly rather than the multiple times seen when testing the sensitivities from the previous test, and the Cash Reserve Fund balance grows again after transferring cash to the General Fund. One area of concern is the oscillatory nature of the Effective Tax Rate once the Computed Effective Tax Rate is switched on. The rate's adjustments can be seen in Figure 35:
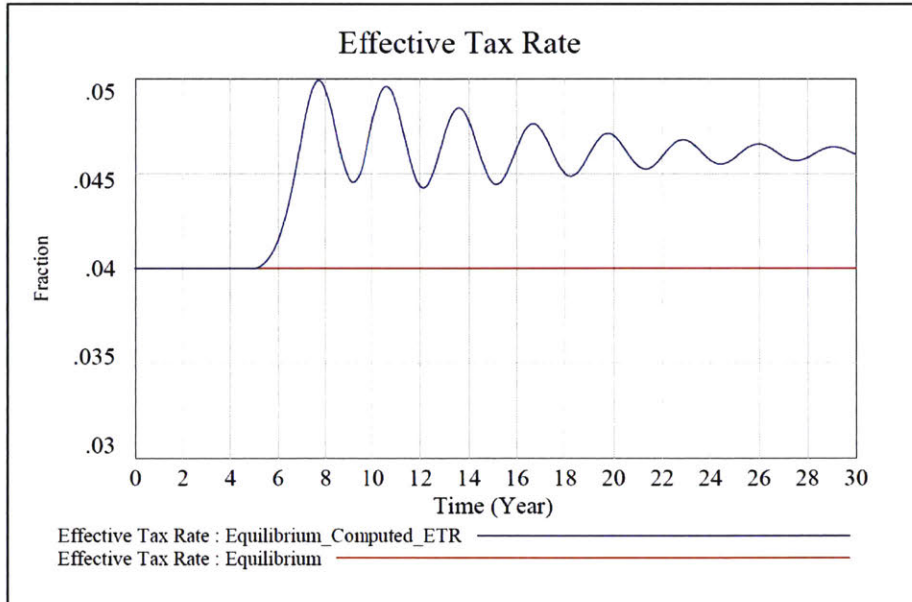
Figure 35 - Effective Tax Rate after Computed Value Switched On

From a policy mechanism perspective, this adjustment does work to combat the decline in agricultural revenues seen from the system shock. However, it might be difficult to pursue in practice, as this requires a significant amount of tax increases and decreases by policymakers. Regardless, the results from the model are encouraging.

Using the same shock to the system, the impact to the General Fund, Revenues, and Expenditures after turning on the Computed Expenditure Multiplier can be seen in Figure 36:

Figure 36 - General Fund, Revenues, and Expenditures after Step Decrease and Computed Expenditure Multiplier On

A brief drop below zero does occur for the General Fund balance, but the Computed Expenditure Multiplier quickly raises back to a positive balance and reaches a new equilibrium based on the new level of revenues being netted by the system. The Cash Reserve Fund never recovers to its original value; however, due to the lower revenues being collected from a 50% decline in agriculture production re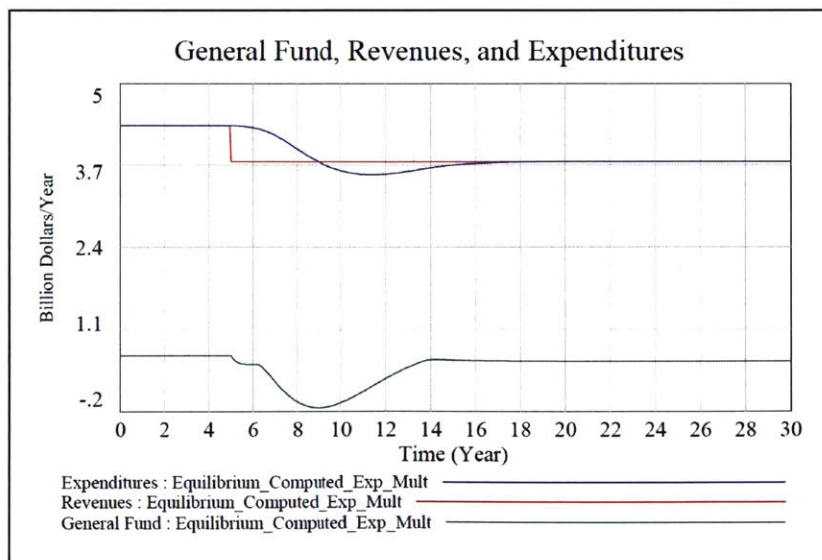venues, the Cash Reserve Fund finds a new equilibrium lower than its original value. The same occurs for the system's expenditures when examined more closely, which can be seen in Figure 37:
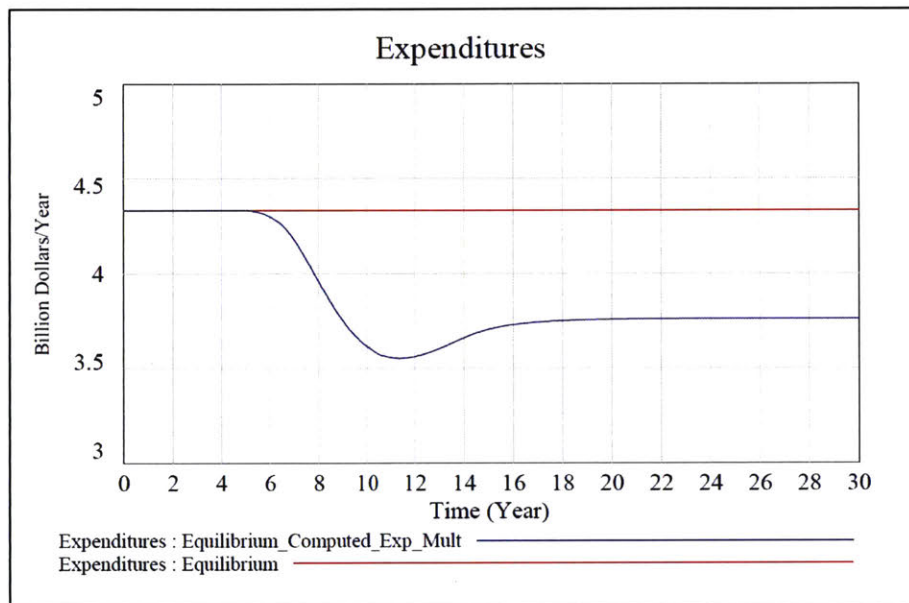
Figure 37 - Expenditures after Computed Value Turned On

While the Computed Expenditure Multiplier does not prevent the General Fund from dropping to a brief negative balance, the mechanism does a better job at reaching a new equilibrium than does the Computed Effective Tax Rate. This mechanism does not exhibit the same oscillatory behaviors as seen from the Computed Effective Tax Rate; this is because the expenses are reduced according to the revenues being brought in, with smoothing effects driving the time it takes for the system to determine this. These time delay parameters cause the expenditures to undershoot and then increase. The Computed Expenditure Multiplier does not, however, work to increase revenues for the system, which means that any future system shocks will not have additional revenues collected by the system to help combat against volatility. Based on the

results seen during equilibrium testing, each of these policy mechanisms do a good job of managing impacts to the state's General Fund when met with a significant shock to the system.

5.4.2 – Testing the Model with Growth and Other Effects

This section explores more in depth model testing, rather than simply exploring the model while in equilibrium. This includes adding shocks and cyclical inputs to the model, adding growth rates, and turning on additional impacts caused by policy mechanisms used by the system for managing the General Fund.

The following test includes adjusted variable parameters from their initial values for the simulation. These parameters have been chosen as a way to provide a scenario to plausibly mimic a real world scenario for the state of Nebraska and policymakers in the future. The parameter settings used for the realistic scenario can be seen in Table 7:

Table 7 – Simulation Parameters

Variable	Value	Explanation
Expenditure Growth Rate	0.064	Nebraska's annual expenditure growth rate prior to budget shortfall issues
Revenue Growth Rate (for Agricultural Production Revenue)	0.01	Minimal growth rate applied to ag production
Other Revenue Growth Rate	0.025	Assumed growth with rate of inflation
Ag Revenue Step Height	-0.5	Similar system shock as compared to equilibrium
Cycle Amplitude	0.15	Introduce a slight positive cycle function to ag production revenues

With neither the Computed Effective Tax Rate nor the Computed Expenditure Multiplier switches turned on, the General Fund faces a significant budget shortfall over a 30 year period (nearing $200 billion), as seen in Figure 38:

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General Fund, Revenues, and Expenditures

Billion Dollars/Year

30
-52.5
-135
-217.5
-300

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Time (Year)

Expenditures : Initial_Settings ———————
Revenues : Initial_Settings ———————
General Fund : Initial_Settings ———————
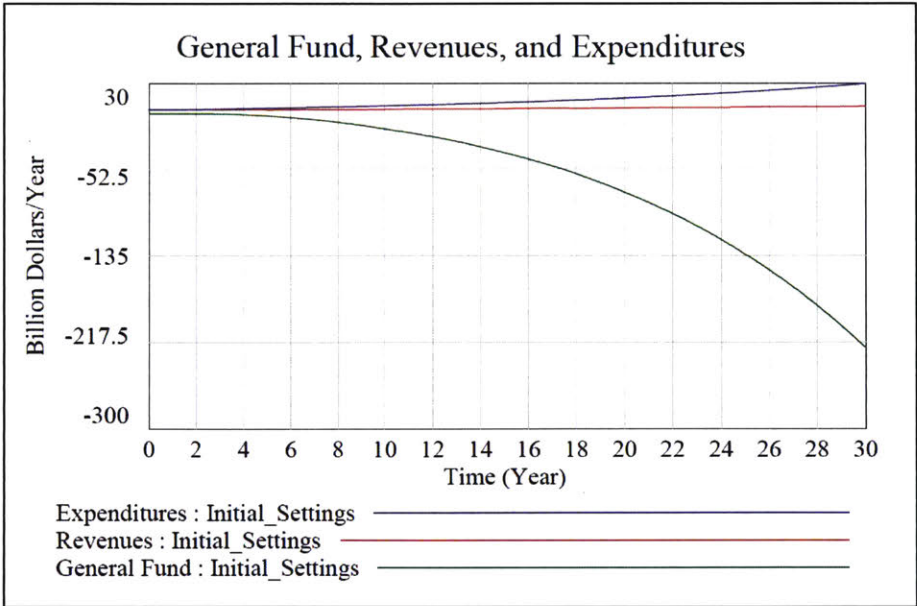
Figure 38 - General Fund, Revenues, and Expenditures, No Action Taken

While not a predictor of the future, this is a general idea of the direction Nebraska's General Fund may go should no action be taken to curb the losses of tax revenues collected by the state caused by falling agricultural commodity prices over a 30 year period, with no adjustment to expenditures or taxes during that entire time. Revenue growth for agricultural and non-agricultural revenues is less than expenditures, and the long time horizon shows the impacts this is having on the state's General Fund.

After turning on the switch for the Computed Effective Tax Rate, the following behaviors are observed with respect to the state's General Fund, Revenues, and Expenditures (Figure 39) and Effective Tax Rate (Figure 40):
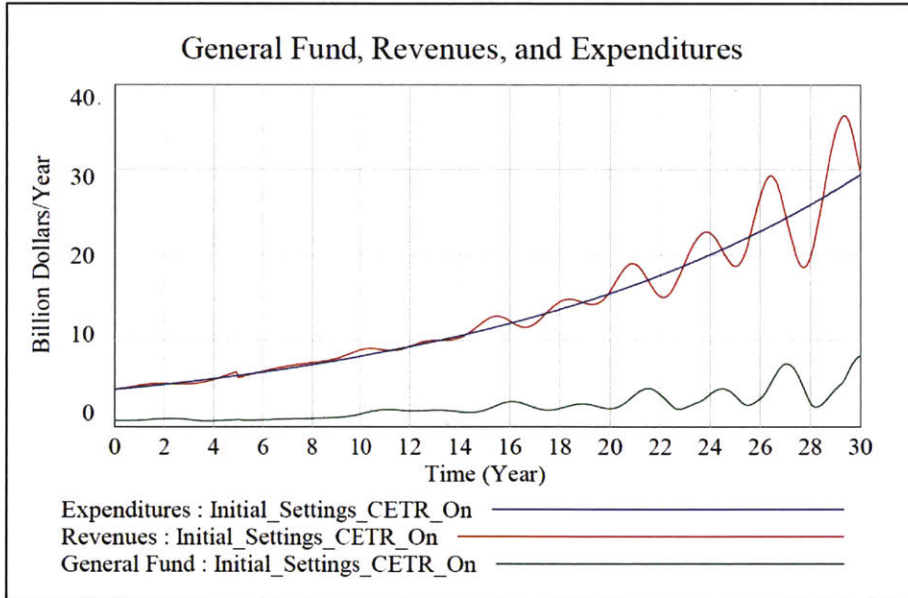
Figure 39 - General Fund, Revenues, and Expenditures, Computed Effective Tax Rate Turned On
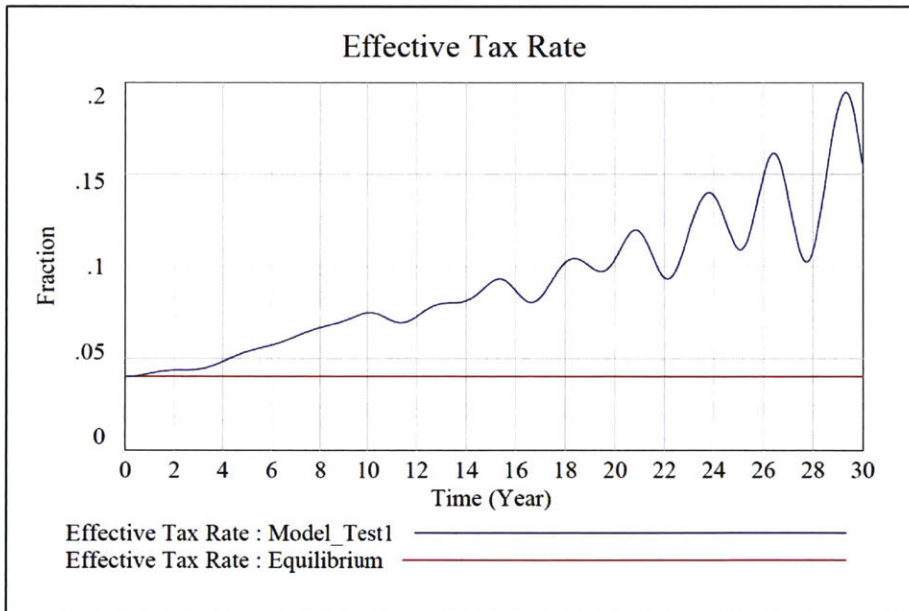
Figure 40 - Effective Tax Rate, Computed Effective Tax Rate Turned On

The model increases the tax rate to a significant level as a means to combat the fall in agricultural revenues, along with maintaining the rise in expenditures. Also, the model is working to ensure that the Cash Reserve Fund has the desired fraction of revenues needed. The General Fund grows at a fairly realistic rate through approximately year 15, after which time the

fund becomes more volatile (as does the Effective Tax Rate). From this point on, the growth of the General Fund and Effective Tax Rate begin to increase, and also become more volatile while trying to manage the dynamics of the system.

When turning off the switch for Computed Effective Tax Rate, and turning on the switch for Computed Expenditure Multiplier, the following behaviors are observed with respect to the General Fund (Figure 41):
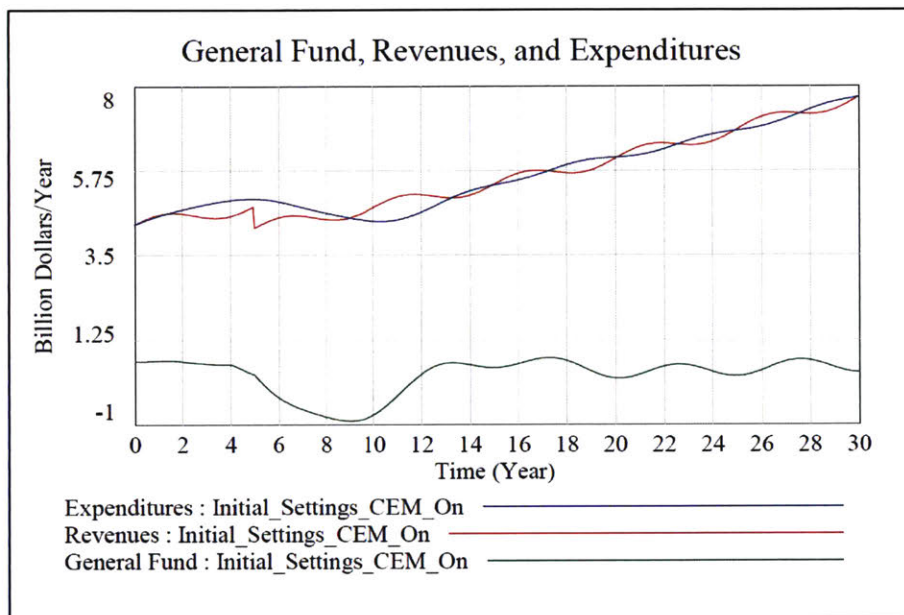
Figure 41 - General Fund, Revenues, and Expenditures, Computed Expenditure Multiplier On

With the Computed Expenditure Multiplier turned on, the model succeeds in managing to bring the General Fund balance back above negative value following a 50% drop in agricultural production revenues, but faces increased volatility during the second half of the simulation. Also note that the General Fund starts to go decline prior to the decline in agricultural production (caused by the difference in growth rates between expenditures and revenues). Expenditures grow fairly consistently from this point forward, as well. This seems to be due to the growth in Baseline Expenditures being set to 6.4%. After adjusting this value down to 4%, a level mentioned to be a realistic expenditure growth rate in Chapter 3, the following results are seen with the General Fund in Figure 42:
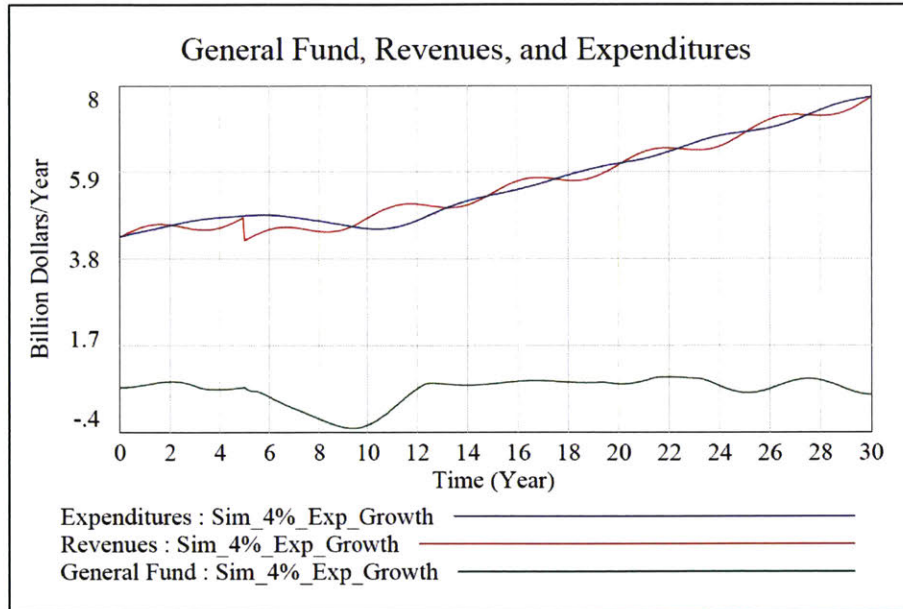
Figure 42 - General Fund, Revenues, and Expenditures, Computed Expenditure Multiplier on and Expenditure Growth 4%

Based on the results, the Computed Expenditure Multiplier works long term so long as the growth in Baseline Expenditures is not significantly higher than the revenues collected by the state. These results makes sense, as long term expenditures being greater than the taxes collected by the state would yield a major deficit. Should the agricultural production revenues increase in the future, it alleviates the expenditure cuts necessary for maintaining a General Fund above zero.

Setting the Baseline Expenditure value back to 6.4%, and turning both switches on for Computed Effective Tax Rate and Computed Expenditure Multiplier, the following results are seen for Nebraska's General Fund in Figure 43:
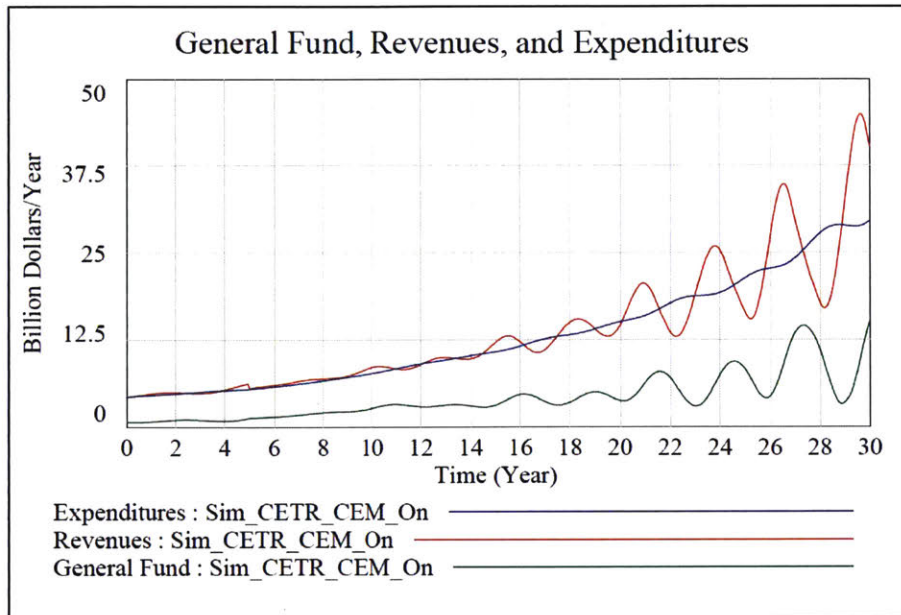
Figure 43 - General Fund, CETR and CEM Switches On

With both multipliers working in tandem, growth in the General Fund attains much higher values than seen with either the Computed Effective Tax Rate or Computed Expenditure Multipliers working alone. The model is able to manage the shock of a 50% drop in agricultural production revenues fairly well, and overall the General Fund grows consistently during the first 15 years of the simulation. Starting after year 15, however, the model's behavior shows increasingly oscillatory behavior, caused by the model's attempt to manage a higher growth in Baseline Expenditures than the revenue being brought in by the model. This is interesting behavior, as the loop dominance seems to shift each time the Effective Tax Rate sends revenues higher than needed. As this occurs and expenditures continue to grow, the Computed Effective Tax Rate begins to dominate the model's behavior again and send the tax rate higher, only to drop it a few years later. This is an interesting upward cycling trend. With both multipliers turned on, it seems that both policy mechanisms are trying to fully solve the problem. It is important to think about the impact that the Cash Reserve Fund might be having in this regard. It is also important to consider how feasible it is for the Effective Tax Rate to climb so high. Regardless, it seems important to test these computed multipliers at lower strengths as a way for the loops to complement one another instead of both working at full strength. This testing is done by only partially turning on the computed multiplier switches and testing their effects through a number of simulations.

Exploring both computed values working together is interesting, but it is also useful to explore a combination of these two policy mechanisms with their switches turned on only partially, as mentioned before. This demonstrates their dual use without either Computed figure turned on in full; basically, this allows policy makers to explore the best combination of tax increases or expenditure cuts, if one combination exists. Three simulations of these partial switches were conducted, with the first simulation consisting of the switch for Computed Expenditure Multiplier set to 0.25 and the switch for Computed Effective Tax Rate set to 0.75, the second simulation set with both switches being set to 0.50 and 0.50, and then finally the third simulation conducted with the switch for Computed Expenditure Multiplier set to 0.75 and the switch for Computed Effective Tax Rate set to 0.25. The results of these simulations can be seen in Figure 44, Figure 45, and Figure 46:
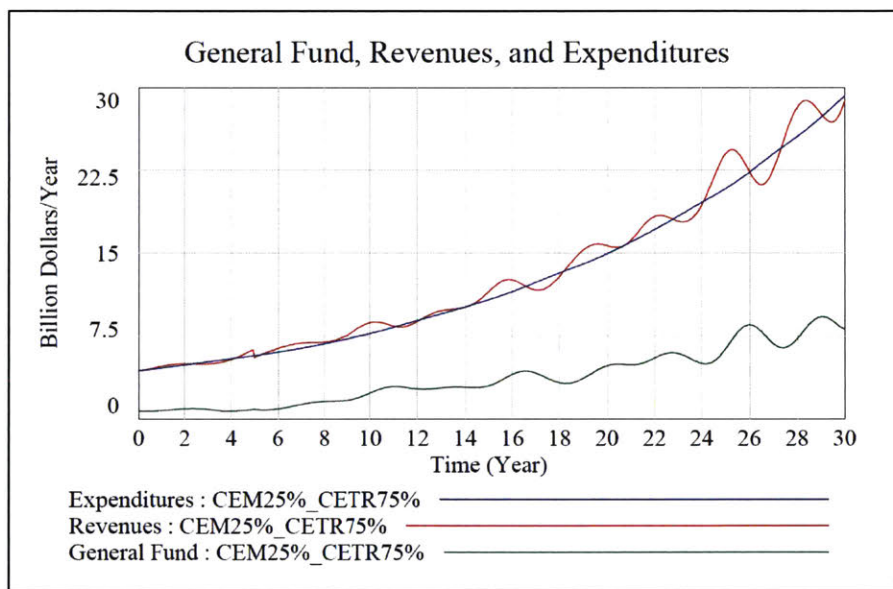
Figure 44 - Partial Switch Testing with CETR 75% and CEM 25%
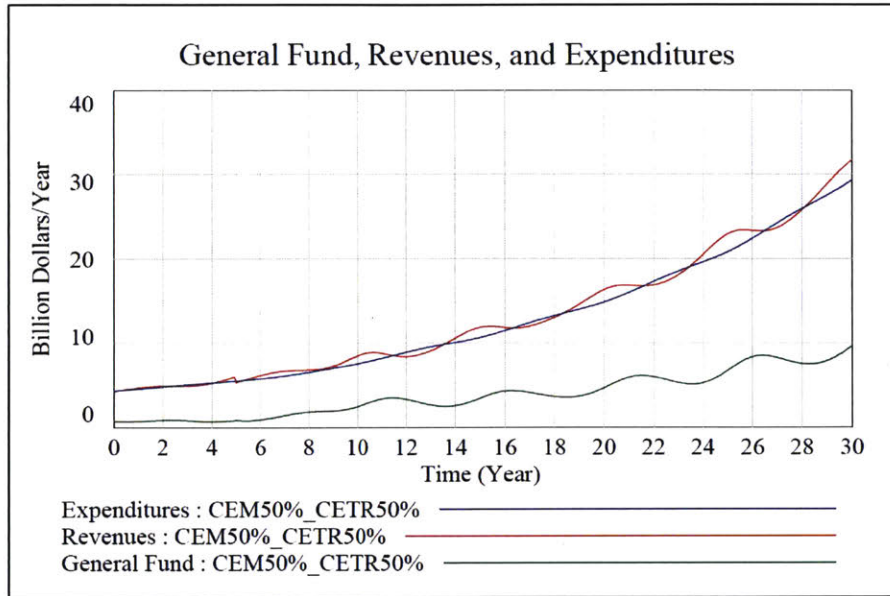
Figure 45 - Partial Switch Testing with CETR 50% and CEM 50%
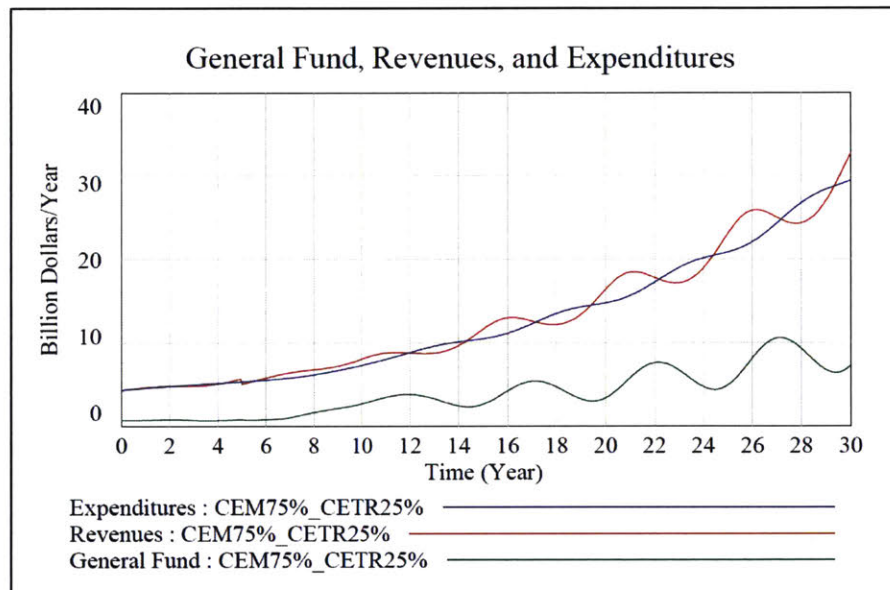
Figure 46 - Partial Switch Testing with CETR 25% and CEM 75%

In comparing the results from these three simulations, it seems that the results from the second simulation, seen in Figure 45, offer the best results with the least amount oscillatory behavior. For Nebraska citizens, the second simulation seems to offer the least oscillatory behavior of the three simulations for the Effective Tax Rate, as well. The Effective Tax Rate between the three of these simulations can be seen in Figure 47:
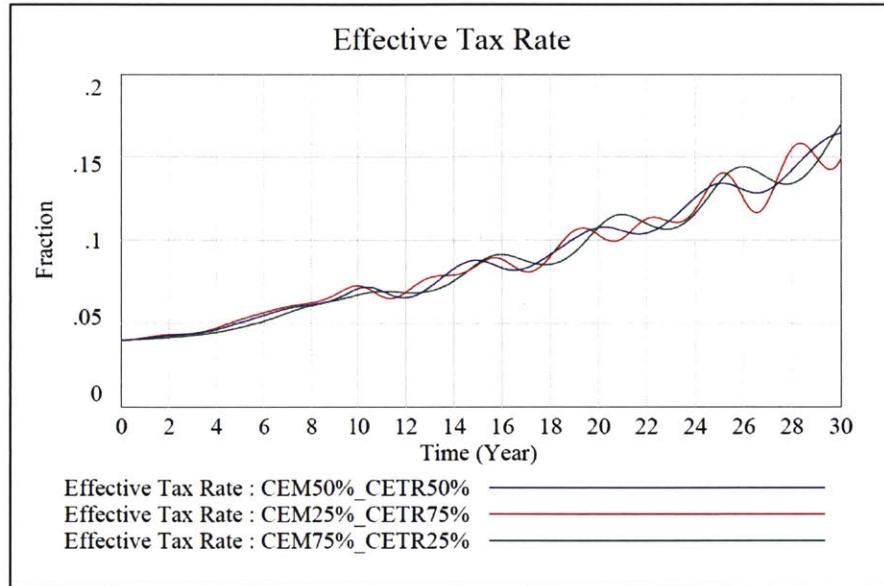
Figure 47 - Effective Tax Rate Comparisons

Simulating the model with the switches for Computed Effective Tax Rate and Computed Expenditure Multiplier only partially on yields interesting results when compared to these switches being both fully on. There is less oscillatory behavior occurring when these computed loops operate at partial strength rather than full strength. This allows the model to adjust its parameters without the same strength that would occur if both switches are on. In all cases, the oscillations tend to increase during the latter half of the simulations, but the partial switch results offer the least of this behavior occurring. While the General Fund doesn't achieve as high of a value, the partial switch simulations would likely provide the best results for Nebraska stakeholders.

5.4.3 – Production Disincentive and Level Services Impact

Turning on the impacts for raising taxes and decreasing expenditures adds some interesting dynamics to the model. Starting the model with the same initial conditions as post-equilibrium testing, with the Computed Effective Tax Rate turned on and the Production Disincentive sensitivity set to 1, the model's behavior yields a surprising result. While revenues do not change drastically, the Effective Tax Rate actually does. Figure 48 illustrates the impact that the production disincentive actually has on the model:
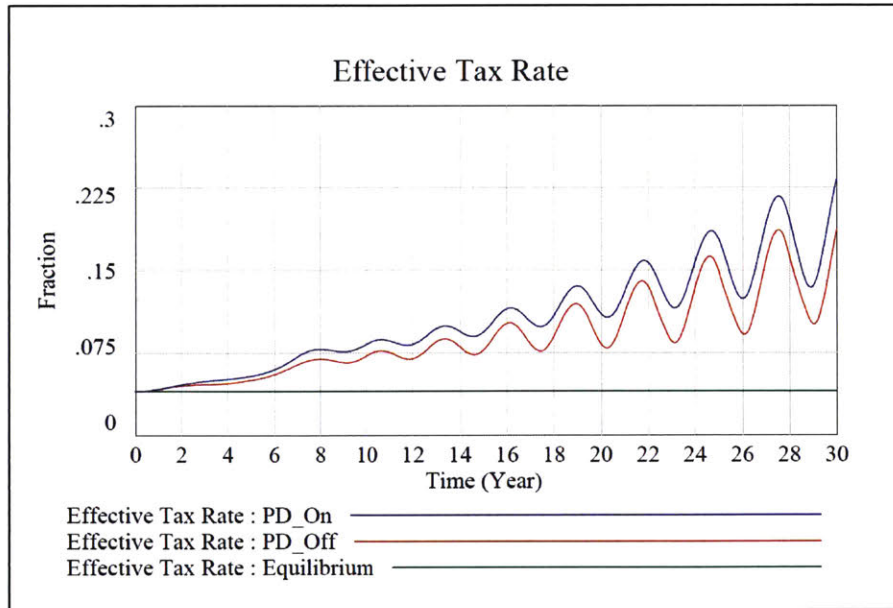
Figure 48 - Production Disincentive Impact on Effective Tax Rate

In effect, when the Production Disincentive is turned on, the model must increase taxes in order to collect the same amount of tax revenues. Ultimately, the revenues collected remain the same, but the population must pay more in taxes in order for the state to collect the same amount of revenues. Thus, raising taxes means those that produce end up paying higher taxes. This is an interesting dynamic.

Similar dynamics are at play when adjusting the sensitivity for the Level Services Impact. In effect, as the sensitivity is increased, the more that Expenditures do not meet the level of Baseline Expenditures, the more additional expenditures are added to the state long term, meaning that the state will be required to pay more in the future. These dynamics can be seen in Figure 49:
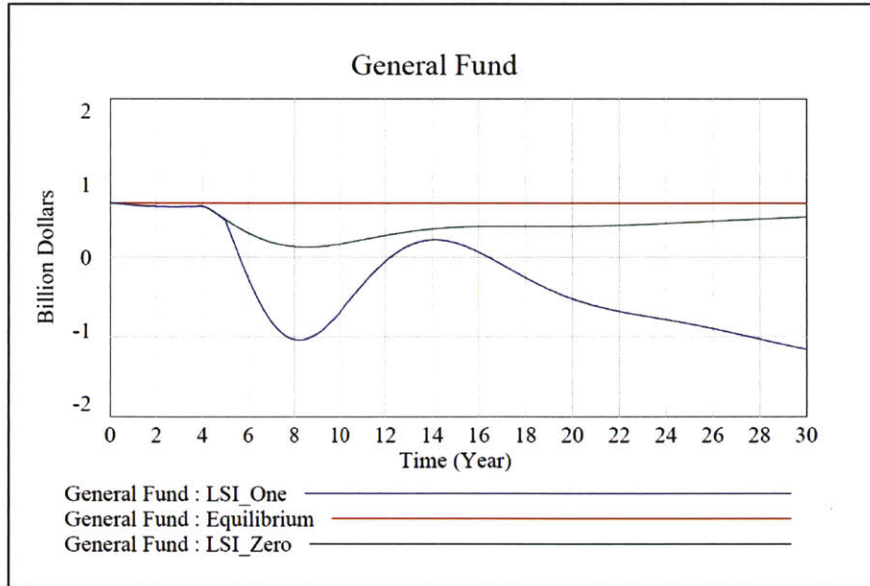
Figure 49 - Level Services Impact on General Fund

With the Level Services Impact sensitivity turned to 1 rather than zero, the model starts being impacted by expenditures equaling less than the baseline level. This adds more costs to the model long term, resulting in the General Fund behavior seen in Figure 49. The Expenditure Multiplier behavior can be seen in Figure 50:
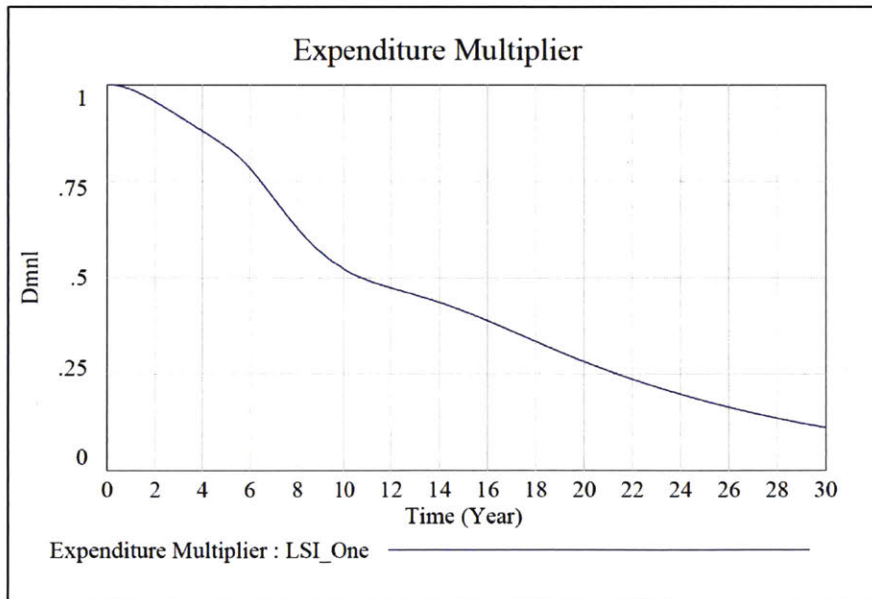
Figure 50 - Expenditure Multiplier Behavior

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Thus, in this simulation the Computed Expenditure Multiplier feedback loop cannot keep up with the additional expenses being necessary to state level services, as expenditures continue to be cut below the Baseline Expenditures level. There is certainly some debate as to what the "Baseline Expenditures" level should be set at; in Figure 46, the rate is 6.4%, much higher than is the likely real baseline rate but set equal to Nebraska's expenditure growth from 2000-2016. Regardless, the dynamics shown are very interesting.

5.4.4 – Additional Revenue Growth Options

While not endogenous to the model, it is beneficial to explore what dynamics an increase in revenues might have on the state long term, either through the addition of revenue from other sources or by increasing Nebraska's Value Added Economic Multiplier by adding additional agricultural non-production activities throughout the state. Nebraska could explore the addition of new agricultural non-production value added enterprises throughout the state as a way to reduce the burden of falling agricultural commodity prices. While increasing the multiplier won't by itself prevent Nebraska from facing a budget shortfall, it will delay the amount of time it takes for that shortfall to occur. With a drop in agricultural production revenue of 50% in year 5, and the expenditure growth rate set to 4%, a 50% increase in the Value Added Economic Multiplier yields interesting results, as seen in Figure 51:
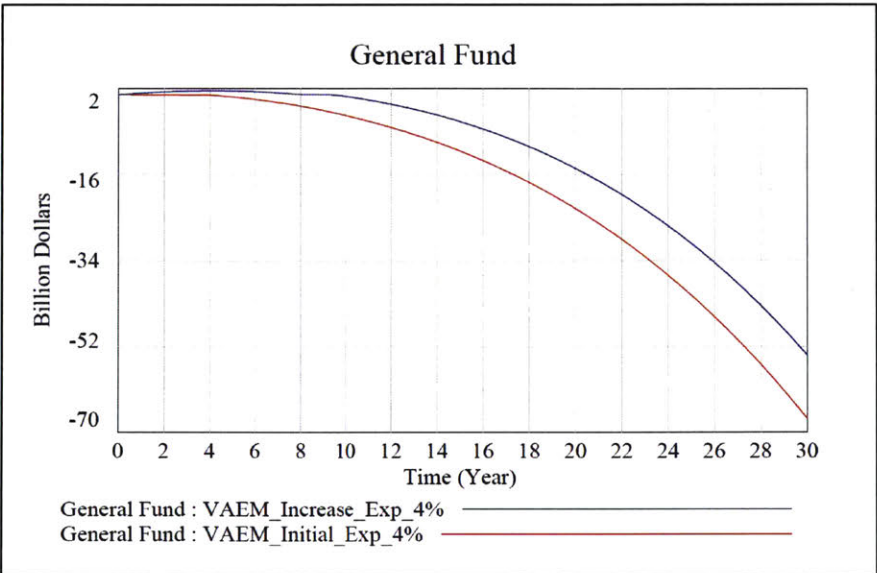
Figure 51 - Value Added Economic Multiplier Increase

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With no increase in the Effective Tax Rate or no decrease to Expenditures, the General Fund eventually faces a steep negative decline. However, the 50% increase in the Value Added Economic Multiplier keeps the state's General Fund positive for approximately five years longer than initial conditions. Only after year 10 with a 50% increase in the Value Added Economic Multiplier does the state's General Fund turn negative, compared with just after year 5 under initial conditions.

Considering revenue growth outside of agriculture is another option for the state. As mentioned by former State Senator Kate Sullivan, considering alternative revenue options like legalizing gambling might be beneficial for the state for solving long term revenue problems. Impacts to the General Fund from keeping the same initial conditions as the previous simulation and adding a 2.5% increase in Non-Ag Revenue generation (from something like the state legalizing gambling) can be seen in Figure 52:
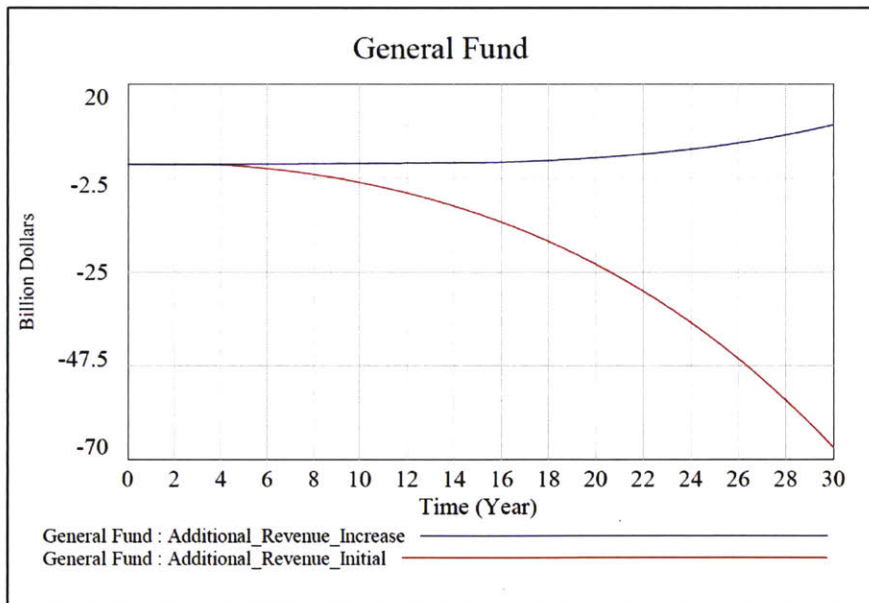
Figure 52 - Non-Ag Revenue Increase

Should the state decide to pursue additional revenue sources such as legalizing gambling (and should those additional revenue streams equal a 2.5% annual increase in revenue generation), then the state would have a much better overall position with regards to revenue generation than it currently has. Although this is certainly speculative, it may behoove the state to consider

additional revenue streams, along with debating the proper policy mechanisms to impose, in order to manage the looming budget shortfall and long term issues facing the state.

5.4.5 – Analyzing the Cash Reserve Fund Dynamics and their Impact on the Model

The last model dynamics to explore are in regards to the Cash Reserve Fund and its impact on the model. The Cash Reserve Fund is an important component of Nebraska's ability to meet its funding needs, especially during economic downturns. When the Cash Reserve Fund is not available for use, interesting dynamics are displayed in the model. Figure 53 displays the results of a 0.5 step down in agricultural production revenue combined with an adjustment of the sensitivity for Willingness to Raise Taxes:
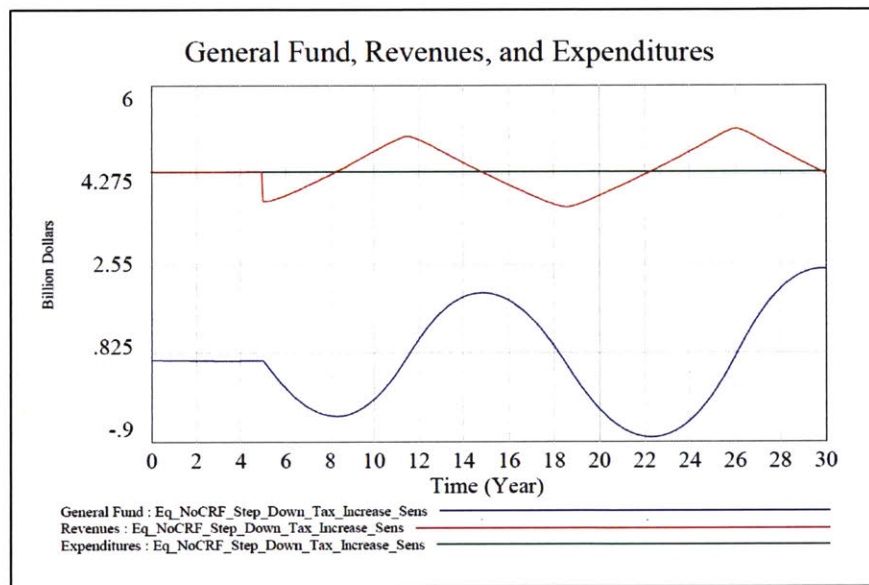
Figure 53 - No Cash Reserve Fund with 50% Ag Production Drop and Tax Increase Sensitivity Adjustment

Without the Cash Reserve Fund, implementing a 0.5 step decrease input to agricultural production revenues and adjusting the sensitivity for Willingness to Raise Taxes to -0.1 results in large scale oscillations over the simulation. When the same input occurs but the sensitivity of the Willingness to Reduce Expenditures increases to 0.1, similar results can be seen in Figure 54:
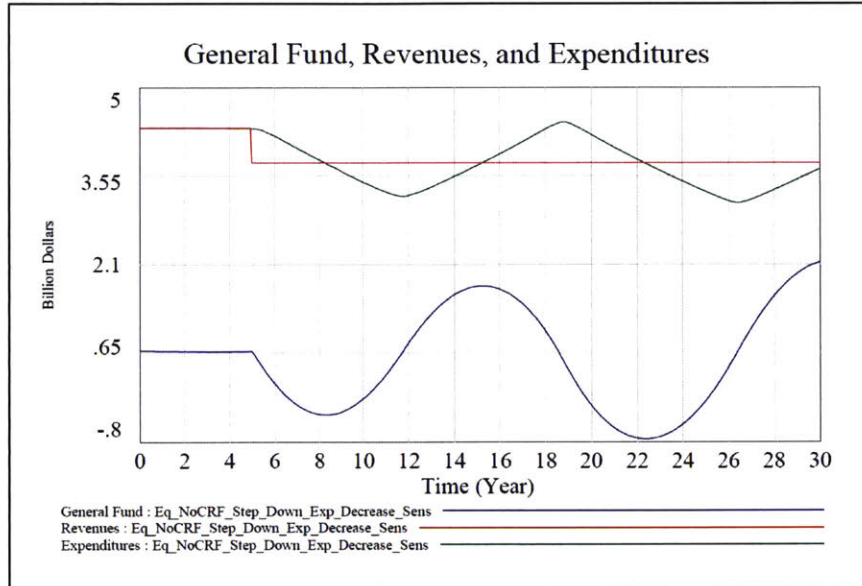
Figure 54 - No Cash Reserve Fund with 50% Ag Production Drop and Expenditure Decrease Sensitivity Adjustment

These oscillations are caused by the impact that the integral control of the model using the sensitivity adjustments. Because the Willingness to Increase Taxes and Willingness to Reduce Expenditures balancing loops react anytime a gap exists between the General Fund and Desired Cash, when the General Fund finally comes into balance the Effective Tax Rate stock and Expenditure Multiplier stock are higher than they need to be. This causes an overshoot; this is especially noticeable when the Cash Reserve Fund is not present, and causes the significant oscillatory behavior to occur.

Testing the computed values shows similar results when the Cash Reserve Fund is not included in the model. The results from turning on the Computed Effective Tax Rate after a 0.5 drop in agricultural production revenues can be seen in Figure 55:

General Fund, Revenues, and Expenditures

General Fund : Eq_NoCRF_Step_Down_CETR_On
Revenues : Eq_NoCRF_Step_Down_CETR_On
Expenditures : Eq_NoCRF_Step_Down_CETR_On
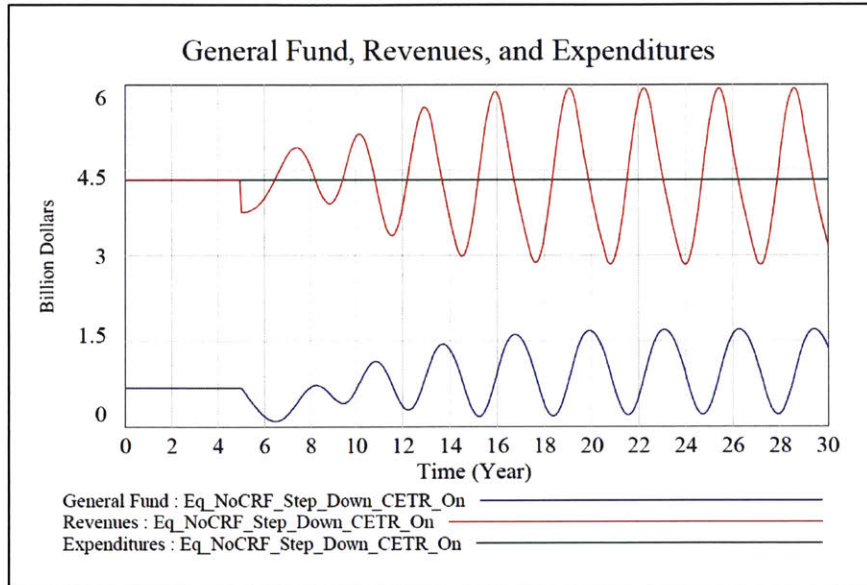
Figure 55 - Computed Effective Tax Rate with no Cash Reserve Fund

The Cash Reserve Fund structure plays an important role in this model as a way to better regulate system shocks by providing the General Fund with needed cash during economic downturns. This important model dynamic can be seen acutely when the Cash Reserve Fund is removed and simulations are run. Without the Cash Reserve Fund, the model becomes increasingly oscillatory. Further analysis of the impacts of the Cash Reserve Fund could be explored during future research, but the importance of this structure to the model should not be understated.

5.5 – Conclusion

This chapter examined the various policy mechanisms and areas for additional revenue generation available to the state, along with the impacts they might have on the state long term. It is important to consider these impacts when planning policy for the state. The next chapter will discuss policy recommendations for the state of Nebraska for improving the state's revenue generating position long term while imposing the least amount of negative externalities on the state's citizens and overall physical and economic health.

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Chapter 6 – Policy Recommendations

6.1 – Introduction

The problem facing Nebraska is a difficult one, but by using a systems approach to determine the best path forward, the unintended consequences of traditional approaches to policy implementations can be avoided or minimized. This section outlines some brief recommendations for setting policy for the state of Nebraska in order to minimize impacts to the state long term and avoid adverse unintended emergences for stakeholders.

6.2 – Recommendations on Tax Policy

As discussed in earlier chapters, tax increases in the state of Nebraska are not generally popular and current lawmakers are not inclined to pursue tax increases as a way to reduce the budget shortfall impacting the state at this time. As a policy mechanism available to policymakers, however, tax increases provide a useful tool for reducing the budget shortfall by generating more revenues for the state government. The model discussed in Chapter 5 outlines the behavior of the Effective Tax Rate as it adjusts throughout the time horizon of the model in order to keep the General Fund at desired levels. Working alone, the Effective Tax Rate nearly reaches 20%, even before accounting for the long term impacts from the Production Disincentive model structure. In practice, implementing a tax increase of this magnitude would surely cause intense pushback from the state's population and policymakers would likely not pursue such increases, even for a short period of time. However, targeted tax increases working in tandem with expenditure cuts, as has been done during previous economic downturns, could potentially be more palatable for the state. Although Nebraska is already a "high tax" state as mentioned previously, should no other options become available to policymakers, this policy mechanism might be necessary. Also, rather than implement tax increases in the oscillatory manner demonstrated in the model, it would be more prudent to implement any tax adjustment without the oscillatory adjustments up and down. The model adjusts the Effective Tax Rate while trying to maintain the Cash Reserve Fund at a set percentage of revenues each year (15.75% in the model); allowing this percentage to be a range rather than a set rate each year (such as 12%-19%,

or something similar) would help to minimize these oscillations and allow the state to be more flexible in the management of its funds.

These increases might not come in the form of an income tax rate increase, but may instead manifest as a sales tax increase or removal of sales and use exemptions on certain items. Nebraska is currently debating the imposition of a sales tax on internet sales, something not done before in the state. Nebraska law states that "…Internet retailers are not required to collect sales tax on purchases from a state unless they have a physical presence in that state, such as a retail store or warehouse" (Hammel, 2016). This new tax could help shore up some of the revenue issues that the state is facing, with the state likely to take in anywhere from $45-$118 million in additional revenue annually (Hammel, 2016). The policy is currently under deliberation, and some lawmakers have voiced their opposition to its implementation, including Nebraska's Governor, who has voiced his intent to veto the bill, should it pass (Hammel, 2017). This debate is likely to continue, but for policymakers, it is important to remember the impacts that raising taxes will have (or will not have) not only on generating new revenues for the state, but also on the state's population and the overall willingness to produce under an increasingly high tax environment. As mentioned earlier, current bills introduced by state lawmakers have sought to remove sales tax exemptions and establish the imposition of higher tax rates on agricultural products and farmland. These policies would create increased hardship for the citizens in the state already being hit hardest by the fall of agricultural commodity prices, likely increasing the rate of farm quits in the state. The analysis conducted also doesn't fully consider the impacts that property taxes and valuations are playing on the state's agricultural producers, either. While the intentions may be good, the likely outcome of such policies would be bad for the state and should only be used if no alternatives are available or the imposition of taxes will be minimal to the state.

In summary, tax increases used as a policy mechanism for managing Nebraska's budget shortfall issues will work, and short of other alternatives may be necessary to the state's policymakers as a way to maintain solvency while combating a long term trend of commodity price declines in the agricultural sector. This mechanism should be used with caution, however, as tax increases result in real impacts to the state's populace, especially if the increases imposed are not general in nature but specific to an industry (such as the removal of sales tax exemptions on agricultural equipment during a downturn in the agricultural economy). Should nothing else

change, including the growth rate of state expenditures, tax increases will absolutely be necessary for balancing the state's General Fund. However, should policymakers decide to raise taxes, it would be wise to pursue a reduction in expenditures along with potential tax increases over a longer time horizon than just the upcoming two year budget period.

6.3 – Recommendations on Spending Policy

The state's expenditures since the turn of the century have grown at a fairly large annual rate (approximately 6.4%). This includes the effects during economic downturns. Although the state's overall revenue generation during this time has also increased, current trends have put a damper on the state's ability to continue spending at this rate for at least the near term. While not popular to all stakeholders, cuts to state expenditures are definitely required to help stem the looming budget shortfall impacting the state. Simply put, if the state does not have the tax revenues available for fully funding its departments and projects at expected levels, cuts to those levels will be needed so as to not accrue a negative balance, take out loans, or fully deplete the state's Cash Reserve Fund, at least in the short term. However, the problem facing Nebraska will likely require future cuts to expenditures as a way to manage increasingly lower tax revenues caused by the decline of agricultural commodity prices. Should this occur, the state will need to consider the impacts these expenditure cuts are having on the state long term, especially in regards to services like education, infrastructure projects, and health and human services funding (as mentioned in Chapter 3). The impacts that these long term cuts can have on the state have been modeled in Chapter 5, and must be considered for any long term policy plan moving forward.

It seems prudent to make expenditure cuts to state government agencies as a way to stem the short term impacts to the Nebraska General Fund. However, in order to prevent major funding issues to vital state services, a long term plan must be considered as a way to manage less than expected revenues collected by the state. Especially as Nebraska's population continues to age and funds are needed to help pay for medical care for the aging population, a long term plan will be vital for determining how best to pay for these costs. As mentioned in Chapter 4.3.2, the problem faced by lawmakers is often only thought of in the short term, rather than considering the long term implications of policy actions being taken now. This is difficult to

overcome sometimes, as re-election for a second term might be the main focus for many lawmakers. However, placing an emphasis on managing the long term impacts that expenditure cuts can have is important. Considering long term spending cuts with targeted tax increases might be a way to manage this problem long term.

6.4 – Revenue Generation Policies

What has seemingly been the least pursued tactic for closing the budget shortfall facing the state of Nebraska has been the promotion of revenue generating activities in the state. Although pitfalls for promoting new businesses exist, this seems to be the best long term option for the state as a way to reduce the budget shortfall while maintaining sustainable growth in the state's Baseline Expenditures. Further, these activities can help provide stakeholders, such as Nebraska's farmers and ranchers, additional opportunities for selling their goods, as well as opportunities for additional work, should it be necessary. Pursuing additional agricultural production facilities such as canneries, ethanol plants, food processing facilities, and other value added operations would help increase the state's economic multiplier on agricultural production and provide farmers with additional options for managing their products. This might also assist in further diversifying the state's agricultural sector, allowing farmers to more easily switch between crops during economic downturns (for instance, producing vegetables or different grains instead of Nebraska's primary crops like corn and soy). Working to expedite the start of these activities (like the Costco chicken plant mentioned before) would provide more revenues for the state and local governments now, and provide farmers with those additional buyers for their products earlier. It is true that legal hurdles remain and local populations might not be as welcoming to these activities, and these concerns are valid. There will certainly be negative externalities facing the state's citizens for any new large-scale activity. However, working with local communities proactively as a way to reduce these negative externalities from new operations from the very beginning would benefit the state overall, as would an effective oversight of these activities, and ability to respond quickly to any major issues created by these operations.

Pursuing the legalization of gambling is one revenue generation activity not originally considered for this analysis. While the issue has been brought up to the state to vote on in the

past without success, gambling's legalization in the state remains fairly popular to many Nebraska citizens. Further, many of the states surrounding Nebraska already allow for gambling within their borders, including Iowa, South Dakota, Missouri, and Kansas (per the author's own knowledge). It seems that keeping Nebraska gambling free does not necessarily keep its citizens away from gambling, but in fact promotes travel to other states for such activity. The issue of negative externalities caused by gambling is certainly an important one, and must be thoroughly vetted during another vote on the legalization of gambling in the state. Even more, this approach doesn't do much to improve the situation facing much of Nebraska's rural communities, and could in fact expedite their decline if not implemented properly. A fact-based, straightforward overview of gambling's legalization in the state would be needed, as Nebraska voters, rather than elected officials, would likely be the deciders of this issue in the future. However, it may be worth reconsidering the legalization of gambling as a way to increase state revenues long term. Should the revenue issue in the state continue to deteriorate over the next few years, this approach might begin to look more attractive to Nebraska voters.

In summary, pursuing policies that increase the revenue generating activities in the state is likely to be an important aspect of dealing with the state's budget shortfall long term. It might not solve all aspects of the state's issues, but finding ways to generate more revenues reduces the need to raise taxes to such high levels on Nebraska's population, and reduces the need to make drastic long term cuts to expenditures. Taking this policy approach alone will not likely solve the issue, but it might help the state better manage the problem long term without creating serious negative consequences from raising taxes too high or cutting the state's level services.

6.5 – Other Recommendations

While not exactly policy related, these recommendations might help to improve some of the problems ailing the state that are likely to continue into the future. For starters, Nebraska's rural/urban gap will most likely continue to grow as more and more agricultural producers leave rural areas and move to larger population bases. If this trend cannot be slowed or reversed, it would be wise to ensure the importance of rural Nebraska is made known to the state's urban populations. Pursuing policies to support rural areas in the state and increase awareness of the state's agricultural history and agri-tourism would be a strong first step in improving awareness

of agriculture's importance to Nebraska. Additionally, it will likely help increase agri-tourism generation for the state. An increased awareness of the struggles facing rural Nebraska's communities may help urbanites empathize more with these issues instead of setting state policies based primarily on urban issues (the property tax issue in Nebraska is a prime example of this).

Another consideration for lawmakers is to ensure a long term approach is taken when setting state policies. Although term limits have hindered lawmakers' willingness to pursue long term goals (now that lawmakers can only be elected twice, there is less of an incentive to think long term on policy issues and more emphasis is placed on short term fixes), it would benefit the state for long term considerations to be a cornerstone of any legislative bill being drafted. Even though term limits have turned lawmakers' focus back towards more short term laws, ensuring legislative bills have sections focusing on long term expectations of these bills might work to turn lawmakers into longer term thinkers. This is but one suggestion for bringing the long term impacts of legislative bills back into the minds of lawmakers; while perhaps not feasible, other tactics for improving the long term thinking of legislators could be explored.

6.6 – Conclusion

The policy recommendations are meant to provide readers with a first step towards improving the state's handling of the budget shortfall issue, and help offer considerations of long term impacts that may be seen by policy mechanisms. This is not conclusive, and in fact it is the hope that readers will generate additional recommendations from the discussion outlined in this chapter and other chapters of this thesis.

Chapter 7 – Recommendations for Future Research and Conclusion

7.1 – Introduction

Nebraska's agricultural production capacity and value added operations have been discussed at length, as have the impacts to the downturn of the agricultural sector of Nebraska's economy. Policy recommendations based on existing research and model analysis have been offered, and the overall long term impacts to the state from a prolonged decline in agricultural commodity prices have been explored. This chapter offers suggestions regarding areas for additional research on the issues facing Nebraska, suggested additions for the system dynamics model, and closing comments.

7.2 – Areas for Additional Research

The issues facing the state of Nebraska over the next 30 years will not all stem from falling agricultural commodity prices, and the impacts felt from this specific impact are not all known or understood at this time. A number of additional areas for research could offer an increased understanding of the underlying dynamics of Nebraska's economy that are likely to have a long term impact on the state over the next three decades. To start, an in depth exploration of the rural/urban gap issue would help to explore the dynamics that continued urban migration might have on the state. These population shifts have been discussed qualitatively, but an in depth analysis would help to add a richer context to the existing system dynamics model. This also includes exploring the impacts that an increasingly aging population, especially in rural areas, will have on the state's economy over the next 30 years. As more Nebraskans retire and require Medicare funding, this will put an increasingly large strain on the state's economy. Baseline expenditures are likely to rise drastically simply to cover the Medicare requirements of the state. The impact this would have on the state was considered for testing, but not explored in this analysis. It should be a major focus for future research, however. Examining the impacts that the Federal government might have on the state's economy from various trade policies, simulating economic recessions, and other factors would certainly add more considerations for policymakers. These considerations were mentioned by a number of stakeholders during the Standard Process followed for this research. Exploring these effects would help provide

lawmakers in the state with an idea for how to best manage external factors impacting Nebraska's economy (from reduced free trade, an increasingly strong US dollar compared to other currencies, and other considerations). Exploring production issues would also be an area for additional research. The model created focuses primarily on revenues from production rather than the production mechanisms themselves. Impacts to production from factors such as a long term global drought or increasing improvements to seeds and production inputs might be beneficial.

7.3 – Future Improvements to the Exploratory Model

The system dynamics model created for analyzing the budget shortfall issue facing the state of Nebraska helped to provide a number of interesting insights into the dynamics facing Nebraska policymakers. However, this model could be expanded upon for future research. To start, the Effective Tax Rate could be broken out into all of the actual taxes imposed by the state. This model aggregates these taxes into one mechanism for ease of use; however, future research could break these out if thought necessary. As mentioned in the previous section, the model does not take into account the actual agricultural production of the state, but instead only considers the revenues generated from these activities. Adding in the actual production activities would provide a model with richer analysis. This was the original goal for the exploratory model used in this analysis, but due to time constraints needed to be cut. The data used in this model was collected from the USDA and additional sources, such as the Nebraska Department of Revenue and Nebraska State Treasurer's office. The data used in analysis works for conducting analyses at an exploratory level (as was done with this analysis), but future work will need to re-examine data for a more accurate fit. This includes examining the value added economic multiplier of the state over a number of years rather than the value used based on existing literature. The author explored collecting data for this analysis from IMPLAN, the same company used for the 2010 Economic Impact report prepared by Thompson, et al, but the scope of the project and cost, along with time constraints, prevented this in depth analysis.

7.4 – Closing Comments

The impacts that falling agricultural commodity prices are having on the state of Nebraska are multifaceted, and in order for the state to manage these impacts appropriately, a long term systems perspective is necessary. Maintaining a holistic view of these impacts is important for the state's leaders, and designing policies to manage these long term impacts is necessary. Further, there will likely be future shocks to the state's economy that add unforeseen dynamics to the system not previously seen by lawmakers and stakeholders. Therefore, it is important to remain flexible and ready to adapt to these new dynamics and ensure the state has the capabilities available to react quickly to unforeseen circumstances as they occur. Proactive planning for these dynamics is as important as remaining flexible to react. However, the ability to react to changing dynamics is only half the battle; policymakers must ensure that the impacts of any decisions to Nebraska's citizens are also considered, and that the state's population is not left to deal with their fallout. Nebraska's policymakers certainly have a complex set of issues to manage moving forward, but by maintaining a long term, holistic view, the policies enacted can be better tailored to existing conditions in order to deal with the issues now while reducing the long term impacts to the state and its citizens.

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Appendix A – Charts and Data

Appendix A contains additional figures outlining trends, forecasts, and additional data relevant to the research conducted for this thesis, and is meant to provide readers with additional information regarding Nebraska's agricultural economy. The figures created are original, but the data has been collected from a number of sources.

Appendix A1 – Nebraska Top Agricultural Commodities – Historical Prices (2000-2016)

Appendix A1 displays historical monthly price data for Nebraska's top agricultural commodities from the years 2000-2016. This is a reference for readers, and provides more detail than annual charts seen in the body of the text. All data used for the creation of these figures has been collected from the USDA ("USDA/NASS QuickStats Ad-hoc Query Tool," n.d.).
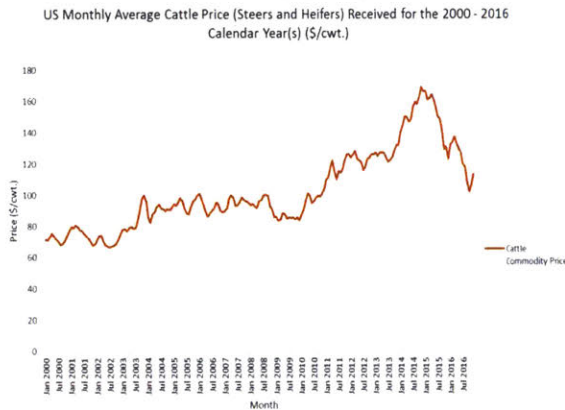

Figure A1.1 - Monthly Average Cattle Prices, 2000-2016

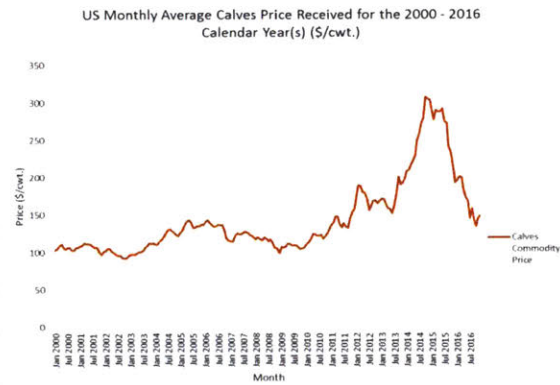Data Source: quickstats.nass.usda.gov

Figure A1.2 - Monthly Average Calves Prices, 2000-2016

Data Source: quickstats.nass.usda.gov

US Monthly Average Corn Price Received for the 2000 - 2016 Calendar
Year(s) ($/bu)

Figure A1.3 - Monthly Average Corn Prices, 2000-2016

Data Source: quickstats.nass.usda.gov

US Monthly Average Hogs Price Received for the 2000 - 2016 Calendar
Year(s) ($/cwt.)
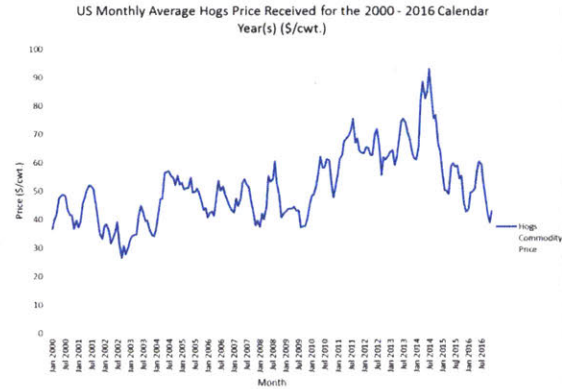
Figure A1.5 - Monthly Average Hogs Prices, 2000-2016

Data Source: quickstats.nass.usda.gov

US Monthly Average Soybeans Price Received for the 2000 - 2016
Calendar Year(s) ($/bu)

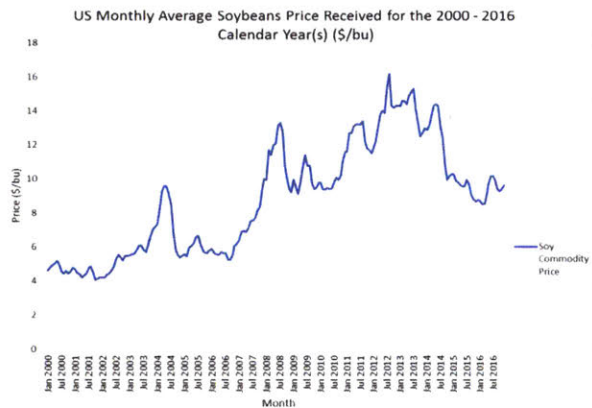*Figure A1.4 - Monthly Average Soybean Prices, 2000-2016*

Data Source: quickstats.nass.usda.gov

US Monthly Average Eggs Price Received for the 2000 - 2016 Calendar
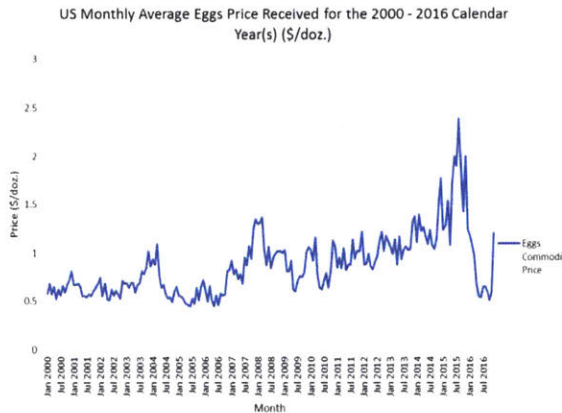Year(s) ($/doz.)

Figure A1.6 - Monthly Average Eggs Prices, 2000-2016

Data Source: quickstats.nass.usda.gov

Appendix A2 – "Porcupine" Charts – Historical Price Data versus Forecast Data

Appendix A2 displays a number of porcupine charts of historical agricultural commodity price data as compared with annual forecasts of these prices for ten years into the future. The agricultural commodity prices shown in these charts are Nebraska's top agricultural commodities produced. As the forecasts are made using normalized future data, these figures have been compiled as a way to gauge the need for a more dynamic model to determine impacts that might occur with future agriculture production and its impacts on various parts of the economy. The historical data used in creating these porcupine charts was collected from the USDA ("USDA/NASS QuickStats Ad-hoc Query Tool," n.d.), and the forecast data was collected from USDA Long Term Projection Reports from the years 2003 (Westcott, Trostle, Young, Schnepf, & Stallings, 2003), 2006 (Westcott, Trostle, Young, & Stallings, 2006), 2009 (Westcott, Trostle, Young, & Stallings, 2009), 2010 (Westcott, Trostle, Young, & Stallings, 2010), 2012 (Westcott, Trostle, & Stallings, 2012), 2014 (Westcott, Trostle, & Stallings, 2014), and 2016 (Westcott, Hansen, & Stallings, 2016).

Figure A2.1 - Cattle Porcupine Chart

Data Source: quickstats.nass.usda.gov, USDA Long Term Projections Reports, years 2003, 2006, 2009, 2010, 2012, 2014, and 2016

Figure A2.2 - Calves Porcupine Chart

Data Source: quickstats.nass.usda.gov, USDA Long Term Projections Reports, years 2003, 2006, 2009, 2010, 2012, 2014, and 2016
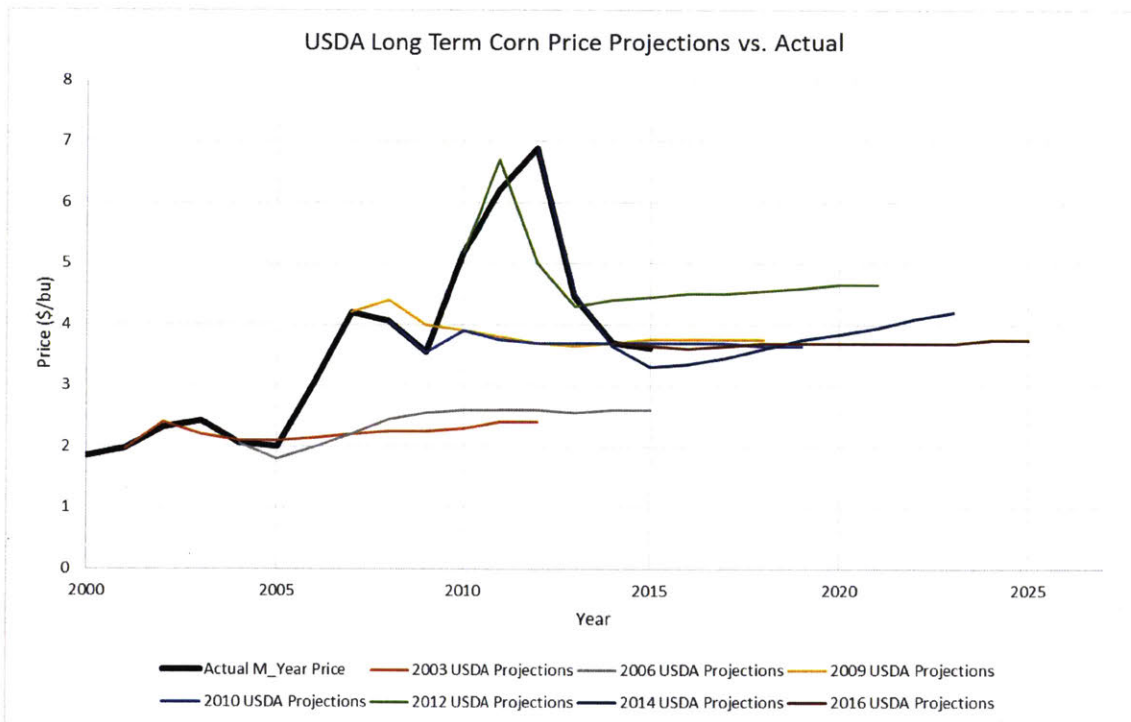
Figure A2.3 - Corn Porcupine Chart

Data Source: quickstats.nass.usda.gov, USDA Long Term Projections Reports, years 2003, 2006, 2009, 2010, 2012, 2014, and 2016
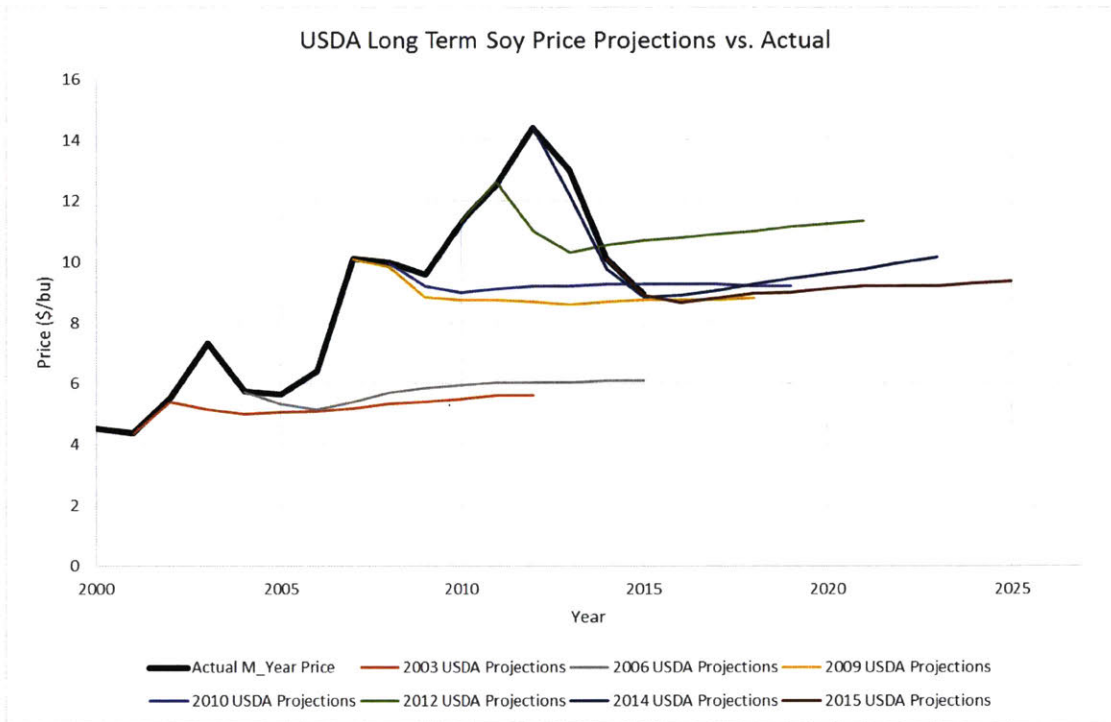
Figure A2.4 - Soy Porcupine Chart

Data Source: quickstats.nass.usda.gov, USDA Long Term Projections Reports, years 2003, 2006, 2009, 2010, 2012, 2014, and 2016
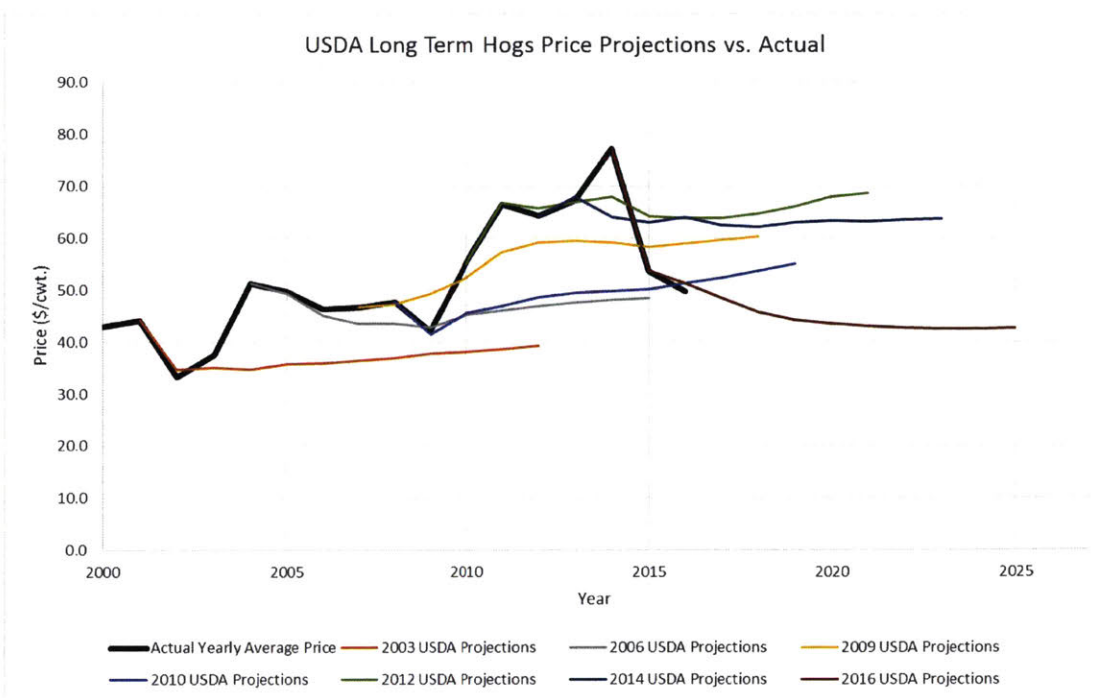
Figure A2.5 - Hogs Porcupine Chart

Data Source: quickstats.nass.usda.gov, USDA Long Term Projections Reports, years 2003, 2006, 2009, 2010, 2012, 2014, and 2016
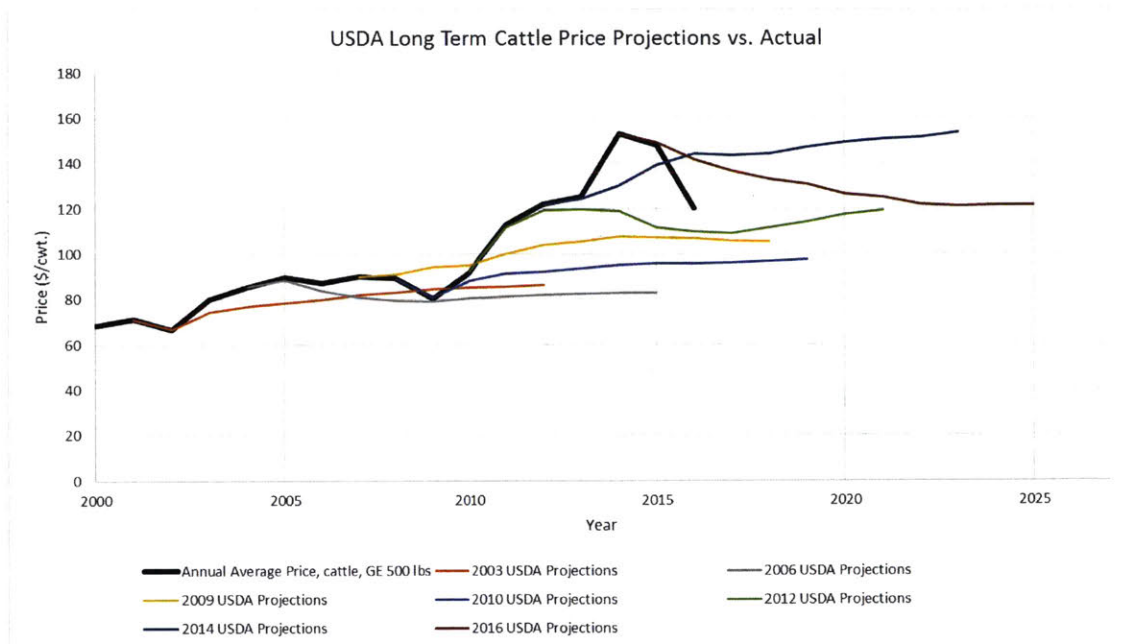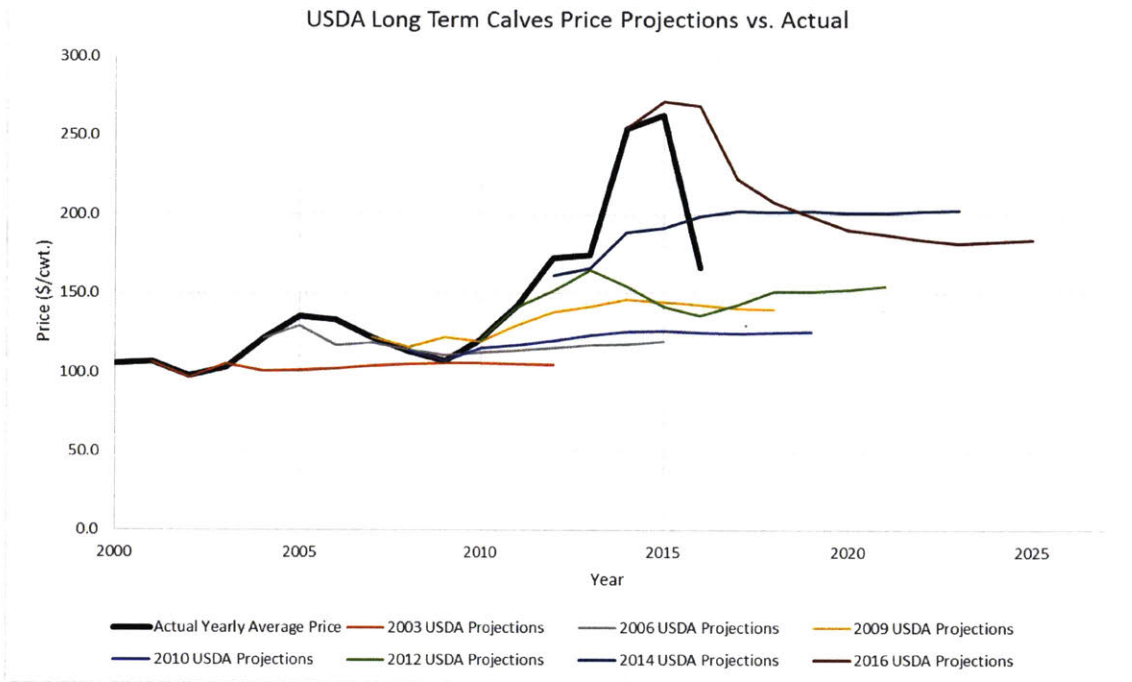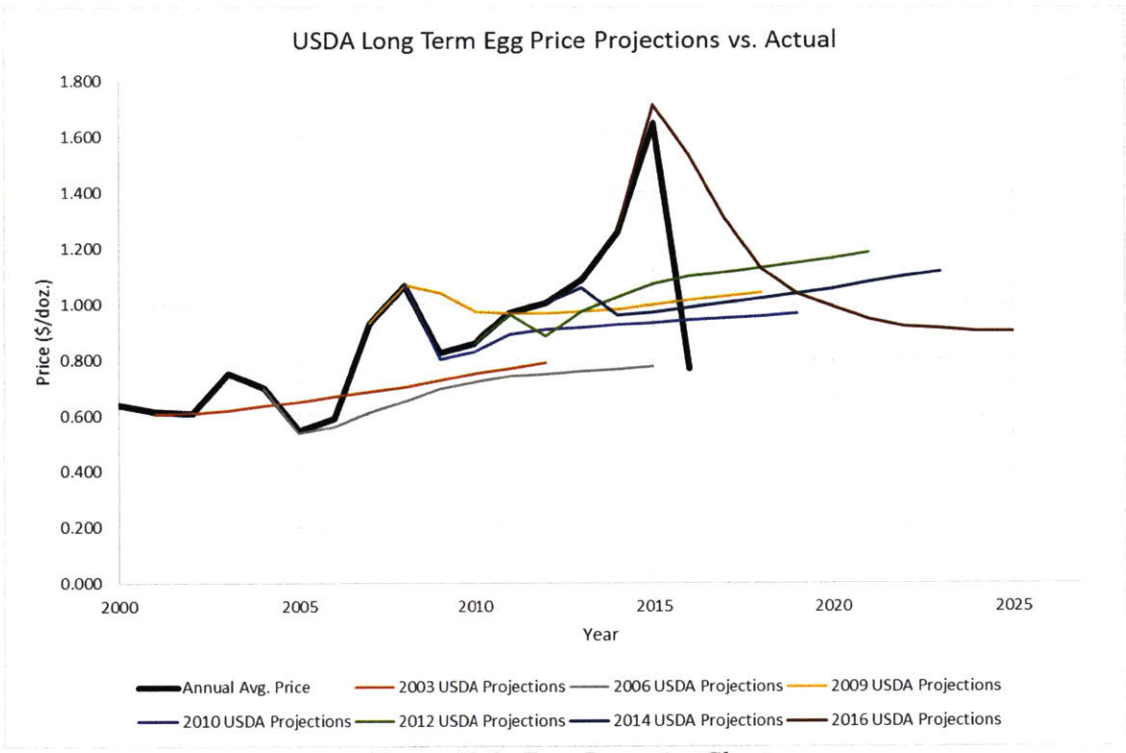
Figure A2.6 - Eggs Porcupine Chart

Data Source: quickstats.nass.usda.gov, USDA Long Term Projections Reports, years 2003, 2006, 2009, 2010, 2012, 2014, and 2016

Appendix A3 – Nebraska State Expenditure Growth, 2000-2016

Appendix A3 displays the state of Nebraska's annual state expenditure growth from years 2000-2016. The data used to create this figure was gathered from the state of Nebraska ("www.StateSpending.Nebraska.gov • Historical Expenditures," n.d.).

Nebraska Annual Expenditure Growth, 2000-2016

Expense Total
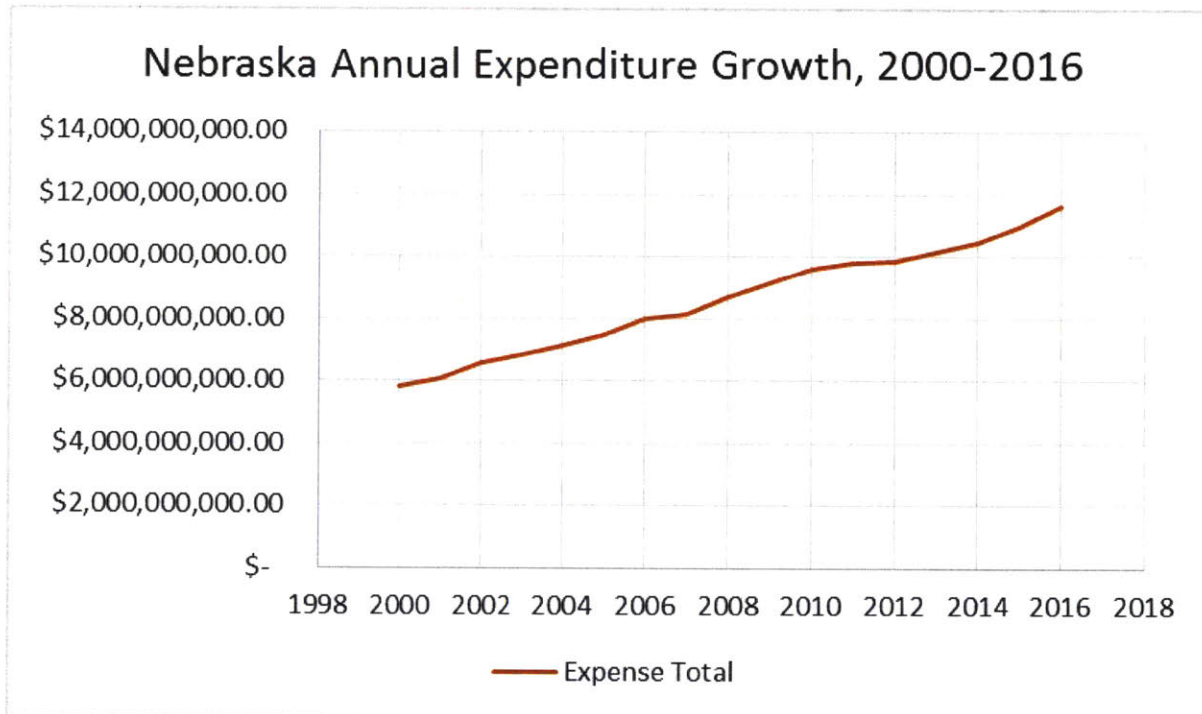
Figure A3.1 - Nebraska Annual Expenditure Growth, 2000-2016

Data Source: statespending.nebraska.gov

Appendix B – Model Documentation

The information in this appendix contains documentation of the model developed for analyzing the budget shortfall problem facing the state of Nebraska. This documentation was captured using Vensim's "Document" tool.

"Ag Non-Production Revenues"=
>Ag Production Revenues*Multiplier Effect
>
>Units: Billion Dollars/Year
>The amount of revenues generated from non-production
>>agricultural activities, such as feedlots, transportation, and
>>other value added activities. This is based on ideas from the
>>UNL 2010 Agricultural Impact Report. This is equal to
>>agricultural production multiplied by the state's economic
>>multiplier.

Ag Production Revenue Test Input=
>Revenue Growth Index+Step Change in Ag Revenue+Cyclical Change in Ag Revenue

Units: Dmnl
Input that determines the growth of ag production each year, as
>well allows the use of test inputs on the system.

Ag Production Revenues=
>Initial Ag Production Revenue*Ag Production Revenue Test Input

Units: Billion Dollars/Year
The annual revenues produced in the state of Nebraska from
>agricultural production.

Ag Revenue Growth Rate=
>(Smoothed Ag Revenue-Historical Ag Revenue)/(Historical Ag Revenue*Time to

Establish Historical Ag Revenue
)
Units: Fraction/Year
Determined by the Smoothed revenues less historical over
>historical multiplied by the time to determine historical ag
>revenues.

Ag Revenue Step Height=
>0

Units: Dmnl
The change in step height of ag production revenues determined
>for testing the model.

Ag Revenue Step Time=

5
Units: Year
The time at which the step function occurs for testing the model.

Agriculture State Tax Revenues=
        (Ag Production Revenues+"Ag Non-Production Revenues")*Effective Tax Rate
Units: Billion Dollars/Year
Tax revenues collected by the state from agriculture. This
        includes production and non-production activities.

Baseline Expenditures= INTEG (
        Change in Baseline Expenditures,
            Initial Expenditures)
Units: Billion Dollars/Year
The expenditures required for maintaining services at current
        levels for all state activities. Adjusted by inflows from the
        change in baseline expenditures.

Cash Buffer Fraction=
        0.92
Units: Dmnl
The fraction of the rainy day fund. Initialized to 92% in order
        to meet present date cash holdings in the fund.

Cash Relative to Acceptable=
        SMOOTH((General Fund-Desired Cash)/Desired Cash,Time to Perceive and Act on
Budget
)
Units: Dmnl
The difference between the amount of money desired on hand by
        the state of Nebraska compared to how much is actually on hand.
        This variable is smoothed in order to simulate the time it takes
        to realize this difference.

"Cash Surplus (Shortfall)"=
        General Fund-Desired Cash
Units: Billion Dollars
The difference between the general fund balance and the desired
        cash on hand by policymakers.

Change in Baseline Expenditures=
        (Baseline Expenditures*Expenditure Growth Rate)*(1+Smoothed Level Services Impact
)
Units: Billion Dollars/Year/Year
Equal to the baseline expenditures multiplied by the growth
        rate, and again multiplied by the impact from reduced level

services.

Change in Effective Tax=
    (1-Switch for Computed Effective Tax Rate)* (Effective Tax Rate*Willingness to Raise
Taxes
/Time to Change Effective Tax) + Switch for Computed Effective Tax Rate * (
Computed Effective Tax Rate-Effective Tax Rate)/Time to Change Effective Tax
Units: Fraction/Year
Adjusts the effective tax rate when either a manual adjustment
        of the Willingness to raise taxes occurs, or the Computed
        Effective Tax Rate is active.

Change in Expenditure Multiplier=
    (1-Switch for Computed Expenditure Multiplier)*(Expenditure Multiplier*Willingness to
Reduce Expenditures
/Time to Change Expenditures) + Switch for Computed Expenditure Multiplier
* (Computed Expenditure Multiplier-Expenditure Multiplier)/Time to Change Expenditures
Units: Dmnl/Year
Adjusts the expenditure multiplier when either a manual
        adjustment of the Willingness to Reduce Expenditures occurs, or
        the Computed Expenditure Multiplier is active.

"Change in Non-Ag Revenues"=
    ("Non-Ag Revenues"*Other Revenues Growth Rate)*(1-Smoothed Production
Disincentive from Tax Increase
)
Units: Billion Dollars/(Year*Year)
The annual adjustment of non-agricultural revenues for the state
        of Nebraska.

Change in Revenue Growth Index=
    Revenue Growth Rate*Revenue Growth Index
Units: Dmnl/Year
Inflow determining the level of change of the Revenue Growth
        Index each year.

Computed Effective Tax Rate=
    MAX(Minimum Effective Tax Rate, (Desired Revenues-"Perceived Non-Ag Tax
Revenues"
)/Projected Revenue)
Units: Fraction
The computed effective tax rate based on the revenues desired
        less the perceived non-agriculture tax revenues over the total
        projected revenue. The effective tax rate adjusts according to
        expected revenues needed.

Computed Expenditure Multiplier=
  Desired Expenditures/Baseline Expenditures
Units: Dmnl
The endogenous computation for determining the expenditure
  multiplier. Equal to desired expenditures over baseline
  expenditures.

Cycle Amplitude=
  0
Units: Dmnl
The strength of the cycles for testing against ag revenues, used
  for testing the model.

Cycle Period=
  5
Units: Year
The year in which the cycle function begins against ag
  production revenue, used for testing the model.

Cyclical Change in Ag Revenue=
  Cycle Amplitude*SIN(6.28*Time/Cycle Period)
Units: Dmnl
The overall cycle function used against ag production revenues
  for testing the model.

Desired Cash=
  Desired Cash Fraction of Revenues*Smoothed Revenues for Desired Cash
Units: Billion Dollars
The amount of cash desired by policy makers based on known
  previous revenues received and the desired fraction of cash on
  hand.

Desired Cash Buffer=
  Smoothed Revenues for Desired Cash*Desired Cash Fraction of Revenues*Cash Buffer
Fraction
Units: Billion Dollars
The total amount of money desired in the rainy day fund. Equal
  to the total smoothed revenues for desired cash multiplied by
  the desired cash fraction and again multiplied by the cash
  buffer fraction.

Desired Cash Fraction of Revenues=
  0.1575
Units: Year
The percentage of tax revenues desired to be held on hand by the
  state of Nebraska. This is generally set to equal between

12-19%. Initialized to 15.75% for model equilibrium and testing
purposes.

Desired Expenditures=
        Smoothed State Revenues+("Cash Surplus (Shortfall)"/Time to Correct Cash Surplus
)
Units: Billion Dollars/Year
The desired level of expenditures based on the determined
        revenues collected and the revenue surplus or shortfall.

Desired Revenues=
        (Switch to Use Baseline Expenditures*Baseline Expenditures+(1-Switch to Use Baseline
Expenditures
)*Smoothed Expenditures)-("Cash Surplus (Shortfall)"/Time to Correct Cash Surplus
)
Units: Billion Dollars/Year
The desired level of revenues based on the determined
        expenditure levels (either using baseline or smoothed
        expenditure values) and the revenue surplus or shortfall.

Desired Transfer to Rainy Day Fund=
        (Desired Cash Buffer-Rainy Day Fund)/Time to Transfer to Buffer
Units: Billion Dollars/Year
The desired amount of money to be transferred to the rainy day
        fund, when possible.

Effective Tax Rate= INTEG (
        Change in Effective Tax,
                Initial Tax Rate)
Units: Fraction
The effective rate at which agricultural revenues are taxed
        annually. Due to the varied ways in which taxes are collected
        for agriculture in Nebraska, this rate is an aggregate
        representation of the income, sales, use, corporate, and other
        tax rates, and meant to be used for testing purposes with the
        model.

Expenditure Growth Rate=
        0
Units: Dmnl/Year
The annual growth rate for baseline expenditures. Initialized to
        zero for testing.

Expenditure Multiplier= INTEG (
        Change in Expenditure Multiplier,
                1)

Units: Dmnl
The multiplier by which the expenditures are increased or
         decreased. This is adjusted by the Change in Expenditure
         Multiplier inflow.

Expenditures=
        Baseline Expenditures*Expenditure Multiplier
Units: Billion Dollars/Year
The annual expenditures of the Nebraska General Fund for the
         general operations of the state.

General Fund= INTEG (
        Revenues+Transfers to GF-Expenditures-Transfers from GF,
         Smoothed State Revenues*Desired Cash Fraction of Revenues)
Units: Billion Dollars
The amount of money held by the State of Nebraska in the General
         Fund. This figure comes from collection of income, sales,
         corporate, and other taxes imposed by the State of Nebraska.
         This is the primary fund used by the state for allocating monies
         to pay for the regular business of the state government.
         Initialized to the smoothed state revenues multiplied by the
         fraction of desired cash revenues on hand.

Historical Ag Revenue=
        SMOOTH3I(Smoothed Ag Revenue, Time to Establish Historical Ag Revenue, Initial
Revenue from Agriculture
)
Units: Billion Dollars/Year
Historical agriculture revenues, determined by initial levels
         over the time it takes to determine actual data.

Initial Ag Production Revenue=
        9.5
Units: Billion Dollars/Year
The amount of money produced in the state of Nebraska from
         agricultural production. The initial value of $9.5 billion is
         the "gross value added" figure provided for Nebraska during the
         year 2015, and provided by
         https://data.ers.usda.gov/reports.aspx?ID=39620#P71c947adbaf943a2
         993f01d3ceff7114_2_108iT0R0x27

Initial Expenditures=
        4.33
Units: Billion Dollars/Year
The initial state expenditures of the model. Equal to $4.33
         billion/year.

Initial Other Revenues=
    79.75
Units: Billion Dollars/Year
The initial value assigned to all non-agriculture revenues for
        testing purposes. Initial value set for model equilibrium
        calibration and for estimate of overall other revenues based on
        state split between agriculture and non-agriculture activities.

Initial Revenue from Agriculture=
    28.5
Units: Billion Dollars/Year
The initial revenues per year from agricultural activities
        entered for the model. Set to $28.5 billion/year for testing.

Initial State Tax Revenues=
    4.33
Units: Billion Dollars/Year
The initial amount of total (from both agriculture and
        non-agriculture activities) state tax revenues collected.
        Initialized to $4.33 billion.

Initial Tax Rate=
    0.04
Units: Dmnl
The initial effective tax rate for the model. Initialized to 4%.

Level Services Impact=
        Table for Level Services Impact(Ratio of Current Expenditures to Baseline)
Units: Dmnl
The impact felt from reducing expenditures below the baseline
        expenditure level.

Magnitude of Pulse Change=
    0
Units: Dmnl
The height of the pulse change.

Minimum Effective Tax Rate=
    0
Units: Dmnl
The minimum effective tax rate that can be achieved in the
        model. This is set equal to zero so no negative values are
        reached.

Multiplier Effect=

Value Added Economic Multiplier
Units: Dmnl
The overall economic multiplier effect of agricultural
                non-production activities in the state of Nebraska.

"Non-Ag Revenues"= INTEG (
        "Change in Non-Ag Revenues",
                Initial Other Revenues)
Units: Billion Dollars/Year
The annual revenues generated from non-agricultural activities
                in the state.

"Non-Ag Tax Revenue"=
        "Non-Ag Revenues"*Effective Tax Rate
Units: Billion Dollars/Year
Tax revenues collected by the state from non-agricultural
                activities.

Other Revenues Growth Rate=
        0
Units: Dmnl/Year
The annual growth rate assigned for all non-agriculture related
                revenues. This is initialized to zero for model equilibrium and
                testing.

"Perceived Non-Ag Tax Revenues"=
        SMOOTH3("Non-Ag Tax Revenue", "Time to Perceive Non-Ag Revenues")
Units: Billion Dollars/Year
The perceived value of non-agricultural tax revenues received by
                the state of Nebraska.

Production Disincentive from Tax Increase=
        1-Table for Production Disincentive from Tax Increase(Ratio of Initial Tax Rate to
Effective Tax Rate
)
Units: Dmnl
The effect that raising taxes has on discouraging production in
                the state.

Projected Revenue=
        (1+Ag Revenue Growth Rate*(Time to Smooth Revenue+Revenue Projection Time)
)*Smoothed Ag Revenue
Units: Billion Dollars/Year
The projected revenues for determining the endogenous computed
                effective tax rate in the model.

Pulse Change=

    STEP(Magnitude of Pulse Change/TIME STEP, Time of Pulse Change)-
STEP(Magnitude of Pulse Change
/TIME STEP, Time of Pulse Change+TIME STEP)
Units: Dmnl/Year
Test input for non-agricultural revenues used for testing
        purposes.

Rainy Day Fund= INTEG (
    Transfers from GF-Transfers to GF,
        Desired Cash Buffer)
Units: Billion Dollars
The fund used by the state to assist with paying off
        expenditures during downturns in the economy. This is
        initialized to equal the desired cash buffer, and is a product
        of the inflows and outflows of funds to and from the general
        fund.

Ratio of Current Expenditures to Baseline=
    Expenditures/Baseline Expenditures
Units: Dmnl
The ratio between the actual annual expenditures of the state of
        Nebraska compared to the baseline expenditures for maintaining
        level services for the state.

Ratio of Initial Tax Rate to Effective Tax Rate=
    Initial Tax Rate/Effective Tax Rate
Units: Dmnl
Ratio determining the difference between the initial effective
        tax rate and the current rate.

Revenue Growth Index= INTEG (
    Change in Revenue Growth Index,
        1)
Units: Dmnl
Index for indicating the level of agricultural production in the
        model.

Revenue Growth Rate=
    0
Units: Fraction/Year
Growth rate for increasing or decreasing the ag revenue growth
        index annually.

Revenue Projection Time=
    0

Units: Year
The amount of time it takes to determine projected revenue.

Revenues=
        Agriculture State Tax Revenues+"Non-Ag Tax Revenue"
Units: Billion Dollars/Year
The revenues collected by the State of Nebraska each year that
        feed the Nebraska General Fund.

Sensitivity for Smoothed Level Services Impact=
        1
Units: Dmnl [0,2,0.1]
The sensitivity of expenditure reduction below baseline levels
        over time. Initialized to 1 for testing.

Sensitivity for Smoothed Production Disincentive=
        0
Units: Dmnl [0,1,0.1]
The level of sensitivity that the production disincentive has on
        the model. Used for testing purposes.

Sensitivity for Willingness to Raise Taxes=
        0
Units: Dmnl [-1,1,0.1]
A measure of the sensitivity of policymakers for raising taxes.
        Used primarily for initial testing purposes.

Sensitivity for Willingness to Reduce Expenditures=
        0
Units: Dmnl [-1,1,0.1]
A measure of the sensitivity of policymakers for reducing
        expenditures. Used primarily for initial testing purposes.

Smoothed Ag Revenue=
        SMOOTH3I(Total Ag Revenues, Time to Smooth Revenue, Initial Revenue from
Agriculture
)
Units: Billion Dollars/Year
The revenues from agriculture determined after a delay in the
        time it takes to capture this information. Initial value set to
        initial revenue from agriculture.

Smoothed Expenditures=
        SMOOTH3I(Expenditures, Time to Smooth Revenue, Initial Expenditures)
Units: Billion Dollars/Year
The expenditures determined after delays in capturing real

expenditure information, with an initial value equal to initial
expenditures.

Smoothed Level Services Impact=
    SMOOTH3(Level Services Impact, Time to Smooth Level Services Impact)*Sensitivity
for Smoothed Level Services Impact
Units: Dmnl
The impact felt from expenditure reductions below baseline
        levels over time, and amplified or reduced based on the
        sensitivity level.

Smoothed Production Disincentive from Tax Increase=
    SMOOTH3(Production Disincentive from Tax Increase, Time to Smooth Production
Disincentive
)*Sensitivity for Smoothed Production Disincentive
Units: Dmnl
The overall production disincentive factored into the model
        after time delays and sensitivities have been considered.

Smoothed Revenues for Desired Cash=
    Smoothed State Revenues*(1-Switch for Long Term Smooth for Desired Cash)+Switch
for Long Term Smooth for Desired Cash
        *Smoothed Revenues Long Term
Units: Billion Dollars/Year
The revenues used for determining the desired cash. This is
        either the revenues determined after a delay in compiling data
        or a long term smoothing function.

Smoothed Revenues Long Term=
    SMOOTH(Smoothed State Revenues, Time to Smooth Revenues for Desired Cash)
Units: Billion Dollars/Year
The long term revenue needs determined after state revenues
        confirmed for the desired cash on hand.

Smoothed State Revenues=
    SMOOTH3I(Revenues, Time to Smooth Revenue, Initial State Tax Revenues)
Units: Billion Dollars/Year
The revenue value determined after the delay in information
        gathering for determining total revenues.

Step Change in Ag Revenue=
    STEP(Ag Revenue Step Height, Ag Revenue Step Time)
Units: Dmnl
The overall step function used against ag production revenues
        for testing the model.

Switch for Computed Effective Tax Rate=
        0
Units: Dmnl [0,1,1]
Switch for turning on the Computed Effective Tax Rate.
                Initialized to zero.

Switch for Computed Expenditure Multiplier=
        0
Units: Dmnl [0,1,1]
Switch for turning on the Computed Expenditure Multiplier.
                Initialized to zero.

Switch for Long Term Smooth for Desired Cash=
        1
Units: Dmnl [0,1,1]
Switch for using long term smoothing for determining smoothed
                revenues for the desired cash on hand.

Switch to Use Baseline Expenditures=
        1
Units: Dmnl [0,1,1]
The switch to use baseline expenditures rather than smoothed
                expenditures when calculating desired revenues. Initialized to
                1, so that baseline expenditures is turned ON.

Table for Level Services Impact(
        [(0,0)-(1,1)],(0,1),(0.207951,0.894737),(0.633027,0.27193),(1,0))
Units: Dmnl
Table for determining the impact from reduced level services.

Table for Production Disincentive from Tax Increase(
        [(0,0)-(1,1)],(0,1),(0.752294,0.561404),(1,-0))
Units: Dmnl
Table created for determining the production disincentive from
                raising taxes.

Table for Raising Taxes(
        [(-1,-1)-(1,1)],(-1,-1),(-0.247706,-0.692982),(0.211009,0.622807),(1,1))
Units: Dmnl
Table generated to determine the impact that of policymakers'
                sensitivity for raising taxes will have on overall revenues.

Table for Reduction in Expenditures(
        [(-1,-1)-(1,1)],(-1,-1),(-0.247706,-0.692982),(0.211009,0.622807),(1,1))
Units: Dmnl
Table generated to determine the impact that of policymakers'

sensitivity for reducing expenditures will have on overall
expenditures.

Time of Pulse Change=
     5
Units: Year
The time when the pulse change occurs.

TIME STEP = 0.0625
Units: Year [0,?]
The time step for the simulation.

Time to Change Effective Tax=
     2
Units: Year
The time it takes to make adjustments to the effective tax rate.
          Initialized to two years.

Time to Change Expenditures=
     2
Units: Year
The amount of time it takes to make changes to the expenditure
          multiplier. Initialized to two years.

Time to Correct Cash Surplus=
     2
Units: Year
The amount of time it takes to correct the cash surplus or
          shortfall back to desired levels.

Time to Establish Historical Ag Revenue=
     4
Units: Year
The estimated time to establish historical agriculture revenue
          data and trends for policymakers.

Time to Perceive and Act on Budget=
     0.1
Units: Year
The time it takes to determine the difference between the
          General Fund and the desired cash on hand.

"Time to Perceive Non-Ag Revenues"=
     1
Units: Year
The amount of time required to determine revenues from

non-agriculture activities.

Time to Smooth Level Services Impact=
        3
Units: Year
The time it takes for impacts from reduced expenditures to be
        felt.

Time to Smooth Production Disincentive=
        0.5
Units: Year
The time it takes for the production disincentive to be felt and
        acted upon by the state's population.

Time to Smooth Revenue=
        2
Units: Year
The amount of time it takes to determine revenue and expenditure
        values.

Time to Smooth Revenues for Desired Cash=
        2
Units: Year
The time it takes to determine the revenue value for total
        desired cash. This is initialized to 2 years.

Time to Transfer to Buffer=
        0.25
Units: Year
The amount of time it takes to transfer funds to and from the
        rainy day fund. Initialized to 0.25 years for testing.

Total Ag Revenues=
        Ag Production Revenues+"Ag Non-Production Revenues"
Units: Billion Dollars/Year
The total amount of revenue produced by agriculture in a given
        year.

Transfers from GF=
        Min(Desired Transfer to Rainy Day Fund,MAX(0,"Cash Surplus (Shortfall)"))/
Time to Transfer to Buffer
Units: Billion Dollars/Year
The rate at which funds transfer from the general fund to the
        rainy day fund. Transfers only occur during years when the
        general fund exceeds the desired fraction of cash on hand.

Transfers to GF=

Min(Rainy Day Fund,MAX(0,-"Cash Surplus (Shortfall)"))/Time to Transfer to Buffer

Units: Billion Dollars/Year

The rate at which funds transfer from the rainy day fund to the

general fund. This occurs when expenditures exceed revenues and
rainy day funds are used to cushion the general fund.

Value Added Economic Multiplier=

2

Units: Dmnl

Based on 2010 UNL Study of Agricultural Production Complex in

State of Nebraska. For every dollar of ag production, there are
2 dollars of non-production value added services added to the
economy, thus this is initialized to 2. This value is adjusted
for testing purposes in the model.

Willingness to Raise Taxes=

Table for Raising Taxes(Cash Relative to Acceptable)*Sensitivity for Willingness to

Raise Taxes

Units: Dmnl

A manual adjustment of tax rates by policymakers, and determined

by the sensitivity of policymakers for raising tax revenues
against the table for willingness to raise taxes.

Willingness to Reduce Expenditures=

Table for Reduction in Expenditures(Cash Relative to Acceptable)*Sensitivity for

Willingness to Reduce Expenditures

Units: Dmnl

A manual adjustment of expenditures by policymakers, and

determined by the sensitivity of policymakers for reducing
expenditures against the table for reduction in expenditures.