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DIETARY GUIDELINES AND OBESITY

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ABSTRACT

This paper attempts to assess the efficiency of a United States government department by specifically looking at the United States Department of Agriculture's dietary recommendations. One of the goals of the USDA's dietary recommendation is to combat obesity and help Americans maintain a healthy weight. The research presented here addresses the effectiveness of these recommendations empirically with the use of an interrupted time series design that compares the 1992, 1995, 2000, and 2005 recommendations to America's adult obesity rate. The results show that the impact of the USDA's dietary recommendations do not have a statically significant effect on the American adult obesity rate, indicating that the department's use of the dietary guidelines is not effectively combating American obesity.

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Chapter 1

Dietary Guidelines

In the United States, there are many federal executive departments that serve as administrative organs. The different departments are responsible for developing and executing various public policies and are allocated an annual budget to assist with this process. Each department often has the expertise of highly educated and informed members in appropriate fields who help formulate certain policies that are aimed at meeting a specific goal. But, when a department's goal is not being met, the implemented policy is often questioned, along with the efficiency of the department. One way to measure the effectiveness of an executive department is assessing if a specific policy is meeting its overall goal.

This paper will measure a department's efficiency by looking at the United States Department of Agriculture's Dietary Guidelines for Americans. These guidelines are updated about every 5 years and are aimed at combating the nation's rising obesity epidemic. The USDA first implemented a shaped-guide for healthy eating with the food guide pyramid in 1992. The food pyramid was an illustration of the main food groups Americans should be consuming. It was later revised in 1995, and again in 2000 and 2005. The current United States Department of Agriculture's dietary guidelines are called MyPlate, which was created in 2011. Revisions of the dietary guidelines are motivated by government-funded research. Revisions to the dietary guidelines are intended to decrease our nation's obesity rate. Nevertheless, our nation's obesity rate steadily increases. Thus, the United States Department of Agriculture's goal of reducing obesity in America is not being met.

This paper will analyze the USDA's dietary guidelines empirically. This process will require examining the history of the USDA's dietary guidelines in relation to our nation's obesity rate. Only by examining how the nation's obesity rate is affected by the United States Department of Agriculture's dietary guidelines is it possible to make accurate claims about the efficiency of the USDA's guidelines. To expand upon on this claim, the paper is organized into five parts. First, I will discuss the existing literature in order to provide context to my research. Second, I discuss the history of the USDA's dietary guidelines and provide details about the different guidelines implemented since 1992. Third, I hypothesize that the USDA's dietary guidelines are ineffective in combating obesity. Next, I will use an interrupted time series design to analyze the impact of the USDA's dietary guidelines on the obesity rate. The conclusion of this paper will discuss the efficiency of the USDA in regards to combating obesity with their dietary guidelines.

Chapter 2

Literature Review

In order to test if government-endorsed dietary recommendations are effective, we must first look into three different areas of prior research. The first area to address is the rising obesity rate in America over the past few decades and to uncover what other researchers believe is the cause. Understanding the extent of this epidemic will lay a solid foundation for general background information about obesity in America. The second area of prior research to consider is the history and development of the USDA's dietary guidelines. This information will establish the science and theories behind these guidelines. The last area of research will focus on similar studies on government policies that attempt to combat obesity. Not only will this research provide different methods and findings in this space, but it will also elaborate on why there is a gap in the literature, which this paper seeks to fill.

One of the most widely used tools for measuring obesity in America is using the Body Mass Index (BMI). According to the Centers for Disease Control and Prevention, calculating an individuals BMI is one of the best methods for assessing weight and obesity within a population. The BMI is the ratio of weight in kilograms to height in meters squared. This number is used as a proxy value to determine whether a person is underweight, average weight, or overweight.

Recent studies have indicated that the obesity rate in America is, indeed, rising. Flegal, Carroll, Kuczmarski, and Johnson (1998) tracked the obesity rate between 1988-1996 using the Body Mass Index formula. Using cross-sectional surveys, including the National Health Examination Survey and the National Health and Nutrition Examination Surveys, researchers calculated a person's BMI based off of height and weight, and defined obesity as anyone who has

a BMI of 30 or higher. The data indicated that between 1976-1980 and 1988-1994, the obesity rate increased dramatically. A more recent study was conducted that also indicated a rising trend of obesity in America. Flegal, Carroll, Odgen, and Curtain (2010) conducted another research project that examined the obesity trend from 1999 to 2008. This studied analyzed height and weight measurements from 5,555 adult men and women aged 20 years or older. This data was collected from the National Health and Nutrition Examination Survey. This study, like the pervious study, defined obesity as a BMI of 30 or higher. The study found that obesity is continuing to rise. Specifically, the prevalence of obesity was 32.2% among adult men and 35.5% among adult women. Interestingly, this particular study found that, when compared to the previous obesity trends in America, the rate of increase in obesity between 1999 and 2008 was less than the rate of increase observed in previous time frames.

Many researchers have tried to pinpoint the cause for the continued increase in obesity. Studies have focused on the factors that could be directly associated with obesity, including age, gender, poverty, education, income, birth weight, race, and per capita health care expenditures. Menifield, Doty, and Fletcher (2008) studied social, demographic, educational, healthcare, and economic variables to explain the rising obesity rate. This study used data from the Center for Medicaid and Medicare Services, the U.S. Bureau of Economic Statistics, the Centers for Disease Control and Prevention, Department of Education, Statistical Abstract of the U.S., The National Center for Health Care Statistics, and the U.S. Census Bureau. Using cross tabulation tables, researchers hypothesized that social, demographic, educational, healthcare, and economic variables influence obesity. Next, the study used a sectional pooled time series regression model to examine how a series of independent variables affected the dependent variable. The data in this research indicate that the obesity rate in America is rising at an alarming rate and education, poverty, income and availability of heath resources may affect obesity rates. The study discusses that other factors may also affect obesity, including dietary consumption and fitness levels.

The United States Department of Agriculture (USDA) has developed plans to help the obesity epidemic. On May 15, 1862, Abraham Lincoln signed the Agricultural Act, establishing the U.S. Department of Agriculture. Fifty-four years later, in 1916, the United States Department of Agriculture began to implement dietary recommendations for the American people. Starting in 1958, the USDA published "Food for Fitness—A Daily Guide," which provided information about nutrient-bearing foods. This guide became known as "The Basic Four" and served as a food guideline for the next twenty years, with slight alterations made over this course of time. In 1978, the USDA developed "The Hassle-Free Guide to a Better Diet", which expanded on the previous guide to include a fifth category called Fats, Sweets, and Alcohol. Still, this provided general foundational information about a healthy diet. However, in 1980, the Department of Agriculture and Health and Human Services published "Nutrition and Your Health…Dietary Guidelines for Americans", which consisted of seven guidelines. The goal was to consume a variety of food and to maintain a recommended body weight. As a result of these new guidelines, the USDA developed "Ideas for Better Eating" that guided Americans in making menu plans that adhere to the new suggestions.

The Human Nutrition Information Service (HNIS), a department within the USDA, created their food guidance system to combine previous guidelines with the USDA's menu guideline. This became the first edition of "The Dietary Guidelines for Americans". It was unique in the sense that it provided information about a total diet as opposed to the previous foundational diet, which focused on diet staples only. A Food Wheel was created to organize this information in a visually appealing manner. This Food Wheel was to be used with its companion piece "A Day's Worth of Food and Nutrients", which contained specific information about food energy, total fat, fatty acids, sodium, sweeteners, and cholesterol content. The goal of this food guidance system was to direct individuals to select diets that provide an appropriate amount of energy to maintain an ideal weight (Cronin, 1987).

Since the 1980s, the USDA has updated the food guidelines about every five years. Subtle changes have been made in regards to wording and emphasis, and it has expanded to include 10 guidelines as opposed to the original seven. Policy makers were concerned that most Americans were unaware of these dietary guidelines. So, in 1992, the Food Guide Pyramid was released and completely changed the look of the USDA's dietary recommendations. In 1990, the Nutrition Labeling and Education Act made a law that required every food item in the grocery store to include a nutritional label, which allowed Americans to easily follow this Food Guide Pyramid. This pyramid was updated in 1995 and 2000, and replaced in 2005 with the MyPyramid Food Guidance System. This new guideline added a band for oils and vertical band to account for exercise, completely changing the appearance of the previous pyramid. Recently, in 2011, the USDA has once again updated the dietary guidelines to MyPlate. MyPlate's is visually represented as an actual plate that is divided into different food groups. This new visual allows Americans to see the appropriate portion sizes of each food group relative to each other. But, with the constant updates and alterations of these food guide recommendations, it is important to investigate their effectiveness ("A Brief History of USDA Food Guides", 2011).

Some researchers have analyzed the impact of public policy on the obesity rate. Variyam and Cawley (2006) studied the impact of the Nutrition Labeling and Education Act (NLEA) of 1990 on body weight and obesity among American adults. The NLEA was enacted due to the growing scientific research that linked dietary habits with obesity. Researchers tested the effectiveness of the NLEA in reducing obesity by using data from the National Health Interview Survey. This was tested by a difference-in-differences method, which compared the change in two groups before and after the NLEA took effect. One group was composed of those who used the labels while shopping and the other of who did not use food labels when grocery shopping. The controls included time varying effects of education, income, marital status, health, and dieting attempts. The results indicated that non-Hispanic white women benefited from the new

food labeled introduced by the NLEA. Specifically, their BMI on average was 0.3 kh/m^2 lower than it would have been without the nutrition labels. But the results showed that the NLEA only benefited one demographic for reducing obesity (Variyam and Cawley, 2006).

Still, this research does not directly relate to USDA's dietary guidelines and obesity. Overall, research on the relationship between the USDA's dietary guidelines and the obesity rate remains limited. This is the case even though there has been concerns about the USDA's effectiveness in combating the obesity epidemic.

Chapter 3

The View of the USDA

This historical review opens the way for thorough consideration of whether or not the USDA's dietary guidelines for combating the obesity epidemic are effective. Over the years, the number of overweight Americans has dramatically increased, ranking our country as the number one obese country in the world. Obesity is commonly recorded by calculating an individual's Body Mass Index (BMI). The Centers for Disease Control and Prevention has maintained and updated a database that tracks obesity based on the BMI. Researchers have conducted numerous studies to track the obesity rate. One such research team tracked obesity from 1960 until 2008, in which all the data indicates that obesity is continuing to rise (Fengal, Margaret, Kuczmarski, and Johnson, 1998; Fengal, Carroll, Kuczmarksi, and Johnson, 2010). Meinfield, Doty, and Fletcher (2008) have studied specific factors, such as age, gender, income, and education level, to try and uncover why obesity is rising. When the obesity rate reached an alarming rate in the eyes of policy makers, the USDA sought a solution by implementing dietary guidelines. The USDA's first dietary recommendation arose in 1977, with a goal of balancing energy levels to reduce the number of individuals who are overweight. The science behind this method is simple in that Americans who are overweight should consume less energy and expend more energy. Cronin, Shaw, Krebs-Smith, Marsland, and Light (1987) researched the purpose and methods of developing the dietary guidelines, in which they indicate that the food guidance system was initially developed to direct individuals to select diets that provide an appropriate amount of energy to maintain a healthy weight.

Since 1977, the USDA has updated and modified their recommendations with the expectation that developing such guidelines will be successful in decreasing the obesity rate in America through a causal change. This process begins with research funded by the federal government. Expert nutritionists conduct studies and tests to develop proper dietary guidelines for an average American. Once these guidelines are implemented, they establish the scientific and policy basis for all Federal nutrition programs, including research, education, nutrition assistance, labeling, and nutrition promotion. All federally-issued dietary guidance for the general public is required by law to be consistent with the current USDA guidelines. In addition, the USDA promotes and publicizes the dietary recommendations through multiple channels, such as posters in public schools and by creating interactive websites that allow users to educate themselves about a proper diet. The final step in the process is Americans adhering to these dietary recommendations and improving their health, leading to a healthy weight. The USDA expects that the result of this process will cause a reduction in the number of obese Americans. This policy can be deemed effective if the USDA's dietary recommendations are reducing the obesity rate. But, there may be reasons to believe that USDA's goal is not being met.

Chapter 4

A Challenge to This View

While the USDA's believes that dietary recommendations will lead to healthier Americans through causal change, this theory may be inaccurate. Legislative intent is not always fulfilled through implementing government-endorsed recommendations. There are many reasons as to why the USDA's dietary guidelines may not be meeting their expected goal. One reason could be that people are simply ignoring these guidelines. Merely implementing a government recommendation does not guarantee that everyone will follow it. If the people in America choose not to eat within USDA guidelines, then the probability that this government policy is effective is greatly reduced. Another reason that the USDA's guidelines may not work could be that not enough Americans know what the proper diet should consist of. Perhaps the USDA's guidelines are, in fact, effective, but the USDA is lacking publicity for their recommendations. Although the USDA does provide an interactive website for their food recommendations, some people lack access or skills needed to use a computer or the Internet. And, although the USDA may provide public schools with posters and flyers that promote healthy food choices, perhaps some schools place these posters in obscure locations where few students see them, or may not even display these promotional pieces at all. Another reason that the USDA could not be meeting its obesity reduction goal is that the agency is being outcompeted by companies who advertise unhealthy lifestyle choices. If this were so, the junk food ads would overshadow the USDA's food guidelines, and the obesity rate would continue to climb. If any of these events were to occur, the causal-change process of the USDA's dietary recommendations leading to a reduction in the obesity rate would not work.

Variyam and Cawley (2006) have conducted a study similar to this, in order to evaluate the effectiveness of requiring nutrition labels on food products. The results indicated that this only slightly benefitted one demographic, questioning the overall effectiveness. This research is very similar to mine in evaluating the USDA's dietary guidelines. In order to assess if the USDA is having an effect on the obesity rate, we must track the obesity rate over an extended period of time. The USDA dietary recommendations are unique in the sense that such recommendations have been updated and altered regularly over the past 50 years, thus allowing us to observe these different recommendations in relation to each other. By tracking America's obesity rate and comparing it to the USDA dietary recommendations, we will be able to deduce three possible outcomes. Although the obesity rate has continued to rise, one possible outcome is that the rate of the increase in obesity is decreasing in relation to the implementation of USDA dietary guidelines. If this is observed, it may be that the USDA's dietary recommendations are fulfilling the goal of reducing the number of obese Americans, thus deeming this an effective government-endorsed recommendation. A second possible outcome could be that the rate of the increase in obesity is increasing in relation to USDA dietary guidelines. Or perhaps there is no relationship between the increasing obesity rate and the USDA dietary guidelines. If either of the last two scenarios are observed, it may be that the USDA is not accomplishing its goal of reducing obesity in America. Therefore, the dietary recommendations may be considered ineffective. By measuring the obesity rate against the USDA dietary recommendations, we can test if the USDA's dietary recommendations are ineffective in combating America's obesity epidemic by a hypothesis: *If the rate of the increase in obesity is rising, then the government-endorsed dietary recommendations are ineffective*.

There could be other possibilities that are affecting the obesity rate that the data may not indicate. Perhaps the dietary recommendations are themselves effective, but there are other factors that hinder their effectiveness. One of these possible factors could be the economy.

Perhaps the state of the economy prevents people from following the USDA dietary guidelines, since healthy foods are often more expensive than junk food. So, if the state economy is worsening, then the obesity rate may rise. But perhaps the obesity rate would be increasing at a faster rate were if not for the USDA's food guidelines. Another possible reason could be that careers today require less physical activity than in the past, such as working on computers versus working on one's feet. This change in lifestyle could also influence obesity in America, since people are less inclined to move in their everyday lives. Even if the USDA's food guidelines are effective, this sedentary lifestyle may override healthy eating. Since obesity is related to diet, physical activity, and other health concerns, possible answers as to why the obesity rate continues to increase seem confounded.

To test whether or not the USDA's dietary guidelines are having an effect on America's obesity rate, this study will use an interrupted time series design. This design will use several waves of observations before and after the introduction of different USDA dietary guidelines. This type of design works best if the independent variable (the USDA's dietary guidelines) is expected to have immediate, marked effect. For this study, the guidelines are being constantly updated and revised, so this leads to the conclusion that the USDA is unsatisfied with the results and thus implements updated versions. However, the results may be difficult to interpret if no statistically significant differences are found.

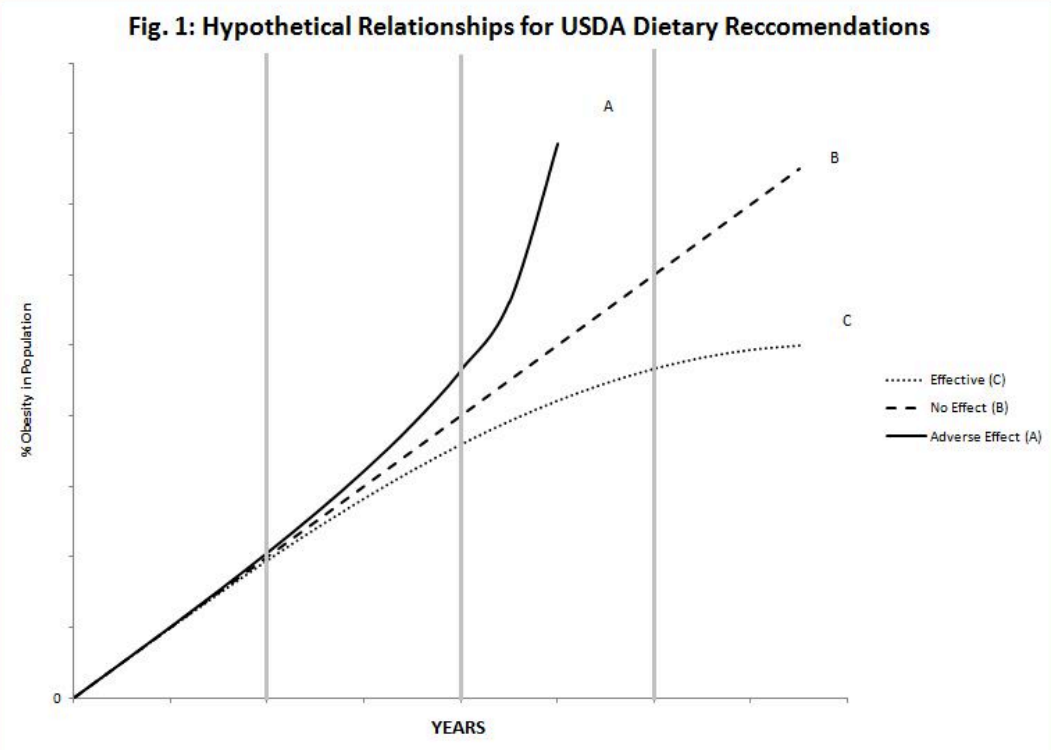


Figure 1 is an illustration of these three possible scenarios. Line A is an indication that the USDA's dietary recommendations are having adverse effects, thus accelerating America's obesity rate. Line A's slope is steadily increasing until the USDA's food guidelines are implemented, which then leads to an increasing rate of the rising obesity. Line B represents the USDA's guidelines having no effect on the obesity rate, which is illustrated by a consistent slope even when the guidelines are implemented. Line C is an illustration of the guidelines being effective. The slope is constant until the guidelines are implemented, after which the slope decreases and eventually levels off. Figure 1 represents three hypothetical situations that may occur when the obesity rate is compared to the USDA's dietary guidelines.

This introduction opens the way for detailed consideration of the effects of USDA's dietary recommendations. Annual figures measuring the obesity rate, Y_t, can be plotted over an extended number of years. The research issue is whether the observations in this time series have been affected by the USDA's dietary guidelines. Take the USDA's MyPyramid

implementation in 1992 as an example. Informally, to assess the effect of this act, we can simply look at the shift in obesity rate both before and after 1992. Formally, we worry about whether the observed change is statistically significant. Correct estimation would permit statistical evaluation of this simple interrupted time-series design:

$$\mathbf{Y_t = b_0 + b_1 X_{1t} + b_2 X_{2t} + b_3 X_{3t} + e_t,} \qquad \mathbf{(1)}$$

Where Y_t = annual observations on the obesity rate, X_{1t} = a counter for years, from 1 to N, the number of observations; X_{2t} = a binary variable scored 0 for observations before 1993, and 1 for 1993 and after; X_{3t} = a counter of years, scored 0 for observations before 1993 and 1,2,3… for 1993, 1994, 1995…and after; b_0, b_1, b_2, b_3 = parameters to be estimated, e_t = error.

The parameters b_0 and b_1 indicate, respectively, the level and slope of the time-series prior to implementation of the 1992 USDA MyPyramid. To evaluate whether b_0 and b_1 were altered by these new federal recommendations, we must examine b_2 and b_3. If the estimate for b_2 is not significantly different from zero, then we infer the recommendations had no effect on the level of the time series. Similarly, if the estimate for b_3 does not differ significantly from zero, the inference is the recommendations had no effect on the slope of the time series.

But, Equation (1) is only a basic example of tracking one regulation and it ignores the impact of the other USDA's guidelines implemented in 1995, 2000, and 2005. This study excludes the MyPlate that was implemented in 2010, since there is not enough time to see the effects. To incorporate these interventions, an extension of the previous logic is involved and leads to a multiple interrupted time-series design represented by the following equation:

$$\mathbf{Y_t = b_0 + b_1 X_{1t} + b_2 X_{2t} + b_3 X_3 + b_4 X_{4t} + b_5 X_{5t} + b_6 X_{6t} + b_7 X_{7t} + b_8 X_{8t} + b_9 X_{9t} + e_t,} \quad \mathbf{(2)}$$

In model 1, the cumulative model: Y_t, X_{2t}, X_{3t} are defined as with Equation (1); X_{4t} = a binary variable scored 0 for observations before 1996 and 1 after, X_{5t} = a counter for years, scored 0 for observations before 1997, and 1,2,3… for 1997, 1998, 1999… and after; X_{6t} = a binary variable scored 0 for observations before 2001 and 1 after, X_{7t} = a counter for years, scored 0 for

observations before 2001 and 1,2,3… for 2001, 2002, 2003… and after; X_{8t} = a binary variable scored 0 for observations before 2006 and 1 after, X_{9t} = a counter for years, scored 0 for observations before 2006, and 1,2,3… for 2006, 2007, 2008… and after. Hence b_4, b_5, b_6, b_7, b_8 ,b_9 capture the short- and long-run impacts of the dietary guidelines in 1995, 2000, and 2005. This model measures the effects of the USDA guidelines as if each one remained in effect and *effective* despite the introduction of new guidelines.

In model 2, the incremental model: Y_t is the independent variable, adult obesity rate. X_{1t} is a counter for years from 1 to N, the number of observations. X_{2t} is a binary variable, 0 for years prior to 1993 and 1 after. X_{3t} is a counter 0 for years prior to 1993 and 1,2,3…for 1993 and after until the next guideline is introduced, at which point it remains at its highest value. X_{4t} = a binary variable scored 0 for observations before 1996 and 1 after, X_{5t} = a counter for years, scored 0 for observations before 1997, and 1,2,3… for 1997, 1998, 1999… and after until the next guidelines are issued, at which point it maintains its highest value; X_{6t} = a binary variable scored 0 for observations before 2001 and 1 after, X_{7t} = a counter for years, scored 0 for observations before 2001 and 1,2,3… for 2001, 2002, 2003… and after until the next guidelines are introduced, at which point it maintains its highest value; X_{8t} = a binary variable scored 0 for observations before 2006 and 1 after, X_{9t} = a counter for years, scored 0 for observations before 2006, and 1,2,3… for 2006, 2007, 2008… and after until the next guidelines are introduced, at which point it maintains its highest value. Hence b_4, b_5, b_6, b_7, b_8 ,b_9 capture the short- and long-run impacts of the dietary guidelines in 1995, 2000, and 2005. This model measures the effect of each policy as if the effect of guidelines leveled off each time new guidelines were issued.

In model 3, the so-called "revoke" model: Y_t is the independent variable, adult obesity rate. X_{1t} is a counter for years from 1 to N, the number of observations. X_{2t} is a binary variable, 0 for years prior to 1993 and 1 after. X_{3t} is a counter 0 for years prior to 1993 and 1,2,3…for 1993 and after until the next guideline is introduced, at which point it returns to zero. X_{4t} = a binary

variable scored 0 for observations before 1996 and 1 after, X_{5t} = a counter for years, scored 0 for observations before 1997, and 1,2,3… for 1997, 1998, 1999… and after until the next guidelines are issued, at which point it returns to zero; X_{6t} = a binary variable scored 0 for observations before 2001 and 1 after, X_{7t} = a counter for years, scored 0 for observations before 2001 and 1,2,3… for 2001, 2002, 2003… and after until the next guidelines are introduced, at which point it returns to zero; X_{8t} = a binary variable scored 0 for observations before 2006 and 1 after, X_{9t} = a counter for years, scored 0 for observations before 2006, and 1,2,3… for 2006, 2007, 2008… and after until the next guidelines are introduced, at which point it returns to zero. Hence b_4, b_5, b_6, b_7, b_8 ,b_9 capture the short- and long-run impacts of the dietary guidelines in 1995, 2000, and 2005. This model measures the effect of the guidelines as if guidelines were revoked (i.e., effect returns to zero) as new guidelines are implemented.

Through estimation of these three models, then, we are able to determine the probable effects of the various pieces of USDA's dietary recommendations on the adult obesity rate.

Chapter 5

Research Design

The actual relationship between the USDA's dietary guidelines and "efficiency" is an empirical question. To test the proposition, *If the rate of the increase in obesity is rising, then the government-endorsed dietary recommendations are ineffective*, I have constructed an interrupted time series research design. Although enough data has been gathered to allow obesity to be broken down into many subcategories such as age, gender, income, race, or education level, my hypothesis can clearly be evaluated by looking at adult obesity rates over time alone.

The research design will use the USDA's dietary guideline changes as the independent variable, *X*. The design will indicate each moment in time when the USDA updates or modifies the dietary recommendations for Americans. While there have been different governmental recommendations prior to 1992, this year marks the first time that the USDA published a graphical depiction of the government's guidelines. Since 1992, the government has updated and revised the dietary recommendations four times, in 1995, 2000, and 2005. So, the years of 1992, 1995, 2000, and 2005 will be indicated in the graph as "interrupters" to the data set.

The design will track obesity rates for adult Americans beginning in 1990 up until 2011. Obesity will serve as the dependent variable, *Y*. The years from 1990 until 1992 will indicate the rate of obesity before the implementation of the Food Pyramid in 1992, which marked the first enforced dietary guideline. This will allow for a comparison of the obesity rate both before and after the USDA began promoting their dietary guidelines. I will track the annual rate of obesity from data obtained from the Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a state-based system of health surveys, which are

compiled through cross-sectional telephone surveys. These surveys are conducted by state health departments. Each year, states conduct monthly telephone surveillance using standardized questionnaire. Adults 18 years or older partake in the surveys and are asked health related questions. The BRFSS data is available from 1984 until 2011. This study will use the data from 1990 to 2011. The BRFSS collect data such as age, height, and weight, which is then used to calculate an individual's body mass index (BMI). CDC defines obesity in adults as having a BMI of 30.0 or higher. The rate of obesity will be tracked by the number of adult Americans who have a BMI of 30.0 or higher and are 18 years or older. This data can be obtained from the Centers for Disease Control and Prevention website.

This paper estimates the impact of USDA's dietary guidelines on America's adult obesity rate, with the guidelines as the independent variable, *X*, and obesity rate as the dependent variable, *Y*. The interrupted time series will be able to indicate if the USDA's dietary recommendations are "efficient" for combating America's rising obesity epidemic. By comparing the data to the "interrupters", this study will be able to draw some broad conclusions about the relationship between both *X* and *Y*.

Figure 2
USA Adult Obesity Rate

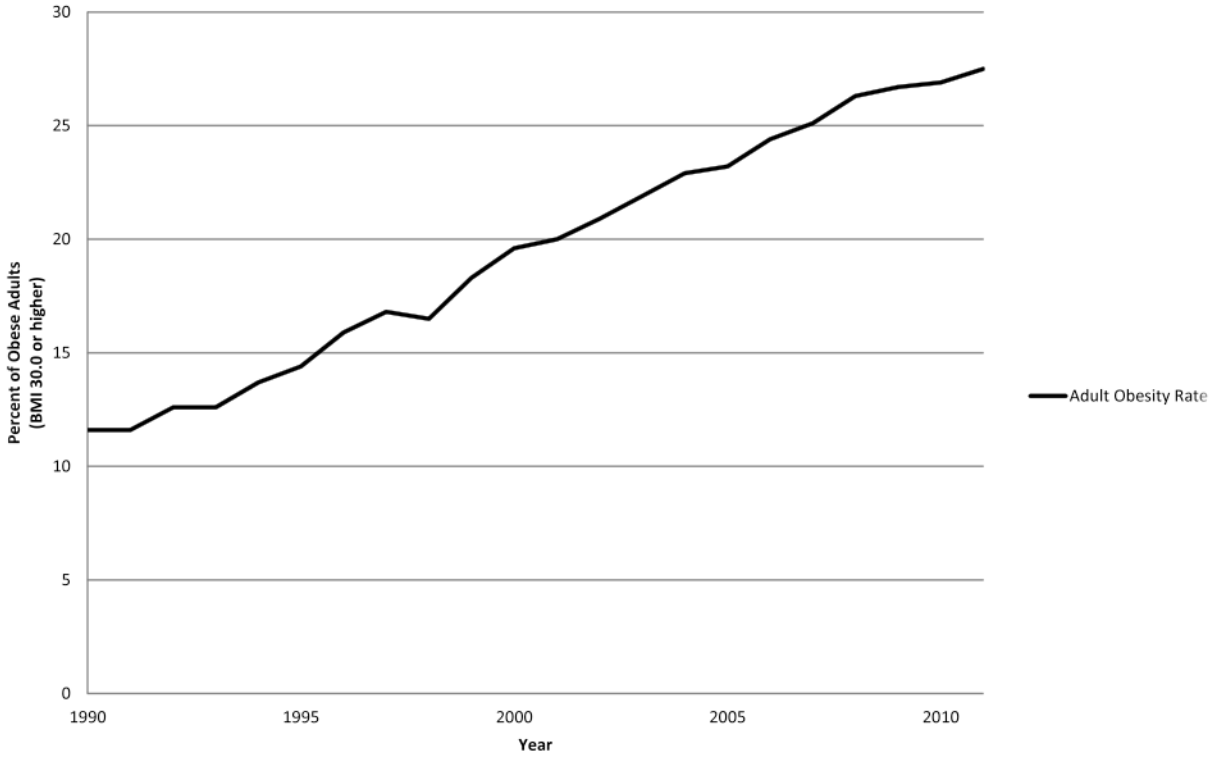


Figure 2 illustrates the rate of obesity in the United States from 1990 until 2011. Obesity is defined by adults 18 years or older who have a body mass index (BMI) of 30.0 or higher. Starting in 1990, America's adult obesity rate was 11.6%. This stayed consistent from 1990 to 1991with a slight increase from 1992 to 1993, rising to 12.6%. Since then, the graph shows how obesity has steadily increased, with the obesity rate being 13.7% in 1994, 14.4% in 1995, 15.9% in 1996, and 16.8% in 1997. In 1998, the obesity rate drops slightly, reaching 16.5%, but then steadily escalates all the way until 2011, reaching 17.5%. Except for the slight drop from 16.8% to 16.5% from 1997 to 1998, the graph depicts the rising rate of obesity in America.

Table 1:USDA's Dietary Reccomendations and the Adult Obesity Rate in the United States						
	Dependent Variable: Adult Obesity Rate in America					
Independent Variable	Model 1: Cummulative		Model 2: Incremental		Model 3: Revoked	
Counter Years (X1)	0.500		0.500		0.842	
	0.280		*0.280*		*0.111*	
	1.788	*	**1.788**	*	**7.565**	***
if >1993 then 0; if >=93 then 1 (X2)	-0.667		-0.667		-1.009	
	0.704		*0.704*		*0.674*	
	-0.947		**-0.947**		**-1.497**	
counter 1993=1 (X3)	0.400		0.400		0.058	
	0.395		*0.395*		*0.308*	
	1.012		**1.012**		**0.189**	
binary 1996 (X4)	0.283		-0.117		0.608	
	0.550		*0.784*		*0.923*	
	0.515		**-0.149**		**0.659**	
counter 1996=1 (X5)	-0.010		0.390		0.007	
	0.306		*0.306*		*0.105*	
	-0.033		**1.273**		**0.068**	
binary 2001 (X6)	0.060		-0.330		0.039	
	0.516		*0.650*		*0.212*	
	0.116		**-0.508**		**0.185**	
counter 2001=1 (X7)	-0.050		0.340		0.668	
	0.177		*0.306*		*0.965*	
	-0.283		**1.110**		**0.692**	
binary 2006 (X8)	0.527		0.187		--	
	0.479		*0.621*		--	
	1.100		**0.301**		**--**	
counter 2006=1 (X9)	-0.217		0.123		-0.219	
	0.157		*0.295*		*0.148*	
	-1.385		**0.416**		**-1.482**	
Constant	10.933		10.933		10.250	
R-Sq.	0.997		0.997		0.997	
Number of Observations	22		22		22	

Coefficients are unstandardized with standard error shown in italics and t-values showin in bold below.
*=p<0.10, **=p<0.05, ***=p<0.01. one tailed tests.
#=p<0.10, ##=p<0.05, ###=p<0.01. two-tailed tests.

For this analysis, three different models are used to measure the impact of USDA dietary guidelines. The first model used is a cumulative model, in that it measures the effects of each dietary recommendation as if they all built upon each other. Model 2 measures the incremental effects, meaning that each time a new recommendation is implemented, the previous recommendation levels off. Model 3 is a revoked model, in that each time a new recommendation is implemented, the effects of the previous model return to zero.

In Model 1, the dependent variable is the adult obesity rate in America from 1990 to 2010. This is measured against the independent variables, which are the dietary guidelines of

1992, 1995, 2000, and 2005. This model measures the effects cumulatively. In other words, prior USDA guidelines remain effective even as new guidelines are introduced. Table 1 displays the data, which indicates that there is little statistical significance. In Table 1, column one shows the results of the model. The coefficient for X1, counter for years, is 0.500 (SE = 0.280, t-score = 1.788), meaning that the obesity rate increase 0.5% each year. The coefficient for X2, a binary variable for the 1992 dietary recommendation, is -0.667 (SE = 0.704, t-score = -0.947), meaning that with the introduction of the 1992 recommendation, the obesity rate decreased by 0.667%. The coefficient for X3, a counter for years after 1992, is 0.400 (SE = 0.395, t-score = 1.012), meaning that for each year after 1992 the obesity rate increased by 0.4%. The coefficient for X4, a binary variable for the 1995 dietary recommendation, is 0.283 (SE = 0.550, t-score = 0.515), meaning that with the introduction of the 1995 recommendation, the obesity rate increased by 0.283%. The coefficient for X5, a counter for years after 1995, is -0.010 (SE = 0.306, t-score = -0.033), meaning that for each year after 1995 the obesity rate decreased by 0.01%. The coefficient for X6, a binary variable for the 2000 dietary recommendation, is 0.060 (SE = 0.516, t-score = 0.116), meaning that with the introduction of the 2000 recommendation, the obesity rate increased by 0.06%. The coefficient for X7, a counter for years after 2000, is -0.050 (SE = 0.177, t-score = -0.283), meaning that for each year after 2000 the obesity rate decreased by 0.05%. The coefficient for X8, a binary variable for the 2005 dietary recommendation, is 0.527 (SE = 0.479, t-score = 1.100, meaning that with the introduction of the 2005 recommendation, the obesity rate increased by 0.527%. The coefficient for X9, a counter for years after 2005, is -0.217 (SE = 0.157, t-score = -1.385), meaning that for each year after 2005 the obesity rate decreased by 0.217%. The constant is 10.933, meaning that the obesity rate was 10.933% prior to any recommendations. The R-squared of 0.977, the coefficient of determination, means that 97.7% of the variation in the dependent variable is accounted for by the model. The only value that is statistically significant in this model is the coefficient for X1, 0.500, meaning that the coefficient

for X1 is not a product of chance. The total number of observations in Model 1 is 22. The data shows that dietary guideline do not fulfill the intended purpose of decreasing the obesity rate, and in fact often causes slight increases in obesity.

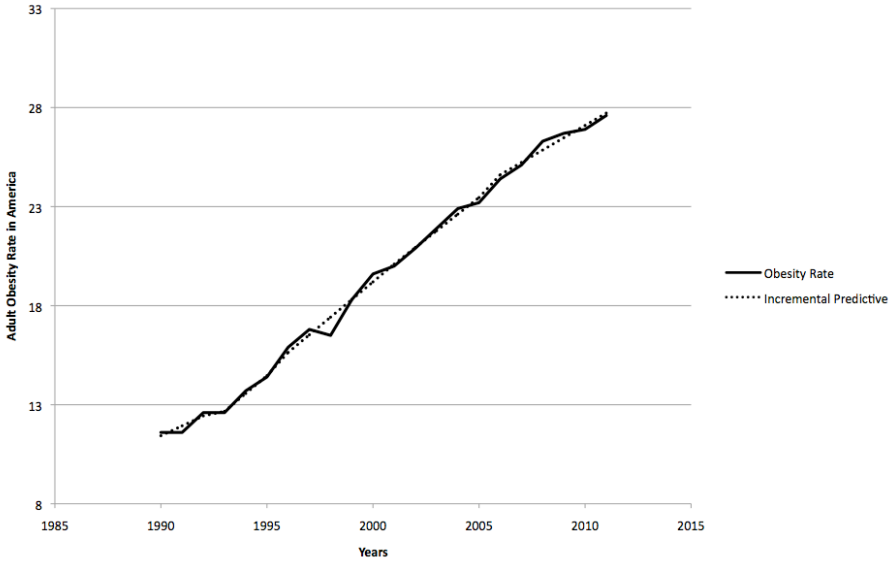
In Model 2, the dependent variable is the adult obesity rate in America from 1990 to 2010. This is measured against the independent variables, which are the dietary guidelines of 1992, 1995, 2000, and 2005. This model measures the effects incrementally. In other words, prior USDA guidelines level off when a new guideline is introduced. Column 2 of Table 1 display the data. Like Model 1, Model 2 is not have statistically significant. In Table 1, column two shows the results of the model. The coefficient for X1, counter for years, is 0.500 (SE = 0.280, t-score = 1.788), meaning that the obesity rate increase 0.5% each year. The coefficient for X2, a binary variable for the 1992 dietary recommendation, is -0.667 (SE = 0.704, t-score = -0.947), meaning that with the introduction of the 1992 recommendation, the obesity rate decreased by 0.667%. The coefficient for X3, a counter for years after 1992, is 0.400 (SE = 0.395, t-score = 1.012), meaning that for each year after 1992 the obesity rate increased by 0.4%. The coefficient for X4, a binary variable for the 1995 dietary recommendation, is -0.117 (SE = 0.784, t-score = -0.149), meaning that with the introduction of the 1995 recommendation, the obesity rate decreased by 0.117%. The coefficient for X5, a counter for years after 1995, is 0.390 (SE = 0.306, t-score = 1.273), meaning that for each year after 1995 the obesity rate increased by 0.39%. The coefficient for X6, a binary variable for the 2000 dietary recommendation, is -0.330 (SE = 0.650, t-score = -0.508), meaning that with the introduction of the 2000 recommendation, the obesity rate decreased by 0.33%. The coefficient for X7, a counter for years after 2000, is 0.340 (SE = 0.306, t-score = 1.110), meaning that for each year after 2000 the obesity rate increased by 0.34%. The coefficient for X8, a binary variable for the 2005 dietary recommendation, is 0.187 (SE = 0.621, t-score = 1.301, meaning that with the introduction of the 2005 recommendation, the obesity rate increased by 0.187%. The coefficient for X9, a counter for

years after 2005, is 0.123 (SE = 0.295, t-score = 0.416), meaning that for each year after 2005 the obesity rate increased by 0.123%. The constant is 10.933, meaning that the obesity rate was 10.933% prior to any recommendations The R-squared of 0.977, the coefficient of determination, means that 97.7% of the variation in the dependent variable is accounted for by the model. The only value that is statistically significant in this model is the coefficient for X1, 0.500, meaning that the coefficient for X1 is not a product of chance. The total number of observations in Model 2 is 22. Figure 3 displays the predicted values for Model 3, which indicate that the obesity rate is increasing at a rate similar to the predicted value. This validates the results by running a regression that compares the predicted obesity values to the actual obesity values. Like Model 1, Model indicates that the dietary guideline do not fulfill the intended purpose of decreasing the obesity rate, and even lead to increases in obesity in some cases.

In Model 3, the dependent variable is the adult obesity rate in America from 1990 to 2010. This is measured against the independent variables, which are the dietary guidelines of 1992, 1995, 2000, and 2005. This model measures the revoked effects. In other words, the effects of prior USDA guidelines return to zero immediately when a new guideline is introduced. Like Model 1 and 2, Model 3 shows that the coefficients for the intervention variables are not statistically significant. In Table 1, column three shows the results of the model. The coefficient for X1, counter for years, is 0.842 (SE = 0.111, t-score = 7.565), meaning that the obesity rate increase 0.842% each year. The coefficient for X2, a binary variable for the 1992 dietary recommendation, is -1.009 (SE = 0.674, t-score = -1.497), meaning that with the introduction of the 1992 recommendation, the obesity rate decreased by 1.009%. The coefficient for X3, a counter for years after 1992, is 0.058 (SE = 0.308, t-score = 0.187), meaning that for each year after 1992 the obesity rate increased by 0.058%. The coefficient for X4, a binary variable for the 1995 dietary recommendation, is 0.608 (SE = 0.923, t-score = 0.659), meaning that with the introduction of the 1995 recommendation, the obesity rate increased by 0.608%. The coefficient

for X5, a counter for years after 1995, is 0.007 (SE = 0.105, t-score = 0.068), meaning that for each year after 1995 the obesity rate increased by 0.007%. The coefficient for X6, a binary variable for the 2000 dietary recommendation, is 0.339 (SE = 0.212, t-score = 0.185), meaning that with the introduction of the 2000 recommendation, the obesity rate increased by 0.339%. The coefficient for X7, a counter for years after 2000, is 0.668 (SE = 0.965, t-score = 0.692), meaning that for each year after 2000 the obesity rate increased by 0.668%. The coefficient for X8, a binary variable for the 2005 dietary recommendation, was excluded from the regression because is perfect collinearity (0.000). The coefficient for X9, a counter for years after 2005, is -0.129 (SE = 0.148, t-score = -1.482), meaning that for each year after 2005 the obesity rate decreased by 0.129%. The constant is 10.250, meaning that the obesity rate was 10.250% prior to any recommendations. The R-squared of 0.977, the coefficient of determination, means that 97.7% of the variation in the dependent variable is accounted for by the model. The only value that is statistically significant in this model is the coefficient for X1, 0.842, meaning that the coefficient for X1 is not a product of chance. The total number of observations in Model 3 is 22. All three models indicate that the implementing new dietary recommendations do meet the expected goal of reducing the obesity rate in America. In fact, the obesity rate continues to increase, regardless if a new guideline is created.

Figure 3: Actual and Predicted Values for Incremental Model



Chapter 6

Conclusion

This empirical research began with the question, "Has USDA's dietary recommendations reduced America's adult obesity rate?" To provide an answer, a multiple interrupted time series model was used. By measuring the obesity rate against the USDA dietary recommendations, we tested if the USDA's dietary recommendations are (in)effective in combating America's obesity epidemic by a hypothesis: *If the rate of the increase in obesity is rising, then the government-endorsed dietary recommendations are ineffective*. The interrupted time series model used several waves of observations before and after the introduction of different USDA dietary guidelines. The research design uses the USDA's dietary guideline changes as the independent variable, *X*, with the recommendations implemented in 1992, 1995, 2000, and 2005 as the "interrupters." Three different models were used to measure the impact of USDA dietary guidelines. The first model is a cumulative model, in that it measures the effects of each dietary recommendation as if they all built upon each other. Model 2 measures the incremental effects, meaning that each time a new recommendation is implemented, the effects of the previous recommendation level off. Model 3 is a "revoked" model, in that each time a new recommendation is implemented, the effects of the previous model return to zero. Through running regressions of the three different models, I found no statistically significant relationship between the USDA guidelines and the adult obesity rate in America.

The results indicate that the USDA's dietary guidelines do not impact the increasing obesity rate in America. The obesity rate in America continues to rise, even with new guidelines policies. The data shows that the dietary guidelines do not fulfill the intended purpose of decreasing the obesity rate, and even results in increases in the obesity in some cases. From these

results, we can conclude that the USDA's dietary recommendations are not effectively combating America's obesity epidemic, and thus we can deem the USDA's policies ineffective.

These results are important when evaluating the effectiveness of a government department. The United States Department of Agriculture uses funding to create and update the dietary recommendations. One of the goals of the guidelines is to reduce obesity and help Americans maintain a healthy weight. But, this goal is clearly not being met, as indicated by the data. Prior research has investigated the cause of America's obesity epidemic, coming up with a multitude of reasons. And, researchers have also looked at the effectiveness of other government policies, such as the nutrition labels, that attempt to help Americans become healthier. This paper looks specifically at the USDA's dietary recommendations, an analysis that seems to have not been attempted before. So, the data generated from the three different models is the first data on this specific topic.

The political implications of these findings imply that the USDA is not handling America's obesity epidemic properly. In fact, their dietary recommendations are correlated with increases in obesity is some instances. These results should cause the USDA to realize that their plan to reduce obesity is simply not working. This department should pull their funding towards the dietary recommendations and instead focus funding on a new project that would better address this epidemic. If a government's department is not achieving its goal, then the department should not continue with the unsuccessful policy; this is a waste of the American government's money.

There are limitations to this research that are important to note. First, this study excludes the current dietary recommendation, MyPlate. Measuring the effects of this guideline was not plausible with an interrupted time series design since there was insufficient data available to measure the after-effects of obesity. But, the MyPlate replaced the prior pyramid visual that was been in effect since 1992. So, future research should be conducted that includes studying the

effectiveness of the 2010 MyPlate. Another limitation to this study is that the data used was from the Centers for Disease Control and Prevention's obesity rate for adults 18 years or older. This excludes those 17 years old or younger. This younger group could see positive effects from the dietary recommendations, as opposed to the adult group. And, the USDA promotes their guidelines in places such as schools where there is a wide audience of younger Americans. Perhaps future research should look specifically at America's juvenile obesity rate in relation to the USDA's dietary recommendations in an interrupted time series design. In addition, this study looked at the overall obesity rate in America since 1990. This average number did not include any controls other than age. Perhaps the results would be different if the obesity rate was broken into two categories: those who claim to follow the USDA dietary recommendations and those who claim to not follow the recommendations. The data may indicate that the USDA's dietary guidelines are effective for those who follow them. Another way to analyze the data would be to compare it to a similar group who did not have dietary recommendations, such as a post-test model. This may show that the rising obesity rate would be increasing at a faster rate if the dietary guidelines did not exist. Future research should continue to study the USDA's dietary recommendations in different ways, such as those described above, in order to fully evaluate the United States Department of Agriculture's efficiency. By studying specific policies within the government departments, we can properly assess the (in)efficiency that exists.

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