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Diploma Thesis

**An Economic Analysis of the Impact of Ethanol Production
on Food Prices in the United States of America**

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Summary

The production of ethanol as a source of renewable energy has increased rapidly over the last ten years. In the United States of America, a growing movement has emerged to reduce the dependence on fossil fuel due to the decline in energy resources expected to occur. In addition to the harmful gas emissions which affect the global climate significantly and contribute the global warming. However, this increase of ethanol production as a source of energy has few pros and cons. On the one hand, the percentage of greenhouse gases resulting from the ethanol is 60% less when it is compared to gasoline. On the other hand, Ethanol production from crops poses an economic problem as agricultural products are often directed to food rather than to energy. This will lead to a negative impact on the agricultural markets and to a conflict of production between fuel and food. To analyze the relationship between ethanol production and food prices in U.S. market, a regression modeling will be used. In this econometric model, the relation between rising ethanol production and agricultural commodity prices (corn and wheat) will be examined in the period 1995-2017.

Keywords: ethanol, renewable energy, energy, agricultural products, food prices, econometrics, United States of America.

Research aims

This research aims to:

- ✚ Analyze the dimensions of the energy problem associated with the existing energy model and the main factors driving the search for alternatives to the fossil energy sources in general and in the transport sector in particular.
- ✚ Explain of the status and the importance of biofuels as one of the energy sources of biomass in the energy market, and the positive and the negative economic, social and environmental impacts resulting from using this fuel as an alternative source to the traditional energy sources in the transport sector.
- ✚ Analyze the policies to support the production and the use of biofuels and their economic feasibility, also to identify the objectives and motives behind these policies in the United States of America.
- ✚ Analyze the correlation between energy markets and agricultural commodity markets and the impact of biofuels on deepening this relationship, and the direct and indirect effects of the growth of biofuel production on the prices of agricultural essential food commodities and their volatility.
- ✚ Explain the potential contribution of biofuels to the development of the farm sector in the United States of America.

Hypotheses

In the light of the above, I propose the following research problem:

- ❖ How can the production of biofuels as alternative energy affect the agricultural development and the food prices in the United States of America?

For this key research problem, the following sub-questions can be asked:

- Does the world live a crisis of energy resources? What is its nature?
- What are the benefits of biofuels as a renewable energy source compared to conventional sources?
- How efficient is the biofuel produced in the United States of America in providing economically sustainable energy?

To answer these questions, I put forward the following assumptions:

- H1: The world is experiencing a multidimensional energy crisis as a result of the depletion of traditional sources and their environmental impacts.

- H2: The expansion of biofuel production and its consumption in the United States play limited roles in achieving energy security for its low economic and environmental efficiency.
- H3: Biofuels are a real contender for food production on water and land resources, they are negatively affecting the food prices in the USA markets.
- H4: There is a positive correlation between the ethanol production and the food prices.

In this research, I address the policy of biofuel production in the United States of America as one of the largest energy consumers in the world. The USA has been implementing and investing in the development of biofuels since the 70s of the last century. It has become the largest producers and consumers of biofuels currently. I have focused on the period between 1995 and 2017 as it is the period of the booming in biofuel production.

Methodology

This thesis starts by providing a literature review about theoretical information on biofuel and its global production and consumption. Then, information about policies in the United States of America and its efficiency will be offered. Next, I move to measure the relationship between ethanol production and food prices during the period 1995-2017, econometric models will be used using a time series framework on ethanol and agricultural prices “especially corn and wheat” as the primary source of ethanol production in the United States of America. Price index numbers will be used to calculate the changes in the prices of food commodities to indicate the difference in prices between periods. The regression analysis will determine the dependency and validity of the examined data.

Conclusion

Given the current problems of the current energy pattern and the diversity of alternative energy sources, it is arguable that what the world is currently experiencing is not a problem of energy. Rather, the world is facing a technological challenge to develop renewable energy sources and to make them more suitable to replace traditional sources of energy in various fields of use, primarily the fuel for transportation. This leads us to deny the first hypothesis that the world is experiencing a multidimensional energy crisis as a result of the depletion of traditional energy sources and their environmental effects. By discussing the importance of biofuels as an alternative to fuel oil, the status of biomass energy has been highlighted as one of the most important renewable energy sources, which is increasingly used in total energy consumption in the world. The biomass energy has the potential for being utilized in various fields of modern energy use. The vast potential for producing biomass energy and its availability in different regions of the world makes it one of the most critical alternatives to fossil fuel. Therefore, biomass energy sources can be relied upon to provide part of the energy requirements for the transport sector in the context of the direction to replace suitable fuel oil alternatives. Biofuels can be considered a modern form of bioenergy and the real and practical alternative to oil derivatives in the transport sector. Thus, the biofuel attracts a growing interest in many countries racing for the development of the production and the use of it and work to replace the destructive oil fuel.

Through the analysis of biofuel production policies in the United States of America, it was found that the massive expansion of biofuel production would not have been possible without the government support. These governmental policies include a set of support tools, mainly; tax incentives, quantitative targets, subsidies and customs tariffs that aims to protect local production. These policies are motivated by economic and environmental demands. They aim to meet the challenge of reducing the energy dependence, especially towards oil. The ability of biofuels to compete with fossil fuel in the current conditions depends heavily on the production and consumption support policies.

Biofuels face some weaknesses in the competition with fossil fuels under the influence of many factors. One of the limiting factor of the use of the biofuels is the fluctuation of oil prices and agricultural raw materials prices used in biofuel production.

Additionally, the use of biofuels represents a real challenge to food security. It represents a competitor to food commodities destined for human consumption, because of the high demand created on these resources to meet the target production for volume under the implemented governmental programs. Furthermore, the growing demand for biofuels puts pressure on water resources and agricultural land.

Biofuels are also a challenge to food security due to their direct impact on the availability of cereals and vegetable oils, which are the primary source of fuel production. This effect is evident in the increase of the prices of these crops and the decrease of their exports in the United States of America. This, ultimately, had an impact on the prices of these commodities in the international markets. From the linear regression equation, a positive correlation can be observed between the price of the corn and the quantities used in the production of ethanol. The increased use of corn as a significant source of biofuels in the United States has led to a sevenfold increase in ethanol production since 1995. As a result, the US maize exports have declined by about a third, and ethanol production has increased corn prices. These results are consistent with the economic principles. Also, from the model, there is a positive correlation between the price of wheat and the price of corn in the United States of America. If the price of corn rises by a certain amount, the price of wheat will rise by half of that rise, which is a natural consequence of substitution. Thus, the expansion of the use of corn in the production of biofuels will naturally lead to higher prices of the corn substitutes due to the increased demand.

Biofuel, like other sources of energy, has advantages and disadvantages. On the one hand, it represents an alternative to the depleted oil energy. On the other hand, biofuel impacts the crops used in its production. This impact extends to the markets of the most basic agricultural commodities through the effect of substitution between crops and by competing with other crops on agricultural land and water resources.

Literature

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