

FOOD SAFETY, FOOD SECURITY AND ENVIRONMENTAL RISKS

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ABSTRACT

This paper shows how food safety, food security and environmental risks associated with agriculture can be alleviated through sustainable agriculture.

Today, most of the countries are arguably food insecure. Developed countries rely mostly on industrial agriculture which has led to increasing monocropping and imported food while developing countries are extremely vulnerable to food price inflation. The risks associated with food insecurity are political and economic instability.

Modern industrial agriculture mindset assumes the reality of substitution between land and external chemicals and management systems that resulted in overvalued land and undervalued social costs of the negative externalities with the associated environmental risks of polluted water, acid rain and degraded soil.

The globalization of the food production and the intensification of food trade enhance the risks associated with food safety. Food consumption all over the world is a mixture of imported agricultural products and domestic products making difficult to find the contamination source in case of a food scare.

The development of agriculture is an essential way to raise national income and improve the welfare of rural dwellers whether a developing country or a developed country. The paper makes the case that sustainable agriculture is the best method for agricultural development with the largest opportunity for economic development and reduction or alleviation of environmental, food security and food safety risks.

Keywords: sustainable agriculture, food safety, food security, environmental risks

JEL Classification: Q18, Q32, Q34, Q57

1. Introduction

Malthus famously predicted that population will grow faster than food production causing widespread starvation and death. Fortunately, this prophecy did not come to fruition since technological advancements, more land dedicated to farming, advanced farming techniques, and capital investment have been able to supply a plentiful amount of food for the world's population. However, another force increasing the demand for food should be considered. Between 1950 and 2011, the level of urbanization increased fivefold (UN DESA 2012:4). High levels of urbanization are linked to changes in the pattern of food consumption (Regmi and Dick, 2012) and also, as income increases, the demand for food, whether fresh or processed, generally increases (Engels' Law). As a result, the increasing amount of food that must be produced and sent from rural farms to cities increases the stress on agricultural production and might force a country to import, or increase its imports, of food. All countries are exposed to both food security and food safety risks, although poorer and less developed countries (where subsistence agriculture is prevalent) are more vulnerable to food security associated risks while developed countries (due to their reliance on industrial agriculture and processed food) are more vulnerable to

food safety associated risks (food scares). High environmental risks are also associated with industrial agriculture.

The paper is organized as it follows: Section 2 discusses some issues related to food security. Section 3 briefly presents the environmental risks associated to modern, industrial agriculture. Section 4 explains why industrial agriculture is related to an unsuccessful integrated rural development while Section 5 introduces sustainable agriculture as a possible solution for the conundrum of modern agriculture. Section 6 argues how food safety associated risks are alleviated by sustainable agriculture. Section 7 concludes.

2. Food security

According to the ideas presented by Clark (1940), Kuznets (1966) and many other neoclassical development economists, the agricultural sector is the support system for the rest of the economy, providing key resources so that the economy can be transformed into an industrial, commercial, and service economy. For this objective to be accomplished public policy must be designed to generate and sustain a structural transformation of an economy. However, no country has ever achieved rapid economic expansion without first being food secure (Timmer, 1998: 205). Therefore, the growth of the agricultural sector must also be encouraged.

Despite the fact that developed countries became food secure and successfully completed a structural transformation of their economies, many, if not all, developed countries are arguably food insecure today, relying on industrial agricultural approaches which has led to monocropping and importing food. Any food crisis, whether a shortage or spike in prices, can cause political and economic instability. This instability causes households to spend more of their income on food and increases their precautionary savings for periods of uncertainty. In turn, these changes by households can have a significant spillover effect on the rest of the economy. Those looking to profit turn to speculation rather than productive investment which slows economic growth (Timmer, 1998: 207). For example, food prices, particularly grain, spiked in 2008 contributing to the financial crisis that occurred late that year. Once again, food prices spiked in 2010 and 2011 causing many forecasters to speculate that further economic, political, and

social disruption will follow. In fact, one news report suggested that the end of cheap food may be drawing to a close (Arasu, 2011).

Since the United States changed their agricultural policy in the 1970s, prices for agricultural inputs have risen steadily over time while the agricultural output price index has remained relatively stable (Fuglie, MacDonald and Ball, 2007). Price variability of important agricultural commodities is correlated with oil prices. Not surprisingly, the major variability in food prices occurs when there is a shock to petroleum prices. This price variability has resulted in small farms going out of business because they are not able to cope with these price changes.

While the price ranges of commodity food prices are uncertain, one thing that is sure is that food prices will remain at a higher level and be more volatile than the world population has experienced the past forty to fifty years. As many countries have little agricultural production and/or infrastructure in-place or have specialized in the production of certain fruits or vegetables, the increase in food prices is highly likely to cause food security issues. Therefore, food production should be a priority of any country. However, the focus should not be just on food production but rather on diversified, sustainable food production. This form of agriculture will counter the speculators investing in commodities and reduce their effects on food prices. Furthermore, focusing on food security through sustainable agriculture would ensure that a nation would not be dependent on food imports. Economic growth could follow as food prices would be stable, domestic farmers would have greater security as their products will have a market, and rural households would have more disposable income to spend spurring rural economic development.

The 2008 global economic crisis was mostly caused by higher energy prices and a breakdown of financial institutions. It triggered higher food and commodity prices, a decrease in profits from exports, and less income that could be used for food purchases or for remittances. Higher food prices caused riots in more than two dozen countries, and renewed political and scientific interest in food security (Barrett, 2010). Also, in many of these countries, riots lasted more than five months and caused companies to go bankrupt (Singh, 2011).

The food price inflation was again the precipitator for more social upheaval in early 2011. Throughout the Middle East and Northern Africa, protests

resulted in the overthrow of the governments in Tunisia and Egypt. Furthermore, many other countries in the region, such as Jordan, Lebanon, Syria, and Algeria, were on the verge of complete turmoil. While there are other reasons that contributed to this social unrest, such as high youth unemployment, the increase in food prices was the main cause for protests in countries with little agricultural production, largely developing countries, and which have been affected the most.

All of these issues have emphasized the importance of agriculture. Agriculture is an especially important sector for economic growth. Periods of economic slowdown reduce the ability of developing countries to import food which creates severe food security issues. Nearly all countries, developed and developing, rely, to varying degrees, on food imports. In fact, the dependence on imports for food from 1970 to 2003 increased the most among least developed countries. In 2003 imports by low income countries accounted for 17% of grain consumption, 45% for sugar and sweeteners, and 55% of vegetable oils, an increase from 8%, 18%, and 9% respectively in 1970 (Rosen and Shapouri, 2009). International trade, globalization, can have the greatest negative impact on developing countries because they have the least influence on world market prices. Furthermore, given today's environmental problems, limits of arable land, water constraints, and increasing reliance on agricultural products for energy, agricultural commodity prices will continue to raise.

3. Ecosystem risks

Some countries developed agricultural policies that focus on the intensification of agricultural production. Many of these policies were centered on high-yielding crop varieties grown in an industrial fashion; in other words, monocropping. Concentration occurs largely because industrial agricultural firms that use high cost external inputs to production, such as fertilizer, can lower per unit cost by farming large plots of land thus obtaining higher profits. Centralization has led to a reduced variety of crops being produced. For example, the number of commodities produced per farm in the United States has significantly decreased in the past century. Currently nearly 70% of agricultural land in the Midwestern United States is devoted to growing corn, soy, and sugar on a farm averaging 14,000 acres (equivalent to slightly more than 7,000 American football fields) (Barber,

2005). Furthermore, California grows approximately 93% of grapes, 50% of tomatoes, 78% of lettuce, 100% of almonds, and 76% of strawberries produced in the United States. Additionally, over 55% of California grapes were grown in three adjacent counties and nearly 78% of lettuce in six bordering counties (Cameron and Pate, 2001).

Other Western countries that have adopted this industrial agricultural approach have had a similar decrease in the number of commodities per farm. While industrial agriculture allows farmers to obtain high yields of one crop, the environmental damage is just as high. Intensive monocropping depletes nutrients from the soil causing fertility to decrease. This, in turn, causes farmers to have to apply higher levels of chemical fertilizer and pesticide. This statement is particularly true for communities or countries which diminish, destroy, or use-up their natural resources that are needed to produce food, as well as for their survival. The Western agricultural system has relied on machinery and biological and chemical technology. These efforts have been made in an attempt to improve output yields and to cut costs. Initially, this was not a problem as the price of fertilizer and pesticides decreased in relation to the price of land, causing fertilizer and pesticide use per hectare to increase substantially. Over time the annual amount of fertilizer in pesticides required to produce the same amount of agricultural output has continuously increased to the point where soon yields will decrease. The extensive use of fertilizer and pesticides will eventually lead to farmland becoming brown-fields, leaving the land unproductive for agricultural use; the total farm output has flattened out in the United States since 1998 (Fuglie, MacDonald and Ball, 2007).

As a result, environmental services, such as the absorption of the residuals from agricultural production, have been treated as a free good. This mindset has caused scientific and technical innovation to be biased toward substitutions for land such as external chemicals and management systems that have overvalued land and undervalued the social costs of the negative externalities of the industrial agricultural process (Runge et al., 1990; Ruttan, 1994).

In addition to pollution caused by fertilizer use, agricultural land has also been negatively affected by other environmental problems such as polluted water and acid rain. Many of these issues came to the forefront during the late 1980s and the early 1990s with the release of the Brundtland report and

the UN conference on the environment and development in Rio de Janeiro (Staatz and Eicher, 1998). Later, in the late 1990s and early 2000s climate change became an important issue with the global populace and concern grew over how agricultural production would be affected. The increased levels of man-made gases such as carbon dioxide in the atmosphere, massive deforestation, as well as other human caused environmental problems are believed to be a major contributor to climate change. These changes to global climate will have an effect on agricultural systems. Models have been simulated to illustrate how global agricultural systems may be affected (Cline, 2007; Mendelsohn and Dinar, 2009; Lobell and Burke, 2010). Not surprisingly, developing countries will be most negatively affected.

Agricultural practices pollute the surrounding ecosystems, which in turn negatively impacts output yields. Thus, there is a vicious feedback loop. Modern agricultural approaches, which require the use of increasing amounts of external man-made inputs, degrade the land in direct use for agricultural production, pollutes the groundwater and the surrounding ecosystem. In turn, the contaminated water and animal excrement are returned to the land which further deteriorates the soil.

4. Industrial agriculture and the unsuccessful integrated rural development

Although agricultural subsidies are the main reason agricultural policies developed for rural economic development are not implemented, a variety of other reasons exist for an unsuccessful integrated rural development program. First, and related to agricultural subsidies, there is a lack of commitment from individual and collective governmental agencies and politicians (World Bank, 1987). This statement is true for both developed and developing countries. Governments and politicians in developed countries do not want to alter agricultural policy because the agricultural corporations and farmers in their respective countries have considerable influence through lobbying groups and political contributions. In developed countries the agricultural corporations and large-scale farmers benefit from a lack of a cohesive rural development strategy. Therefore, the politicians and government agencies are often afraid to challenge the agricultural corporations and farmers because they are fearful of losing political power

as well as monetary contributions from these special interest groups. This lack of government commitment and power of the agricultural industries and large-scale farmers create an adverse policy environment that hampers agricultural policy reform from occurring.

A second reason for an unsuccessful integrated rural development program is the lack of infrastructure. This reason is more generally a problem for developing countries as infrastructure is often limited due to insufficient funds to carry-out expensive development projects. In particular, the lack of revenue has a major impact on the accessibility of technology (World Bank, 1987). Infrastructure, such as roads, food processing plants, and railways are needed to expand rural development. Without proper infrastructure additional agricultural production will not occur because farmers will not grow additional product that they cannot bring to market to sell. Therefore, infrastructure is a necessary investment in rural areas if a country seeks to increase agricultural development. Additionally, initial investment in technological improvements such as irrigation systems and tractors would most likely need to be financed by national governments until the agricultural system moved away from subsistence or semi-subsistence agriculture. However, these issues also exist because in many countries struggling to achieve development there is a lack of institutions in rural regions. To facilitate rural development, local and regional institutions, such as agriculture agencies, are needed to monitor development programs (World Bank, 1987). However, perhaps most important is access to financial services for rural dwellers. Often in rural areas there is either a severe shortage of or no financial institutions at all for people living in these regions to receive credit or to save their earnings. While in recent years microfinancing has filled this void somewhat, there is still a large problem for those living in rural regions to obtain financing. Access to financial services is a vital component of rural economic development because without access to these services farmers cannot make the appropriate investments they need to expand their productive capacity.

A third reason for an unsuccessful integrated rural development program is that the benefits for participating in agricultural development are often unrecognized. Farmers, especially in developing countries, do not see the point in expanding their production if the support programs and institutions, such as those listed above, are not available because they do not have access

to markets that are large enough to sell their goods. From a governmental perspective, financing of these initiatives must occur without a guarantee that agricultural development will occur. The government must convince farmers that if they produce more they will earn more money and be better off. In many countries this obstacle is very difficult to overcome as many citizens do not trust their government because of bad previous experiences in their relations. Therefore, a major problem is the lack of beneficiary participation (World Bank, 1987).

Despite these complex issues and problems, small, sustainable farms can result in growth in the agricultural sector as productivity is often higher on small farms than larger farms (Berry and Cline, 1979) supporting the opinion that sustainable agriculture is an acceptable alternative to modern, industrial agricultural systems. However, over time the most fertile land was already in use and agriculture was in an ever-increasing competition for land with industrial, commercial, and residential developers. Therefore, the land suitable for agriculture is already in some form of use, leaving only marginal land, at best, for farming. This realization has led to the second concern nations and individuals have about sustainable agriculture which is related to producing sufficient output yields. In the industrial agriculture approach farmers have turned to fertilizer, pesticides, herbicides, and irrigation to increase output yields. However, sustainable agriculture does not use artificial, external inputs to increase output yields. This reality has caused concern that productivity growth using sustainable agriculture will not be possible.

Therefore, reliance on industrial agriculture has continued despite increased calls and demand for sustainable agricultural approaches. This reliance on industrial agriculture has limited the capacity of countries to respond to the concerns of food shortages, particularly in developing countries where there is considerable difficulty in developing and maintaining agricultural research (Eicher, 1994). Furthermore, the external inputs used in industrial agricultural practices, fertilizer, herbicides, pesticides, and irrigation, are heavily energy intensive. As stated previously, ever-increasing amounts of these external inputs will be needed to maintain production yields consuming more energy. However, as energy prices increase these external inputs will increase the costs of production in the industrial agricultural

approach and become a significant primary resource constraint to expanding production further (Desai and Gandhi, 1990; Chapman and Barker, 1991).

5. Sustainable agriculture: a possible light at the end of the tunnel

Making matters worse there has been a worldwide decrease in the number of farms. Furthermore, the farms that remain are much larger in size. Efland and Conklin (2005) show the inverse relationship between average farm size and the number of farms in the United States.

Other Western countries have a similar relationship. In large part these changes to the structure of farms has come as a result of globalization. As Western countries have increasingly shifted their production to grow but just a few crops for biofuels and other non-food purposes, developing countries are exporting their agricultural production for money, taking food out of their system and, on many occasions, making their countries food insecure. For example, India has been successful in increasing agricultural production the past decade or so, yet the country still has a high percentage of citizens which are either under- or malnourished because they export their food crops. Although some may think this to be an isolated case, due to financial considerations many developing countries are also exporting their agricultural production. The result has been for small farms all over the world, developed countries and developing countries alike, to go out of business while large farms relying on the industrial agricultural method of monocropping has become the norm. Governments, using neoclassical economic theory, have promoted industrial agriculture with mega-sized farms to shift labor to non-agricultural purposes because technological advancements, as discussed previously, would cause the prices of agricultural products to decrease. Furthermore, the neoclassical theory also encourages that resources are employed in non-agricultural sectors because the returns will be greater in these other sectors now that agricultural prices are lower.

Thus, neoclassical economic theory has contributed to the agricultural conundrum that exists today; large, mega-farms producing relatively few crops. However, these same policies in conjunction with environmental concerns and apprehension over population pressures has caused many individuals to understand that the current industrial agricultural methods will result in lower agricultural productivity, higher food prices, and

increased poverty in rural regions (Eicher and Staatz, 1998). This realization has resulted in a demand driven movement for sustainable agricultural products that has significantly expanded in the past decade.

Using sustainable agricultural techniques can halt, and with some methods reverse, the negative externalities caused by industrial agriculture. Rural household incomes and living standards, given some external assistance, can increase substantially using a sustainable approach to agriculture. Agricultural products made using sustainable methods have higher value-added and cut costs due to the reduction of external inputs to production and the goods are sold locally. However, there are indirect benefits to sustainable agriculture as well. Rural economic development will lead to improved public health, better public services such as education and sewage treatment, a cleaner environment, and improved rural-urban equity.

Furthermore, sustainable agricultural practices can also alleviate food inflation risks. Since food is not imported from long distances, transaction costs are not incurred because food is available locally. Additionally, if food was produced and sold locally, world prices would drop keeping food inflation in check.

6. Food safety

Due to various international trade agreements such as the World Trade Organization, the European Commission, and the North American Free Trade Agreement the levels of food actively traded has reached unprecedented heights which has put undue pressure on inspection centers and reduced food safety. Import shares of U.S. food consumption have steadily increased from 1981 to 2001 in every major food consumption category. From 1990 to 2007, total fresh and processed fruit and vegetable imports in the United States have more than doubled (USDA, 2003). According to the FAO (2010), food imports in developing countries are projected to increase considerably in the coming years in most major food consumption categories.

The increase in imported food causes domestic farmers in a country to quit farming because of increased competition. In particular, farmers in developing countries often cannot compete with farmers in developed countries. Furthermore, the importation of agricultural products has led to the monocropping that is prevalent in industrial agriculture.

Domestic agricultural products, especially in developed countries, are much less likely to have harmful bacteria. That does not mean that foodborne illnesses do not occur domestically. For example, the United States has had a number of high profile outbreaks of Salmonella in the past few years. Additionally, the United Kingdom experienced a large outbreak of foot-and-mouth disease in 2001. However, domestically produced food will typically be safer to consume. First, domestically produced agricultural goods are easier to inspect, whereas the amount of imported food is very large and requires an extensive inspection system. Secondly, consumers have a resistance to the bacteria in domestically produced food while imported food will most certainly contain bacteria that are foreign to their bodies leaving them susceptible to disease and illness. Lastly, if an outbreak does occur, domestically produced agricultural products are much easier to track in order to find the source of the outbreak. Imported agricultural products are combined with domestic products which severely complicates the ability to find a contamination source because the food has been cross-contaminated. Perhaps the greatest indirect impact on economic development from using local, sustainable agricultural practices is the reduction in health care costs, both monetarily and with improved health of workers which leads to higher productivity. There are a few reasons for health improvements. First, because food is grown locally and does not have to be picked before maturity in order to be shipped thousands of miles, the food will be more nutritious. Second, agricultural products produced using sustainable methods do not have harmful pesticide and herbicide residues. According to the United States FDA (Food & Water Watch, 2008) imported fruit is four times more likely and vegetables twice as likely to have illegal levels of pesticide residues. Other Western countries are likely to have similar results. Beru and Salisbury (2002) reported that imported produce to the United States was more than three times more likely to contain Salmonella and Shigella than domestic produce.

7. Conclusion

Despite all the advantages of a sustainable agricultural approach for economic development, the environment, and society, industrial agriculture remains the leading method today. Countries and policy-makers around the world have been led to believe that agricultural commodities can be treated

like any other product and traded on the global marketplace. This belief has become the dominant viewpoint based upon neoclassical economic theory and the concept of comparative advantage which stresses that each country has their own development path given resource endowments and their stage of development. The result was economic policies promoted by economic development agencies that stressed industrialization for developing countries which resulted in monetary resources being diverted from agriculture. Unfortunately, in many instances, those economic policies led to stagnant economic growth and countries that were once food secure are now relying on imports of agricultural products. In developed countries the impact has been slightly less severe. In these countries, as development expanded, both population and household incomes rose, which increased the demand for food. To feed this economic growth, labor was shifted from the agricultural sector to nonagricultural production. The key difference between developed and developing countries is that developed countries already have high agricultural production and the necessary support infrastructure. However, whether a developing country or a developed country, it is clear that agricultural development is a real opportunity to raise national income and improve the welfare of rural dwellers.

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