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Introduction

The past half-century has seen an explosion in the volume of international trade, in large part due to the plethora of multilateral trade agreements that have been signed. However, the multilateral system is in danger of collapsing over disagreements regarding one major issue; agricultural support in developed countries. Differences in opinion between developed countries and developing countries over the optimal level of agricultural support in developed countries have left the current Doha Round on life support. The agricultural sector represents a large share of the economy in many sub-Saharan countries. If U.S. and E.U. agricultural support does indeed hurt developing economies, this impact should be particularly significant in sub-Saharan Africa. The debate over whether agricultural support in wealthy countries negatively affects growth in developing countries has been raging for several decades. Nearly all economists recognize the harmful effects tariffs have on agricultural trade; however, there is still no consensus regarding the effects subsidies have on trade. While many developed countries support their agricultural sectors through the use of tariffs, subsidies, and other protectionist measures, the debate has mainly focused on U.S. and E.U. support due to the size of their economies.

In this paper I will be examining the effects U.S. and E.U. agricultural support have on economic growth in sub-Saharan Africa. The first section gives a general overview of agricultural support programs in the U.S. and E.U. The second section describes the construction of the models used to estimate the effects of support policies. The third section provides the regression results, which is then followed by a few closing remarks.

Background Information

The U.S. and E.U. have several different methods of supporting their farmers, and these methods have evolved over time. A common method of distinguishing between types of support is by their effect on domestic prices. If a government policy causes domestic prices to be higher than world prices, it is called market price support (MPS). Examples of MPS include import restrictions such as tariffs and quotas, as well as public stockholding, production quotas, and export subsidies (Elliott, 14). All of these instruments of support aim to restrict supply in order to increase prices, and consequently farmers' incomes. Domestic subsidies on the other hand, raise farmers' incomes in a more direct manner. They are payments made to farmers that represent the difference between domestic prices, which are roughly equivalent to world prices after adjusting for transportation costs, and government price targets (Elliott, 14). A major difference between MPS and domestic subsidies are the groups who bear the costs of these forms of support. Since domestic subsidies require government outlays, the costs fall on taxpayers. This is also true for certain types of MPS such as public stockholding, which is when the government purchases a portion of producers' harvests and prevent it from reaching the market. However, there are several types of MPS, such as tariffs and quotas, which do not require any spending on the government's part. In this case, consumers bear the costs of protection. Most countries prefer MPS over domestic subsidies because many forms of MPS do not require government outlays. This is particularly true for developing countries, many of whom simply do not have the resources to support their farmers through the use of domestic subsidies. While there are many differences between MPS and domestic subsidies, they are similar in one major way; they reduce export

opportunities for foreign producers. Domestic subsidies allow farmers to sell their products below world prices and still profit from it since subsidies cover a large percentage of production costs. Foreign producers simply cannot sell their products at such low prices without taking a loss.

The Uruguay Round of trade negotiations, which began in 1986 and ended in 1993, marked the first time barriers to agricultural trade were addressed in the multilateral trade system. One of the results of the negotiations was the creation of a system to categorize different types of domestic subsidies. Domestic subsidies are placed into different "boxes" according to what degree they distort trade. Green box subsidies are those which have no distortionary effect on trade, and no limits were placed on subsidies in this box. Subsidies in the amber box are considered to be highly trade distorting, and were subject to gradual reduction. Amber box subsidies in developed countries were subject to 20 percent cuts over six years, while developing countries had to implement 13 percent cuts over the same period (Elliott, 19). The final category is the blue box, which covers subsidies that are considered to be trade distorting but are accompanied with production limits in order to mitigate their distorting effect. These production controls diminish the ability of farmers in developed countries to flood the domestic market with subsidized crops. As a result, foreign producers still have the opportunity to export their crops to developed countries. Blue box subsidies were left uncapped by the Uruguay agreement.

The support policies of the U.S. and E.U. have evolved substantially since their inception, both in terms of which support instruments are used and to what degree. The European Economic Community (EEC) implemented the Common Agricultural Policy

(CAP) in 1962. The EEC did not possess the fiscal powers that national governments held, which is why import restrictions were used to support farm incomes rather than domestic subsidies. However, this policy proved to be untenable over a long period of time because there were no domestic production controls in place (Elliott, 38). Farmers had an incentive to increase production since they could now sell their goods at higher prices. Surpluses became very large due to the dampening effect higher prices had on consumption. In order to reduce these surpluses, which were placing an increasing burden on the European Community (EC) in the form of storage costs, export subsidies were implemented to sell the surplus stocks in international markets (Elliott, 38). However, while this policy improved the competitiveness of domestic producers in international markets, it did not alleviate the budgetary burden on the EC since export subsidies required additional outlays.

By the 1980s, surpluses posed a dire threat to the fiscal health of the EC. The EC decided to implement production quotas to reduce the growing level of surpluses (Elliott, 38). Unlike export subsidies, production quotas required no additional government outlays. However, these quotas were only used on dairy products and were modest in size. The EC also began to pay farmers to not plant areas of land; however, these payments were also modest in size and consequently did not significantly reduce surpluses (Elliott, 38). The Uruguay Round agreement only reduced the overall level of support in the EC by a small amount; however, it was successful in reducing the share trade distorting support had in the overall level of support from nearly 100 percent to 65 percent (Elliott, 40). In 2000, EU target prices were reduced for several commodities, including dairy products, cereals, and beef (Elliott, 40). Since price targets were lower,

price supports were consequently reduced. The CAP was reformed again in 2003, this time with changes being made to domestic subsidies. A "single farm payment" based on historical support levels and not tied to current production was introduced. Since this payment is decoupled from current production, its trade distorting effect is minimal.

Agricultural support programs were created in the U.S. during the Great Depression. The Depression dramatically reduced international trade, eliminating export opportunities for U.S. farmers. In 1933, Congress passed the Agricultural Adjustment Act, which implemented payments to farmers to reduce the acreage they planted. The goal was to raise prices by restricting supply. The act also created import restrictions in the form of tariffs and quotas to further restrict supply and protect domestic producers from foreign competition (Elliott, 42). One particularly important policy instrument that was introduced in the 1930s was commodity loans. They allowed farmers "to take out loans using their crops as collateral, which they could either sell to repay the loans if prices rose or forfeit to the government as payment in full if prices dropped below the level specified as the loan rate" (Elliott, 43). These loans were initially supposed to be a temporary measure to support farmers; however, Congress failed to eliminate them and they became a permanent fixture of U.S. agricultural support. High loan rates resulted in the federal government holding large surplus stocks. As a result, Congress lowered loan rates in the 1960s which helped to increase exports. Farmers who voluntarily agreed to reduce the number of acres planted were given direct payments to compensate for the lower level of production (Elliott, 43).

The Food Security Act of 1985 was primarily designed to increase the competitiveness of U.S. exports. Commodity loan rates were lowered, providing an

incentive to farmers to export a greater share of their production, and export subsidies were also introduced. The introduction of export subsidies was largely a reaction to European export subsidies. Policymakers felt that subsidized European exports were diminishing the competitiveness of U.S. exports, and the only way to reestablish U.S. prominence in world markets was to implement export subsidies of their own (Elliott, 44). The act also substantially increased the amount of paid land-set asides, which were similar to the provisions in the early Agricultural Adjustment Act where farmers were paid to not plant some of their land in an effort to raise prices. The next major piece of reform legislation was the Federal Agriculture Improvement and Reform (FAIR) Act of 1996. Unlike the Food Security Act, FAIR resulted in dramatic reforms of U.S. farm policy. Decoupled subsidies were introduced in an effort to reduce the trade distorting effect of U.S. farm policies. This helped to reduce tensions between the U.S. and some of its trading partners. FAIR also eliminated the paid land set-aside program, which had been in place since the 1930s. One major downside to the legislation however, was that it only applied to certain crops; specifically wheat, corn, other grains, cotton, rice, and oilseeds. It did not reduce price supports for sugar, dairy, peanuts, or tobacco (Elliott, 46). Similar to the EU, the U.S. has gradually moved towards less distorting forms of support. The next farm bill is scheduled to be passed this year but no radical reforms proposals are expected. The Doha Round has completely stalled and no agreement is expected in the near future, which means the U.S. government does not have a strong incentive to further liberalize agricultural support.

Literature Review

In a working paper for the IMF, Claudio Paiva used a gravity model to assess the impact of protectionism in bilateral agricultural trade. He begins the paper by describing the growth of world agricultural trade over the past several decades. Paiva points out that world agricultural trade has grown much more slowly than overall world trade, with the former growing at an annual rate of 3.6 percent from 1950-2002 and the later growing at 6.3 percent. More importantly, he notes that agricultural exports of developed economies, such as the U.S. and E.U., have grown at a faster rate than agricultural exports from developing countries since 1990. Furthermore, he states that "the only important gains in market share for agricultural exports of less developed countries (LDCs) during the last decade were observed in other LDCs" (Paiva, 4). This is a troubling sign for developing countries since the agricultural sector generally represents a larger share of their economy than it does in developed countries.

Paiva used a large data set of 152 countries for his model. The dependent variable in the model was the real U.S. dollar amount of imported agricultural goods. His independent variables were comprised of various economic, geographic, and historical factors. The economic variables included the seller/buyer's real GDP, the seller/buyer's real GDP per capita, the seller/buyer's share of agriculture in GDP, and whether or not the two countries are part of a regional trade agreement. Paiva included several geographic variables, such as: the distance between the two trading countries, the distance between the exporter and a GDP weighted average of its primary trading partners, the seller/buyer's physical area, whether two, one, or none of the countries were landlocked, whether the two countries share a common border, and a regional dummy

variable. He also included two historical variables; one of them indicated whether the two countries were colonized by the same country, and another to indicate if one of the countries had ever been a colony of the other. Paiva created a dummy variable called Brich, which identified importing countries that had per capita income greater than $10,000.

Paiva found that the distance between two countries negatively affected trade between them. He also found that rural population density was negatively correlated with agricultural exports. Paiva claimed that countries with a high rural population density may have agricultural sectors that are devoted more to subsistence rather than commerce. Additionally, he found that trade between countries was greater when they shared a common border, were colonized by the same country, were a colony of the other country, or if they were part of a regional trade agreement. The Brich dummy was significant and had a negative coefficient, indicating that as countries become wealthier, they import fewer agricultural products. He postulated that this was the result of import barriers and other forms of protection present in developed countries. Paiva's use of bilateral trade data allowed him to substantially increase the number of observations in his sample, helping to make his results more robust. The data set he used for his model had 18,200 observations. His model did lack a variable specifically designed to measure agricultural support in developed countries.

A working paper for the National Bureau of Economic Research by McMillan et al. examined the effect agricultural support programs in OECD countries have had on poverty in developing countries. The authors' first step was to identify which countries OECD support may have had the greatest effect on. They did this by determining which

countries had spent the greatest fraction of their income on supported products using data from the Food and Agriculture Organization (FAO) from 1970 to 2000. They attached weights to the level of support for each crop according to that crop's share in production in 1970. One problem with this approach is that production for most crops can vary greatly from year to year. A crop's share in total agricultural output in 1970 may have been much lower or higher than its historical average. The volatility of commodity production means that this may not be the most desirable way to determine each crops share in total production.

The poorest countries in the sample were found to historically have spent the largest fraction of their income on cereal imports. This is an important discovery since a substantial percentage of the agricultural support in OECD countries goes to cereal producers. These countries were however, overall net exporters of agricultural products, while wealthier developing countries tended to be net importers of total agricultural products.

The authors then estimated the two equations, the first having the log of the headcount poverty rate as the dependent variable, while the second equation had the log of average per capita income as the dependent variable. The most innovative aspect of their model is in the construction of the independent variable OECDPOLICY. It measures OECD support for the commodities produced in the developing country in question. As a measure of OECD support, the authors used the producer nominal protection coefficient (NPC). It is "the ratio between the average price received by producers (at farm gate) and the border price, net of transportation costs and marketing margins" (NBER, 12). Small countries that rely heavily on imports were found to have

low values of OECDPOLICY, as were African countries. Countries that were large rice producers had high values of OECDPOLICY, while grain and oilseed exporters had moderate values of OECDPOLICY.

The authors' results were also robust for other measures of OECD support, such as the producer support estimate (PSE). For both equations, the coefficient for OECD policy was not statistically significant. There was no evidence that OECD support increased or decreased poverty in developing countries. In the authors' opinion, one possible explanation for this was the lack of data on poverty in developing countries. The authors attempted to rectify this by using average per capita income, but they admit it is not a very good substitute for actual poverty data. The primary problem the authors faced was the lack of data for crop production before the widespread use of subsidies and import restrictions in the E.U. and U.S.

A working paper by Dimaranan, Hertel, and Keeney of the Global Trade Analysis Project (GTAP) entitled "OECD Domestic Support and the Developing Countries" examined the effects of a variety of agricultural policy reforms in OECD countries. They used a computable general equilibrium model to estimate the effects OECD domestic support and market price support have on developing countries. The authors included developing countries from Asia, Latin America, and sub-Saharan Africa in their analysis.

First, they analyzed the welfare effects in developing countries resulting from a 50 percent cut in all forms of domestic support in all OECD countries. The authors then examined the welfare effects resulting from a 50 percent cut in all forms of market price support in OECD countries, accompanied with an increase in decoupled domestic subsidies based on land use. Their results were fairly surprising; they found that overall,

developing countries would be harmed by the 50 percent cut in OECD domestic support. The primary reason for this welfare loss is deterioration in the terms of trade. The authors found that most of the developing countries they included in their model were net importers of the agricultural products that were supported by OECD countries. By reducing domestic support by such a large amount, world prices increased substantially. This meant that developing countries were now importing the same goods at much higher prices, while the prices of their agricultural exports remained unchanged. Farm incomes in OECD countries would also be reduced substantially as a result of this cut in domestic support. The authors estimated that farm incomes in the EU-15 would be reduced by 16 percent, while farm incomes in the US would be reduced by 5 percent.

The second policy reform considered by the authors was a 50 percent reduction in tariffs and export subsidies in OECD countries, together with an increase in decoupled subsides to OECD farmers to compensate for any income loss. In contrast to the reduction in domestic support, the MPS reduction results in welfare gains in most developing countries. Reducing MPS does not have as substantial of an effect on world prices as does reducing domestic support. It also increases developing countries export opportunities in developed countries. The authors point out that the decoupled subsidies are a more effective way of increasing farm income than indirect measures like tariffs and export subsidies.

Explanation of the Models

The first model examined the effect of US and EU agricultural support on per capita GDP growth in sub-Saharan Africa. The data set was comprised of pooled data from 48 countries for the period beginning in 1986 and ending in 2004. Several

macroeconomic variables were controlled for including inflation, investment, population growth, initial per capita GDP, and human capital. The data for investment was obtained from the Penn World Tables, while the data for the remaining variables were extracted from the World Bank's World Development Indicators. Inflation was measured as the annual percent increase in consumer prices, investment was measured by its share in real GDP, and human capital was estimated by the primary school completion rate. Initial per capita GDP was estimated in the model by lagging per capita GDP, measured in constant 2000 U.S. dollars, by one year.

The most important variable in the growth model is the agricultural support variable. The only national or international organization that has recorded agricultural support for a substantial period of time is the Organization for Economic Cooperation and Development (OECD). Their primary measure of agricultural support is called the producer support estimate (PSE), which is defined as "the annual monetary transfer from consumers and taxpayers to support agricultural producers, measured at farm gate level, arising from policy measures, regardless of their nature, objectives or impacts on farm production" (OECD website). Since the PSE takes into account forms of MPS as well as subsidies, it is an imperfect measure of the effect subsidies alone have on growth and production. The support variable was constructed as follows: for each sub-Saharan country, I determined which crops had at least a ten percent share in total crop production from 1961 to 1970. I then summed the PSE levels for each crop that met this criterion, and divided it by the country's population. I used this per capita PSE variable as the measure of U.S. and E.U. support in the model. I felt that by using a longer period of

time to determine crop shares in total production, I would diminish the possibility of weather related supply shocks distorting historical crop shares.

The second model examined the effect U.S. and E.U. agricultural support has on maize production in certain sub-Saharan countries. Data on maize production was obtained from the Food and Agricultural Organization for the period 1986-2004, and was measured in tons produced. There were three independent variables included in the model; lagged per capita GDP growth and inflation in each sub-Saharan country, and a variable measuring U.S. and E.U. agricultural support. The support variable was very similar to the one in the first model, the sole difference being only maize PSE levels were included. These totals were then divided by population just as in the first model. Countries where maize had at least a 10 percent share in total crop production from 1961-1970 were included in the data set. This resulted in 31 countries being included, 17 less than in the first model.

I gathered PSE data on the following crops from the period beginning in 1986 and ending in 2004: wheat, sugar, rice, maize, eggs, beef and veal, sheep meat, poultry, pig meat, milk, and oilseeds. During this period, the U.S. and E.U. generally supported the same crops, with European farmers almost always receiving more support then their American counterparts. Milk has been the most protected product in both the U.S. and E.U., and both governments have heavily supported beef and wheat as well. However, the U.S. also heavily supports maize and sugar, two crops that are, relatively speaking, only moderately protected in the E.U. The E.U. also heavily protects such products such as pig meat and sheep meat, which receive almost no protection in the United States.

Out of the 48 countries I gathered data on, in 31 of them maize was at least ten percent of total production from 1961-1970. The next most widely produced crop was milk, which had at least a 10 percent share in production in 22 countries, followed by sugar cane which had at least a 10 percent share in 21 countries. However, maize's share in total crop production has dropped significantly in several sub-Saharan countries over the past three decades. Table 3 presents maize production in 13 countries for two separate time periods, 1961-1970 and 1995-2004. In Burundi, Cameroon, Cape Verde, Central African Republic, and Malawi, the share of maize in total crop production dropped by over twenty percentage points from the initial period.

Results

The results of the first model are presented in Table 1. The R-squared was surprisingly low, even after allowing for different intercepts for each country. The human capital variable was dropped because of a lack of observations, having cut the degrees of freedom nearly in half. PopGrowth and Inflation were also insignificant; however, Investment and Lag pcGDP were strongly significant and both had the expected sign. Although Support was significant and had the expected negative sign, it had a negligible impact on Growth. The most likely explanation for this is a lack of data. Increasing the number of years in the data set would be preferable, but agricultural support data for any time before 1986 is difficult to obtain. Another explanation is that sub-Saharan countries are net importers of the goods supported by the U.S. and E.U. However, this raises the question as to whether sub-Saharan countries have historically been net importers or if U.S. and E.U. agricultural support programs have altered their production choices over time. In order to answer this question satisfactorily, one would

need data on crop production in sub-Saharan Africa from before those support programs were implemented. This would require data from before the 1930s, which was when the U.S. support program was created. While Suppor*t* could have been constructed in a different manner, I do not believe it would have significantly altered the results. It was constructed in a very broad manner; for example, if maize constituted 70 percent of total crop production in a certain country and sugar constituted 15 percent, corresponding weights were not attached to maize and sugar PSE to reflect their respective shares in production.

The results of the second model are also presented in Table 1. U.S. and E.U. maize support was not a significant determinant of maize production in the selected sub-Saharan countries. Lagged per capita GDP growth and inflation were both insignificant as well. The most significant limitation of the model is the small number of observations. While maize production data is available from as far back as 1961, the OECD only began to trade agricultural support since 1986. However, the results in the second model do mirror those in the first in that neither model gives support to the claim that US or EU agricultural support programs have a significant detrimental effect on poor countries, particularly those in sub-Saharan Africa.

Conclusion

Although US and EU agricultural support does not appear to influence per capita GDP growth in sub-Saharan Africa as a whole, it may still harm certain countries in the region. For example, nearly all of Malawi's output is concentrated in the agricultural sector and it also produces crops, such as maize, that are highly protected in the U.S. It is reasonable to assume that US and EU agricultural support has a greater effect on Malawi

than Angola or Nigeria, two countries that have small agricultural sectors. In order to more accurately describe the effect US and EU agricultural support has on developing countries, it may be desirable to examine each country by itself, rather than large, diverse regions like sub-Saharan Africa. It is extremely important that a consensus among economists is developed on this issue. This would help bridge differences between developed and developing countries regarding the optimal level of support, which is necessary if the Doha Round is to be completed. The most harmful aspect of agricultural support might not be its effect on farmers in developing countries, but rather its power to bring the multilateral trade system to gridlock.

Table 1

Growth Regression

Variable	Coefficient	t-value
Support	0	-2.20
Investment	.39	4.03
Lag pcGDP	-.005	-3.30

R2 = .2167
No. of obs. = 814
Dependent Variable: Per Capita GDP Growth
Support = PSE/Population (PSE measure in US dollars)

Production Regression

Variable	Coefficient	t-value
LagpcGrowth	1951.44	0.41
Inflation	-1.33	-0.07
Support	4.34	0.58

R2 = .93
No. of obs. = 557
Dependent Variable: Quantity of Maize Produced (tons)

Table 2

U.S. PSE, 1986-2004 (USD mn)

	Wheat	Sugar	Sheep meat	Rice
Total	71,552	21,008	643	13,538
Mean	3,766	1,106	34	713
Median	3,411	1,090	24	781

	Oilseeds	Milk	Maize	Eggs
Total	37,187	185,719	109,277	5,154
Mean	1,957	9,775	5,751	271
Median	881	9,169	5,227	209

	Beef & Veal	Poultry	Pig meat
Total	24,563	13,857	8,270
Mean	1,293	729	435
Median	1,390	663	382

Highest Median Values

1.) Milk
2.) Maize
3.) Wheat
4.) Beef &Veal
5.) Sugar

Highest Mean Values

1.) Milk
2.) Maize
3.) Wheat
4.) Oilseeds
5.) Beef & Veal

Highest Total Values

1.) Milk
2.) Maize
3.) Wheat
4.) Oilseeds
5.) Beef & Veal

Table 3

	Maize Production Share 1961-70	Maize Production Share 1995-04
Angola	31.11	37.38
Benin	88.60	80.90
Burkina Faso	40.57	35.27
Burundi	57.28	28.31
Cameroon	63.23	28.11
Cape Verde	51.20	17.51
Cen. African Rep.	60.29	25.08
Congo, Dem. Rep.	34.57	35.64
Ghana	61.70	53.72
Kenya	38.81	24.74
Malawi	85.87	38.74
South Africa	25.80	20.75
Median	54.24	31.79

*Malawi data for 2nd period is from 88-97

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