Assessing the Impact of Southeast Asia's Increasing Meat Demand on Global Feed Demand and Prices

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Abstract

Over the past 20 years increasing global growth and increased per capita income have led to significant changes in food production, consumption and trade for many countries. As incomes and urbanization increase, food consumption patterns exhibit increased demand for a more diversified diet increasing meat and dairy consumption, which leads to improved meat production systems and modern animal science-based feed rations. Greater demand for feed grains and oilseeds is provided by domestic production and through imports. This study analyzes the effects of Southeast Asia's changing food consumption patterns on agriculture production, consumption, and trade out to the year 2021. The impact of increasing consumption of poultry and pork and increased meat production and feed demand on domestic agricultural markets of Southeast Asia and international markets is assessed. Countries analyzed include Philippines, Indonesia, Vietnam, Thailand, and Malaysia. Results provide insights to potential higher global feed prices in the near future and constraints to expanding production. Global markets respond to higher feed prices through increased production and decreased demand.

Key words: Southeast Asia, food consumption, feed demand, poultry and pork livestock industry, trade, emerging markets, dynamic partial equilibrium simulation model

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Introduction

Over the past 20 years increasing global growth and increased per capita income have led to significant changes in food production, consumption and trade for many countries. As incomes increased, food consumption patterns exhibited increased demand for a more diversified diet, including meats and dairy. This led to improved meat production systems and modern animal science-based feed rations. Greater demand for feed grains and oilseeds led to increased domestic production and imports from the global market. A major source of uncertainty in the near future is the increasing import demand for livestock feed stuffs in emerging markets as meat demand increases. Southeast Asia includes some of the fastest-growing economies in the world and a relatively large population base. In addition to the uncertainty of increased feed demand, most of these countries are constrained by limited arable land, moderate yield growth, increasing water shortages, encroaching urbanization, and limited funding for agricultural research. There is also the increasing uncertainty of climate change with increasing extreme weather events. Many countries have responded through policies to expand cultivated area, improve irrigation structure, and provide subsidies for modern seed varieties, fertilizer, and other inputs.

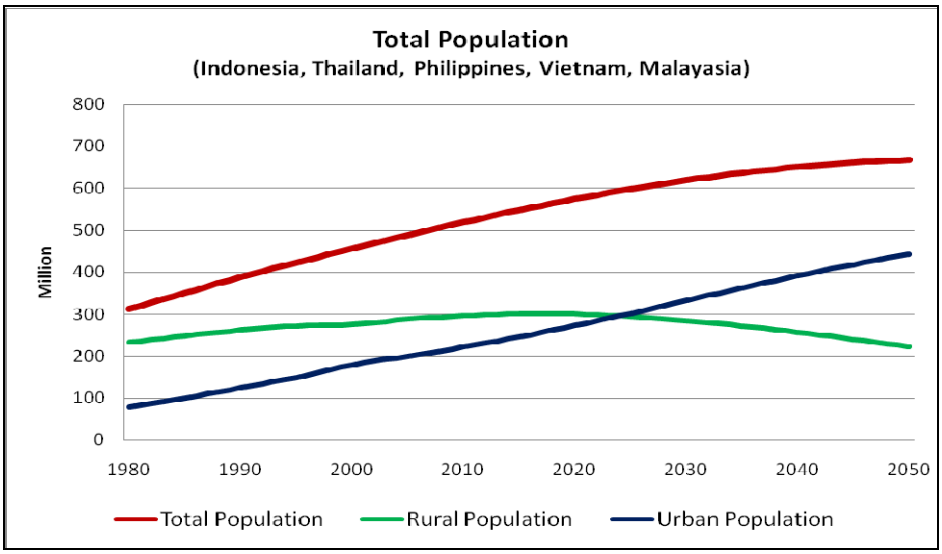
This study analyzes the effects of Southeast Asia emerging markets as food consumption patterns evolve toward more western diets with increasing meat consumption. The specific focus is on increased consumption of poultry and pork and the impact increased meat production will have on feed demand in domestic markets of Southeast Asia and international grain markets. This research also addresses the potential of constraints in expanding future arable land for corn production in these countries. Countries analyzed include Indonesia, Philippines, Thailand, Vietnam and Malaysia. Results provide insights to the potential increase in meat consumption and feed import demand resulting in higher global feed prices in the near future. Other insights are of the global market's ability to respond to increasing feed demand as emerging economies move toward a more diversified diet with greater meat consumption and a decrease in demand for staple commodities.

As emerging economies develop, their diets exhibit considerable change. The changing consumption behavior is surprisingly consistent across numerous countries and well documented. The major factors driving changes in food consumption behavior are well known, increasing incomes, urbanization, improved infrastructure and transportation, increased access to markets, and demographic shifts. Increasing education along with income also plays a large role in consumer awareness of food safety and quality. The westernization of diets, the transition toward increased meat consumption and away from staple-based diets such as rice, corn, wheat, and cassava is well-established in the literature (Muhammad et al. 2011, Fabiosa 2005; Pingali 2004; Seale, Regmi, Bernstein 2003; Gehlhar and Coyle 2001; Haley 2001; Regmi and Dyck 2001; and Cranfield et al. 1998). But even with increased understanding of the evolving diets in emerging markets as incomes increase, projections of future food consumption patterns are difficult to develop and have often been inaccurate.

Background

There are a number of variables and factors which affect food consumption and changing food consumption patterns. This variation is dependent upon numerous factors such as income levels, urbanization rates, infrastructure development, population age, immigration, and other demographic variables. The size of the population and its growth rate directly affect current and future food demand. The five countries under study exhibited a population growth rate of 1.67 percent, from 1980 to 2011, which is an increase in population of 211 million people, with an average increase of 6.8 million people per year. The most recent annual increase in population was 5.83 million people. This population growth rate has not been constant, but decreasing over time. The population growth rate for these five countries for the decades of 1960s, 1980s and 2010s averaged 2.71 percent, 2.17 percent and 1.29 percent, respectively. Projections indicate future population growth rates will continue to decrease, therefore this region's population will continue to increase at a decreasing rate. Over the next 10 years the population is forecasted to increase by 54.3 million people, a growth rate of almost 1 percent per year. Figure 1 shows the total population for these five countries from 1980 through 2012 and projections to 2050. These countries approach a maximum of about 680 million by 2050 and then begin to decrease.

Figure 1. Total population, rural and urban aggregate for five Southeast Asian countries studied, (million).

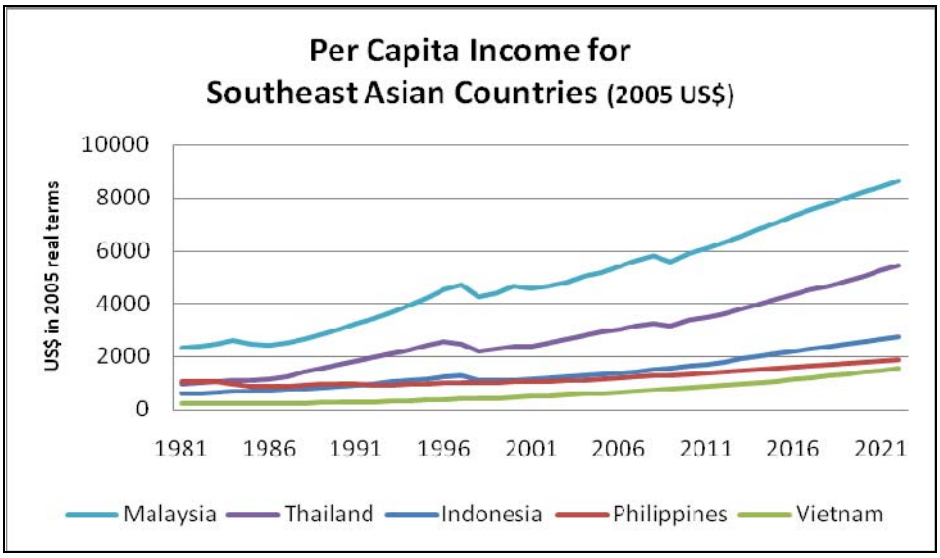


Source: UN-FAO, FAOSTAT, http://faostat.fao.org

Population Growth and Urbanization:

An increasing number of individuals and households have moved away from the farm and rural areas to seek employment within the cities and urban areas. Figure 1 shows total, urban and rural population for the five Southeast Asian countries studied combined. Even though the population growth rate is slowing, the growth rate of urbanization is relatively constant. The percentage share of urban population has increased from 18.5 percent in 1961 to 43 percent by 2010 for these 5 countries. Projections from United Nations Food and Agricultural Organization (UN-FAO) indicate rural and urban populations may be equal in the year 2024 with 296 million people in each sector. Malaysia has the highest percent of urban population in 2011 at 73 percent followed by the Philippines, Indonesia, Thailand, and Vietnam at 49, 45, 34, and 31 percent respectively. Urbanization results in large changes of food consumption patterns. Normally with urbanization per capita income increases, access to food is easier and a greater variety is available. Urban diets often change dramatically moving from staple commodities toward a more commercialized diet with increased meat, vegetable and fruit consumption.

Figure 2. Current and projected per capita income for Southeast Asian countries (US$ 2005).



Source: USDA, Long-Term Commodity Projections, 2012.

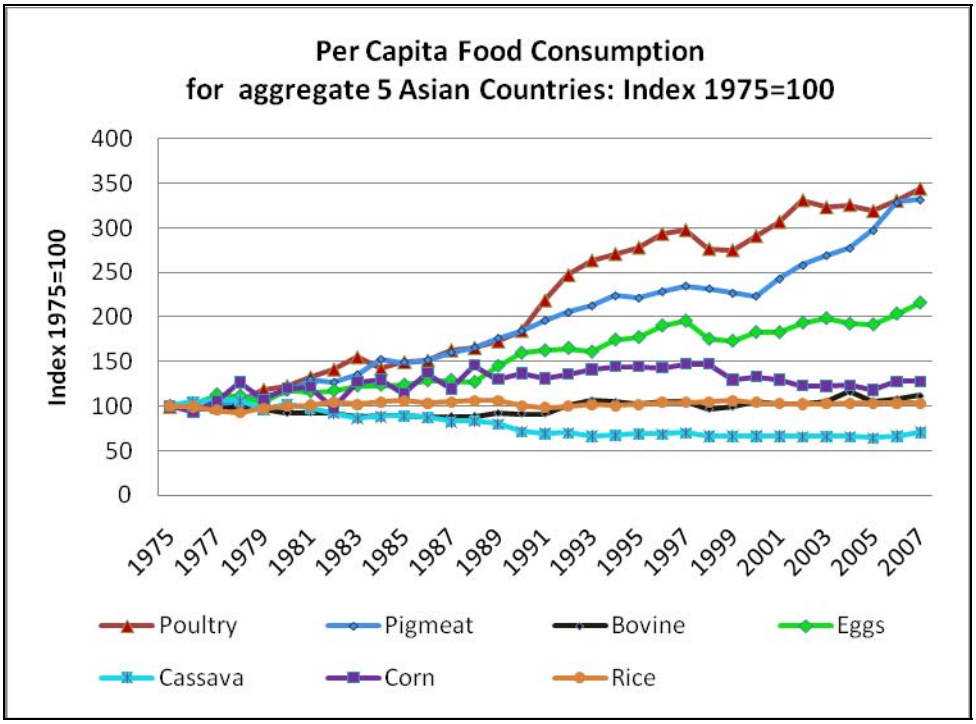
Household Incomes:

Increasing incomes is one of the most important variables affecting food consumption patterns. Engle's law is apparent in emerging markets as household income rises and the proportion of income spent on food declines and household income elasticity for food decreases. Households with increasing incomes change their diet toward higher value products, which include meat, vegetables, fruit, and increasing consumption of food away from home. As household incomes increase, consumption of major staple commodities decrease, such as rice, corn, cassava and wheat. Income elasticities for staple foods approach zero and become negative indicating an inferior good.

Figure 2, per capita income, clearly indicates that income has increased significantly for all of these countries except the Philippines. Malaysia has the highest per capita income followed by Thailand, Indonesia, Philippines, and Vietnam. Since the early 1980s per capita income has more than doubled and almost tripled for all of these countries except the Philippines. The annual growth rates in real per capita Gross Domestic Product (GDP) from 1981 to 2011 for Indonesia, Philippines, Thailand, Vietnam, and Malaysia are 3.58, 0.88, 4.31, 4.49, and 3.22 percent respectively. Vietnam has experienced the fastest growth rate over the past decade averaging 5.82 percent, followed by Indonesia at 4 percent and Thailand at 3.58 percent annual growth rate.

Future 10 year projections of increasing per capita income for Indonesia, Philippines, Thailand, Vietnam, and Malaysia are 4.4, 2.92, 4.1, 5.65, and 3.23 percent, respectively. Projections indicate that Vietnam and Indonesia will maintain the fastest growth rates over the next decade.

Figure 3. Index of per capita food consumption from 1975 to 2007.



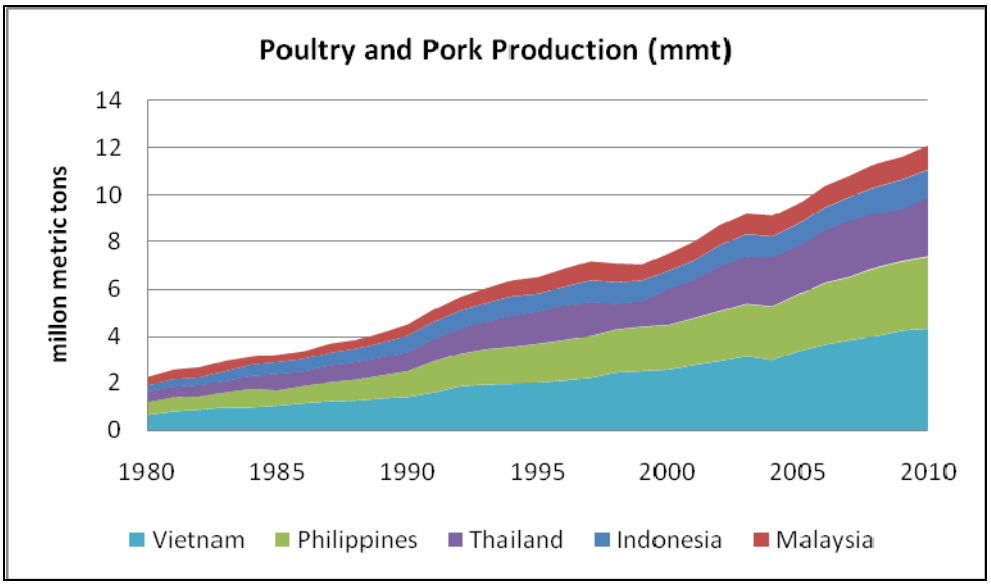
Source: UN-FAO, FAOSTAT, http://faostat.fao.org

Meat Consumption:

Consumption of poultry and pork has increased significantly for the five Southeast Asian countries studied as a whole as indicated in figure 3, which is an index of per capita consumption for poultry, pigmeat, eggs, cassava, corn and rice. Both poultry and pork increased significantly with an annual growth rate of 3.7 and 3.5 percent from 1990 to 2007. Data were unavailable from FAO after 2007. Bovine (beef) consumption was virtually flat with no change in per capita consumption. Per capita consumption of cassava and corn have been decreasing. These are both staple commodities consumed by lower income households. Per capita consumption of rice has been decreasing moderately especially since 1990. The fastest growing per capita consumption of pork or pigmeat is in Vietnam and Thailand growing at 6.3, and 4.6 percent per year, respectively, from 1975 through 2007. Vietnam, the Philippines, and Indonesia exhibit the fastest

annual growth rate of poultry per capita consumption at 6.2, 4.5, and 4.4 percent respectively, from 1975 through 2007.

Figure 4. Combined poultry and pork production by country (million metric tons).

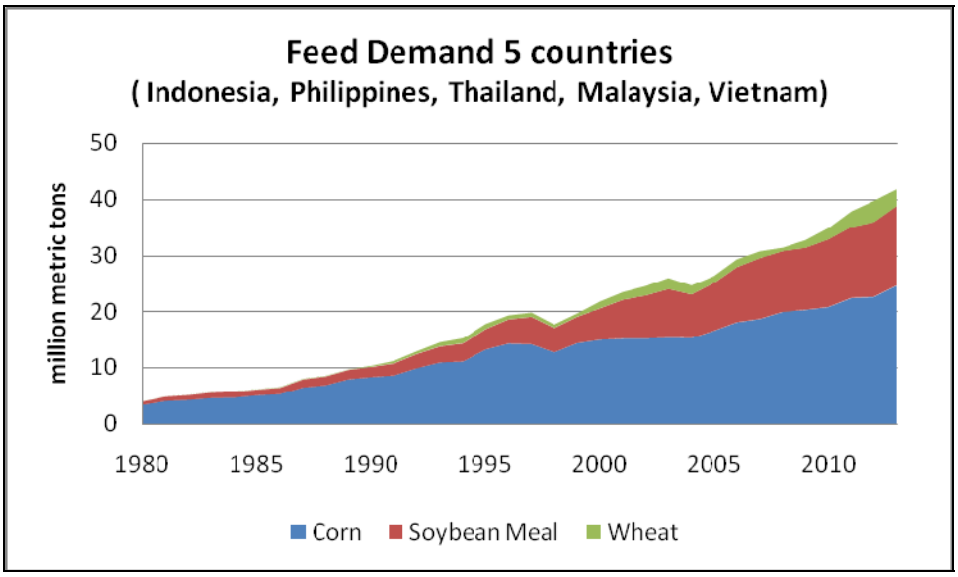


Source: UN-FAO, FAOSTAT, http://faostat.fao.org

Meat production:

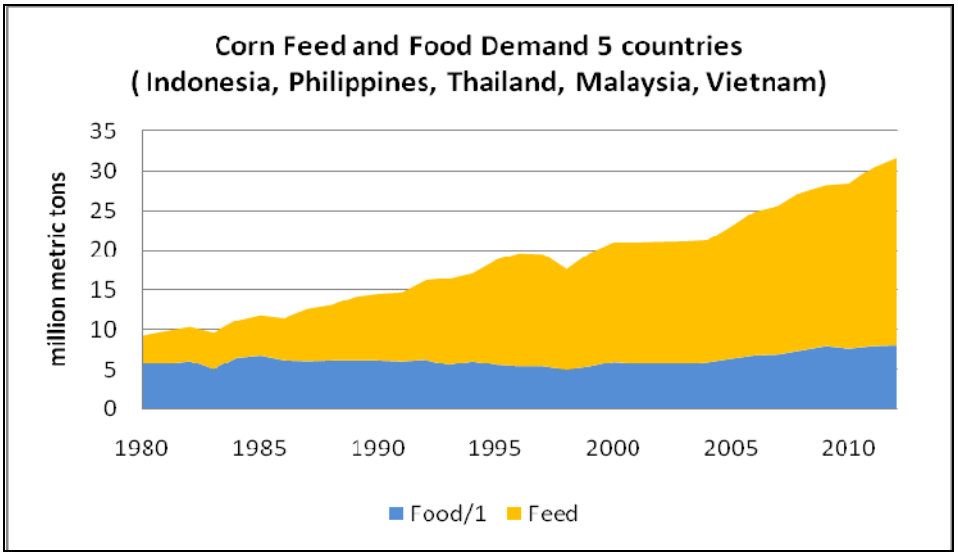
Figure 4 clearly indicates that agricultural producers have responded to changing food consumption patterns within Southeast Asia, as pork and poultry demand increases. Since the 1980s, total pork and poultry production have expanded by almost six fold from approximately 2 million metric tons (mmt) to 12 mmt in 2010. The greatest expansion has been in Vietnam followed by the Philippines and Thailand, respectively. The annual growth rate from 1980 to 2010 is 6.6, 5.9, and 4.9 percent for the three countries, respectively. Poultry production has been growing at a faster rate since 1980 at 6 percent per year as compared to pork at 5.5 percent per year. From 1980 to 2010 poultry production increased from 0.98 mmt to 5.69 mmt while pork production increased from 1.28 mmt to 6.38 mmt. The share of meat consumed as poultry increased from 31 percent in 1980 to 42 percent by 2010 (FAOSTAT, 2012).

Figure 5. Aggregate Feed demand for five Southeast Asian countries (million metric tons)



Source: USDA, FAS, PS&D, May 2012.

Figure 6. Corn food and feed demand for aggregate five Southeast Asian countries (million metric tons)



Data: USDA, PS&D, May 2012.

1/ food includes seed and industrial use

Feed Demand:

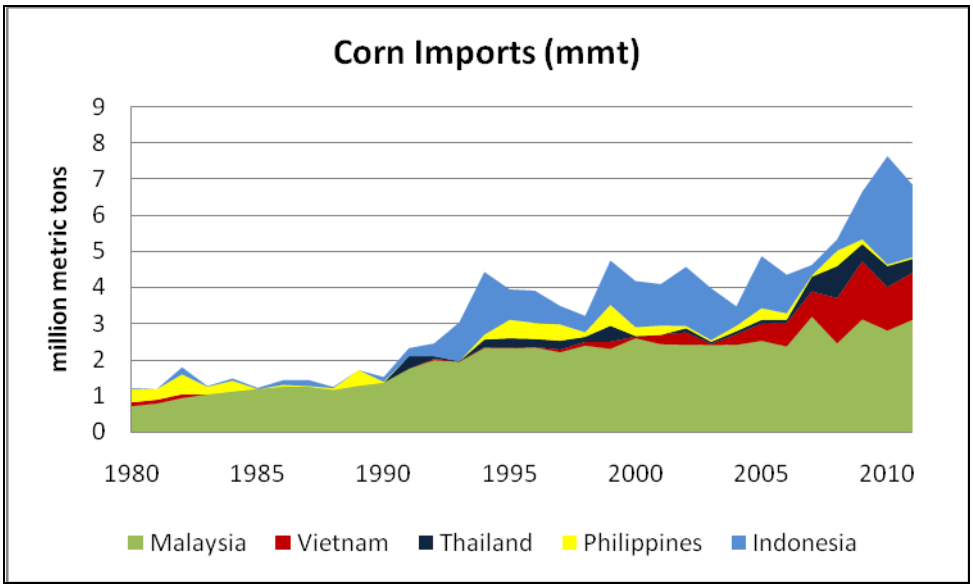
Increased production of pork and poultry has led to increased feed demand, but the composition of feed has also changed because of adoption of modern feed rations, and using least cost rations to minimize the cost of production. A transition from backyard or household production toward commercial operations increases as emerging economies develop, which also leads to adoption of modern feed rations and the need for better quality control in feed. Figure 5 shows that total feed demand for corn, soybean meal and wheat for the five countries has increased from 4.9 mmt to 41.8 mmt from 1980 to 2011, which is over an eightfold increase in feed demand over the past 31 years, about 7 percent per year increase. Since 1980, corn feed demand has increased the most at 5.8 percent per year. In the 1980s soybean meal was only minimally used as feed, but demand began to increase in the 1990s and has continued. Since 2000 soybean meal feed demand has increased at 6.2 percent per year. Wheat is used as feed, but still only marginally. This could change as minimum cost feed rations are adapted, leading to substitution toward low-quality wheat during times of high corn prices. The annual growth rates in corn feed demand since 2000 for Indonesia, Philippines, Thailand, Vietnam, and Malaysia are 4.1, 3.9, 1, 11.4, and 2.1 percent respectively. The annual growth rates in soybean meal feed demand since year 2000 for Indonesia, Philippines, Thailand, Vietnam, and Malaysia are 5.5, 2.5, 4.1, 19.2, and 4.7 percent respectively. Vietnam exhibits the fastest growth rate in feed demand, but starts at a lower base and is one of fastest growing economies of Southeast Asia.

Figure 6, corn food and feed demand for the 5 Southeast Asian countries studied, shows that consumption patterns are changing significantly as consumers grow away from staple foods such as corn. Per capita consumption of food corn has been decreasing, but demand is still stable because of growing populations. Since the 1980s all of the growth in corn demand has been for livestock feed, increasing from 4 mmt in 1980 to 24.6 mmt by 2011. Indonesia and Philippines account for most of the corn being consumed for food at a share of 81 percent in 2011. Per capita consumption of corn for food has continued to decrease in both Indonesia and the Philippines. The slight increase in food demand in figure 6 beginning in 2000 is largely due to increased industrial use of corn in all countries and increased overall demand in Vietnam.

Corn Area, Yield, and Production:

The total corn area for the five Southeast Asian countries studied has decreased from its highest level reached in 1988 at 8,729,000 hectors to its lowest level in 1997 at 7,035,000 hectors. Since 1997, corn area harvested has increased to approximately 8 million hectors. Total area would be relatively flat, except for Vietnam which continues to expand corn area at a rate of about 5 percent per year. Indonesia and Philippines corn area has been relatively constant over the past decade, but Thailand's has been decreasing at a rate of 1.7 percent per year over the past decade. Malaysia's corn area is quite small, 26,000 hectares, and stable. Corn production has increased about 3.4 percent per year over the past decade with almost all of this coming from increasing yields. The corn yield growth rates ranges from a high of 4.2 percent per year for Vietnam to the lowest growth rate at 1 percent for Thailand over the past decade. Future increasing supplies of corn in these five countries is dependent on increasing yields, but even increasing yields may not be sufficient to provide feed corn for the region's increasing meat production, which would lead to increased corn imports.

Figure 7. Corn imports for five Southeast Asian countries (million metric tons).



Source: USDA, PS&D, 2012.

Among the five Southeast Asian countries studied, Malaysia is the largest importer of corn and has continued to grow at a modest rate as domestic meat production has expanded. Malaysia only

produces a small amount of corn and is unable to expand area, and therefore dependent upon imports for its feed industry. Vietnam has exhibited the greatest expansion of corn imports, from almost none in the mid 1990s to 1.3 mmt in 2011 and projected to increase to 2.7 mmt by 2021. Even though Vietnam is expanding corn production through increasing area and yields, the increase in supply is not sufficient for the increasing demand from poultry and pork producers. Indonesian corn imports are quite volatile, which are affected by weather conditions since most of Indonesia's corn is rain fed.

Data:

The two major sources of international data are USDA's production, supply and disappearance data (USDA-PS&D, 2011), and the United Nations Food and Agriculture Organization data (UN-FAO, 2011). The USDA data does not have complete coverage for meat production and consumption. USDA's beef data covers Malaysia, Philippines, and Vietnam, but does not cover Thailand and Indonesia. USDA's pork data covers Philippines and Vietnam. USDA's poultry data covers all the countries. The data for feed crops, (corn, soybeans, soybean meal, and wheat) by USDA's PS&D is complete, covering production, consumption and trade as commodity balance sheets. The United Nations data are not complete for all commodities and countries. The production data are complete out to 2010, trade data exists to 2009, and food supply data only exist to 2007. The commodity balance sheet data for the commodities only exists to 2007. Commodity balance sheet data are most important because they provide detail for total demand to equal total supply.

Scenario Analysis

The following scenarios were developed to analyze the impact of increasing per capita consumption of poultry and pork in five Southeast Asian countries and the effect on domestic and international markets. Specifically, the focus is on increased corn and soybean meal feed demand. This research also focuses on the potential impact of limiting expansion of corn area in the five Southeast Asian countries. The scenarios are formulated to capture the impacts of increased meat consumption on domestic and global grain production, feed markets, and livestock markets.

Scenario1: Change in food consumption patterns in developing countries is well established and caused by numerous factors. As discussed earlier these factors include increasing income, urbanization, improved access to food markets and processed foods, a continued movement in food consumption toward a more western diet, and changing demographics toward younger generations. In this scenario, per capita consumption of poultry and pork is gradually increased over the projection period from 2012 through 2021 from the baseline projection. The initial years exhibit a small increase in per capita consumption, 1.83 percent per year, and by 2021 the increased per capita consumption of poultry and pork is greater by about 20 percent from the baseline projection. In the model, a trend variable in the demand equation captures numerous factors and variables affecting consumption, aside from income, own price and substitute prices, which is increased to represent additional changing factors, discussed above. Per capita income is gradually increased throughout the project period, which captures the transition to greater household incomes.

Scenario 2: In this scenario, we capture the impact of constraints in expanding corn area harvested for four of the five Southeast Asian countries. Indonesia, Philippines, Thailand, and Vietnam are constrained to current levels of corn area harvested and not expanded. Malaysia's corn area harvested is the only country which did not exhibit an increase in corn area throughout the baseline projection period and therefore does not need to be constrained. The projected 2021 area is lower by approximately 558,000 hectares, which is a 6.53 percent decrease compared to the baseline.

Scenario 3: In this scenario we combined Scenario 1 and 2 together to capture the total effect of increased per capita consumption of pork and poultry, while imposing constraints to expanding corn area harvested in the four countries. This scenario assumes continued rapid growth of Asian economies and maintains environmental constraints which prevent expansion of arable land for crop production.

Model and Data

This study uses the USDA-ERS Country-Commodity Linked System (CCLS), which includes the individual USDA-ERS country models for Indonesia, Philippines, Thailand, Vietnam, and

Malaysia, and the USDA-ERS Food and Agricultural Policy Simulator (FAPSIM) model of U.S. agriculture. This is a large-scale dynamic partial equilibrium simulation system consisting of 42 country and regional models. The country models incorporate domestic and trade policies and institutional behavior, such as tariffs, subsidies, and TRQs. Production, consumption, imports, and exports are endogenous and depend on domestic and world prices, which are solved within the modeling system. Macroeconomic assumptions and projections are exogenous based on USDA's 10 year agricultural projections (USDA, 2012). The system reaches simultaneous equilibrium in prices and quantities for 24 world commodity markets for each of the 10 projected years in the analysis to 2021. The 24 commodity markets include detailed coarse grains, food grains, oilseeds, meals, oils, cotton, sugar, and animal products. Primary data sources are USDA's Production, Supply, and Disappearance, (USDA, November 2011), USDA's National Agricultural Statistical Service, the United Nations Food and Agricultural Organization's FAOSTAT, and data from individual country governments such as the Chinese Ministry of Agriculture (MOA).

Country Models:

The USDA-ERS individual Southeast Asian country models are used for developing 10 year commodity projections and in analyzing alternative scenarios including potential policy changes and the impacts on international and U.S. agricultural markets and trade. The grain sectors of the models have four major components: 1) price and expected revenue equations; 2) production and consumption; 3) feed demand linked to livestock sectors; and 4) trade equations. Production of corn, wheat, and rice is calculated from area harvested and yield equations. Area harvested and yields are determined by expected returns for a given crop and substitute crops. Food demand is modeled by rural and urban per capita consumption equations for the individual commodities, which are functions of own consumer price, substitute food prices, and income. Feed demand is a function of derived feed demand, based on quantity of pork and poultry produced in the commercial and specialized livestock sectors. Corn import demand is an identity for the five Southeast Asian countries studied, total demand minus total supply. Imports close the modeling system for equilibrium in supply and demand. Export supply is a function of the export price and consumer price. Producer or farm prices are solved through price transmission from the

global markets. Production, consumption, and domestic prices are affected by the international price through global equilibrium in all countries' import demand and export supply functions.

The supply response elasticities of corn for Indonesia, Philippines, Thailand, Vietnam, and Malaysia with respect to expected revenues are 0.28, 0.25, 0.41, 0.51, and 0.31 respectively. Area harvested and consumption adjust as new equilibrium commodity prices are solved for in the model. Indonesia has two corn area supply responses, the elasticities are the same, one is for corn produced on Java island and the second is for corn produced on the other islands, mostly Sumatra. Corn food demand is expressed as per capita consumption. Elasticities for corn consumer price for Indonesia, Philippines, Vietnam, and Malaysia are -0.02, -0.10, -0.22, and -0.15, respectively. The income elasticity for corn food demand are 0.15, -0.22, -0.13, and -0.20, respectively. The own price elasticity for poultry consumer price for Indonesia, Philippines, Thailand, Vietnam, and Malaysia are -0.65, -0.65, -0.35, -0.90, and -0.50, and income elasticities are 1, 0.90, 0.48, 1.47, and 0.20, respectively. The own price elasticity for pork consumer price in the demand equation for Indonesia, Philippines, Thailand, Vietnam, and Malaysia are -0.51, -0.40, -0.90, -0.90, and -0.60, respectively, and income elasticities for pork demand are 0.15, 0.85, 0.42, 1.47, and 0.30, respectively.

Results

The results from an increase in per capita consumption of poultry and pork, scenario 1 (increased per capita consumption), scenario 2 (constrained corn area harvested) and scenario 3 (scenario 1 and 2 applied together) are provided in tables 1 through 9. Tables 1 through 5 provide the results for individual countries from all three scenarios and table 6 provides an aggregate of the 5 countries. Tables 7, 8, and 9 provide the trade impacts, under scenario 3, for the five Asian countries and major importing and exporting countries of corn, soybeans, and soybean meal. As mentioned earlier, scenario 1 involves a change in consumption patterns affecting domestic markets and is quantitatively designed to capture the impact of numerous factors affecting food consumption patterns as economies develop. Scenario 2 captures the impact of constraints in expanding corn area to be used for livestock. Results from scenario 3 are discussed in greater detail, because of the increasing likelihood of limiting land area and changes in Asian diets toward a more Western diet, including an increase in consumption of meat.

Consumption:

Under both scenario 1 and 3, poultry and pork consumption increase by similar levels, with scenario 3 slightly less because of the increased cost of corn due to less corn area harvested in the five Southeast Asian countries. However, only under scenario 2 consumption of pork and poultry decrease, which is less than one 10th of a percent for all five Southeast Asian countries by 2021. Consumption decreases under scenario 2 due to higher prices because of the increased cost of production of pork and poultry as expansion of corn area in the five countries is limited and domestic and international price of corn increases. Under scenario 3 poultry consumption increases for Indonesia, Philippines, Thailand, Vietnam, and Malaysia by 88, 49, 35, 27, and 37 thousand metric tons (tmt) in 2012 and by 399, 243, 213, 197 and 233 tmt by 2021, respectively. Consumption increases range from 3.53 percent in 2012 to 20.55 percent by 2021 for poultry. Under scenario 3 pork consumption increases for Indonesia, Philippines, Thailand, Vietnam, and Malaysia by 7, 66, 20, 9, and 13 tmt in 2012 and by 43, 328, 120, 56 and 80 tmt by 2021, respectively. Consumption increases range from 2.42 percent in 2012 to 20.56 percent by 2021 for poultry. Increased consumption is derived from the assumptions of increasing meat consumption and movement away from staples, as the economy continues to develop, income increases, urbanization increases and there is greater access to a variety of foods as the infrastructure continues to develop.

Production:

Under scenario 3, an increase in per capita consumption of pork and poultry leads to increased demand and increased production of pork and poultry in the domestic market. Due to the limitations in expanding corn area in the five countries, the cost of production of pork and poultry is slightly higher due to increased corn prices. This results in slightly less production than under scenario 1. Poultry production in Indonesia, Philippines, Thailand, Vietnam, and Malaysia increases by 88, 40, 21, 313, and 38, tmt in 2012 and by 398, 192, 132, 56, and 234, tmt by 2021 respectively. (See Tables 1-6) The increased production ranges from 1.42 percent in 2012 to 20.54 percent by 2021. Pork production in Indonesia, Philippines, Vietnam, Thailand, and Malaysia increases by 7, 60, 93, 20, and 13 tmt in 2012 and by 43, 308, 960, 120, and 80 tmt by 2021, respectively. Increased production ranges from 3.64 percent in 2012 to 20.45 percent by

2021. The results indicate that increased revenue and profit for livestock producers from increased per capita consumption are sufficient to increase poultry and pork production. This results in increased feed demand for corn and soybean meal, and allocation of resources away from other crops at a global level as feed import demand increases.

Feed Demand:

The five Southeast Asian countries aggregate pork and poultry production under scenario 3 increased by 387 tmt and 2,522 tmt in 2012 and 2021, respectively. The combined increase for both pork and poultry production led to an increase in corn feed demand of 908 tmt and 4,562 tmt in 2012 and 2021, respectively. Under scenario 3, by the year 2021, corn feed demand for Vietnam, Philippines, Indonesia, Malaysia, and Thailand increased by 1,362 tmt (15.12 percent), 1,209 tmt (17.58 percent), 738 tmt (11.03 percent), 670 tmt (17.48 percent), 592 tmt (10.35 percent), respectively. The five Southeast Asian country aggregate increase in corn feed demand is 4,562 tmt which is a 14.23 percent increase above the baseline projection by the year 2021.

Prices:

International feed prices increase the most under scenario 3 as feed demand increases, and corn area expansion is limited in the five Southeast Asian countries. International corn prices increase 0.48 percent in 2012 and 3.02 percent by 2021. Under scenario 1, corn prices increase slightly less ranging from the initial increase of 0.31 percent to 2.44 percent by 2021. Scenario 2 exhibited the smallest increase in prices, from 0.17 percent 2012 to 0.57 percent by 2021. Scenario 2 indicates area expansion of corn is not as critical a factor in maintaining increased production and lower feed cost prices for Southeast Asia as yields. Continued increases in yield is a critical factor for increased supplies given the area constraints. Corn yield and area increases averaged 2.7 and 0.32 percent per year over the past decade for these five Southeast Asian countries, respectively. International soybean and soybean meal prices increased by 0.31 percent and 0.90 percent in 2012 and by 2.74 percent and 7.5 percent in 2021, respectively. The major corn producing countries, the United States, Argentina, and Brazil responded to increased feed demand and higher international prices by increasing their production by 0.73, 0.72, and 0.61 percent by 2021, respectively.

Trade:

Increased per capita consumption of pork and poultry and limited area expansion of corn under scenario 3 gives the largest trade effects for corn, soybeans, and soybean meal. In scenario 2 corn area expansion was restricted beginning in 2012, which had a large impact on corn supplies and increased corn import demand significantly. By the year 2021 the percentage increase in corn import demand ranged from 21.73 percent for Indonesia to 61.59 percent for the Philippines (tables 1-5), however Malaysia's area was flat throughout the projection period and not affected. Under scenarios 1 and 3, increased per capita meat consumption leads to increased profitability for pork and poultry producers in the five Southeast Asian countries. This leads to increased production and increased feed demand, which cannot be met by the domestic market. By the year 2021 corn import demand increased most for Philippines, Thailand, Vietnam, Indonesia, and Malaysia at 336.4, 100.4, 84.6, 55.9, and 17.0 percent respectively. But in terms of the impact on international corn markets, by million metric tons (mmt), the greatest increase in corn import demand is by Vietnam, Philippines, Indonesia, Thailand, and Malaysia at an increase of 2.35, 1.65, 1.17, 1.03, and 0.67 mmt by 2021, respectively. The five Southeast Asian country aggregate increase in import demand is 6.88 mmt by 2021 and accounts for 5 percent of total corn import demand from the baseline projection. A number of countries reduced corn imports in response to higher international prices. Japan, South Korea, China, Egypt, and Taiwan all reduced imports by less than 1 percent, (table 7).

The increase in import demand for corn is easily met by the major corn producing and exporting countries of the world. Corn exports increase for the United States, Argentina, Brazil, Ukraine, Russia, the European Union and South Africa by 7.63 percent (4.63 mmt), 1.15 (0.26 mmt), 4.90 (0.67 mmt), 3.02 (0.48 mmt), 6.08 (0.09 mmt), 1.12 (0.30 mmt), and 2.23 percent (0.47 mmt), respectively, (table 7). These combined seven countries account for about 98.6 percent of the increased corn exports. As international corn price increased, exporting countries responded by increasing production through increased area, reducing domestic use, and drawing down stock levels. Increased pork and poultry production also led to increased demand for soybeans and soybean meal, presented in tables 8 and 9.

Summary and Conclusions

The contribution of this research is to investigate potential implications of recent changes in food consumption toward increased meat consumption in Southeast Asia and increased livestock feed demand and quantitatively analyzed their impacts on domestic and international commodity markets. This study begins with a brief review of factors and variables affecting consumption patterns in emerging markets. The paper discusses the growth in livestock demand and production for Indonesia, Philippines, Thailand, Vietnam, and Malaysia with a focus on pork and poultry. The potential for increasing global feed demand, (corn and soybean meal), are discussed. Understanding the impact of increasing meat consumption in emerging Southeast Asian countries on feed import demand, particularly corn and soybean meal, is important for both Asian and U.S. officials, grain traders, and farmers. Our scenarios are formulated to capture the impacts of changing consumption patterns within Southeast Asia and their impact on the national and global market.

In our simulation model, we increased meat consumption of pork and poultry for Indonesia, Philippines, Thailand, Vietnam, and Malaysia over the projection period to the year 2021. Per capita consumption was increased by approximately 21 percent. The model results indicate that the impact on international markets is not small, with price changes of 3 to 7 percent for corn and soybean meal. Global Markets responded to increasing feed demand from the Southeast Asian countries and increased corn production on a global basis. It is clear that as emerging market economies grow and food consumption patterns change there will be increasing pressure on global feed for livestock production. Higher price levels domestically benefit crop producers but hurt lower income and rural households, whose diets are largely based on rice and wheat as staple foods. Increased feed demand benefits global producers and major exporters of corn, soybean, and soybean meal.

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Table 1. Indonesia Impacts on Consumption, Production, Feed Demand and Imports from Scenarios 1, 2, and 3; level and percent differences from reference projections.

Countries and Scenarios	2012	2018	2021
Indonesia			
Poultry Consumption Base (1000 mt)	1639	1799	1939
Scenario1: Increased Per Capita Cons.	5.36%	12.76%	20.61%
Scenario2: Constrained Corn Area	-0.01%	-0.03%	-0.04%
Scenario3: Scenario 1 and 2	5.34%	12.74%	20.56%
Scenario3: Difference from Base (1,000 mt)	88	229	399
Pork Consumption Base (1000 mt)	180	196	212
Scenario1: Increased Per Capita Cons.	3.74%	11.71%	20.30%
Scenario2: Constrained Corn Area	-0.01%	-0.02%	-0.03%
Scenario3: Scenario 1 and 2	3.73%	11.69%	20.26%
Scenario3: Difference from Base (1000 mt)	7	23	43
Poultry Production Base (1000 mt)	1638	1797	1937
Scenario1: Increased Per Capita Cons.	5.36%	12.76%	20.59%
Scenario2: Constrained Corn Area	-0.01%	-0.03%	-0.04%
Scenario3: Scenario 1 and 2	5.34%	12.73%	20.54%
Scenario3: Difference from Base (1,000 mt)	88	229	398
Pork Production Base (1000 mt)	180	196	212
Scenario1: Increased Per Capita Cons.	3.74%	11.71%	20.30%
Scenario2: Constrained Corn Area	-0.01%	-0.02%	-0.03%
Scenario3: Scenario 1 and 2	3.73%	11.69%	20.26%
Scenario3: Difference from Base (1000 mt)	7	23	43
Corn Feed Demand Base (1000mt)	5329	5921	6611
Scenario1: Increased Per Capita Cons.	2.96%	7.07%	11.10%
Scenario2: Constrained Corn Area	-0.02%	-0.04%	-0.06%
Scenario3: Scenario 1 and 2	2.94%	7.02%	11.03%
Scenario3: Difference from Base (1000mt)	157	416	730
Corn Import Demand Base (1000mt)	1483	1764	2102
Scenario1: Increased Per Capita Cons.	10.49%	23.25%	34.14%
Scenario2: Constrained Corn Area	11.71%	17.40%	21.73%
Scenario3: Scenario 1 and 2	22.20%	40.66%	55.88%
Scenario3: Difference from Base (1000mt)	329	717	1175
Soymeal Feed Demand Base (1000mt)	3309	3655	4131
Scenario1: Increased Per Capita Cons.	1.56%	3.51%	5.16%
Scenario2: Constrained Corn Area	-0.02%	-0.04%	-0.06%
Scenario3: Scenario 1 and 2	1.54%	3.47%	5.10%
Scenario3: Difference from Base (1000mt)	51	127	211
Soymeal Import Demand Base (1000mt)	3309	3655	4131
Scenario1: Increased Per Capita Cons.	1.56%	3.51%	5.16%
Scenario2: Constrained Corn Area	-0.02%	-0.04%	-0.06%
Scenario3: Scenario 1 and 2	1.54%	3.47%	5.10%
Scenario3: Difference from Base (1000mt)	51	127	211

Table 2. Philippines Impacts on Consumption, Production, Feed Demand and Imports from Scenarios 1, 2, and 3; level and percent differences from reference projections.

Countries and Scenarios	2012	2018	2021
Philippines			
Poultry Consumption Base (1000 mt)	977	1103	1234
Scenario1: Increased Per Capita Cons.	4.98%	12.09%	19.69%
Scenario2: Constrained Corn Area	-0.01%	-0.01%	-0.02%
Scenario3: Scenario 1 and 2	4.98%	12.08%	19.68%
Scenario3: Difference from Base (1,000 mt)	49	133	243
Pork Consumption Base (1000 mt)	1393	1485	1596
Scenario1: Increased Per Capita Cons.	4.72%	12.30%	20.56%
Scenario2: Constrained Corn Area	0.00%	0.00%	0.00%
Scenario3: Scenario 1 and 2	4.72%	12.30%	20.56%
Scenario3: Difference from Base (1000 mt)	66	183	328
Poultry Production Base (1000 mt)	819	906	1002
Scenario1: Increased Per Capita Cons.	4.92%	11.91%	19.17%
Scenario2: Constrained Corn Area	-0.01%	-0.01%	-0.01%
Scenario3: Scenario 1 and 2	4.92%	11.90%	19.16%
Scenario3: Difference from Base (1,000 mt)	40	108	192
Pork Production Base (1000 mt)	1300	1393	1504
Scenario1: Increased Per Capita Cons.	4.63%	12.19%	20.44%
Scenario2: Constrained Corn Area	0.00%	0.00%	0.00%
Scenario3: Scenario 1 and 2	4.64%	12.19%	20.45%
Scenario3: Difference from Base (1000 mt)	60	170	308
Corn Feed Demand Base (1000mt)	5485	6050	6875
Scenario1: Increased Per Capita Cons.	4.26%	10.73%	17.61%
Scenario2: Constrained Corn Area	-0.01%	-0.02%	-0.03%
Scenario3: Scenario 1 and 2	4.25%	10.71%	17.58%
Scenario3: Difference from Base (1000mt)	233	648	1209
Corn Import Demand Base (1000mt)	210	250	492
Scenario1: Increased Per Capita Cons.	131.20%	295.70%	274.50%
Scenario2: Constrained Corn Area	60.42%	82.22%	61.59%
Scenario3: Scenario 1 and 2	191.70%	378.10%	336.40%
Scenario3: Difference from Base (1000mt)	402	944	1654
Soymeal Feed Demand Base (1000mt)	2035	2243	2412
Scenario1: Increased Per Capita Cons.	4.13%	12.23%	17.25%
Scenario2: Constrained Corn Area	-0.02%	-0.03%	-0.04%
Scenario3: Scenario 1 and 2	4.11%	12.20%	17.21%
Scenario3: Difference from Base (1000mt)	84	273	415
Soymeal Import Demand Base (1000mt)	1944	2139	2301
Scenario1: Increased Per Capita Cons.	4.32%	12.83%	18.09%
Scenario2: Constrained Corn Area	-0.02%	-0.03%	-0.04%
Scenario3: Scenario 1 and 2	4.31%	12.80%	18.04%
Scenario3: Difference from Base (1000mt)	84	273	415

Table 3. Thailand Impacts on Consumption, Production, Feed Demand and Imports from Scenarios 1, 2, and 3; level and percent differences from reference projections.

Countries and Scenarios	2012	2018	2021
Thailand			
Poultry Consumption Base (1000 mt)	948	1031	1092
Scenario1: Increased Per Capita Cons.	3.74%	11.47%	19.54%
Scenario2: Constrained Corn Area	-0.01%	-0.03%	-0.04%
Scenario3: Scenario 1 and 2	3.73%	11.44%	19.49%
Scenario3: Difference from Base (1,000 mt)	35	118	213
Pork Consumption Base (1000 mt)	529	570	608
Scenario1: Increased Per Capita Cons.	3.71%	11.52%	19.80%
Scenario2: Constrained Corn Area	-0.02%	-0.04%	-0.07%
Scenario3: Scenario 1 and 2	3.69%	11.47%	19.72%
Scenario3: Difference from Base (1000 mt)	20	65	120
Poultry Production Base (1000 mt)	1476	1607	1749
Scenario1: Increased Per Capita Cons.	1.41%	4.42%	7.58%
Scenario2: Constrained Corn Area	-0.01%	-0.02%	-0.03%
Scenario3: Scenario 1 and 2	1.40%	4.39%	7.55%
Scenario3: Difference from Base (1,000 mt)	21	71	132
Pork Production Base (1000 mt)	529	570	608
Scenario1: Increased Per Capita Cons.	3.71%	11.52%	19.80%
Scenario2: Constrained Corn Area	-0.02%	-0.04%	-0.07%
Scenario3: Scenario 1 and 2	3.69%	11.47%	19.72%
Scenario3: Difference from Base (1000 mt)	20	65	120
Corn Feed Demand Base (1000mt)	4883	5200	5718
Scenario1: Increased Per Capita Cons.	1.98%	6.24%	10.39%
Scenario2: Constrained Corn Area	-0.01%	-0.03%	-0.04%
Scenario3: Scenario 1 and 2	1.96%	6.21%	10.35%
Scenario3: Difference from Base (1000mt)	96	323	592
Corn Import Demand Base (1000mt)	859	945	1025
Scenario1: Increased Per Capita Cons.	10.51%	31.82%	53.87%
Scenario2: Constrained Corn Area	12.57%	31.28%	46.37%
Scenario3: Scenario 1 and 2	23.10%	63.20%	100.40%
Scenario3: Difference from Base (1000mt)	198	597	1029
Soymeal Feed Demand Base (1000mt)	4289	4699	5105
Scenario1: Increased Per Capita Cons.	3.48%	12.73%	18.40%
Scenario2: Constrained Corn Area	-0.04%	-0.07%	-0.09%
Scenario3: Scenario 1 and 2	5.32%	12.66%	18.30%
Scenario3: Difference from Base (1000mt)	148	508	934
Soymeal Import Demand Base (1000mt)	2709	2910	3111
Scenario1: Increased Per Capita Cons.	4.88%	15.37%	26.54%
Scenario2: Constrained Corn Area	-0.04%	-0.07%	-0.09%
Scenario3: Scenario 1 and 2	4.85%	15.29%	26.42%
Scenario3: Difference from Base (1000mt)	131	445	822

Table 4. Vietnam Impacts on Consumption, Production, Feed Demand and Imports from Scenarios 1, 2, and 3; level and percent differences from reference projections.

Countries and Scenarios	2012	2018	2021
Vietnam			
Poultry Consumption Base (1000 mt)	760	878	994
Scenario1: Increased Per Capita Cons.	3.58%	11.25%	19.95%
Scenario2: Constrained Corn Area	-0.02%	-0.05%	-0.08%
Scenario3: Scenario 1 and 2	3.56%	11.20%	19.86%
Scenario3: Difference from Base (1,000 mt)	27	98	197
Pork Consumption Base (1000 mt)	3284	4393	4890
Scenario1: Increased Per Capita Cons.	2.82%	15.23%	20.17%
Scenario2: Constrained Corn Area	-0.05%	-0.32%	-0.46%
Scenario3: Scenario 1 and 2	2.82%	14.86%	19.62%
Scenario3: Difference from Base (1000 mt)	93	653	960
Poultry Production Base (1000 mt)	367	408	455
Scenario1: Increased Per Capita Cons.	2.49%	7.62%	12.75%
Scenario2: Constrained Corn Area	-0.07%	-0.20%	-0.33%
Scenario3: Scenario 1 and 2	2.42%	7.41%	12.38%
Scenario3: Difference from Base (1,000 mt)	9	30	56
Pork Production Base (1000 mt)	3284	4393	4890
Scenario1: Increased Per Capita Cons.	2.82%	15.23%	20.17%
Scenario2: Constrained Corn Area	-0.05%	-0.32%	-0.46%
Scenario3: Scenario 1 and 2	2.82%	14.86%	19.62%
Scenario3: Difference from Base (1000 mt)	93	653	960
Corn Feed Demand Base (1000mt)	6083	7468	9010
Scenario1: Increased Per Capita Cons.	5.30%	10.92%	15.92%
Scenario2: Constrained Corn Area	-0.16%	-0.43%	-0.70%
Scenario3: Scenario 1 and 2	5.14%	10.45%	15.12%
Scenario3: Difference from Base (1000mt)	313	781	1362
Corn Import Demand Base (1000mt)	1573	2114	2784
Scenario1: Increased Per Capita Cons.	20.37%	38.00%	50.54%
Scenario2: Constrained Corn Area	10.15%	24.21%	34.24%
Scenario3: Scenario 1 and 2	30.49%	62.11%	84.57%
Scenario3: Difference from Base (1000mt)	480	1313	2354
Soymeal Feed Demand Base (1000mt)	3080	4297	4907
Scenario1: Increased Per Capita Cons.	6.13%	20.81%	28.32
Scenario2: Constrained Corn Area	-0.09%	-0.59%	-0.86%
Scenario3: Scenario 1 and 2	6.03%	20.11%	27.25%
Scenario3: Difference from Base (1000mt)	186	864	1337
Soymeal Import Demand Base (1000mt)	2096	3031	3498
Scenario1: Increased Per Capita Cons.	11.09%	20.81%	28.32%
Scenario2: Constrained Corn Area	-0.11%	-0.71%	-1.03%
Scenario3: Scenario 1 and 2	7.82%	23.51	31.46
Scenario3: Difference from Base (1000mt)	164	713	1100

Table 5. Malaysia Impacts on Consumption, Production, Feed Demand and Imports from Scenarios 1, 2, and 3; level and percent differences from reference projections.

Countries and Scenarios	2012	2018	2021
Malaysia			
Poultry Consumption Base (1000 mt)	1059	1139	1204
Scenario1: Increased Per Capita Cons.	3.55%	11.21%	19.43%
Scenario2: Constrained Corn Area	-0.02%	-0.04%	-0.06%
Scenario3: Scenario 1 and 2	3.53%	11.17%	19.36%
Scenario3: Difference from Base (1,000 mt)	37	127	233
Pork Consumption Base (1000 mt)	348	377	401
Scenario1: Increased Per Capita Cons.	3.65%	11.50%	19.98%
Scenario2: Constrained Corn Area	-0.01%	-0.02%	-0.03%
Scenario3: Scenario 1 and 2	3.64%	11.48%	19.94%
Scenario3: Difference from Base (1000 mt)	13	43	80
Poultry Production Base (1000 mt)	1025	1102	1163
Scenario1: Increased Per Capita Cons.	3.69%	11.64%	20.20%
Scenario2: Constrained Corn Area	-0.02%	-0.04%	-0.06%
Scenario3: Scenario 1 and 2	3.67%	11.60%	20.13%
Scenario3: Difference from Base (1,000 mt)	38	128	234
Pork Production Base (1000 mt)	348	377	401
Scenario1: Increased Per Capita Cons.	3.65%	11.50%	19.98%
Scenario2: Constrained Corn Area	-0.01%	-0.02%	-0.03%
Scenario3: Scenario 1 and 2	3.64%	11.48%	19.94%
Scenario3: Difference from Base (1000 mt)	13	43	80
Corn Feed Demand Base (1000mt)	3412	3630	3832
Scenario1: Increased Per Capita Cons.	3.24%	10.19%	17.53%
Scenario2: Constrained Corn Area	-0.01%	-0.03%	-0.04%
Scenario3: Scenario 1 and 2	3.23%	10.16%	17.48%
Scenario3: Difference from Base (1000mt)	110	369	670
Corn Import Demand Base (1000mt)	3517	3745	3942
Scenario1: Increased Per Capita Cons.	3.10%	9.87%	17.06%
Scenario2: Constrained Corn Area	-0.01%	-0.03%	-0.05%
Scenario3: Scenario 1 and 2	3.09%	9.84%	17.00%
Scenario3: Difference from Base (1000mt)	109	368	670
Soymeal Feed Demand Base (1000mt)	1432	1650	1728
Scenario1: Increased Per Capita Cons.	3.03%	22.50%	33.38%
Scenario2: Constrained Corn Area	-0.03%	-0.06%	-0.07%
Scenario3: Scenario 1 and 2	3.01%	22.43%	33.28%
Scenario3: Difference from Base (1000mt)	43	370	575
Soymeal Import Demand Base (1000mt)	1132	1292	1342
Scenario1: Increased Per Capita Cons.	3.01%	22.07%	32.85%
Scenario2: Constrained Corn Area	-0.03%	-0.06%	-0.07%
Scenario3: Scenario 1 and 2	2.99%	22.01%	32.77%
Scenario3: Difference from Base (1000mt)	34	285	440

Table 6. Five Southeast Asian Countries Aggregate Impacts on Consumption, Production, Feed and Imports from Scenarios 1, 2, and 3; level and percent differences from reference projections.

Countries and Scenarios	2012	2018	2021
Indonesia, Philippines, Thailand, Vietnam, and Malaysia (aggregate)			
Poultry Consumption Base (1000 mt)	5382	5950	6462
Scenario1: Increased Per Capita Cons.	4.40%	11.90%	19.93%
Scenario2: Constrained Corn Area	-0.01%	-0.03%	-0.05%
Scenario3: Scenario 1 and 2	4.39%	11.86%	19.88%
Scenario3: Difference from Base (1,000 mt)	236	706	1285
Pork Consumption Base (1000 mt)	5734	7022	7707
Scenario1: Increased Per Capita Cons.	3.46%	13.79%	19.89%
Scenario2: Constrained Corn Area	-0.01%	-0.01%	-0.02%
Scenario3: Scenario 1 and 2	3.45%	13.77%	19.86%
Scenario3: Difference from Base (1000 mt)	198	967	1531
Poultry Production Base (1000 mt)	5324	5820	6306
Scenario1: Increased Per Capita Cons.	3.68%	9.75%	16.12%
Scenario2: Constrained Corn Area	-0.02%	-0.04%	-0.06%
Scenario3: Scenario 1 and 2	3.66%	9.71%	16.05%
Scenario3: Difference from Base (1,000 mt)	195	565	1012
Pork Production Base (1000 mt)	5641	6930	7615
Scenario1: Increased Per Capita Cons.	3.40%	13.79%	19.85%
Scenario2: Constrained Corn Area	-0.01%	-0.01%	-0.02%
Scenario3: Scenario 1 and 2	3.40%	13.78%	19.83%
Scenario3: Difference from Base (1000 mt)	192	955	1510
Corn Feed Demand Base (1000mt)	25193	28269	32046
Scenario1: Increased Per Capita Cons.	3.66%	9.12%	14.49%
Scenario2: Constrained Corn Area	-0.05%	-0.13%	-0.23%
Scenario3: Scenario 1 and 2	3.61%	8.97%	14.23%
Scenario3: Difference from Base (1000mt)	908	2536	4562
Corn Import Demand Base (1000mt)	7641	8817	10344
Scenario1: Increased Per Capita Cons.	12.44%	29.74%	45.43%
Scenario2: Constrained Corn Area	7.43%	14.95%	21.13%
Scenario3: Scenario 1 and 2	19.86%	44.68%	66.53%
Scenario3: Difference from Base (1000mt)	1518	3940	6882
Soymeal Feed Demand Base (1000mt)	13863	16755	18282
Scenario1: Increased Per Capita Cons.	2.80%	13.72%	19.33%
Scenario2: Constrained Corn Area	-0.08%	-0.19%	-0.28%
Scenario3: Scenario 1 and 2	2.77%	13.50%	18.99%
Scenario3: Difference from Base (1000mt)	384	2262	3472
Soymeal Import Demand Base (1000mt)	10974	13187	14383
Scenario1: Increased Per Capita Cons.	3.25%	14.92%	20.89%
Scenario2: Constrained Corn Area	-0.08%	-0.19%	-0.28%
Scenario3: Scenario 1 and 2	3.16%	14.79%	20.77%
Scenario3: Difference from Base (1000mt)	347	1951	2988

Table 7. Corn Trade and Price Impacts from Scenario 3: percent differences from reference projections.

Selected Years	2012	2018	2021
Difference from Baseline			
International Prices: Scenario 3			
Corn	0.48%	2.12%	3.02%
Trade Quantity: Scenario 3			
Corn Exporters			
United States	1.38%	5.52%	7.63%
Argentina	0.14%	0.81%	1.15%
Brazil	0.79%	3.88%	4.90%
Ukraine	0.58%	2.19%	3.02%
Russia	1.66%	4.98%	6.08%
European Union	0.18%	0.60%	1.12%
South Africa	0.35%	1.68%	2.23%
Corn Importers:			
World	0.86%	3.54%	4.82%
Japan	-0.30%	-0.14%	-0.21%
South Korea	-0.12%	-0.11%	-0.17%
China	-0.02%	-0.27%	-0.26%
Egypt	-0.09%	-0.56%	-0.84%
Taiwan	-0.07%	-0.32%	-0.45%
South East Asia 5 aggregate countries	13.14%	50.18%	66.53%
Indonesia	16.05%	44.63%	55.88%
Philippines	142.61%	357.40%	336.40%
Thailand	11.81%	72.70%	100.41%
Vietnam	20.10%	67.60%	84.57%
Malaysia	1.48%	11.58%	17.01%

Table 8. Soybean Trade and Price Impacts from Scenario 3; percent differences from reference projections.

Selected Years	2012	2018	2021
Difference from Baseline in percent			
International Prices: Scenario 3			
Soybeans	0.31%	1.88%	2.74%
Trade Quantity Scenario 3			
Soybean Exporters			
United States	-0.09%	-0.26%	-0.40%
Argentina	0.04%	0.48%	0.73%
Brazil	0.21%	0.71%	0.94%
Soybean Importers:			
World	0.06%	0.33%	0.48%
China	-0.01%	-0.07%	-0.08%
Mexico	-0.01%	-0.04%	-0.05%
EU	-0.03%	-0.21%	-0.32%
Indonesia	-0.05%	-0.28%	-0.40%
Philippines	0.00%	0.05%	0.09%
Thailand	0.42%	3.69%	5.09%
Vietnam	2.38%	11.51%	16.01%
Malaysia	2.04%	16.19%	24.09%
South East Asia 5 aggregate countries	0.91%	5.82%	8.33%

Table 9. Soybean Meal Trade and Price Impacts from Scenario 3; percent differences from reference projections.

Selected Years	2012	2018	2021
Difference from Baseline in Percentage			
International Prices: Scenario 3			
Soybean Meal	0.90%	5.09%	7.50%
Trade Quantity Scenario 3			
Soybean Meal Exporters			
United States	1.78%	8.26%	12.43%
Argentina	0.09%	0.31%	0.43%
Brazil	-0.09%	-0.52%	-0.77%
Soybean Meal Importers:			
World	0.29%	1.33%	1.90%
Japan	-0.29%	-1.49%	-2.11%
South Korea	-0.07%	-0.60%	-0.97%
China	-0.49%	-3.72%	-5.16%
Mexico	-0.04%	-0.15%	-0.19%
EU	-0.44%	-2.52%	-3.78%
Indonesia	1.04%	3.89%	5.10%
Philippines	2.83%	12.80%	18.04%
Thailand	2.34%	18.01%	26.42%
Vietnam	7.82%	23.51%	31.46%
Malaysia	2.99%	22.01%	32.77%
South East Asia 5 aggregate countries	3.16%	14.79%	20.77%