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Ex Ante Analysis of Price and Trade Effects for the Rice Sector in the Transatlantic Trade and Investment Partnership

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by

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Abstract

In 2013, trade negotiations began between the United States and the European Union to create a free trade agreement with the goal of phasing out tariffs for all but the most sensitive products. To aid negotiators in analyzing potential agriculture agreements, the objective of this study is to quantify policy impacts of a potential trade liberalization of rice. This study will also be a useful analysis for various participants in the rice market to make educated business decisions.

This study utilizes the spatial partial equilibrium model RICEFLOW to project the differences in market prices, production volumes, trade volumes, and consumption volumes that would result from a 10 year straight line decrease of bilateral import tariffs. The global rice market is disaggregated by rice type and milling level in the model, which helps to generate interesting results that would not be apparent in a model that is more highly aggregated.

The results suggest US rice becomes more competitive in the EU market causing an increase in the US rice prices. US production is projected to increase greatly, both in paddy production and the milling sector from the trade policy reform. EU production is projected to decrease. The results suggest that there will be some substitution by type in the EU as a result of the agreement.

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Alvaro Durand-Morat created an exceptional model of the international rice market and trade flows. By patiently guiding me through the steep learning curve for learning equilibrium models, Alvaro taught me a large amount about modeling, independent learning, and the global rice market. Thank you.

Specific thanks for help from Claudia Bazzani and Diana Danforth for creating a plan to finish, Mary Lou Hilliard and Hannah Shear for editing my completed document, Jeff Hooe and Jake Newcomb for helping with my presentation, Erin Killeen for sympathizing the thesis struggle, and many others on a list that is too long for this section.

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Acronyms

ACP	Africa, Caribbean and Pacific States
AGOA	Africa Growth and Opportunity Act
AGRM	Arkansas Global Rice Model
AoA	Agreement on Agriculture
B	Brown/husked rice
CAP	Common Agricultural Policy
CAPRI	Common Agriculture Policy Regional Impact Model
CGE	Computable General Equilibrium Model
CIF-	Cost of insurance and freight
CUSTA	Canada-US Trade Agreement
EBA	Everything but Arms
EC	European Commission
EFTA	European Free Trade Association
EU	European Union
FAPRI	Food and Agricultural Policy Research Institute
FOB-	Free on board
FR	Fragrant rice
FRB	Fragrant brown rice
FRP	Fragrant paddy rice
FRW	Fragrant white rice
FTA	Free trade agreement
GAIN	Global Agricultural Information network
GATS	Global Agricultural Trade System
GDP	Gross Domestic Product
GM	Genetically modified
GSP	Generalized System of Preferences
GTAP	General Trade Analysis Project
HLWG	High Level Working Group on Jobs and Growth
LDC	Least Developed Countries
LG	Long grain rice
LGB	Long grain brown rice
LGP	Long grain paddy rice
LGW	Long grain white rice
MG	Medium/short grain rice
MGB	Medium grain brown rice
MGP	Medium grain paddy rice
MGW	Medium grain white rice
MT	Metric ton
NAFTA	North American Free Trade Agreement
NOAA	National Oceanic and Atmospheric Administration
NPV	Net present value
NTB	Non-tariff barrier
OCT	Overseas Countries and Territories
P	Paddy rice
PE	Partial Equilibrium Model

PS&D	USDA Production, Supply and Demand database
SSM	Special Safeguard Measure
SPS	Sanitary and phytosanitary
TBT	Technical barriers to trade
Tmt	Thousand metric tons
USD	United States Dollars
W	White/milled rice
TTIP	Transatlantic Trade and Investment Partnership
TRQ	Tariff rate quota
US	United States
USDA	United States Department of Agriculture
WTO	World Trade Organization

1. Introduction

A. Background of the TTIP negotiations

i. Objective of partnership

The Transatlantic Trade and Investment Partnership (TTIP) negotiations began in July 2013 after the High Level Working Group on Jobs and Growth (High Level Working Group, 2013) recommended the reduction of barriers to trade between the European Union (EU) and the United States (US) (European Commission, 2014) (USTR, 2013). The move toward freer trade is designed to promote economic growth and create more jobs in both economies (USTR, 2013). The recommended course of action is estimated to create a gross domestic product (GDP) increase of €68.2-119.2 billion for the EU and €49.5-94.9 billion for the US. The estimated impact on GDP when removing tariffs alone are €23.7 billion increase for the EU and €9.4 billion increase for the US (Francois, Manchin, Norberg, Pindyuk, & Tomberger, 2013).

The HLWG recommended eliminating all duties and phasing out "all but the most sensitive tariffs in a short time frame" (HLWG, 2013, p. 3). The group also recommended advancing cooperation involving sanitary and phytosanitary (SPS) measures beyond the current status of the World Trade Organization (WTO). This advancement of cooperation is referred to as "SPS-plus". The HLWG also recommended advancing cooperation in the removal of technical barriers to trade (TBT) between the regions beyond the current status of the WTO regulations. This cooperation is referred to as "TBT-plus". These measures will be necessary in order to reduce non-tariff barriers to trade by establishing ongoing communication about the topics. The goal of this newly established communication would be to eliminate unnecessary double testing and agree upon acceptable standards with justification grounded by scientific proof (High Level Working Group, 2013).

ii. Importance of Agriculture and Food Trade Policy

There is a long list of reasons why countries have failed to liberalize trade in agriculture. These reasons are embedded in the importance of food for survival and the necessity of a stable supply of food at all times. Agriculture also has great economic significance and political power in both the EU and US. In this section I will discuss the significance to the global market of liberalizing the trade of agricultural products between the US and EU.

The first major multilateral agreement on agriculture in the WTO took place during The Uruguay Round in 1994 and is known as the Agreement on Agriculture (AoA) (WTO, 1994). Manufacturing had already been through eight rounds of trade reform (Hart & Beghin, 2004). The AoA was a major success for the time, considering there had not been a prior WTO agreement in the agricultural sector. Even though market liberalization resulting from the agreement was relatively modest, it created a framework by which trade barriers became more transparent.

Despite efforts to expand market access for agricultural goods in subsequent WTO rounds of negotiations, policies for agricultural products still suffer high levels of protectionism (Grant, Hertel, & Rutherford, 2006a). It is argued that high levels of agricultural protectionism have contributed to derailing advancement in recent multilateral trade negotiations, such as the Doha Round, where agriculture has been a major focal point (Miller et al., 2008).

The Doha Round, or more formally, the Doha Development Round, is the most recent WTO round of negotiations to attempt to reduce barriers to trade. The Doha Round began from a commitment included in the AoA stating that by the end of 1999, new negotiations on agricultural policy had to start. By November 2001, the Doha Ministerial Declaration was approved. It stated the goals of the negotiations to be: 1) improving market access, 2) moving to

phase out export subsidies, and 3) reducing trade-distorting domestic support (WTO, 2001). The negotiations have continued through 2014. The next work program to organize a schedule and continue working on the round was expected to be completed in December 2014 (Azevêdo, 2014). An update shows that the deadline for the work program has been extended to July 2015 (Azevêdo, 2015).

The Bali Package is the latest Ministerial agreement (WTO, 2013a). The package states that the goals for multilateral agricultural policy are to advance regulations for the administration of tariff rate quotas (TRQ) to ensure importers below the tariff quota fill line are operating fairly (WTO, 2013c). The tariff fill line is the ratio of imports for a specific good and the specified quota for that good. It is a measurement to determine if a TRQ has been filled. In this declaration, if less than 65% of the quota has been filled, then the importing country must prove this low level of imports is not due to their own administrative processes causing a Non-Tariff Barrier (NTB). It also states that members should work to identify and remove export competition policies (WTO, 2013b).

The breaking point of negotiations in 2008 was between India, China, and the US. India and China wanted a lower level of import surges required to activate the Special Safeguard Measure [1](SSM) and the US would not compromise from its position on the higher level for the trigger (Miller et al., 2008). In a larger picture, there are two sides that explain this breaking point. First, the developing powers believed that the developed countries of the US and the EU have too much domestic production support. Second, the US and EU believed that the

[1] Safeguard measures defined by the WTO are "'emergency' actions with respect to increased imports particular products, where such imports have caused or threaten to cause serious injury to the importing Member's domestic industry (Article 2)."Agricultural goods have special provisions for safeguards which allow for a higher level of market protection.

developing countries needed to agree to lower import tariffs for non-agricultural market access (Ismail, 2009).

Considering the two major powers had similar stances in the WTO agriculture rounds, it would be a step forward in trade policy for the two powers to reduce agricultural trade barriers in the TTIP.

B. Objective: Ex Ante Evaluation of Liberalizing Rice Trade between the United States and European Union

The objective of this thesis is to conduct an empirical analysis to assess the potential impacts on regional production, regional demand, and bilateral trade flow changes driven by the changes in price resulting from the liberalization of rice trade between the United States (US) and the European Union (EU).

Based on the partial equilibrium theory of international trade in Figure 7 on page 33 in the Method of Analysis, this study anticipates the expected results of trade reform in TTIP to be:

Figure 1: List of Alternative Hypotheses for this Study

EU Market Impacts
- Price will decrease
- Production and milling volume will decrease
- Volume of consumption will increase
- Imports will increase
- Bilateral Trade will increase with US

US Market Impacts
- Price will increase
- Production and milling volume will increase
- Volume of consumption will decrease
- Exports will increase
- Bilateral trade will increase with EU

Importing Third Countries
- Price will increase
- Production will increase
- Consumption will decrease

Exporting Third countries
- Price will either increase or decrease
- Production will either decrease or increase
- Volume of consumption will either increase or decrease

C. Overview of Current Barriers to Free Trade in Rice between US and EU

i. EU Import Tariffs

European Union (EU) tariff levels vary according to the level of milling. The tariff rates and policies are presented in Table 1 (European Commission, 2015).

While paddy rice does not require an import license the applied import duty is €211/mt (European Commission, 2008)(European Commission, 2015).

The tariff rate quotas for milled and brown rice are decided twice a year. They can be changed at the beginning of the marketing year or in the middle of the marketing year, based on the level of imports during the previous six months. The rice marketing year in the European Community is September 1 to August 31 (European Commission, 2015).

Table 1: EU TRQs for Rice Imports

	EU TRQs for Rice Imports			
	Paddy	Brown (husked)	Milled/ Semi-milled	Broken
Price of Tariff €/MT	€211	a = €30 b = €42.5 c = €65	a = €145 b = €175	€65
Quantity imported previous 6 months		a < 382,326 382,326< b < 517,130 c > 517,130	a < 387,743 b > 387,743	

ii. Other EU Bilateral Trade Agreements

There are also other special TRQs for imports of rice into the EU as summarized in Table 2. These TRQs are discussed below as they are laid out in the informational note for the EU rice regime (European Commission, 2015)**Error! Reference source not found.**.

The EU has multiple bilateral trade agreements that result in zero import tariffs for rice. The Africa, Caribbean and Pacific states (ACP) and the Caribbean sub-group CARIFORUM states, as defined by EU Regulation, enjoy duty and quota-free access for all types of rice (European Commission, 2015). The most notable countries with this distinction for rice trade are Suriname and Guyana.

Countries included in the Everything But Arms (EBA) development policy also have duty-free access to the European rice market. EBA is a policy that removes tariffs and quotas for all goods, except armaments, that originate in the Least Developed Countries (LDC) (European Commission, 2013c). Free trade privileges were reinstated for Myanmar in 2013 (European

Commission, 2013a). Cambodia is the most notable rice exporting country with the EBA distinction. In 2013 Cambodia was the second largest exporter of rice to the EU, following India.

Overseas Countries and Territories (OCT) have zero tariff until exports reach the tariff rate quota of 35,000 tons of husked rice equivalent. Twenty-five thousand tons are allowed for Netherland Antilles (Aruba, Bonaire, and Curaçao) and ten thousand tons are allowed for the countries considered least-developed OCT including: Anguilla, Mayotte, Montserrat, Saint Helena, Ascension Island, Tristan da Cunha, Turks and Caicos Islands, Wallis and Futuna Islands, and St. Pierre and Miquelon. These quotas are divided equally into three sub-periods which are January to May, May to September and September to January (European Commission, 2009). The above is what this study modeled. However, beginning on the 1st of January 2014, this TRQ is no longer in effect (European Commission, 2015).

India and Pakistan have duty-free, quota-free access to import nine different varieties of husked Basmati (European Commission, 2015).

The EU grants Bangladesh a tariff rate quota of 4,000 tons of husked equivalent, for which the import duty is reduced by 50%. (European Commission, 2006)

Egypt receives different duty-free quotas for different levels of processed rice. The quotas for each level of processing increase by three percent until 2015. For example, 2014 quotas will increase by three percent in 2015, and then stay at the 2015 levels for an undetermined length of time. For husked rice the 2014 quota is 22,510 tons, for semi- or wholly-milled rice the quota is 78,786 tons, and for broken rice the quota is 90,041 tons (European Commission, 2001).

Table 2: EU TRQs for rice imports 2014

	Specified EU TRQs for Rice Imports 2014				
	Paddy	Brown (husked)	Milled/ Semi-milled	Broken	All
OCT (MT) - Duty	 0	 0	 0	 0	35000 0
EBA (MT) - Duty	∞ 0	∞ 0	∞ 0	∞ 0	∞ 0
Bangladesh (MT) - Duty	 50% of normal tariff rate	 50% of normal tariff rate	 50% of normal tariff rate	 50% of normal tariff rate	4000 50% of normal tariff rate
India/Pakistan (MT) - Duty	0 Normal	∞ 0€ for husked Basmati	0 Normal	0 Normal	0
Egypt (MT) - Duty	0 Normal	22,510 0 €	78,786 0 €	90,041 0 €	
WTO quotas (MT) - Duty	7 15% ad valorem	1,634 15% ad valorem	103,216 0	132,788 32,788MT with 0€ duty; 100,000MT with 30.77€ reduction	

iii. US Import Tariffs

The US has relatively low trade barriers on imported rice. Paddy (rough) rice, brown rice, milled rice, and broken rice are open to free trade for imports from least developed beneficiary countries eligible for Generalized System of Preferences (GSP), Australia, Bahrain, Canada, Chile, Colombia, Africa Growth and Opportunity Act (AGOA) countries[2], Caribbean Basin Initiative countries[3], Israel, Jordan, Korea, Morocco, Mexico, Oman, Panama, Peru, and Singapore.

Parboiled imports tariffs are on an ad valorem basis. There is free trade for the same countries listed above except the list includes all of the GSP countries, and excludes the AGOA countries. There is a special rate of 8.9% ad valorem for South Korea (USITC, 2014). Finally for countries not mentioned parboiled rice imports have an 11.2% tariff.

[2] Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Chad, Comores, Congo, Djibouti, Ethiopia, Gabon, Ghana, Guinea, Guinea Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome, Senegal, Seychelles, Sierra Leone, South Africa, Tanzania, Togo, Uganda, Zambia

[3] Anguilla, Antigua and Barbuda, Aruba, the Bahamas, Barbados, Belize, British Virgin Islands, Cayman Islands, Costa Rica, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Montserrat, Netherlands Antilles, Nicaragua, Panama, St. Christopher and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Islands

Table 3: US Tariffs for Rice Imports

	Paddy	Brown Basmati	Other Brown	Milled	Broken	Parboiled
	($/MT)	($/MT)	($/MT)	($/MT)	($/MT)	(% ad valorem)
GSP Countries	18	8.3	21	14	4.4	0
Least Developed GSP Countries	0	0	0	0	0	0
AGOA Countries	0	0	0	0	0	11.2
South Korea	0	0	0	0	0	8.9
Rest of World	18	8.3	21	14	4.4	11.2

iv. Production in the US and EU

While rice accounts for a relatively small portion of total agricultural production in the US and the EU, it is extremely important for specific regions and localities within both the US and the EU.

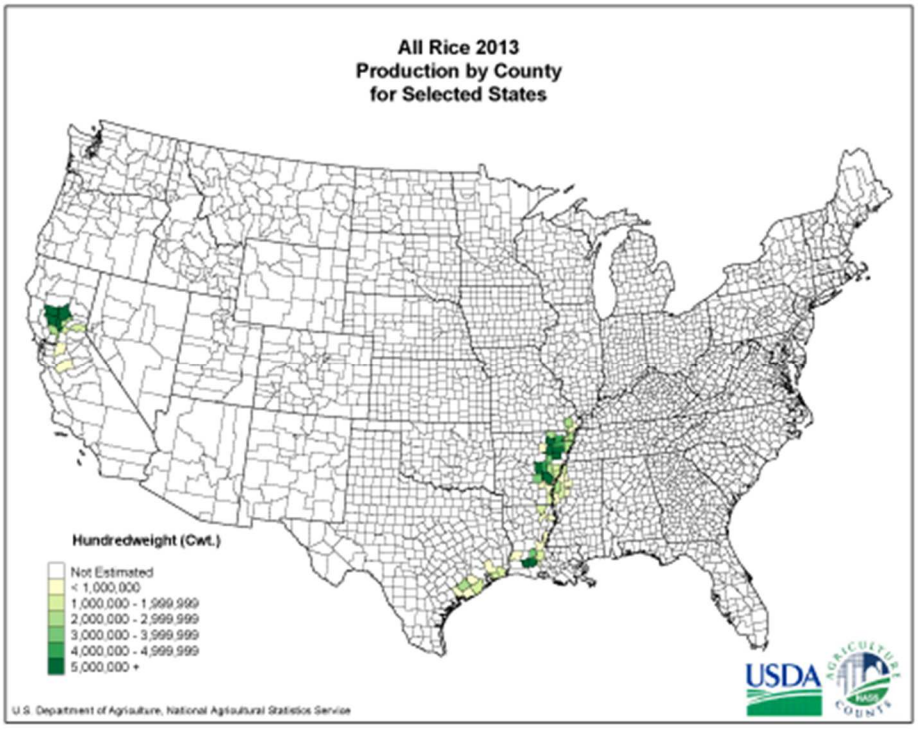
In the US, rice accounted for 1.5% of the value of total crop production in the US in 2013 (NASS, 2015). However, rice accounted for 4.4% of the bulk total commodity value of exports from the US (USDA, 2014). Rice is produced in Arkansas, California, Louisiana, Mississippi, Missouri, and Texas. On average, from 2009-2013, Arkansas produced about 45% of the total US rice and California produced about 22%. Arkansas, California and Louisiana account for over 80% of the total rice produced in the US (Childs, 2014). From 2009 to 2013 US production averaged 10,540 thousand metric tons (tmt) paddy equivalent. On average from 2009 to 2013 long grain varieties accounted for almost 70% of total rice production (Childs, 2014).

Of total long grain production, Arkansas accounted for over half of the production, and together with Louisiana account for more than 80% of the production. California is the only state that produces a very small amount of total US long grain rice production. Medium grain varieties are grown in all rice growing states, except for Mississippi. California averages more than 75%

of the US production of medium grain. California combined with Arkansas produce more than 95% of the medium grain. Short grain rice is grown almost exclusively in California with a small amount also grown in Arkansas (Childs, 2014).

Agriculture accounts for 3.8% of the total GDP of Arkansas in 2013 (U.S. Department of Commerce, 2015). Rice accounted for 12.5% of the total agricultural receipts and about 25% of the cash receipts from crops in 2012 in Arkansas. Arkansas rice accounted for 41.8% of the total receipts for rice in the US (NASS, 2013). In 2009, rice production and milling contributed $6.08 billion to the Arkansas economy, and contributed to the creation of 25,835 jobs (Richardson & Outlaw, 2010). Next was California where rice production and milling contributed $5.423 billion to the economy and contributed to the creation of 24,941 jobs (Richardson & Outlaw, 2010). While in the entire US this is a relatively small number, in the regions that the production exists, these values are very important.

Figure 2: Production per Harvested Acre by County in the US, 2013



Source: USDA-NASS

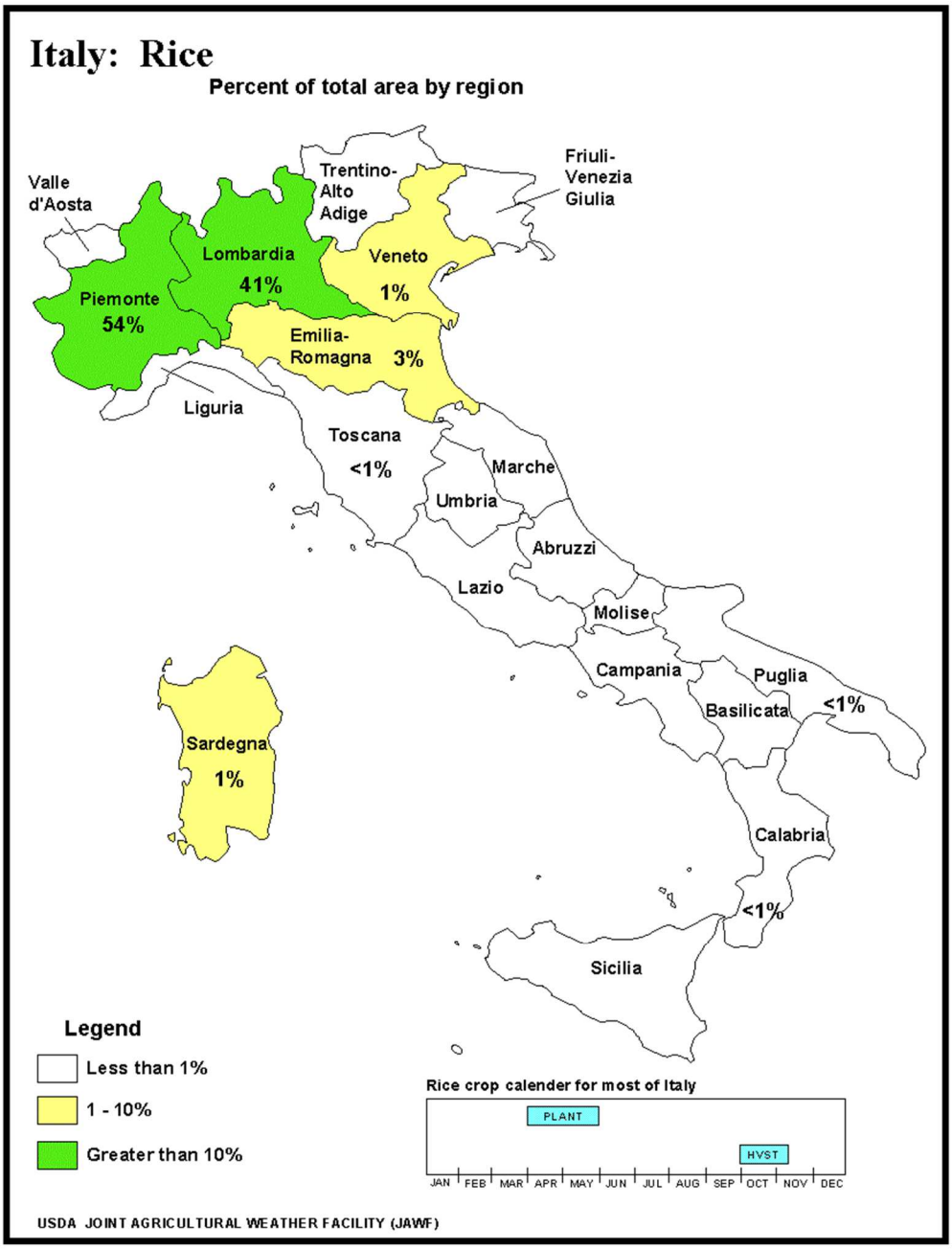
In the EU, rice is produced in Italy, Spain, Greece, Portugal, France, Romania, and Bulgaria. From 2009 to 2013, Italian producers were responsible for about half of the total production and Spain was responsible for about 30% of total production on average. Both long and short grain varieties are grown in the EU. Medium grain varieties account for about two-thirds of total production (FAOSTAT, 2014). However, from 2010 to 2013 the medium grain percentage of total EU production varied as much as 2.8% from the previous year (European Commission, 2013b).

Most of the rice grown in Italy and Spain are from a select few regions, shown in Figure 3: Map of Rice Growing Regions in Italy and **Error! Reference source not found.**. The most notable regions in Italy are Lombardia and Piemonte with 41% and 54% of the

rice acres in Italy, respectively. The most notable regions in Spain are Andalucía and Cataluña with 26% and 24% of the rice acres in Spain, respectively.

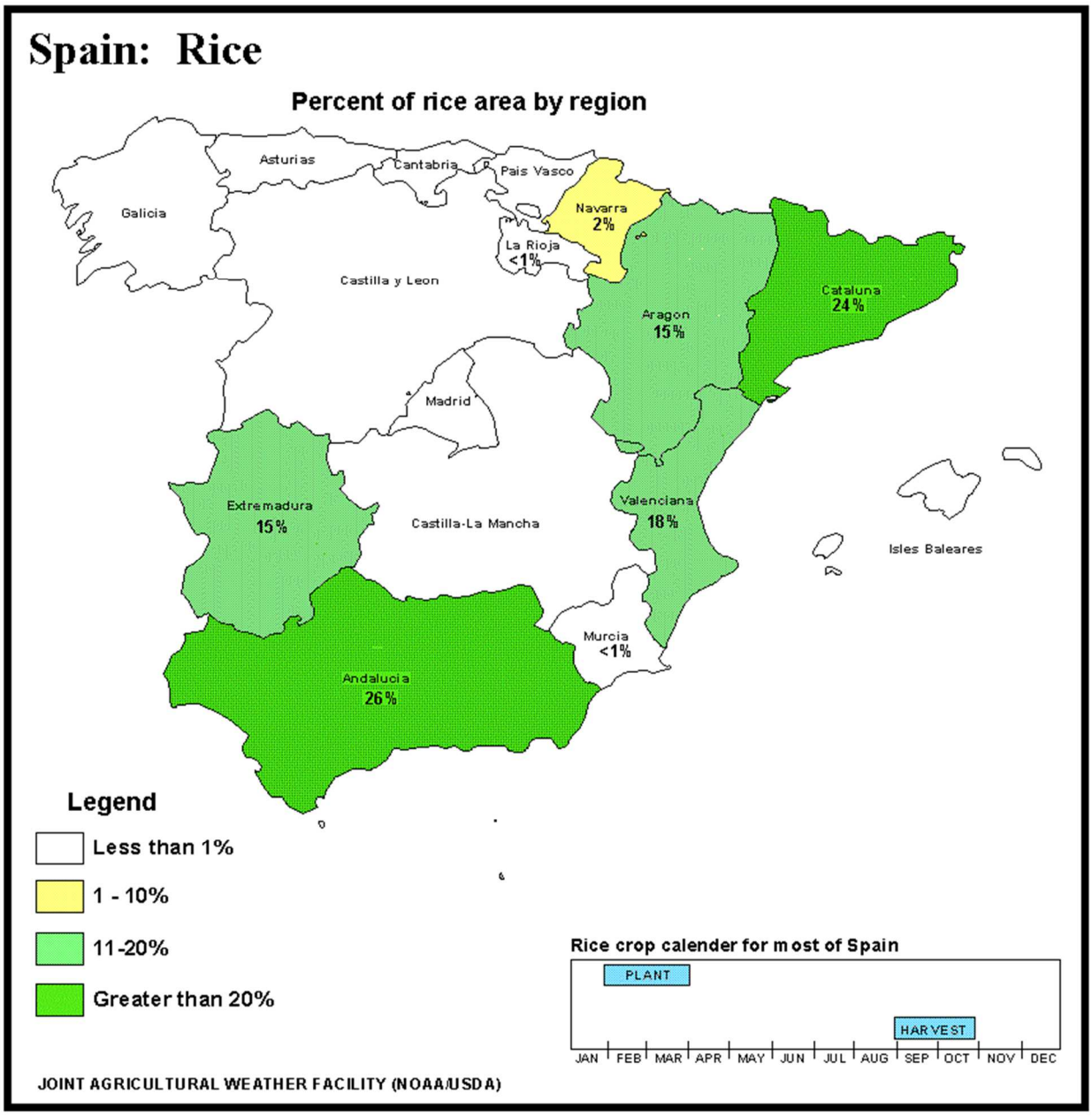
Rice is an important ingredient in cultural dishes for these countries. Risotto in Italy and paella in Spain are common dishes with rice bases. Rice production started in Italy around the middle of the 15th century (FAO, 2004) and helped to economically develop areas that were previously unsuitable for habitation. Now the rice fields are important in keeping in balance a fragile ecosystem (CGIAR, n.d.).

Figure 3: Map of Rice Growing Regions in Italy



Source: NOAA

Figure 4: Map of Rice Growing Regions in Spain



Source: NOAA

v. Rice Trade in the EU and US

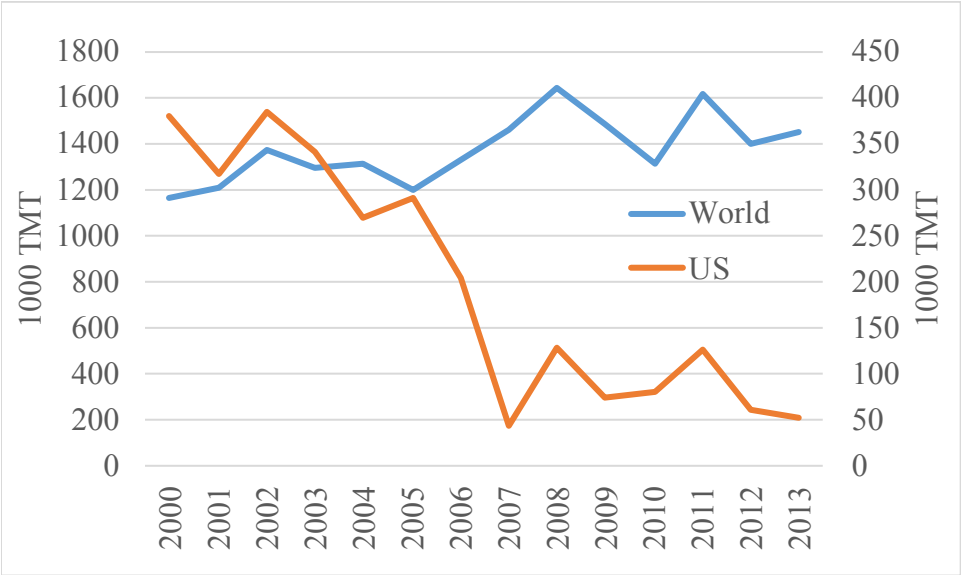
From 2006 to 2014 the US exported an average of 50% of both medium and long grain rice production. The US also imported a portion of rice for domestic use, primarily fragrant (aromatic) jasmine and basmati rice. From 2006 to 2014, the amount of total imported rice averaged 16.5% of domestic use. While fragrant rice was the primary rice type imported, long grain imports were equal to 18.3% of domestic use, and medium grain imports were equal to 11% of domestic use (Childs, 2014).

The EU exported about 10% of total rice production between 2009 and 2014, 14% and 3.8% of the medium grain and long grain crops, respectively. A greater amount of rice for consumption was imported into the EU. While only 7.3% of domestically used medium grain rice was imported, 55% of domestically used long grain rice was imported into the EU (European Commission, 2013b)

The US exported an average of 330 tmt of rice to the European Union from 2000-2005, compared to an average of only 80.5 tmt from 2007 to 2013. From 2005 to 2007 there was a 85% decrease in the rice imports by the EU from the US (UN, 2015). Although in 2008 the trade of rice imported by the EU from the United States increased, in 2011 it was 57% lower than it was in 2005, and in 2013 it was 82% lower than trade levels in 2005 (UN, 2015).

The genetically modified (GM) Liberty Link Rice contamination event in 2006 in the US caused the great decrease of imports to the EU from the US. This is explained in the following section.

Figure 5 Historical EU Rice Imports: World vs US



Source: UN Comtrade

While EU imports of rice from the US decreased greatly, total rice imports increased (Figure 5). From 2000-2005 the EU imported an annual average of 1,257 tmt while from 2007-2013 the EU imported 1,478 tmt. These figures show that the decrease in US rice imports into the EU was not due to a decrease in overall demand.

vi. GMO Contamination Event in 2006

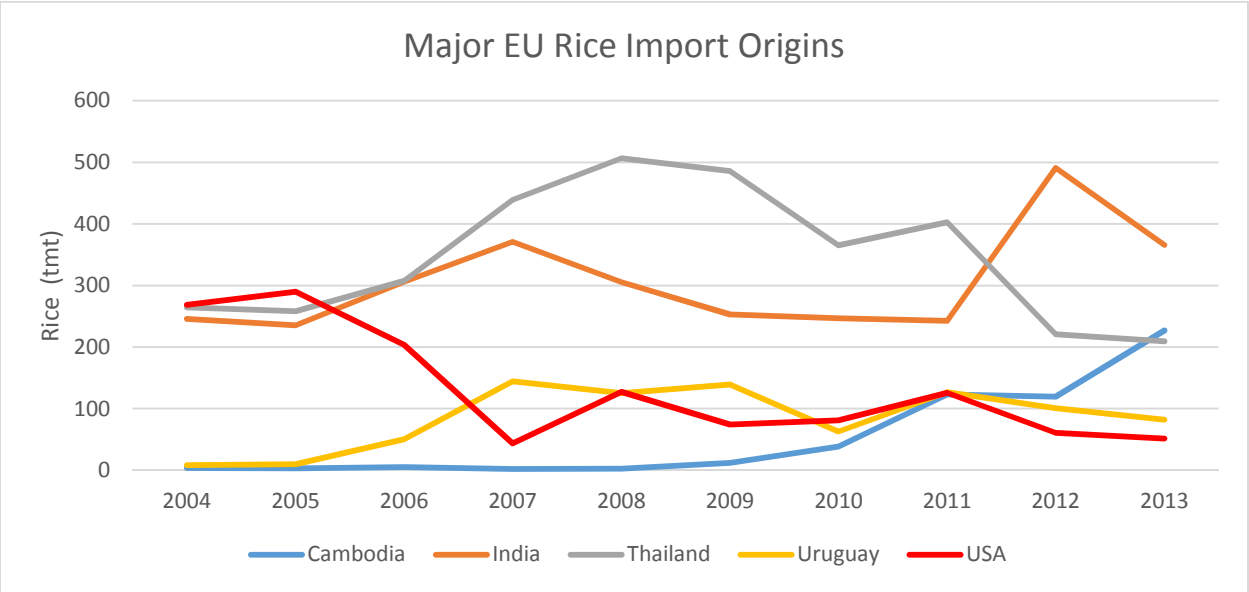
The EU has a zero tolerance policy against the presence of unauthorized genetically modified (GM) products, or accidental presence (Viju, Yeung, & Kerr, 2011). In the case that unauthorized GM products are detected, EU officials can take significant actions which include emergency measures. These measures have only been enacted three times since the European Regulation (EC) 1829/2003 was enacted, and in every instance the GM variety in question was not approved by either the EU or the country of origin. One of these instances involved a variety of GM rice known as Liberty Link rice (LL601) with an origin in the US. (Viju et al., 2011)

In 2006 trace amounts of LL601 were found in commercial rice supplies in Arkansas and Missouri. Two weeks after this initial finding, the USDA publically announced that the unapproved rice variety was found in supplies that were bound for human consumption and export. Shortly after this public notice, the EU and other countries banned all shipments of US rice unless the rice was tested, and confirmed to not contain any of the unapproved GM rice varieties. After these measures were enacted, there were no more European purchases of US long-grain rice until 2008.

While it was expected to see major price decreases in US rice exports after this incident, there was a decrease for only a few weeks. One would also expect that competitor prices would increase as the demand for their rice would increase. However, Thai prices were not significantly higher (Li, Wailes, McKenzie, & Thomsen, 2010).

The rice contamination can explain the substantial decrease in imports for a short period of time from the US. The amount of EU rice imports from the US remains relatively small. Importers in the EU claim that the extensive efforts to remove the GM traits from export supply have reduced their concerns (Cummings, 2013). Stating the only deterrent from importing US rice, is that the price is not competitive anymore (Cummings, 2013). Other exporters, especially from South America and Asia, have gained this market share.

Figure 6: Major Origins of EU Rice Imports



Source: UN Comtrade

2. Literature Review

A. Debunking Black Box Idea of Equilibrium Models

A wide variety of modeling approaches to assess trade reform are available, including computable general equilibrium (CGE), partial equilibrium (PE) and gravity models. Equilibrium models are deemed by some people in the policy and economics arena to be a "black box" in which it is difficult for non-modelers to connect the results to the data and algebraic modeling (Wing, 2004). There is thought to be a steep learning curve for people without extensive experience using these models (Böhringer, Rutherford, & Wiegard, n.d.). While there is a steep learning curve to understanding the programming of these models, if provided with the proper files, one has the opportunity to analyze the researcher's work to the smallest detail.

For more technical explanations with mathematical representations one can read the discussion paper by Böhringer, Rutherford, and Wiegard, (n.d.) or the technical note by Wing (2004).

B. Computable General Equilibrium v. Partial Equilibrium for Rice Trade

Computable general equilibrium (CGE) models provide very useful insight into the general economic effects of trade liberalization. However, they suffer from specificity problems associated with the aggregation of separate sectors that have distinctly different policies. The aggregation of products can result in assigning the same policy and values to products with very different realities. Aggregation decisions of researchers can lead to different results while studying the same trade policy change scenarios (Bureau & Salvatici, 2003). Partial equilibrium (PE) models usually take a closer look into specific sectors, while assuming separation from other economic sectors. For these reasons PE models can be capable of more accurately

portraying the subtleties within specific sectors. However, this characteristic inhibits the ability to capture the broader effects of trade policy, including changes in industries or markets related to the specific market analyzed in the PE model (Grant, Hertel, & Rutherford, 2006b).

Both frameworks have pros and cons that should be weighted before making a selection. In the case of studying the global rice market, it is important to be able to disaggregate the different product types. As noted above, both the US and the EU have different tariff regimes for different rice products by level of processing. This implies that a study of bilateral rice trade reform would benefit more by using a more disaggregated approach, because failing to disaggregate the differing tariffs would ultimately fail to capture potential impacts specific to specific segments of the rice market.

C. EU and Canada Free Trade Agreement Studies

Kitou and Phillippidis (2010) studied the potential gains from trade that would result from a Canada-EU free-trade agreement. Using the initial tariff offers from the EU and Canada, they estimated that sensitive product exceptions reduce combined real income gains for Canada the EU. Trade diversion was estimated for the US and the European Free Trade Association (EFTA). China was estimated to see small effects on trade. The researchers accounted for the likely CAP (Common Agricultural Program) reform by reducing the single farm payment by two percent per annum. They ran two scenarios, in which the first scenario simulated complete liberalization, and the second scenario examined the impacts of sensitive product exemptions. The study was also able to compute the effects of NTBs in service sectors by using an econometric study previously published by a joint effort of the European Union and Government

of Canada (European Union and Government of Canada, 2008). They employed a two percent assumption of NTB cost-saving for non-commodity goods sectors used in the same study.

In the full liberalization scenario, the EU was estimated to have larger total gains for welfare and production changes. The study noted that estimated domestic prices of some goods increased due to the pressure on input factor prices from increases in economic activity. Due to trade competitiveness, in the full liberalization scenario the researchers estimated a large output increase for Canadian wheat, and a decrease of wheat production in the EU. Canadian production in other agricultural areas was estimated to fall due to land reallocation to wheat and the downstream sectors of vegetable oils and fats. The projected values for Canada's vegetables, fruits and nuts, sector only decreased slightly in output, but the dairy industry decreased, while the EU dairy sector grew slightly. Primary agricultural production was estimated to increase in Canada and fall in the EU. Aggregate agro-industry production was projected to fall in Canada and increase by in the EU.

In the second scenario, where sensitive products remain protected, the estimated equivalent variation benefits decreased in Canada and the EU. The sensitive products in the scenario were agricultural products as well as textiles, clothing, and manufacturing. Most of the trade diversion effects for the third countries were mitigated by the protection of the sensitive products, because the third countries retained their trade advantage. Another notable part is that one of the sensitive products for the EU was wheat, and one for Canada was dairy products. Both products were major components in the welfare impact projections for the first scenario. Compared to the first scenario, under the second scenario Canadian agriculture and fishing production decreased in relation to the baseline and the aggregate land use decreased. The estimated benefits for the EU in the agricultural production sector increased compared to the first

scenario, but the EU dairy production decreased due to the simulated Canadian protection, while the Canadian dairy producers were estimated to benefit from the protection.

The researchers concluded that trade creation would exceed trade diversion in these scenarios. This conclusion was consistent with two other studies on the trade agreement. They also concluded that Canada would see larger gains considering the relative size of the EU in Canada's overall trade. They remarked that both sides of the potential agreement had good political reasons to increase market access, but there were obvious impediments, including lobbying groups for the industries – that would be negatively impacted locally – food processing regulations, ownership restrictions, and disaggregated political powers in the EU.

D. NAFTA Free Trade Agreement Study

Naanwaab and Yeboah (2012) conducted an ex-post study of the trade effects on agricultural products in the North American Free Trade Agreement (NAFTA). Since the agreement became active, trade increased between the US and the other trade partners, especially Mexico. Agricultural trade increased more than 300 percent between the US and the other partners from 1994 to 2010. The US had an overall trade deficit as well as a deficit in goods. Obviously there were other factors involved with this growth, but the NAFTA effects were generally positive (Zahniser & Roe, 2011). The US total trade with NAFTA partners increased 78% percent. It increased 141% with Mexico alone, while trade growth with the rest of the world only increased 43% from 1993 to 2002. There was higher trade growth with Mexico compared to Canada, which was likely a result of the Canada-US Trade Agreement (CUSTA). CUSTA had already been in place for five years. The products that experienced the largest increases in trade were the products that had the highest level of tariff and non-tariff barrier reductions (Zahniser &

Roe, 2011). Studies of the impact on rural employment in the US, which was an arguing point for the opponents of NAFTA, showed slightly positive or close to zero effects from NAFTA (Ojeda, Runsten, Paolis, & Kamel, 2000; USITC, 1997). Although, Mclaren & Hakobyan (2012) found that high school dropouts who became blue collar workers suffered from a lack of wage increases across industries.

The analysis of Naanwaab and Yeboah (2012) showed that the US export of corn decreased to Canada while it increased to Mexico. They also found that the depreciation or appreciation of the currencies between the countries affected levels of trade. As the Canadian dollar appreciated against the US dollar, cotton exports from the US to Canada increased. The same effect was seen when the Mexican Peso appreciated to the US dollar and poultry exports from the US to Mexico increased. Increasing per capita incomes in Mexico and Canada also led to increased exports to those countries from the US. Dairy and wheat prices in the US decreased as a result of the increased competition from Canada.

E. Single Countries Removing Barriers

Lee, et al. (2008) examined the potential impact in Taiwan from reducing tariff escalation for agricultural products in the Doha Round Negotiations. They used a general equilibrium (GE) model to assess the impacts across the entire economy. Using 3 scenarios, the group studied the impact from different levels of tariff reduction as well as different levels of the escalated tariff wedge. The escalated tariff wedge is the difference in the tariffs for raw and processed products. The study estimated that larger reductions in tariffs would have a larger impact on the macro economy. While all the scenarios estimated positive impacts for total welfare, the employment and production in the domestic agricultural industries actually decreased. Also, the scenario that

measured the decrease in the tariff wedge showed a larger negative impact on the agricultural industries.

Obi-Egbedi, Okoruwa, Yusuf and Kemisola (2013) performed a study to analyze the economic impacts of a large increase in tariffs versus a small decrease in tariffs in Nigeria. In the protectionist policy simulation, they simulated an 80% rice import tariff increase. In the liberalized policy they simulated a five percent decrease in the rice import tariff. Using a CGE model, the study aggregated data by the rice sector, other agriculture, oil and mining, manufacturing and services, urban north households, urban south households, rural north households, and rural south households. The study projected that even though the protectionist policy would increase welfare for rural households, the overall net welfare for the country would decrease. This welfare measurement included negative impacts on the oil, mining, manufacturing and service sectors. Negative effects were also estimated for government funds, GDP, and wage rates under the protectionist policy. The liberalized policy projected a larger increase in rice production as well as an increased wage rate compared to the protectionist policy.

F. Rice Trade Specific Liberalization

Mane and Wailes (2006) studied the different proposals that were offered for the Doha Round, and applied them for ex-ante analysis of trade liberalization scenarios for the major rice importing and exporting countries. They used the econometric Arkansas Global Rice Model. Two of the four proposals studied by Mane and Wailes are the US proposal and the EU proposal. As those are the two most relevant for this thesis, we only looked at the results for those scenarios. World prices in long grain rice increased in both scenarios. However, much of the increase came from reductions in import tariffs from countries that would be outside of the TTIP

agreement. The price for US No.2 Medium Grain (MG) rice (fob) in California, which was the world reference price for medium grain, was estimated to increase greatly. However, it was again largely due to policy changes in countries outside of the TTIP negotiations, notably northeast Asia including Japan, South Korea and Taiwan.

Exports from long grain producing countries increased in all of the scenarios, except for the US and the EU. Decreases in support caused decreases in production for the US and EU. The medium grain export markets grew for the US and EU under the US proposal as TRQs were expanded for importing countries like Japan. However, in the EU model, medium grain exports for the US and EU were estimated to decrease. While this paper was somewhat irrelevant in this study due to the multilateral nature versus bilateral, its focus on rice trade liberalization had implications for results that may be anticipated in this study.

Fuller, Fellin, and Salin (2003) performed an ex-ante study to project the impact of the liberalization of rice trade between the US and Mexico in the context of the NAFTA agreement. Before the liberalization, the tariff was relatively low for rough rice at ten percent, but there was a tariff escalation wedge with milled rice having a twenty percent tariff. The study was to be used as a tool for US millers to decide upon the opportunity for creating relationships with rice packers in Mexico. This was relative information because Mexican millers would become less competitive. In the NAFTA agreement, rice tariffs were to be phased out by straight line decreases. The rough rice tariff decreased by one percent per year and milled rice tariff by two percent per year. Both tariffs would reach zero in 10 years, or by 2003.

The study projected that US producers had the largest welfare gains followed by the welfare gains of Mexican consumers. The US consumers and Mexican producers were projected to experience welfare losses. The projected total net welfare gain was substantial at $20 million

when compared with a total redistribution of $78 million in welfare. From 1997 to 2003 US rice exports to Mexico were projected to increase. Production and prices in the US were estimated to increase, while production and prices in Mexico estimated to decrease. Another important factor was the replacement of rough rice exports from the US with milled rice exports as a result of the reduction of the tariff escalation wedge for milled rice. The study also noted the importance of breaking apart the different levels of processing in which rice can be traded. The authors concluded that focusing on only one historically significant product, in this case rough rice, would give an inaccurate or incomplete result. Making it better to disaggregate and study the different rice products.

G. EU and Mercosur Ex-Ante FTA Research

Drogue and Ramos (2005) studied the ex-ante effects of the EU agricultural proposal for the EU and MERCOSUR[4] free trade agreement (FTA) using the most recent EU proposal available during the study. The study modified the General Trade Analysis Project (GTAP) CGE model to include TRQs. They used seven regions and 14 sector aggregates in which all were agricultural except two that represented the manufacturing and services sectors. They faced a problem in modeling, in that there was not a specific quota already in place for MERCOSUR. To alleviate this problem they created "pseudo initial bilateral TRQs," which created tariff rates slightly above a value of one. The results were surprising as the projected net global welfare decreased by $5 million. The estimation showed the EU as the loser and MERCOSUR the winner by way of receiving one-hundred percent of the rent transfer. Also noted in the estimation

[4] This model defines Mercosur as a free trade area between Argentina, Brazil, Uruguay, and Paraguay.

was a competition for factors leading to large increases in meat production, in turn, creating losses in the services and manufacturing sectors.

Weissleder, Adenauer, and Heckelei (2008) studied the potential effects of the bilateral trade agreement between the EU-25 and MERCOSUR[5] using the Common Agriculture Policy Regional Impact (CAPRI) model. The CAPRI model is a partial comparative static equilibrium model known for its detailed accuracy of the EU markets. The study was designed to examine three scenarios of (1) unilateral partial liberalization for MERCOSUR products into the EU, (2) combining scenario one with the G20 proposal for multilateral liberalization, most importantly retaining some protection for sensitive products, and (3) full liberalization between the two regions. Also, the study examined the impact of using alternative elasticity values in the equilibrium model, in order to judge the accuracy and sensitivity of the quantitative assessment.

The model accounted for many TRQs globally, with all of the important policies of the EU represented. The study used supply and demand elasticity values estimated by Cap, Brescia, & Lema (2006) as prior information in a constrained Bayesian framework (Weissleder et al., 2008) in order calibrate the elasticity values for behavioral functions in the model. There were also two baselines for MERCOSUR production. Production developments in the MERCOSUR countries can be dynamic and difficult to forecast. Therefore, one of the baselines was based on current production trends, while the other baseline assumed a dynamic development. The projections for both baselines were from Cap, Brescia, & Lema, (2006)

In scenario 1 the estimated increase in exports from MERCOSUR into the EU were large and came from increased production in MERCOSUR. In scenario 2 with the addition of the G20

[5] This model includes Venezuela in the free trade area. With Bolivia and Chile as associated members.

proposal, “preferential erosion” came into play and lessened the estimated gains for MERCOSUR. The G20 proposal simulation increased access for other countries into the EU, therefore decreasing the overall trade advantage for MERCOSUR. In scenario 3, large changes of trade patterns from MERCOSUR to the EU took place. These changes are generally a redirection of MERCOSUR exports, originally going to third countries, projected to go to the EU. The changes in trade were greatly related to the production baseline used. The results supported the idea that production levels will be more crucial for accurate estimations than the level of liberalization. Finally, the sensitivity analysis of the Armington elasticity value shows the selection of elasticity values pivotal to the projected results.

Burrell et al. (2011) conducted a study using the CAPRI model and the GLOBE model, a CGE model calibrated from GTAP data, for an ex-ante study of the MERCOSUR[6] and EU free trade agreement. By using both of the models, they could analyze not only the full economic impact, but also a more detailed breakdown of the different agricultural commodities and regional applications within the EU. In each model the researchers created a reference scenario, a Doha round scenario in the reference year, a European offer scenario, a MERCOSUR request scenario, then each of the European and Mercosur scenarios combined with the Doha round implications.

The results from all the simulations showed that, in general, the EU agricultural producers would have large decreases in economic welfare, and the Mercosur agricultural producers would have large gains in welfare. By using the GLOBE CGE model, the researchers projected larger increases in the manufacturing sector than the agricultural losses. Which would

[6] This model defines MERCOSUR as including members Argentina, Brazil, Paraguay and Uruguay.

create a net increase in the EU GDP. Manufacturing in non-agrifood sectors of Mercosur was projected to experience losses. In the EU, agricultural workers were estimated to have larger losses per capita than the gains per capita for workers in the manufacturing sector. Distribution changes for different stakeholders in the model were reliant upon the assumption that the trading companies passed on the benefits to primary producers and consumers. There were also assumptions of who would capture the newly available rents from TRQ changes.

H. Studies on TTIP

Rickard, Gergaud and Hu (2014) simulated the ex-ante impact on wine markets in the US and EU with the removal of tariffs and regulations in the framework of the TTIP. The model simulated bilateral trade, but included three regions because they split the US into eastern and western regions to account for different regulations on distribution. The researchers observed that in the eastern US wine could not be sold in supermarkets, thereby decreasing demand. Also, the domestic policy examined in this paper for the EU was a reduction in the production support. The model analyzed four products which were EU bottled wine, EU bulk wine, US bottled wine, and US bulk wine. The bulk wine was also described as low quality wine, and the bottle wine as high quality wine. This disaggregation has reason because bulk wine and bottled wine have different tariff levels. The simulation was designed to examine the effects of domestic regulations for all regions as well as the impact of tariff reductions.

The researchers found that the tariff reductions were the most influential factor impacting the wine market changes. However, the solutions were preliminary and dependent on the model parameter. Therefore, the authors chose to only highlight the direction of changes in prices, trade and welfare effects. When reducing tariffs on both sides by 50%, total demand increased for US

low quality wine and EU high quality wine, while decreasing for US high quality wine and EU low quality wine. Therefore, the model estimated that US bulk producers and EU bottled producers would have increased welfare, while the EU bulk producers and US bottled producers would have decreased welfare. Consumer and total surplus was estimated to increase in the EU and US.

Francois et al. (2013) studied the potential impacts of removing tariffs and NTBs in the context of the TTIP. They estimated an agreement for tariffs and NTBs to create a GDP increase of €68.2-119.2 billion for the EU and €49.5-94.9 billion for the US. The estimated impact on GDP when removing tariffs alone is a €23.7 billion increase for the EU and €9.4 billion increase for the US. This showed a large amount of impact coming from the reduction of NTBs.

I. Contribution of this study

This study will contribute to the existing literature with a detailed analysis of the impacts to the global rice market in the context of trade liberalization of rice between the US and the EU. In the literature discussed above there are studies of multilateral liberalization of rice trade, rice trade in NAFTA, EU and MERCOSUR agricultural trade, a general equilibrium analysis of the TTIP, and a partial equilibrium study on wine in the TTIP. As, rice is important to specific regions in the US and the EU, this empirical analysis of the impact of the TTIP on rice will provide a decision making tool for participants in the rice market in both regions.

3. Method of Analysis and Data

A. International Trade Theory

The hypotheses for this study are based on theory presented in Koo & Kennedy (2005) showing the impact of a tariff removal on an agricultural commodity market. While this framework has some different assumptions than the RICEFLOW model used in this study, it is a useful tool for visual representation. The framework in Koo & Kennedy (2005) assumes homogenous goods and the law of one price. RICEFLOW does not assume either of these. In this case, the EU is an importing country and the US is an exporting country (Figure 7). The framework does not incorporate transaction costs in order to simplify the figure, however the RICEFLOW model does incorporate these costs.

Autarky for a country's domestic market is defined as the price of a good when there is not any trade. Considering the difference of comparative advantages in different countries, trade allows for gaining higher social utility by increasing consumption and production. Countries with autarky prices lower than other countries can become exporters, and countries with autarky prices above other countries can become importers. The freer trade that is allowed, the more the different market prices will converge. Therefore, increasing production for countries that can become exporters, and increasing consumption for countries that can be come importers.

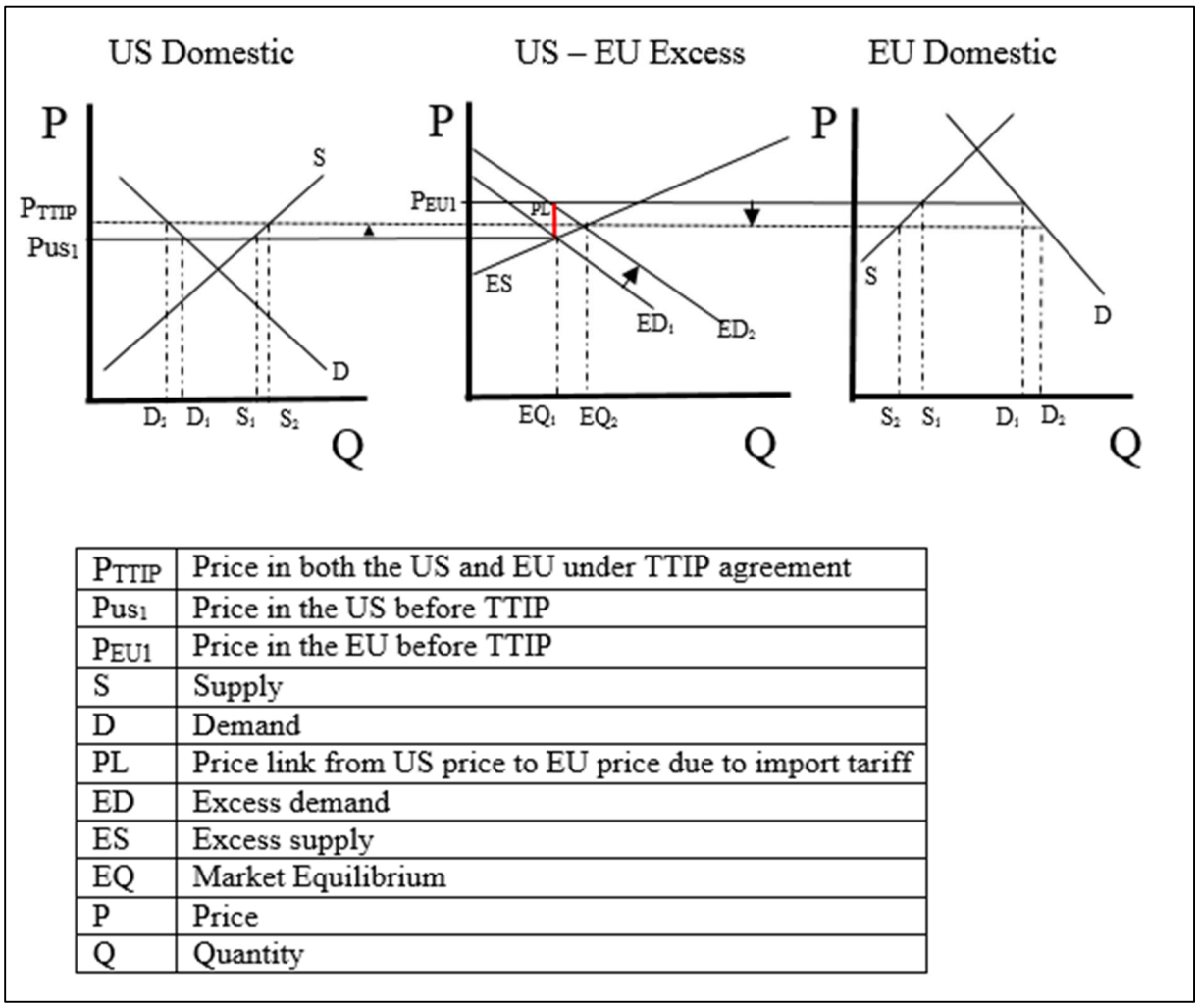
The status quo of the US market is a price above the autarky price. This makes the US an exporting country with excess supply, where domestic supply is greater than domestic demand. The status-quo of EU market is that the domestic price is below the autarky price. Making the EU an importing country with excess demand, where the domestic supply is lower than the domestic demand. However, the EU has import tariffs which protect the rice producing industry. The import tariffs are represented by the red line in the figure below labeled price link (PL). It

increases prices in the domestic market, making supply greater and demand lower than it would be with free trade.

By simulating TTIP, the price link will be removed. This will lower rice prices in the EU domestic market, causing domestic supply to decrease and domestic demand to increase. These changes caused by the EU domestic price change will cause a shift outwards in the excess demand curve. The shift outwards of the excess demand curve will cause an increase of price for the US market, causing an increase in supply and a decrease in demand. Therefore in the end, the EU price will decrease to meet the US price that increases.

An agreement in the TTIP will also impact third countries, however most of the impacts will be marginal. As the price increases in the US, US rice will become less competitive in the markets where it currently exports. The countries that are importers from the US will see an increase in the price of imports from the US. The price of composite imports will be affected depending on the import share coming from the US. Then the increase in composite import prices will trigger substitution for domestically-produced rice according to the Armington elasticity. Exporters to the EU will lose market share in the EU. Depending on how large that market share loss impacts the overall domestic market, the domestic price of those exporters could decrease, or the new world import demand could cause an increase in price and production.

Figure 7: International Agricultural Trade Theory on Tariff Removal



P_{TTIP}	Price in both the US and EU under TTIP agreement
Pus_1	Price in the US before TTIP
P_{EU1}	Price in the EU before TTIP
S	Supply
D	Demand
PL	Price link from US price to EU price due to import tariff
ED	Excess demand
ES	Excess supply
EQ	Market Equilibrium
P	Price
Q	Quantity

B. RICEFLOW Model

The RICEFLOW model is a multi-region, multi-product, spatial partial equilibrium model framework of the world rice market. The model is written in linearized form using the software GEMPACK®.

The RICEFLOW model, which is used for this study, specifies the behavioral equations that are relevant according to neoclassical, marginal economic theory, instead of using optimization of transaction costs. The model maximizes utility for consumers and revenue for producers by solving a system of conditions.

Production is specified as a two stage process in RICEFLOW. The two stages of production is basically used decrease the amount of parameter values that are necessary to provide, by not allowing substitution between primary and intermediate inputs. Therefore the elasticity of substitution at the second stage of production, where factors of production and inputs are combined, is equal to zero. In the first stage, the producer selects the optimal combination for factors of production, as well as the optimal combination of intermediate inputs. The behavior for both of these decisions is represented by their respective elasticity values of substitution.

The model simply calibrates the equations to the data from a specific year or baseline market outcome from a detailed database. The consequence of the calibration method is that if a trade flow does not exist in the baseline data used for the simulation, the model will not create trade in the simulation. However, bilateral trade can expand and contract along with the other factors in the market. Just as trade flows cannot be created when it does not exist in the base data, production and consumption of products cannot be created either. They can only expand and contract. This characteristic is a main limitation of the framework.

Final consumption of rice is allowed only for milled rice. Demand for final consumption is represented by an isoelastic demand function accounting for own and cross price effects, income effects, and population growth.

All markets are cleared using changes in price to make supply equal demand in each market. The markets include, final product, input markets, composite markets, etc.

This model assumes heterogeneity aside from the 9 products in the model. Rice from different regions is considered to be different products based on the Armington model (Armington, 1969). The elasticity that accounts for the consumption preference of domestic products over imported is called the Armington model (Armington, 1969). The Armington model is specified through two elasticity values. One value for substitution between domestic and imported products, the higher tier, and another value for substitution between imported products from different sources, the lower tier. The higher the value, the more substitutability exists between the products.

A final point of the model that is important for interpretation of the outcome is the constraint of the zero profit condition for primary and composite production. The zero profit condition normal profits. Therefore, all representations of price and revenue are equal to the cost for the producers.

C. RICEFLOW Data

The fact that the model is spatial means that it differentiates trade flows bilaterally into separate geographical entities. The model has 73 regions with 66 countries specified. The EU countries are aggregated, and countries that are not specified are aggregated into their respective

geographical regions. The regions are specified in **Error! Reference source not found.** on the following page.

The model disaggregates rice by variety and level of processing. The varieties represented are long grain (LG), medium/short grain (MG), and fragrant rice (FR). The levels of processing are paddy (P), brown (husked) (B), and white (milled) (W). This disaggregation provides for 9 different products. The disaggregation of rice products is important in modeling the rice market because the tariffs are different for the different products. As we described earlier, the EU has tariff escalation for higher levels of processing in rice products. When these different products are aggregated into a single product, the results become inaccurate and unrepresentative of the market.

The production data come primarily from the USDA Production, Supply, and Demand database (PS&D) and FAO. For some countries, extra consultations and estimations are needed to convert USDA and FAO production data to calendar year basis. Neither PS&D nor FAO data are disaggregated by rice type. The disaggregation process required data from external sources including USDA Global Agricultural Information Network (GAIN) reports, national statistics from relevant countries, and personal communication with a network of collaborators.

Table 4: Regions included in RICEFLOW 2013 database

Argentina	Cuba	Indonesia	Paraguay	Togo
Australia	Ecuador	Iran	Peru	Turkey
Bangladesh	Egypt	Iraq	Philippines	UAE
Benin	El Salvador	Japan	Russia	Uruguay
Bolivia	EU	Laos	Saudi Arabia	USA
Brazil	Gambia	Liberia	Senegal	Venezuela
Burkina Faso	Ghana	Malaysia	Singapore	Vietnam
Cambodia	Guatemala	Mali	Sierra Leone	Africa
Cameroon	Guinea	Mexico	South Korea	Asia
Canada	Guinea Bissau	Myanmar	South Africa	Caribbean
Chile	Guyana	Nicaragua	Sri Lanka	Europe
China	Haiti	Niger	Suriname	Middle East
Colombia	Honduras	Nigeria	Taiwan	Oceania
Costa Rica	Hong Kong	Pakistan	Tanzania	
Côte D'Ivoire	India	Panama	Thailand	

Notes: List of the countries included in the region aggregates

EU: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherland, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom

Africa: Algeria, Angola, Botswana, Burundi, Cape Verde, Central African Republic, Chad, Comoros, Congo, Congo D. Republic, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Kenya, Libya, Madagascar, Malawi, Mauritania, Mauritius, Mayotte, Morocco, Mozambique, Namibia, Reunion, Rwanda, Sao Tome, Somalia, Sudan, Swaziland, Uganda, Western Sahara, Zambia, Zimbabwe

Asia: Afghanistan, Azerbaijan, Bhutan, Brunei, Kazakhstan, DPR Korea, Kyrgyzstan, Maldives, Mongolia, Nepal, Seychelles, Tajikistan, Turkmenistan, Uzbekistan

Caribbean: Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Cayman Islands, Dominica, Dominican Republic, French Polynesia, Grenada, Guadeloupe, Jamaica, Martinique, Netherlands Antilles, Puerto Rico, St. Lucia, St. Kitts Nevis, St. Vincent, Trinidad and Tobago, Turks and Caicos Islands, Virgin Islands US

Europe: Albania, Andorra, Armenia, Belarus, Bosnia Herzegovina, Croatia, Georgia, Gibraltar, Iceland, Kosovo, Moldova, Norway, Romania, Serbia, Switzerland, Ukraine,

Middle East: Bahrain, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, State of Palestine, Syria, Yemen

Oceania: East Timor, Fiji Islands, Guam, Marshall Islands, Micronesia, New Caledonia, New Zealand, Northern Mariana Islands, Palau, Papua, Samoa, Tahiti, Timor-Leste, US Minor Outlying Islands, Vanuatu

Trade data comes primarily from exporter's custom records and COMTRADE. The information provided by exporters is cross checked with that from importers to the extent allowed by data availability. The approach of focusing on trade data from exporters has the main advantage of allowing more frequent updates, since only 5 exporters account for over 80% of global rice trade. On the downside, this approach implicitly assumes that reporting from exporters is reliable.

The export data from exporting country databases usually include the free on board (f.o.b.) price. However, the cif (cost of insurance and freight) prices needed to be calculated. In order to calculate the cif price, data needed to be obtained about transportation costs. This data were found on the website www.worldfreightrates.com and combined with knowledge from industry contacts.

i. Elasticity Values

Elasticities represent the behavior of producers and consumers. As mentioned earlier, exogenously set elasticity values are also one of the characteristics typically criticized about equilibrium models. Therefore in this section we will discuss the elasticity values and the reasoning behind them.

For factors of production, the elasticity values of substitution are zero for paddy production and one for brown and white production. These elasticity values are used because land is absolutely essential for paddy production, and labor and capital cannot replace land. However, in the processing steps, labor and capital are assumed to be unitarily elastic. Unitary elasticity means that an increase of one unit in the ratio of capital price to labor price will lead to

an increase of one unit in the labor to capital use ratio (Tipper, 2011). This specifies that labor and capital are easily substituted for each other in the processing steps.

The elasticity of substitution for intermediate inputs is assumed unitary across all rice products and regions. The intermediate inputs are fertilizer, pesticide, energy, water, seed, paddy rice, and brown rice (the last two represent the largest input cost for the milling activities). Land supply was assumed to be very inelastic in most regions with values varying from 0.01 to 0.25.

The aspect of land being the binding factor is also represented in the supply elasticity values. All of the supply elasticity values of intermediate inputs are perfectly elastic for all products and regions. Labor and capital supplies are also perfectly elastic for all products and regions. The inelasticity of land supply shows that the supply of land changes slowly in respect to changes in the market (Appendix Table 1).

The elasticity of transformation for factors of production controls the amount that factors of production change with respective changes in price. Land again is sluggish as the elasticity of transformation in only unitary (-1) for most regions. However, important for this study is an elasticity of land transformation at negative five in the EU (Appendix Table 1). The elasticity of transformation for labor and capital are near perfect (-1000).

Calculating exact Armington elasticity values has proven to be very difficult according to the literature (Mcdaniel & Balistreri, 2002). Under different circumstances, accurate Armington elasticity values range mostly between one and ten. In this study we used a value for the Armington elasticity higher tier in the middle of this range with a value of five. The Armington elasticity value of the lower tier is usually twice the value of the upper tier (Mcdaniel & Balistreri, 2002), so we used a value of ten to differentiate between import sources .

The demand price elasticity values and income elasticity values are primarily from the Arkansas Global Rice Model (AGRM) as repeated by Food and Agricultural Policy Research Institute.

D. Scenarios

Two dynamic scenarios are generated for analysis of removing rice import tariffs between the US and EU. Each scenario will project rice market values from 2014 to 2027.

The benchmark scenario simulates impacts of the projected changes in exogenous variables. All of the regions in the benchmark model will have exogenously specified shocks to population and consumer expenditures from 2014 to 2027. Also, regions with data available from the AGRM model will have shocks specified for changes in yield and stocks from 2014 to 2024. From 2025 to 2027 the stocks are held constant and yields change at the same rate as 2024. The shock for these variables is set exogenously and all other exogenous variables are held constant. The shock values for population and consumer expenditures are from data obtained from IHS Global Insight Inc[7]. The original data are projections of population and real GDP growth figures. We use the GDP growth figures as a representative of the change in consumer expenditures, because accurate consumer expenditure values are difficult to obtain.

The impact scenario builds upon the benchmark by adding the removal of all import tariffs for rice trade between the US and the EU. Tariff elimination is assumed to linear and over 10 years starting in 2017. We also assume in this study that all existing preferences granted by

[7] The data is from the October 2014 updated forecasts by the private company IHS Global Insight.

the EU (as discussed in Overview of Current Barriers above) are to be honored despite the implementation of TTIP.

4. Results

A. Impacts to the US Market

i. US Production

Table 5: Projected US Production in 2027

Projected U.S. Production in 2027								
	Volume (1000MT milled equivalent)				Value at Market Price ($1000)			
Product	Benchmark	Scenario	Percent Difference	Nominal Change	Benchmark	Scenario	Percent Difference	Nominal Difference
LGP	5,125	5,252	2%	127	2,331,308	2,430,347	4%	99,038
MGP	2,386	2,419	1%	33	1,218,541	1,257,293	3%	38,753
FRP	0	0	0%	0	0	0	0%	0
LGB	3,723	3,906	5%	183	1,718,622	1,834,302	7%	115,681
MGB	2,386	2,419	1%	33	1,234,494	1,273,756	3%	39,261
FRB	0	0	0%	0	0	0	0%	0
LGW	3,634	3,819	5%	186	1,766,679	1,888,990	7%	122,310
MGW	2,167	2,215	2%	47	1,172,756	1,219,565	4%	46,809
FRW	5	5	0%	0	7,360	7,365	0%	5

The results of this simulation suggest that rice trade liberalization between the US and the EU will have an important impact on the US long grain rice industry (Table 5). Long grain paddy production is estimated to increase by 127 thousand metric tons (tmt) or 2% in 2027 as a result of TTIP. This is encouraged by increases in aggregate demand that pushes market prices for long grain higher by 1.7% in the scenario. The market value of long grain paddy output is estimated to be greater in the scenario by roughly USD 99 million or 4%.

The volume of milled long grain rice output in the US is also estimated to be greater in the scenario by approximately 186 tmt or 5%. Making the value of the US milling output greater by USD 122 million in 2027 and helping sustain the investments in the US milling sector.

The differences between the 2027 estimations of long grain production vary by degree of processing, with the larger difference for products that are further processed. In a milled basis, the output is similarly greater in the scenario for long grain brown (LGB) and long grain white (LGW) at about 183 and 186 tmt respectively. While paddy production is only about 127 tmt greater in the scenario on a milled basis. On a percentage basis, LGB and LGW production is about 5% greater, while LGP production is only 2% greater.

Rice trade liberalization between the US and the EU is expected to have smaller but still notable impacts on the US medium grain sector (Table 5). Medium grain paddy (MGP) and brown (MGB) production are expected to be greater in the scenario by 1% in 2027. Medium grain white (MGW) production in the scenario is expected to be greater by 2% in 2027.

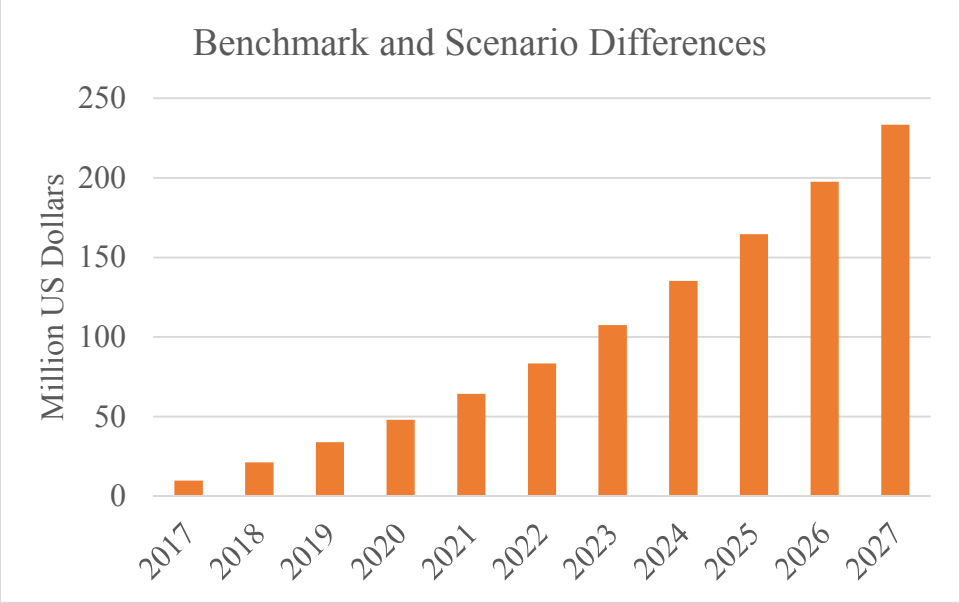
Production values for MGP and MGW are estimated to be greater in the scenario by USD 39 million and USD 46 million respectively in 2027. These production value increases are also driven by an increase in market value of 1.7%.

The decreased price of US rice in the EU market, causes an increase in demand for US rice. This in turn increases the price of US rice which causes an increase of production. Also, in this study, it is assumed the price elasticity for land in Europe is lower than most regions, because according to historical figures it is not likely the rice area will increase greatly. Finally, it is assumed that EU imports from Egypt will hold constant at the 2015 TRQ level in current EU policy.

Remembering that these values are projections in to the future, it is useful to look at the net present value (NPV) of the projected differences in production. The impact of trade reform from 2017 to 2027 generate differences in the projected production values year to year. Therefore, it is worth looking at the future stream in the difference of production value, as well

as the accumulated NPV of the years combined. This analysis uses a five percent discount rate and utilizes 2013 as the base year.

Figure 8: NPV of Projection Difference for Production Value in the US



The difference between the NPV of the projected production value of the scenario and the benchmark increases as tariffs are reduced in a straight line through the implementation of the policy beginning in 2017. The accumulated NPV from the implementation of trade liberalization evaluated in this study is equal to USD 1.1 billion in 2013 USD.

ii. US Consumption

Table 6: Projected US Consumption in 2027

	US Volume of Final Consumption (1000MTs)				US Value of Final Consumption ($1000s)			
Product	Benchmark	Scenario	Percent Difference	Nominal Difference	Benchmark	Scenario	Percent Difference	Nominal Difference
LGW	2,553	2,553	-0.01%	-0.27	5,187,450	5,265,324	1.5%	77,874
MGW	1,282	1,282	-0.01%	-0.17	693,750	705,841	1.7%	12,091
FRW	594	594	0.01%	0.05	833,158	833,354	0.0%	196

The volume of final US consumption of LGW and MGW is estimated to be marginally lower in 2027 as a result of TTIP. FRW consumption is estimated to be marginally greater in the scenario in 2027 as some consumers substitute it for LGW and MGW. Consumer prices for long grain and medium grain rice increase by 1.5% and 1.7% respectively, leading to increases in the value of final consumption of USD 90 million for all rice products.

iii. US Imports

Table 7: Projected US Imports in 2027

	US Total Imports (1000MT)				US Imports From EU (1000MT)			
Product	Benchmark	Scenario	Percent Difference	Nominal Difference	Benchmark	Scenario	Percent Difference	Nominal Difference
LGP	0	0	0%	0	0	0	0%	0
MGP	0	0	0%	0	0	0	0%	0
FRP	0	0	0%	0	0	0	0%	0
LGB	15	17.1	14%	2.2	0	0	0%	0
MGB	0	0	0%	0	0	0	0%	0
FRB	6.0	6.0	0%	0	0	0	0%	0
LGW	137	151	10%	13.7	10.3	17.1	67%	6.9
MGW	0.3	0.4	38%	0.1	0.3	0.4	41%	0.1
FRW	588	588	0%	0	0	0	0%	0
Total Milled Equivalent			2%	15.7	Total Milled Equivalent		66%	7.0
LG Milled Equivalent			10%	15.7	LG Milled Equivalent		67%	6.9

The estimated volume of total milled equivalent rice imported into the US in 2027 is 2% greater in the scenario than in the benchmark. This number is slightly misrepresentative of the difference because it includes FRW imports, which are estimated in the scenario to be unchanged from the benchmark. The estimated LG milled equivalent of US imports are greater in the scenario by 10% or 15.7 tmt. The volume of US imports for LGW is estimated to be 10% or 13.7 tmt greater in the scenario in 2027. In particular, about one-half of the increase in US LGW

imports (6.9 tmt) comes from the EU. Imports of long grain from other countries such as India, Thailand and Vietnam also increase as a result of the scenario.

The EU is projected to be the only exporter of MGW to the US in both the benchmark and the scenario in 2027. This could be an over estimation as the original data from 2013 is from a drought year in Egypt, in which the production and exports from Egypt were low. For this reason, as demand pressure increases for Egypt in the model, the only regions that Egypt maintain notable exports to are the EU and Africa. The exports to the EU are held exogenous at the 2015 TRQ level as mentioned above.

iv. US Exports

Table 8: Projected US Exports in 2027

	US Total Exports (1000MT)				US Exports to EU (1000MT)			
Product	Benchmark	Scenario	Percent Difference	Nominal Difference	Benchmark	Scenario	Percent Difference	Nominal Difference
LGP	1975	1896	-4%	-79	0	0	0%	0
MGP	0	0	0%	0	0	0	0%	0
FRP	0	0	0%	0	0	0	0%	0
LGB	62	60	-4%	-2	4	4	0%	0
MGB	211	195	-8%	-17	1	1	0%	0
FRB	0	0	0%	0	0	0	0%	0
LGW	1246	1456	17%	210	18	320	1730%	303
MGW	885	933	5%	48	21	94	342%	72
FRW	0	0	0%	0	0	0	0%	0
Total Milled Equivalent			4.9%	185	Total Milled Equivalent		970%	375

As expected there is a large difference in estimated US exports as a result of the TTIP policy. Total US rice exports in 2027 in milled equivalent volume are estimated to be greater in the scenario by 4.9% or 185 tmt. The increased volume comes from a large expansion in LGW and MGW rice exports, while paddy and brown exports decreased. Total US LGW export

estimates in 2027 are 17% or 210 tmt greater in the scenario. Total MGW export estimates in 2027 are 5% or 48 tmt greater in the scenario.

The larger US export volumes estimated in the scenario are driven by increased exports to the EU, as expected. US LGW exports to the EU in 2027 are estimated to be higher by 1,730% or 303 tmt in the scenario and MGW exports to the EU are estimated to be 342% or 72 tmt greater in the scenario. However, the MGW exports to the EU could be over-estimated due to the simplification in modeling the Egyptian market that was mentioned in the US imports section.

Total US exports of LGW in 2027 are estimated to be greater by 210 tmt in the scenario. However, US exports of LGW to the EU are estimated to be greater by 303 tmt. Meaning that benchmark bilateral trade flows of rice to other countries decrease. The impact on US exports of LGW to third countries is given in

Table 9 and discussed below. The same situation of changing export flows to expand US MGW also occurred with US MGW. The estimated exports are 48 tmt greater in the scenario total MGW exports, but US MGW exports increased by 72 tmt. Meaning there are 24 tmt of US MGW exports not going to their previous other destinations. This impact on benchmark flows is presented in Table 11Table 10 and discussed below.

Table 9: Projected US LGW Export Destinations in 2027

LGW US Export Destinations (1000MT)				
Region	Benchmark	Scenario	Percent Difference	Nominal Difference
EU	18	320	1730%	303.0
Haiti	396	374	-5%	-21.7
Canada	156	151	-3%	-5.0
Mexico	150	142	-6%	-8.8
Iran	100	89	-11%	-11.5
Saudi Arabia	85	75	-11%	-9.6
Ghana	79	69	-12%	-9.7
Colombia	49	46	-7%	-3.3
Caribean	40	35	-12%	-4.8
Iraq	36	31	-14%	-4.9
Pakistan	27	25	-7%	-2.0
Panama	23	20	-12%	-2.7
Honduras	17	16	-3%	-0.5
Costa Rica	12	10	-12%	-1.4
Other	58	52	-11%	-6.7
Total (No EU)	1228	1135	-8%	-92.6
Total	1246	1456	17%	210.4

Other: Liberia, Guatemala, Middle East, Benin, Philippines, Africa, El Salvador, Guinea, Mali, Sri Lanka, Oceania, Nicaragua, Japan, UAE, India, Cameroon, Australia, Cambodia, Peru, Laos, South Africa, Malaysia, Tanzania, Hong Kong, Europe, Nigeria, Singapore, Chile, Indonesia, South Korea, Egypt, Suriname, Vietnam, Venezuela, Thailand, Asia, Russia, Taiwan

The table above includes all trade partners that imported at least 10 tmt of US LGW in 2013 as well as a category for other regions which imported less than 10 tmt. The largest estimated decrease in trade flows is to Haiti, a decrease of 21.7 tmt. This list of trade partners shows where the rice is diverted from in order to expand exports of US LGW to the EU.

Much of the estimated increase of LGW exports comes from an estimated decrease in LGP exports. Exports for LGP in 2027 are 79 tmt or 4% lower in the scenario. Destinations that

would be impacted by this estimated change in bilateral trade flows are reported in Table 10 and discussed below.

Table 10: Projected US LGP Export Destinations in 2027

LGP US Export Destinations (1000MT)				
Region	Benchmark	Scenario	Percent Difference	Nominal Difference
Venezuela	331	301	-9.0%	-29.8
Mexico	944	929	-1.6%	-15.3
Turkey	102	92	-9.8%	-10.0
Costa Rica	100	92	-8.2%	-8.2
Africa	98	91	-7.2%	-7.0
Guatemala	98	94	-3.3%	-3.3
Panama	27	26	-5.6%	-1.5
Honduras	164	162	-0.8%	-1.3
Nicaragua	10	8	-14.1%	-1.3
El Salvador	97	96	-1.1%	-1.1
Colombia	4	4	-5.4%	-0.2
Other	1.8	1.7	-9%	-0.2

Other: United Arab Emirates, Canada, Brazil, Caribbean, EU, Haiti, Oceania, Australia, Middle East

The largest nominal decreases of US LGP imports are in Venezuela, Mexico, and Turkey. However, the largest percentage decreases are Nicaragua, Turkey and Venezuela. The impact that TTIP rice trade liberalization has on the importing countries is a result of higher border prices. When the export price changes for the U.S., the import markets with lower demand or more negative price demand elasticity values, decrease the most. Another factor that impacts the demand for these import levels is the amount of domestic production in comparison to the amount of imports. If a country has the ability to increase production due to the increased price, then their imports are reduced further than a country that must import to meet domestic demand.

Table 11: Projected US MGW Export Destinations in 2027

MGW US Export Destinations (1000MT)				
Region	Benchmark	Scenario	Percent Difference	Nominal Difference
EU	21	94	341.7%	72.5
Middle East	211	210	-0.5%	-1.0
South Korea	54	48	-12.2%	-6.7
Africa	28	25	-9.7%	-2.7
Turkey	27	21	-20.3%	-5.4
Hong Kong	18	16	-9.5%	-1.7
Australia	15	14	-8.5%	-1.3
Taiwan	10	9	-9.7%	-0.9
Russia	8	6	-15.6%	-1.2
Europe	7	5	-32.8%	-2.4
Other	222	221	-0.5%	-1.1
Total (No EU)	600	576	-4%	-24.4
Total	621	669	8%	48.0

Other: Chile, Saudi Arabia, Canada, Oceania, United Arab Emirates, Cote d'Ivoire, Pakistan, Asia, Singapore, Brazil, Mexico, Thailand, Tanzania, Malaysia, Indonesia, Liberia, South Africa, China, Benin, Colombia, Ghana, Senegal, Haiti, Cameroon, Cambodia, Caribbean, Costa Rica, India, Nicaragua, Peru, Venezuela, Panama, Ecuador, Guatamala, El Salvador, Uruguay, Sri Lanka, Vietnam, Guinea, Philippines, Nigeria, Suriname, Togo

Table 11 represents US trade partners with an estimated difference of MGW imports greater than 0.5 tmt, as well as an aggregate of other importers of US MGW. The two largest differences in trade flows of US MGW exports are to South Korea and Turkey. The scenario estimates 6.7 tmt or 12% less exports to South Korea and 5.4 tmt or 20.3% less exports to Turkey.

Japan is missing from this table because in a preliminary run of the model, there was a large decrease in US MGW exports to Japan. This did not seem reasonable because in the base data from 2013 there were 278 tmt of US MGW exported to Japan. This value was low historically and for it to decrease more seemed unrealistic. Especially given the geographical relation of Japan to California where most of the MGW is produced in the US. To handle this

issue, US MGW exports to Japan are held exogenous starting in 2017, the first year the TTIP policy is implemented.

B. Impacts to the EU Market

i. EU Production

Table 12: Projected EU Production in 2027

E.U. Production								
	EU Production(1000MT milled equivalent)				Value at Market Price ($1000)			
Product	Benchmark	Scenario	Percent Difference	Nominal Difference	Benchmark	Scenario	Percent Difference	Nominal Difference
LGP	724	682	-5.8%	-42	363,809	327,652	-9.9%	-36,157
MGP	1,648	1,591	-3.4%	-56	949,743	877,049	-7.7%	-72,695
FRP	0	0	0.0%	0	0	0	0.0%	0
LGB	728	686	-5.9%	-43	377,473	339,888	-10.0%	-37,585
MGB	1,648	1,591	-3.4%	-56	960,713	887,178	-7.7%	-73,534
FRB	0	0	0.0%	0	0	0	0.0%	0
LGW	840	757	-9.9%	-83	526,127	456,613	-13.2%	-69,514
MGW	1636	1579	-3.4%	-56	997,679	921,168	-7.7%	-76,511
FRW	60	60	-0.5%	-0.3	66,974	66,655	-0.5%	-319

Note: The exchange rate used is $1 is equal to €0.7532

The results of the bilateral trade liberalization scenario between the US and EU reflect a reduction of production in the EU rice sector. The projections for EU production in 2027 are lower in the scenario for all levels of processing for long grain and medium grain rice varieties.

The negative impacts on LGW and MGW are greater as tariff escalation is removed. The quantity decrease for LGB is almost equal to LGP at 43 tmt and 42 tmt, respectively. The 2027 production value for LGP is estimated to be about USD 36 million lower in the scenario than the benchmark.

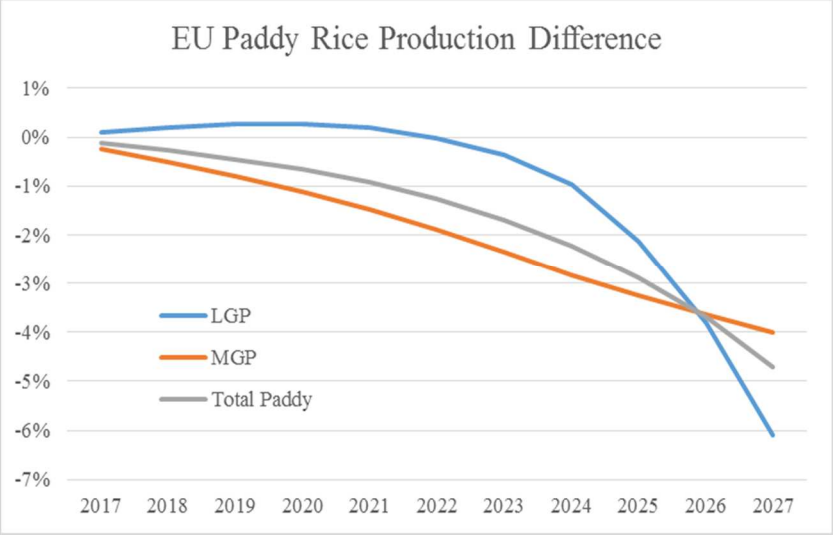
The estimation for LGW production in 2027 in the scenario is 9.9% or 83 tmt lower than the benchmark, equating to loss in value of production of 13.2% or almost USD 70 million. These large negative impacts in LGW and MGW rice production show the negative impact on the EU rice milling industry. Again, this impact is due to removing the tariff escalation. Current protection favors the EU milling industry to import paddy and brown rice and then mill it within the EU. As the escalation is reduced and ultimately eliminated, the milling industry loses its implicit subsidy and more white rice is projected to be imported rather than the paddy and brown rice.

Medium grain production is estimated to be 3.4% lower for all levels of processing. While rice trade liberalization also erodes tariff escalation in the medium grain market, the EU doesn't import a notable amount of MGP or MGB to process. In 2013, the EU imported less than 1 tmt of MGB, which was from the US. The increased competition of US MGW in the EU market causes a decrease in the price. With the decrease in price, less MGP is estimated to be produced. The lower production of paddy carried through to reduce brown and white rice production. The estimated value of 2027 MGP production in the scenario is lower by 7.7% or almost USD 73 million, and the estimated value of MGW production loss is also 7.7% but valued greater at USD 76.5 million. These values predict a much greater impact on the EU medium grain market than the US medium grain market as percentage change. Even in nominal terms the EU MGW production value is estimated to be USD 76.5 million lower in the scenario, while US MGW production value is only estimated to be USD 46.8 million greater.

he model shows that in the first few years of the policy implementation, LGP production actually increases (Figure 109). This is surprising because the increased competition to the EU market should decrease the price at all phases of production. The price decrease would be

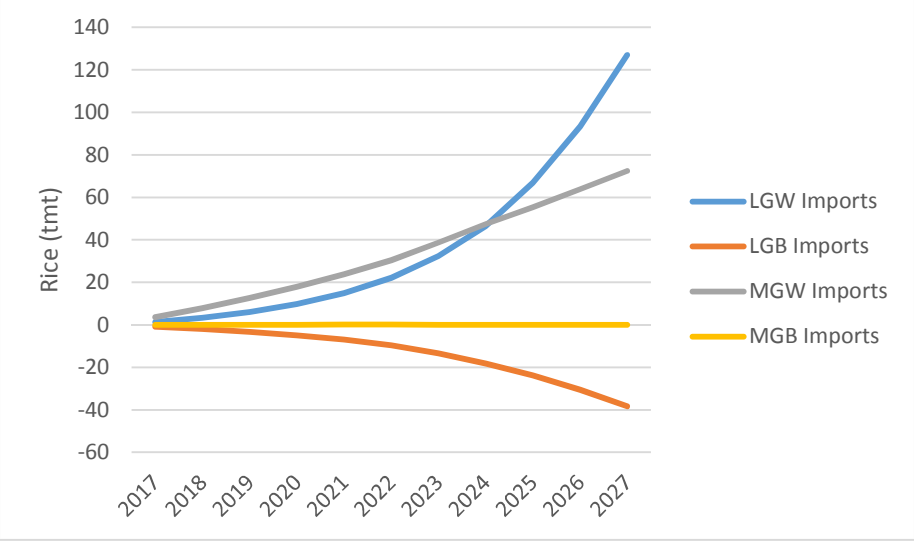
expected to cause a decrease in production in the EU. After analysis, it is found that the quickly declining MGP production is substituted with LGP production in the first several years of liberalization. This can be seen in Figure 10 below.

Figure 9: Timeline of EU Paddy Rice Production



Source: Based on data from this study

Figure 10: Timeline of Production Difference between Benchmark and Scenario



Source: Based on data from this study

ii. EU Consumption

Table 13: Projected EU Consumption in 2027

	EU Volume of Final Consumption (1000MTs)				EU Value of Final Consumption ($1000s)			
Product	Benchmark	Scenario	Percent Difference	Nominal Difference	Benchmark	Scenario	Percent Difference	Nominal Difference
LGW	1,468	1,481	0.92	13	1,816,875	1,729,444	-5%	-87,430
MGW	1,700	1,713	0.74	13	4,058,026	3,883,345	-4%	-174,680
FRW	864	860	-0.56	-4.82	946,772	941,947	-1%	-4,825

The estimated volume of consumption in the scenario is marginally greater for LGW and MGW due to lower domestic prices. FRW consumption is estimated to be lower in the scenario, due to the substitution effect by consumers switching to LGW and MGW rice that becomes less expensive. The 2027 retail prices of final consumption for LGW and MGW are estimated to be 6% and 5% lower in the scenario, respectively. The large difference of prices estimated in the scenario compared to the benchmark, creates savings for EU consumers. Where they are projected to ultimately pay less to consume more. The value of consumption in 2027 for LGW is estimated to be 5% or USD 87.4 million lower and MGW is estimated to be 4% or USD 174.7 million lower in the scenario. FRW value of consumption in 2027 is estimated to be almost 1% or USD 5 million lower in the scenario.

iii. EU Imports

Table 14: Projected EU Imports in 2027

	EU Total Imports (1000MT)				EU Imports From US (1000MT)			
Product	Benchmark	Scenario	Percent Difference	Nominal Difference	Benchmark	Scenario	Percent Difference	Nominal Difference
LGP	7	7	0%	-0.03	0.10	0.07	-27%	-0.03
MGP	0	0	0%	0	0	0	0%	0
FRP	0	0	0%	0	0	0	0%	0
LGB	138	100	-28%	-38	4	3.93	3%	0.11
MGB	0.80	0.76	-5%	-0.04	0.80	0.76	-5%	-0.04
FRB	70	69	-1%	-0.36	0	0	0%	0
LGW	727	854	17%	127	18	320	1730%	303
MGW	102	175	71%	72	21	94	342%	72
FRW	804	800	-1%	-5	0	0	0%	0
Total Milled Equivalent			9%	161.3	Total Milled Equivalent		877%	375.5
LG Milled Equivalent			11%	93.7	LG Milled Equivalent		1450%	303.1
MG Milled Equivalent			70%	72.4	MG Milled Equivalent		330%	72.4

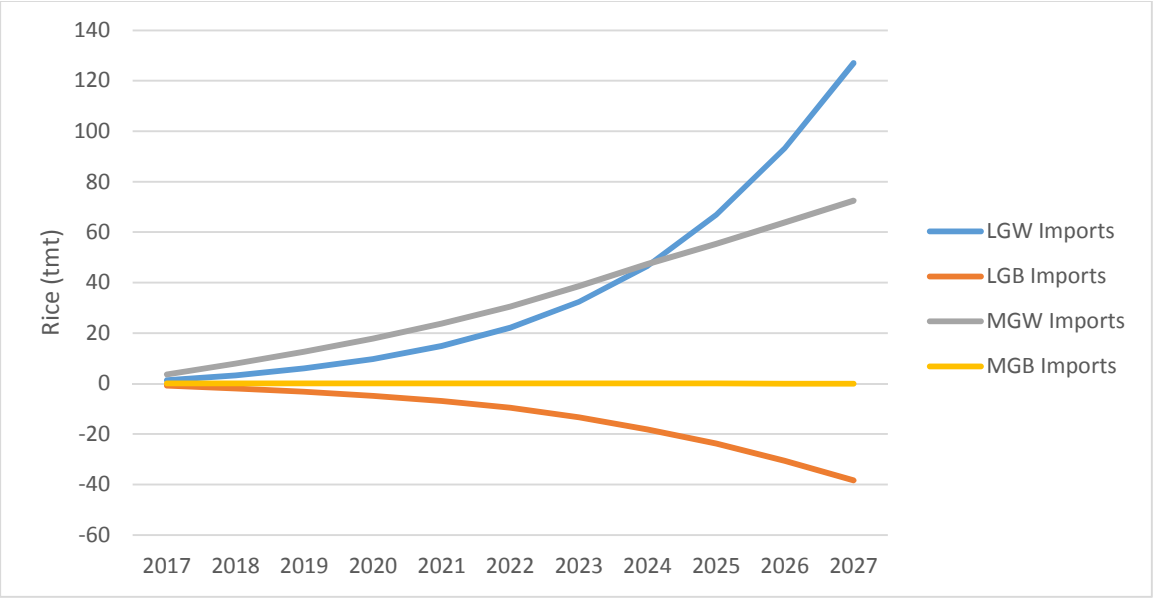
The scenario results for total EU imports of long grain and medium grain products are substantial in 2027. The values are driven by large increases of LGW and MGW imports, while brown rice imports declined. These results are due to the elimination of the tariff escalation.

Under the scenario, total imports of LGW are larger and imports of LGW from the US are much larger. Total imports of LGW are greater by 17% or 127 tmt, and LGW imports from the US are 1,730% or 303 tmt greater in the scenario. Total 2027 LGB imports to the EU are estimated to be 28% or 38 tmt less in the scenario. As the US processed rice products increase in competitiveness in the EU markets, the EU stops importing raw materials and imports the milled rice.

The EU imported a negligible amount of MGB in 2013, less than 1 tmt. Even though the scenario estimates a 5% reduction MGB imports, that value was only 0.04 tmt. However, MGW

imports are projected to be much greater in the scenario to the amount of 72 tmt, a 71% increase. This increase of imports is in line with the decrease in production.

Figure 11: Timeline of Projected Difference of Imports in Benchmark and Scenario

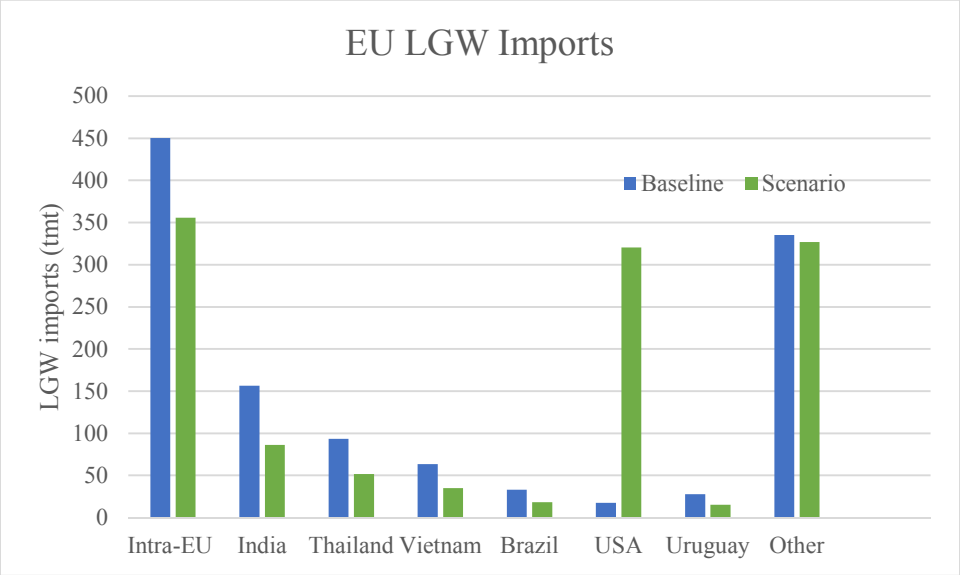


Source: Based on data from this study

The MGW import values increase almost linearly. A straight line increase is expected, because of the straight line reduction of import tariffs. Considering the import tariffs are the only changing variable it would be expected that the other affected variables would change linearly as well. The nonlinear expansion of LGW and LGB was not expected, and it reflects the substitution of LGP production in the EU for MGP production, which delays the upward trend in LGW imports.

In this analysis it is important to remove the values for intra-EU trade from the results. By removing those values from the overall trade, the EU is treated as a single region or trading entity. The change in trade among the EU members was a direct result of the decrease in production (Figure 12).

Figure 12: EU Import Origin Projections in 2027



Imports of LGW from the US increases by 303 tmt, which is 176 tmt greater than the total increase of import volume to the EU. This implies that there are 176 tmt of EU imports coming from the US that previously came from another country source. The situation is not similar for MGW because imports from Egypt are held constant and the US is the only other source of imports for MGW. The next section analyzes what countries were affected by these new trade flows of LGW.

Table 15: Projected EU LGW Import Origination

	EU LGW Import Originiation (1000MT)			
Region	Benchmark	Scenario	Percent Difference	Nominal Difference
Intra-EU	450	356	-21%	-94
USA	18	320	1730%	303
India	157	86	-45%	-70
Thailand	93	52	-45%	-42
Vietnam	64	35	-45%	-28
Brazil	33	18	-45%	-15
Uruguay	28	15	-44%	-12
Pakistan	11	6	-45%	-5
Paraguay	7	4	-44%	-3
Argentina	1.7	1.0	-45%	-0.8
Ecuador	0.0007	0.0004	-45%	-0.0003

Note: Cambodia, Myanmar, Tanzania, Suriname, and Guyana are excluded from the table because their trade flows were held exogenous in the model in order to create more realistic results

The percent change in imports from other countries is remarkably similar with all third countries losing 44% or 45% (Table 15: Projected EU LGW Import Origination). The largest projected decreases in trade flows in 2027 for LGW imported into the EU are from India, Thailand, Vietnam, Brazil, and Uruguay. The largest of which is India with a decrease of exports to the EU equal to 70 tmt. Thailand and Vietnam also lose large shares of the market with decreases of 42 tmt and 28 tmt, respectively. Brazil and Uruguay both decrease exports to the EU by 9.2 tmt and 9.7 tmt respectively. Intra-EU trade decreases as a result of the lower estimated production. The decreased share of the European market is spread evenly across the different origins because of how the RICEFLOW model works. The newly created preferential market access was treated as a relative change in advantage, rather than optimizing market efficiency. Since these origins have similar market access, the relative decreases are also similar.

iv. EU Exports

Table 16: Projected EU Exports in 2027

	EU Total Exports (1000MT)				EU Exports to US (1000MT)			
Product	Benchmark	Scenario	Percent Difference	Nominal Difference	Benchmark	Scenario	Percent Difference	Nominal Difference
LGP	1	1	62%	0	0	0	0%	0
MGP	0	0	0%	0	0	0	0%	0
FRP	0	0	0%	0	0	0	0%	0
LGB	1	2	36%	0	0	0	85%	0
MGB	1	1	11%	0	0	0	0%	0
FRB	0	0	0%	0	0	0	0%	0
LGW	102	140	36%	37	10	17	67%	7
MGW	34	46	37%	12	0	0	41%	0
FRW	0	0	0%	0	0	0	0%	0
Total Milled Equivalent			36.4%	51	Total Milled Equivalent		66%	7

Surprisingly, EU exports in 2027 are actually projected to be greater in the scenario. LGW exports in 2027 are projected to be 36% or 37 tmt greater in the scenario, and MGW exports are projected to be 37% or 12 tmt greater in the scenario. LGW exports in 2027 are projected to be 67% or 7 tmt greater in the scenario.

Table 17: Projected EU LGW Export Destinations in 2027

	LGW EU Export by Destinations (1000MT)			
Region	Benchmark	Scenario	Percent Difference	Nominal Differnce
Turkey	50.4	63.0	25%	12.7
Europe	20.4	28.5	39%	8.0
US	10.3	17.1	67%	6.9
Middle East	9.2	13.3	44%	4.1
Africa	3.1	4.5	45%	1.4
Brazil	2.7	3.8	41%	1.1
Australia	2.5	3.5	41%	1.0
Canada	2.0	3.3	63%	1.3
Other	1.8	2.6	44%	0.8

Regions included in other in order of benchmark exports greatest to least: Russia, Cuba, Saudi Arabia, Oceania, India, Iraq, United Arab Emirates, South Africa, Caribbean, Singapore, Hong Kong, China, Colombia, Panama, Philippines, Chile, Peru, Senegal, Asia, Mexico, Taiwan, Japan, Malaysia, Nicaragua, Ecuador, Haiti, Venezuela, Paraguay, Benin, Bangladesh

Table 17 includes all the regions that are projected to import more than 1 tmt of LGW from Europe in 2027 of the benchmark. Turkey, Europe, US and the Middle East are the regions that are projected to be the destinations for the largest increase in exports of LGW from the EU. It would be expected that the US has the largest relative increase at 67% because of the decreasing import tariffs.

Table 18: Projected EU MGW Export Destinations in 2027

	MGW EU Export by Destinations (1000MT)			
Region	Benchmark	Scenario	Percent Difference	Nominal Differnce
Turkey	18.7	26.7	43%	8.0
Europe	11.6	14.0	21%	2.4
Russia	2.7	4.2	53%	1.4
Australia	0.68	1.12	65%	0.4
USA	0.27	0.38	41%	0.11
Brazil	0.024	0.041	72%	0.02
Canada	0.010	0.018	81%	0.008
Middle East	0.003	0.006	81%	0.003

Error! Reference source not found. shows all of the countries that import MGW from the EU in 2027 of the benchmark. Turkey, Europe, and Russia have the largest increases of EU MGW export share. Turkey imports an additional 8 tmt, Europe imports an additional 2.4 tmt, and Russia imports an additional 1.4 tmt.

Europe becomes more competitive in the global market, because the domestic price decreases. With the domestic price decrease, FOB price also decreases. Therefore, the EU is able to increase exports to third countries.

C. Impacts on Third Country Markets

i. Third Country Production

This section provides a discussion of the potential impacts on third countries from the TTIP proposed agreement. The countries reported are chosen based on the level of trade with the US and the EU. The countries with the largest level of bilateral trade flow differences between the scenario and benchmark are represented in this group. The countries are Brazil, Ghana, Haiti, India, Mexico, South Korea, Venezuela, and Vietnam.

Table 19: Projected Difference in Producer Price in 2027

	Producer Price							
	Brazil	Ghana	Haiti	India	Mexico	South Korea	Venezuela	Vietnam
LGP	-0.001%	0.13%	0.58%	0.05%	0.77%	0%	0.47%	0.02%
MGP	0%	0%	0%	0%	0%	0.04%	0%	0%
FRP	0%	0%	0%	0.07%	0%	0.00%	0%	0.03%

It was hypothesized that production price would increase for importing countries due to the decrease in supply coming from the US. This hypothesis could not be rejected for Ghana, Haiti, Mexico South Korea, and Venezuela in this analysis.

Table 20: Projected Difference in Production in 2027

	Difference in Production Volume 2027							
	Brazil	Ghana	Haiti	India	Mexico	South Korea	Venezuela	Vietnam
LGP	-0.01%	0.26%	2.24%	0.01%	2.78%	0%	0.64%	0.05%
MGP	0%	0%	0%	0%	0%	0.11%	0%	0%
FRP	0%	0%	0%	-0.08%	0%	0%	0%	-0.04%
LGB	-0.22%	0.26%	2.24%	0.01%	-1.02%	0%	-0.14%	0.05%
MGB	0%	0%	0%	0%	0%	0.11%	0%	0%
FRB	0%	0%	0%	-0.08%	0%	0%	0%	-0.04%
LGW	-0.09%	0.27%	2.24%	0.02%	-1.03%	0.05%	-0.14%	0.06%
MGW	-2.21%	-0.37%	-0.12%	-0.13%	-0.06%	0.02%	-0.16%	-0.33%
FRW	0%	0%	0%	-0.08%	0%	0%	0%	-0.04%

It was expected that production projections would be greater in the countries that had greater projected producer prices. Haiti and Mexico have the most substantial increases in paddy production. While the greater paddy production in Haiti carries fully through the milling sector, Mexico has lower projected milling volumes in the scenario than in the benchmark. This projection was expected, because Mexico imported a large amount of US paddy rice in 2013 that it then milled. While the projected volume of production is lower in Mexico's milling sector, the value of the LGW estimated production is actually 0.4% or USD 2.4 million greater due to price increases. Also, the value of production in Haiti is projected to be about 3% greater at all milling

levels which in nominal figures is about USD 1.5 million for LGP production and USD 1.6 million for LGW production. As for the apparent negative effect on Brazil MGW, there was an extremely marginal amount of production in Brazil in 2013, and this negative amount of change is also extremely marginal.

ii. Third Country Consumption

The trade agreement would impact the level of consumption of rice in third countries due to a global rice price increase. An increase of price in third countries could lead to a reduction in food security and would be a negative consumer impact from this trade agreement, however producers of rice in third countries would benefit as shown above for Mexico and Haiti.

Table 21: Projected Difference in Retail Price of Consumption in 2027

	Consumer Price at Retail							
	Brazil	Ghana	Haiti	India	Mexico	South Korea	Venezuela	Vietnam
Weighted Average	-0.01%	0.15%	1.04%	0.05%	1.34%	0.07%	0.61%	0.02%
LGW	-0.01%	0.17%	1.03%	0.05%	1.33%	0.01%	0.60%	0.02%
MGW	1.28%	1.52%	1.67%	1.67%	1.72%	0.07%	1.72%	1.64%
FRW	0.02%	0.01%	0.00%	0.07%	0.01%	0.01%	0.07%	0.03%

The regions that are impacted the greatest are, again, Haiti and Mexico. The percent changes of price in the disaggregated rows are deceiving because the volume of consumption can be very low, therefore a higher percentage change can still mean very marginal impacts on the market. This is especially true for MGW in this instance, except for South Korea. In order to show which values are significant, we added the weighted average row above which is price change weighted by volume of consumption. Haiti and Mexico are projected to have increases in price over one percent at retail value. However, Table 22: Projected Difference in Consumption Volume in 2027shows that the projected difference in consumption volumes is marginal. That

does not mean the change in price would not affect household budgets. It just means that rice is own-price inelastic.

Brazil has a marginal decrease in price. This is a result of an overall decrease in brown and white rice exports. Paddy rice exports increased. Total exports decreased by 1.33 tmt, causing an increase of supply in the domestic market and a decrease in price.

Table 22: Projected Difference in Consumption Volume in 2027

	Consumption Volume							
	Brazil	Ghana	Haiti	India	Mexico	South Korea	Venezuela	Vietnam
Weighted Average	0.03%	0.04%	-0.03%	0.08%	-0.05%	-0.04%	-0.01%	0.08%
LGW	0.033%	0.03%	-0.03%	0.08%	-0.04%	0.00%	-0.01%	0.08%
MGW	-0.126%	-0.22%	-0.07%	-0.33%	-0.07%	-0.04%	-0.11%	-0.32%
FRW	0.030%	0.06%	0.03%	0.07%	0.04%	0.00%	0.04%	0.08%

5. Conclusion

A. Summary

This study developed estimates of the potential global market impacts of the liberalization of rice bilateral trade between the EU and US under the Transatlantic Trade and Investment Partnership (TTIP). The results were expected to show an increase of production in the US of paddy rice and output in the milling sector. A decrease of production of paddy rice and milled output in the milling sector was expected in the EU. These results were expected because the US is a more competitive producer of rice than the EU, the US is a top five exporter of rice, the US has the capacity to increase production acres, and the EU has greater protection on rice than the US, in the form of import tariffs. Therefore, when both regions remove all tariffs, the relative competitiveness of US rice in the EU market increases greater than the relative competitiveness of EU rice increases in the US market.

Along with the impacts to the volume of production in each region, other relative market values were also expected to be different in the scenario projections. The increased imports from the US in the EU rice market was expected to cause a decrease in prices for rice at every stage in the market, and an increase in the prices in the US market driven by the increased demand. US rice exports to the EU were expected to increase and total rice exports from the US were expected to increase. The increase in bilateral trade between the US and the EU was expected to cause a change in bilateral trade flows that the two regions had with third region trading partners. US exports to third countries were expected to decrease and EU imports from third countries were expected to decrease. These bilateral trade flow altering impacts would affect price and production in the third countries, but only marginally.

The results indicate that our hypotheses were not rejected. The analysis compared the projections of the benchmark to the projections of the scenario for the year 2027. The reason for using projection for 2027 in our analysis, was that it was the year the tariffs are assumed to be reduced to zero.

US paddy production in 2027 was estimated to be greater by two percent in the scenario compared to the benchmark. White production was estimated to be four percent greater in the scenario. EU paddy production was estimated to be four percent less in the scenario and EU white rice production was estimated to be 5.5% less in the scenario. Price in the US increased for production and consumption, while price in the EU decreased for production and consumption. US exports to the EU as well as total US exports increased. Total EU imports increased notably. US exports to third countries decreased, and EU imports from third countries decreased. The price effects in third countries had marginal effects on demand in those countries.

The most surprising finding was that EU LGP production actually increased slightly in the first years of the implementation of the policy. This was unexpected because of the increased competition in the white rice market from the US. However, the model projects that resources will be substituted from the more quick reduction in MGP production to LGP production. A decrease in the land rental value drives a slight increase in the land used for LGP production. This was an advantage of the model disaggregating production by type and milling degree. If the model was aggregated by type, this substitution of production resources would not be apparent or even observable.

The approach of this study was different from previous studies of the TTIP due to the focus on rice, instead of the entire economy or another commodity such as wine. This study differs from previous studies of rice trade because it focused on bilateral trade liberalization rather than a single country or a multilateral agreement. Again, the level of disaggregation of the RICEFLOW model was very important to the results we obtained, because the EU protection and preferences are very different by degree of processing and type of rice. When models aggregate different agricultural products, or in this case different levels of milling or types of rice, the results can be misleading. From the results of this study different advice can be given to producers and millers.

The EU milling industry will have the largest negative impact from the liberalization of rice trade. This study would recommend millers to study their market to see if it is likely their product will still be in demand. Millers would also be encouraged to increase efficiency in order to stay competitive. Specialized millers with good relationships in the market may not be impacted as heavily.

Different advice can even be given to producers of different types of rice. Producers in the EU medium grain market would be advised by this study to be cautious about continuing production after an agreement under TTIP. While some production will still be demanded, a portion of producers will need to make plan to change their business strategy. EU long grain will have less pressure for the first few years of policy implementation, however, when the tariffs are reduced further, they will have a similar situation as the medium grain producers.

Producers and millers in the US would be advised that the demand for their products is likely to increase from the agreement, helping to sustain their investments in capital.

B. Limitations of Study

Since the RICEFLOW model is a partial equilibrium model, impacts to other related markets are not measured. There could be important relationships between rice production and other sectors of the economy that would affect the rice market behavior. The same limitation exists for the demand side, as prices of rice change, consumers might prefer a different product as a substitute. While there are variables in the model to account for some substitution of production and consumption into other products, these measurements were not analyzed.

Data collection for the RICEFLOW model is time intensive and some values such as production costs are difficult to obtain. Also, much of the data are only available for certain years making it more difficult to insure that all of the database data are from the same year. This is due to time lags for government data collection and publishing. This data can also be aggregated in the report, so therefore it must be disaggregated manually. For example, total rice production would need to be disaggregated using external sources of information to separate it into types of rice. Some of the data required can also be considered as industry secrets by the commercial

entities from which it is obtained, for example, milling costs for a certain region. Ideally, the data set would contain an average cost of many millers for each region. However, obtaining that data would be a very difficult task and instead the values from a single or a few millers must be sufficient. Finally, the data are aggregated into annual values. This creates an unrealistic value for variables such as price, considering the market price changes constantly throughout the year.

Relevant policy reforms, such as the 2014 US Farm Bill, the 2013 CAP Reform, and outgoing preferential trade agreements (PTAs) such as DR-CAFTA and U.S.-Colombia PTA are likely to impact the way the US and EU rice markets behave in the near future. These policies are not accounted for in this study. Modeling the policies through the dynamic modelling would be an advantage to creating an accurate model to project future values. While these policies can be accounted for in the RICEFLOW model, it was decided to not include it in this study due to time constraints.

Non-tariff barriers are not accounted for in this model. As mentioned above, a cause for the decrease of US exports to the EU was the finding of an unapproved GMO variety in shipments of rice bound for the EU. However, the scope of this study was limited to tariff barriers.

Fragrant rice production in the US in not accounted for in this model. However, rice trade liberalization will have practically zero effect on US fragrant rice production. This study recognizes that there is fragrant paddy rice produced in the US. However, this production was not reported in the database that was used for this model. The US does not export fragrant rice, so this missing data had a marginal impact on the study.

The model relies heavily on elasticity values to regulate the behavior of the equations. Some of the elasticity values are obtained from authoritative sources, such as demand price elasticity from FAPRI. However, others are set to reflect reasonable assumptions, such as the elasticity of sluggish factors of production. The more accurate that the elasticity values can be calculated, the more accurate the model results would be.

C. Future Research

As mentioned in the limitations section, the RICEFLOW model can be altered to account for many of the limitations of this study. However, additional research is a large requirement to successfully alter the model to be more representative of the current market environment.

The elasticity value for factors of supply are very important for the production values in the RICEFLOW model. In this study these elasticity values are set within reason. A study to accurately calculate the elasticity values for land in each region could greatly help the model generate even more realistic results. These values would also be very useful for other studies in projecting agricultural production.

As mentioned in the limitations section, incorporating ongoing policy reforms in the model would bring the model further up to date. GEMPACK offers a way to implement non-linear functions such as TRQs and minimum price support programs in the models. Investing in the implementation of these non-linear policies will likely improve the quality of the analysis.

As mentioned in the limitations section, NTB values were not included in this study. Considering the history of the LL601 contamination, this point is debatable. In fact, a USA Rice Federation study declares the EU zero-tolerance policy for unapproved GM traits bound for consumption to be a NTB (USA Rice Federation, 2014). This argument makes sense even without the cost of double testing US rice, because the EU importers also assume risk by

importing US rice under the zero-tolerance policy (USA Rice Federation, 2014). EU importers incurred expenses from the Liberty Link 601 event in 2006 as they had to pay for testing, product withdrawal, legal costs, etc. (Brookes, 2008). It is reasonable to believe the companies would incur similar losses from another similar event. Considering these points, a study attempting to measure the impact of NTBs between the US and the EU would be valuable.

Finally, the strength of the model is the disaggregation of rice by type and milling level. In the study of rural development, it would also be interesting to disaggregate the consumers by income level. This study projected over one percent price increases in Haiti and Mexico. While, the projected change in consumption is marginal in this model, this price increase could affect different members of the population differently. For members of the population living in poverty, that spend a large percentage of their income on food, this price change could have a greater effect on their household budget.

6. References

Armington, P. S. (1969). *A Theory of Demand for Products Distinguished by Place of Production* (No. v 16 n 1) (pp. 159–176).

Azevêdo, R. (2014). Our aim now should be nothing less that to complete the round and do it quickly. Geneva, Switzerland: World Trade Organization. Retrieved from http://www.wto.org/english/news_e/spra_e/spra10_e.htm

Azevêdo, R. (2015). Report by the Chairman of the Trade Negotiations Committee. Retrieved from https://www.wto.org/english/news_e/news15_e/gc_rpt_20feb15_e.htm

Böhringer, C., Rutherford, T. F., & Wiegard, W. (n.d.). Computable General Equilibrium Analysis : Opening a Black Box.

Brookes, G. (2008). Economic impacts of low level presence of not yet approved GMOs on the EU food sector Briefing document. Retrieved from http://www.agrodigital.com/images/estudio.pdf

Bureau, J.-C., & Salvatici, L. (2003). WTO Negotiations on market Access: What We Know, What We Don't and What We Should. In *Agricultural policy reform and the WTO: Where are we Heading*. Capri, Italy.

Burrell, A., Ferrari, E., Mellado, A. G., Himics, M., Michalek, J., Shrestha, S., & Van Doorslaer, B. (2011). *Potential EU-Mercosur Free Trade Agreement : Impact Assessment Volume 1 : Main results*. (A. Burrell, Ed.) (Vol. 1). Seville, Spain. doi:10.2791/66155

Cap, E., Brescia, V., & Lema, D. (2006). D14- Documentation of results of the constructed Mercosur model with variables' estimations and impact options.

CGIAR. (n.d.). Ricepedia.

Childs, N. (2014). USDA Rice Yearbook. (U. S. D. of Agriculture, Ed.). Washington, D.C.: USDA. Retrieved from http://www.ers.usda.gov/data-products/rice-yearbook-2014.aspx#.U0_TDfldXTo

Cummings, B. (2013, September 25). EU Importers Say Price, Not GM Presence, Holding Back U.S. Sales to EU. *USA Rice Daily*. Arlington, VA. Retrieved from http://www.usarice.com/index.php?option=com_content&view=article&id=2341:usa-rice-daily-092513&catid=104:usa-rice-daily

Drogue, S., & Ramos, M. P. (2005). TARIFF-RATE QUOTAS AND AGRICULTURAL TRADE : an application to the agricultural free-trade negotiation between the MERCOSUR and the EU. In *European Association of Agricultural Economists* (pp. 1–17). Copenhagen, Denmark. Retrieved from http://ageconsearch.umn.edu/handle/24637

European Commission. (2001). providing for the management of Community tariff quotas and of reference quantities for products elegible for preferences by virtue of agreements with certain Mediterranean countries and repealing Regulations(EC) No. 1982/94 and (EC) No 934/95. Brussels, Belgium: European Council.

European Commission. (2006). laying down detailed rules for the opening and administration of an import quota for rice originating in Bangladesh. Official Journal of the European Union L408 (30 December 2006).

European Commission. 26.4.2008 (2008).

European Commission. No 1274/2009: opening and providing for the administration of import quotas for rice originating in the overseas countries and territories (2009). Brussels, Belgium: European Commission.

European Commission. (2013a). EU re-opens its markets to Myanmar/Burma. Retrieved from http://europa.eu/rapid/press-release_IP-13-695_en.htm

European Commission. (2013b). EU Rice: Overview 2009/10 to 2013/14. Retrieved from http://ec.europa.eu/agriculture/cereals/balance-sheets/rice/overview_en.pdf

European Commission. (2013c). Everything But Arms(EBA)-Who Benefits? Brussels, Belgium: European Commission.

European Commission. (2014). Transatlantic Trade and Investment Partnership: TTIP explained. Brussels, Belgium. Retrieved from http://trade.ec.europa.eu/doclib/docs/2014/may/tradoc_152462.pdf

European Commission. (2015). The EU Rice Regulatory Regime. Retrieved from http://ec.europa.eu/agriculture/cereals/factsheet-rice_en.pdf

European Parliament. Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed (2003). Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32003R1829

European Union and Government of Canada. (2008). *Assessing the costs and benefits of a closer EU-Canada economic partnership, Government of Canada and European Union joint study*.

FAO. (2004). International Year of Rice 2004. Retrieved from http://www.fao.org/rice2004/en/p7.htm

FAOSTAT. (2014). FAOSTAT. United Nations. Retrieved from http://faostat.fao.org/

Francois, J., Manchin, M., Norberg, H., Pindyuk, O., & Tomberger, P. (2013). Reducing Transatlantic Barriers to Trade and Investment: An Economic Assessment. London, UK:

Centre for Economic Policy Research. Retrieved from http://trade.ec.europa.eu/doclib/docs/2013/march/tradoc_150737.pdf

Fuller, S., Fellin, L., & Salin, V. (2003). Effect of Liberalized U . S . -Mexico Rice Trade : A Spatial , Multiproduct Equilibrium Analysis. *Agribusiness*, *19*(1), 1–17. doi:10.1002/agr.

Grant, J. H., Hertel, T. W., & Rutherford, T. F. (2006a). Extending General Equilibrium to the Tariff Line: U.S. Dairy in the Doha Development Agenda. West Lafayette, IN: Department of Agricultural Economics, Purdue University.

Grant, J. H., Hertel, T. W., & Rutherford, T. F. (2006b). Extending General Equilibrium to the Tariff Line: U.S. Dairy in the DOHA Development Agenda. In *26th Conference of the International Association of Agricultural Economics*. Queensland, Australia.

Hart, C. E., & Beghin, J. C. (2004). Rethinking Agricultural Domestic Support Under the World Trade Organization. In K. Anderson & W. Martin (Eds.), *Agricultural Trade Reform & The Doha Development Agenda* (pp. 221–244). Washington D.C: Palgrave MacmillanWorld Bank.

High Level Working Group. (2013). Final Report: High Level Working Group on Jobs and Growth. High Level Working Group. Retrieved from http://www.ustr.gov/sites/default/files/02132013 FINAL HLWG REPORT.pdf

Ismail, F. (2009). An assessment of the WTO Doha Round July–December 2008 collapse. *World Trade Review*, *8*(04), 579–605. doi:10.1017/S1474745609990073

Kitou, E., & Philippidis, G. (2010). An EU-Canada bilateral trade agreement a Defra TAP application. In *84th Annual Confeence of the Agricultural Economics Society*. Edinburgh. Retrieved from http://ageconsearch.umn.edu/bitstream/91679/2/11kitou_philippidis.pdf

Koo, W. W., & Kennedy, P. L. (2005). *International Trade and Agriculture*. Malden, MA: Blackwell Publishing.

Lee, H., Chang, C.-C., Weng, Y.-H., Hsu, S.-M., & Hsu, S.-H. (2008). An Economy-wide Analysis of Impacts on Taiwan of Reducing Tariff Escalation on Agriculture-Related Products in WTO Doha Round Negotiations Huey-Lin Lee, (1), 1–23. Retrieved from file:///C:/Users/Standard User/Documents/Effects of WTo Negotiation on Taiwan.pdf

Li, Y., Wailes, E. J., McKenzie, A., & Thomsen, M. (2010). LL601 Contamination and Its Impact on U.S. Rice Prices. Southern Agricultural Economics Association. Retrieved from http://ageconsearch.umn.edu/bitstream/57154/2/jaae255.pdf

Mane, R., & Wailes, E. J. (2006). IMPACT OF TRADE LIBERALIZATION IN RICE – ASSESSING ALTERNATIVE PROPOSALS. In *American Agricltural Economics Asociation Annual Meeting*. Long Beach, California. Retrieved from http://ageconsearch.umn.edu/bitstream/21188/1/sp06ma11.pdf

Mcdaniel, C. A., & Balistreri, E. J. (2002). A Review of Armington Trade Substitution Elasticities. *USITC*. Washington D.C.

Mclaren, J., & Hakobyan, S. (2012). Looking for Local Labor-Market Effects of the NAFTA, (April).

Miller, J. W., Lyons, J., Beckett, P., Johnson, I., & Hitt, G. (2008). Global Trade Talks Fail as New Giants Flex Muscle. *Wall Street Journal*. New York, New York: Dow Jones and Company.

Naanwaab, C., & Yeboah, O. (2012). The Impact of NAFTA on Agricultural Commodity Trade: A Partial Equilibrium Analysis. In *Southern Agricultural Economics Association Annual Meeting*. Birmingham, AL. Retrieved from http://core.kmi.open.ac.uk/download/pdf/6272977.pdf

NASS. (2013). Arkansas Agricultural Cash Receipts Report (pp. 7–8). Retrieved from http://www.nass.usda.gov/Statistics_by_State/Arkansas/Publications/Economic_and_Demographic_Releases/cashrec12.pdf

NASS. (2015). USDA NASS statistics. Retrieved from http://www.nass.usda.gov/Statistics_by_Subject/index.php?sector=CROPS

NOAA. (2013). Spain: Rice, percent of total area by region. Retrieved from http://www.usda.gov/oce/weather/pubs/Other/MWCACP/Graphs/eur/spnric.gif

Obi-Egbedi, O., Okoruwa, V. O., Yusuf, S. A., & Kemisola, O. (2013). Rice Trade Protectionism Versus Liberalization in Nigeria : A CGE Analysis of Economic and Welfare Effects. In *International Conference of the African Association of Agricultural Economists*. Hammamet, Tunisia. Retrieved from http://ageconsearch.umn.edu/handle/161528

Ojeda, R. H., Runsten, D., Paolis, F. De, & Kamel, N. (2000). *The U . S . Employment Impacts of North American Integration After NAFTA : A Partial Equilibrium Approach*. Los Angeles. Retrieved from http://www.naid.ucla.edu/uploads/4/2/1/9/4219226/_c12_2000.pdf

Richardson, J. W., & Outlaw, J. L. (2010). Economic Contributions of the US Rice Industry to the US Economy. College Station, TX. Retrieved from http://calrice.org/pdf/RR-10-03-Economic+Contributions+of+the+US+Rice+Industry.pdf

Rickard, B. J., Gergaud, O., & Hu, W. (2014). Trade Liberalization in the presence of domestic regulations: Impacts of the EU-U.S. free trade agreement on wine markets. In *Agricultural and Applied Economics Annual Meeting*. Minneapolis, MN.

Tipper, A. (2011). One for all ? The capital-labour substitution elasticity in New Zealand. In *52nd New Zealand Association of Economists conference*. Wellington, New Zealand: Macroeconomic Statistics Development Unit, Statistics New Zealand.

U.S. Department of Commerce. (2015). Bureau of Economic Analysis. Retrieved March 4, 2015, from http://www.bea.gov/index.htm

UN. (2015). UN Comtrade. Retrieved from http://comtrade.un.org/data/

USA Rice Federation. (2014). Re: Comments Regarding the 2015 National Trade Estimate Report on Foreign Trade Barriers. Arlington, VA: USA Rice Federation.

USDA. (2014). Global Agricultural Trade System. Retrieved from http://apps.fas.usda.gov/gats/ExpressQuery1.aspx

USDA NASS. (2012). Rice, Harvested Acres: 2012. Retrieved from http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Ag_Atlas_Maps/Crops_and_Plants/Field_Crops_Harvested/12-M176.php

USITC. (1997). *Impact of the North American Free Trade Agreement on the U.S. Economy and Industries: A Three Year Review*. Washington D.C.

USITC. (2014). Harmonized Tariff Schedule of the United States. Retrieved from http://hts.usitc.gov/

USTR. (2013). White House Fact Sheet: Transatlantic Trade and Investment Partnership. Washington D.C: Office of the United States Trade Representative. Retrieved from http://www.ustr.gov/about-us/press-office/fact-sheets/2013/june/wh-ttip

Viju, C., Yeung, M. T., & Kerr, W. A. (2011). *POST-MORATORIUM EU REGULATION OF GENETICALLY MODIFIED PRODUCTS : TRADE CONCERNS CATPRN Commissioned Paper 2011-02*.

Weissleder, L., Adenäuer, M., & Heckelei, T. (2008). Impact assessment of trade liberalisation between EU and Mercosur countries Impact assessment of trade liberalisation between EU and Mercosur countries. In *EAAE: Modeling of Agricultural and Rural Development Policies* (pp. 0–19). Sevilla, Spain.

Wing, I. S. (2004). Computable General Equilibrium Models and Their Use in Economy-Wide Policy Analysis, (6).

WTO. (1994). Agreement on Agriculture. Retrieved December 1, 2015, from http://www.wto.org/english/docs_e/legal_e/14-ag_01_e.htm

WTO. (2001). Ministerial Declaration: Ministerial Conference, 4th Session. Doha, Qatar. Retrieved from http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_e.pdf

WTO. (2013a). Bali Ministerial Declaration. Bali, Indonesia.

WTO. (2013b). Export Competition. *Ministerial Conference: Ninth Edition*. Bali, Indonesia: World Trade Organization. Retrieved from http://www.wto.org/english/thewto_e/minist_e/mc9_e/desci40_e.htm

WTO. (2013c). Understanding on tariff rate quota administration provisions of agricultural products, as defined in Article 2 of the Agreement on Agriculture. *Ministerial Conference: Ninth Session*. Bali, Indonesia: World Trade Organization. Retrieved from http://www.wto.org/english/thewto_e/minist_e/mc9_e/desci39_e.htm

Zahniser, S., & Roe, A. (2011). *A Report from the Economic Research Service NAFTA at 17 Full Implementation Leads To Increased Trade and Integration*. Washington D.C. Retrieved from http://www.ers.usda.gov/media/129506/wrs1101.pdf

APPENDIX

Appendix Table 1: Model Elasticity Values Not Explicitly Stated in Text

	Production Supply: Land	Production Supply: Land Transformation	Consumption Demand: Income	Consumption Demand: Own Price	Consumption Demand: Substitution
ARGENTINA	0.25	-1	0.11	-0.07	0.0175
AUSTRALIA	0.25	-1	0.43	-0.41	0.1025
BANGLADESH	0.25	-1	-0.04	-0.01	0.0025
BENIN	0.25	-1	0.25	-0.15	0.0375
BOLIVIA	0.25	-1	0.11	-0.1	0.025
BRAZIL	0.25	-1	-0.05	-0.1	0.025
BURKINA FASO	0.25	-1	0.25	-0.15	0.0375
CAMBODIA	0.25	-1	-0.23	-0.2	0.05
CAMEROON	0.25	-1	0.25	-0.15	0.0375
CANADA	0.25	-1	0.47	-0.21	0.0525
CHILE	0.25	-1	0.11	-0.07	0.0175
CHINA	0.25	-10	-0.07	-0.16	0.04
COLOMBIA	0.25	-1	-0.05	-0.1	0.025
COSTARICA	0.25	-1	0.46	-0.05	0.0125
COTE D'IVOIRE	0.25	-1	0.14	-0.55	0.1375
CUBA	0.25	-1	0.46	-0.05	0.0125
ECUADOR	0.25	-1	0.11	-0.1	0.025
EGYPT	0.025	-1	0.3	-0.15	0.0375
ELSALVADOR	0.25	-1	0.46	-0.05	0.0125
EU	0.15	-5	0.38	-0.2	0.05
GAMBIA	0.25	-1	0.14	-0.15	0.0375
GHANA	0.25	-1	0.14	-0.15	0.0375
GUATEMALA	0.25	-1	0.46	-0.05	0.0125
GUINEA	0.25	-1	0.14	-0.15	0.0375
GUINEA BISSAU	0.25	-1	0.14	-0.15	0.0375
GUYANA	0.25	-1	-0.05	-0.1	0.025
HAITI	0.25	-1	0.46	-0.05	0.0125
HONDURAS	0.25	-1	0.46	-0.05	0.0125
HONG KONG	0.25	-1	-0.26	-0.11	0.0275
INDIA	0.01	-10	-0.04	-0.2	0.05
INDONESIA	0.25	-1	-0.12	-0.14	0.035
IRAN	0.25	-1	0.2	-0.35	0.0875
IRAQ	0.25	-1	0.14	-0.1	0.025
JAPAN	0.25	-1	-0.26	-0.11	0.0275
LAOS	0.25	-1	-0.23	-0.2	0.05
LIBERIA	0.25	-1	0.14	-0.15	0.0375

Appendix Appendix Table 1: Continued

	Production Supply: Land	Production Supply: Land Transformation	Consumption Demand: Income	Consumption Demand: Own Price	Consumption Demand: Substitution
MALAYSIA	0.25	-1	0.09	-0.3	0.075
MALI	0.25	-1	0.14	-0.15	0.0375
MEXICO	0.25	-1	0.46	-0.05	0.0125
MYANMAR	0.25	-1	0.13	-0.1	0.025
NICARAGUA	0.25	-1	0.46	-0.05	0.0125
NIGER	0.25	-1	0.25	-0.15	0.0375
NIGERIA	0.25	-1	0.25	-0.15	0.0375
PAKISTAN	0.25	-10	0.1	-0.18	0.045
PANAMA	0.25	-1	0.46	-0.05	0.0125
PARAGUAY	0.25	-1	0.11	-0.1	0.025
PERU	0.25	-1	-0.05	-0.1	0.025
PHILIPPINES	0.25	-1	0.15	-0.25	0.0625
RUSSIA	0.25	-1	0.38	-0.15	0.0375
SAUDI ARABIA	0.25	-1	0.1	-0.25	0.0625
SENEGAL	0.25	-1	0.14	-0.15	0.0375
SIERRA LEONE	0.25	-1	-0.03	-0.11	0.0275
SINGAPORE	0.25	-1	0.14	-0.15	0.0375
SOUTH KOREA	0.25	-1	-0.27	-0.54	0.135
SOUTH AFRICA	0.25	-1	0.47	-0.2	0.05
SRILANKA	0.25	-1	-0.04	-0.2	0.05
SURINAME	0.25	-1	-0.05	-0.1	0.025
TAIWAN	0.25	-1	-0.26	-0.11	0.0275
TANZANIA	0.25	-1	0.25	-0.15	0.0375
THAILAND	0.01	-10	-0.16	-0.05	0.0125
TOGO	0.25	-1	0.25	-0.15	0.0375
TURKEY	0.25	-1	0.38	-0.15	0.0375
UAE	0.25	-1	0.1	-0.25	0.0625
URUGUAY	0.25	-1	0.5	-0.17	0.0425
USA	0.25	-5	0.34	-0.01	0.0025
VENEZUELA	0.25	-1	0.11	-0.07	0.0175
VIETNAM	0.01	-1	-0.23	-0.2	0.05
OAFRICA	0.25	-1	0.18	-0.15	0.0375
OASIA	0.25	-1	-0.04	-0.11	0.0275
OCARIBBEAN	0.25	-1	0.46	-0.05	0.0125
OEUROPE	0.25	-1	0.38	-0.15	0.0375
OMIDDLE EAST	0.25	-1	0.1	-0.25	0.0625
OOCEANIA	0.25	-1	0.43	-0.41	0.1025

Appendix Table 2: Percent Changes in Yield

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	1.6	1.2	1.2	1.4	1.1	0.9	0.9	1.4	1.4	1.4	1.4
AUSTRALIA	1.1	1.2	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3
BANGLADESH	1.4	1.3	1.4	1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.2
BENIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOLIVIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BRAZIL	0.6	1.3	1.9	1.3	1.0	1.1	1.1	0.9	0.9	0.9	0.9
BURKINA FASO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAMBODIA	3.4	3.4	1.8	2.7	2.7	2.7	2.6	1.6	1.6	1.6	1.6
CAMEROON	3.4	2.3	2.3	1.8	1.8	1.3	2.3	2.3	2.3	2.3	2.3
CANADA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHILE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHINA	0.3	0.3	0.5	0.5	0.6	0.6	0.2	0.0	0.0	0.0	0.0
COLOMBIA	1.2	1.3	1.2	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1
COSTARICA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COTE D'IVOIRE	2.8	2.0	1.9	1.9	1.9	1.8	1.8	2.8	2.8	2.8	2.8
CUBA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ECUADOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EGYPT	1.4	1.9	1.1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
ELSALVADOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8
GAMBIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GHANA	2.9	2.1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
GUATEMALA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUINEA	2.1	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9
GUINEA BISSAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUYANA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HAITI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HONDURAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HONG KONG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INDIA	1.5	1.0	1.1	1.1	1.4	1.2	0.9	0.7	0.7	0.7	0.7
INDONESIA	1.5	1.0	1.4	1.3	1.2	0.9	1.2	0.4	0.4	0.4	0.4
IRAN	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
IRAQ	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
JAPAN	0.4	0.2	0.3	0.3	0.2	0.1	0.2	0.2	0.2	0.2	0.2
LAOS	1.7	1.6	1.6	1.6	1.1	1.5	1.5	2.0	2.0	2.0	2.0
LIBERIA	3.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
MALAYSIA	0.8	0.8	1.3	1.3	1.0	1.2	1.2	1.2	1.2	1.2	1.2
MALI	3.5	3.0	2.7	2.2	2.5	2.9	2.3	2.3	2.3	2.3	2.3
MEXICO	0.7	0.7	0.6	0.7	0.8	0.8	0.6	-0.3	-0.3	-0.3	-0.3
MYANMAR	1.7	2.0	1.8	1.7	1.7	1.3	1.5	1.2	1.2	1.2	1.2
NICARAGUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NIGER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NIGERIA	2.9	3.6	1.9	1.1	1.5	1.5	1.8	2.5	2.5	2.5	2.5

Appendix Appendix Table 2: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	0.7	1.6	1.0	0.1	1.7	1.0	0.3	0.4	0.4	0.4	0.4
PANAMA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PARAGUAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PERU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PHILIPPINES	0.9	0.8	1.1	0.9	1.1	1.2	1.0	1.0	1.0	1.0	1.0
RUSSIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SAUDI ARABIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SENEGAL	2.6	2.3	2.3	2.2	2.4	1.8	1.8	1.8	1.8	1.8	1.8
SIERRA LEONE	3.6	3.1	2.1	2.1	1.1	3.1	2.1	1.6	1.6	1.6	1.6
SINGAPORE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOUTH KOREA	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
SOUTH AFRICA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SRILANKA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SURINAME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TAIWAN	0.0	0.2	0.2	0.3	0.4	0.6	0.6	0.6	0.6	0.6	0.6
TANZANIA	1.8	1.8	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6
THAILAND	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.1
TOGO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TURKEY	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
UAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
URUGUAY	1.0	0.8	0.7	0.7	0.7	1.3	1.3	1.3	1.3	1.3	1.3
USA	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
VENEZUELA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VIETNAM	0.6	0.7	0.7	0.8	0.2	0.6	0.5	0.4	0.4	0.4	0.4
OAFRICA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OASIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OCARIBBEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OEUROPE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OMIDDLE EAST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OOCEANIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix Table 3: Beginning Stocks in TMT

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	127	104	100	82	82	91	95	98	100	100	100
AUSTRALIA	32	59	98	138	165	180	188	186	180	180	180
BANGLADESH	900	861	854	864	864	863	872	881	890	890	890
BENIN	0	0	0	0	0	0	0	0	0	0	0
BOLIVIA	0	0	0	0	0	0	0	0	0	0	0
BRAZIL	1,422	1,525	1,583	1,632	1,675	1,720	1,765	1,812	1,860	1,860	1,860
BURKINA FASO	10	10	10	10	10	10	10	10	10	10	10
CAMBODIA	273	276	279	281	284	286	289	292	294	294	294
CAMEROON	0	0	0	0	0	0	0	0	0	0	0
CANADA	0	0	0	0	0	0	0	0	0	0	0
CHILE	79	79	79	79	79	79	79	79	79	79	79
CHINA	46,574	48,591	51,000	53,078	55,269	58,008	61,228	64,719	68,757	68,757	68,757
COLOMBIA	219	276	325	365	402	436	469	504	535	535	535
COSTARICA	40	40	40	40	40	40	40	40	40	40	40
COTE D'IVOIRE	295	306	309	315	321	327	335	343	349	349	349
CUBA	0	0	0	0	0	0	0	0	0	0	0
ECUADOR	85	85	85	85	85	85	85	85	85	85	85
EGYPT	648	556	600	654	704	747	766	767	755	755	755
ELSALVADOR	25	25	25	25	25	25	25	25	25	25	25
EU	881	816	753	698	649	596	549	532	544	544	544
GAMBIA	26	26	26	26	26	26	26	26	26	26	26
GHANA	126	137	145	154	163	171	179	188	196	196	196
GUATEMALA	0	0	0	0	0	0	0	0	0	0	0
GUINEA	120	121	122	123	124	125	126	127	129	129	129
GUINEA BISSAU	24	24	24	24	24	24	24	24	24	24	24
GUYANA	75	75	75	75	75	75	75	75	75	75	75
HAITI	68	68	68	68	68	68	68	68	68	68	68
HONDURAS	24	24	24	24	24	24	24	24	24	24	24
HONG KONG	0	0	0	0	0	0	0	0	0	0	0
INDIA	21,704	22,693	23,792	24,531	24,728	24,862	25,016	25,075	24,986	24,986	24,986
INDONESIA	4,736	4,906	5,041	5,120	5,160	5,178	5,186	5,189	5,190	5,190	5,190
IRAN	530	494	484	491	500	515	532	549	569	569	569
IRAQ	347	358	365	371	377	383	387	391	394	394	394
JAPAN	2,909	2,750	2,611	2,426	2,262	2,084	1,963	1,892	1,850	1,850	1,850
LAOS	30	30	30	30	31	31	31	32	32	32	32
LIBERIA	0	0	0	0	0	0	0	0	0	0	0
MALAYSIA	735	730	736	721	729	725	721	718	724	724	724
MALI	292	288	287	284	281	277	274	270	265	265	265
MEXICO	165	166	168	172	172	174	177	177	171	171	171
MYANMAR	436	520	638	816	943	1,059	1,169	1,307	1,486	1,486	1,486
NICARAGUA	139	139	139	139	139	139	139	139	139	139	139
NIGER	0	0	0	0	0	0	0	0	0	0	0
NIGERIA	667	683	696	704	711	715	718	721	722	722	722

Appendix Appendix Table 3: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	604	617	622	676	699	700	718	702	669	670	670
PANAMA	45	45	45	45	45	45	45	45	45	45	45
PARAGUAY	31	31	31	31	31	31	31	31	31	31	31
PERU	285	285	285	285	285	285	285	285	285	285	285
PHILIPPINES	2,846	2,919	2,956	2,986	3,019	3,045	3,071	3,100	3,130	3,130	3,130
RUSSIA	94	94	94	94	94	94	94	94	94	94	94
SAUDI ARABIA	234	234	234	234	234	234	234	234	234	234	234
SENEGAL	281	294	307	320	333	346	358	371	376	376	376
SIERRA LEONE	0	0	0	0	0	0	0	0	0	0	0
SINGAPORE	0	0	0	0	0	0	0	0	0	0	0
SOUTH KOREA	872	941	966	989	1,036	1,080	1,142	1,190	1,233	1,233	1,233
SOUTH AFRICA	32	32	32	32	32	32	32	32	32	32	32
SRILANKA	395	395	395	395	395	395	395	395	395	395	395
SURINAME	0	0	0	0	0	0	0	0	0	0	0
TAIWAN	242	220	208	206	204	201	199	200	207	207	207
TANZANIA	0	0	0	0	0	0	0	0	0	0	0
THAILAND	10,994	10,174	9,304	8,479	7,641	6,810	6,008	5,219	4,455	4,455	4,455
TOGO	0	0	0	0	0	0	0	0	0	0	0
TURKEY	215	223	222	225	229	233	231	233	235	235	235
UAE	0	0	0	0	0	0	0	0	0	0	0
URUGUAY	153	160	169	177	187	196	206	217	228	228	228
USA	1,488	1,422	1,328	1,270	1,247	1,212	1,194	1,170	1,165	1,165	1,165
VENEZUELA	149	149	149	149	149	149	149	149	149	149	149
VIETNAM	2,091	2,391	2,517	3,160	3,869	3,998	4,080	4,206	4,312	4,312	4,312
OAFRICA	107	107	107	107	107	107	107	107	107	107	107
OASIA	39	39	39	39	39	39	39	39	39	39	39
OCARIBBEAN	43	43	43	43	43	43	43	43	43	43	43
OEUROPE	58	58	58	58	58	58	58	58	58	58	58
OMIDDLE EAST	0	0	0	0	0	0	0	0	0	0	0
OOCEANIA	0	0	0	0	0	0	0	0	0	0	0
Total	106,058	108,713	111,722	114,647	117,166	119,482	122,350	125,483	129,097	129,097	129,097

Appendix Table 4: Benchmark Percent Changes in LGP Production

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	2.57	2.03	1.31	2.33	1.62	1.12	1.33	2.19	2.10	2.16	2.14
AUSTRALIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BANGLADESH	0.95	0.99	0.94	0.86	0.84	0.84	0.79	0.76	0.71	0.70	0.67
BENIN	0.82	0.69	0.64	0.45	0.15	0.41	0.57	0.69	0.67	0.63	0.58
BOLIVIA	1.08	1.01	0.78	0.90	0.88	0.82	0.78	0.77	0.69	0.69	0.65
BRAZIL	0.33	1.00	1.68	1.23	0.94	1.03	1.17	1.07	0.71	1.03	1.01
BURKINA FASO	1.65	1.08	1.09	0.80	0.71	0.88	0.83	1.01	0.62	0.84	0.78
CAMBODIA	2.28	2.15	1.11	1.72	1.48	1.69	1.82	1.06	0.90	1.04	1.03
CAMEROON	6.60	4.30	4.26	3.06	2.78	2.10	3.90	3.94	3.84	3.82	3.76
CANADA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHILE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHINA	0.85	0.05	-0.19	-0.12	-0.03	0.03	-0.14	-0.05	-2.13	-0.33	-0.35
COLOMBIA	1.02	0.97	0.82	1.03	0.92	1.04	1.06	0.85	-0.21	0.93	0.89
COSTARICA	0.56	0.79	0.71	0.74	0.63	0.62	0.61	0.64	0.54	0.49	0.44
COTE D'IVOIRE	5.67	2.99	3.43	2.81	2.44	2.76	2.85	4.53	4.28	4.46	4.38
CUBA	0.79	-0.64	0.45	-0.15	-0.72	-0.04	0.23	0.47	0.18	0.51	0.51
ECUADOR	1.39	1.39	1.38	1.37	1.33	1.33	1.31	1.30	1.26	1.25	1.22
EGYPT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ELSALVADOR	-1.38	0.54	0.79	0.74	0.19	0.46	0.47	0.72	0.48	0.52	0.46
EU	1.10	0.83	0.78	0.59	0.46	0.70	0.48	0.73	1.53	1.35	1.34
GAMBIA	1.99	0.95	0.58	1.11	0.51	1.11	1.50	1.92	1.79	1.87	1.80
GHANA	6.93	4.10	3.83	3.14	2.65	3.05	3.33	3.18	2.72	3.22	3.15
GUATEMALA	-0.44	0.97	1.10	1.10	0.65	0.84	0.84	1.03	0.82	0.84	0.78
GUINEA	2.98	3.20	2.84	2.63	2.30	2.47	2.54	2.62	2.49	2.54	2.50
GUINEA BISSAU	1.41	1.21	1.19	1.01	0.59	0.97	1.20	1.33	1.30	1.28	1.22
GUYANA	0.23	0.27	0.27	0.27	0.24	0.25	0.25	0.26	0.23	0.23	0.21
HAITI	-0.58	0.47	0.95	0.64	-0.22	0.22	0.32	0.55	0.30	0.45	0.42
HONDURAS	-0.59	0.70	0.88	0.83	0.40	0.58	0.57	0.73	0.55	0.57	0.52
HONG KONG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INDIA	1.42	1.03	0.93	0.88	1.22	1.09	0.85	0.70	0.73	0.71	0.70
INDONESIA	1.06	0.62	0.75	0.69	0.63	0.60	0.66	0.43	0.40	0.38	0.36
IRAN	3.17	2.41	1.99	1.62	1.53	1.53	1.49	1.57	1.05	1.46	1.43
IRAQ	-7.38	-0.21	2.26	3.63	2.02	1.93	2.47	2.68	0.54	2.72	2.61
JAPAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAOS	0.72	0.70	0.68	0.66	0.54	0.60	0.58	0.63	0.59	0.56	0.53
LIBERIA	3.11	1.38	0.93	0.51	-0.12	0.69	1.25	1.67	1.77	1.65	1.57
MALAYSIA	1.69	1.32	1.84	2.17	0.85	1.72	1.81	2.09	1.70	1.89	1.86
MALI	3.51	3.50	3.17	2.91	2.95	3.15	2.84	2.80	2.86	2.71	2.67
MEXICO	-0.46	2.49	2.24	1.59	2.19	1.95	1.21	-1.36	1.00	-0.19	-0.23
MYANMAR	3.04	2.53	2.38	1.80	1.71	1.52	1.82	1.63	0.82	1.45	1.42
NICARAGUA	1.25	1.03	0.45	0.76	0.78	0.73	0.70	0.75	0.66	0.64	0.60
NIGER	3.67	3.50	3.25	2.87	2.59	2.84	3.03	3.19	3.20	3.14	3.08
NIGERIA	7.34	8.47	4.63	2.81	3.15	3.37	4.12	5.38	5.23	5.04	4.87

Appendix Appendix Table 4: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	1.20	2.59	1.95	-0.17	2.83	1.46	0.07	0.50	0.25	0.49	0.50
PANAMA	0.56	0.63	0.49	0.55	0.43	0.40	0.37	0.41	0.31	0.32	0.30
PARAGUAY	-1.07	-1.39	-2.21	-1.58	-1.55	-1.67	-1.60	-1.46	-1.82	-1.65	-1.75
PERU	0.52	0.55	0.48	0.50	0.46	0.38	0.38	0.38	0.30	0.32	0.29
PHILIPPINES	1.18	1.80	2.12	1.94	1.88	2.08	1.98	2.02	1.84	1.96	1.94
RUSSIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SAUDI ARABIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SENEGAL	3.83	3.36	3.23	2.96	3.07	2.55	2.64	2.55	2.60	2.69	2.65
SIERRA LEONE	5.07	4.27	3.10	3.04	1.85	3.91	2.99	2.57	2.51	2.50	2.46
SINGAPORE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOUTH KOREA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOUTH AFRICA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SRILANKA	0.30	0.30	0.29	0.25	0.17	0.18	0.17	0.17	0.14	0.12	0.10
SURINAME	0.52	0.52	0.50	0.47	0.44	0.43	0.41	0.39	0.38	0.37	0.36
TAIWAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TANZANIA	5.03	4.49	4.51	4.32	3.54	3.96	4.13	4.13	4.05	3.94	3.81
THAILAND	-0.14	-0.83	-0.28	-1.02	-1.79	-0.84	-0.39	0.19	2.66	0.09	0.03
TOGO	1.12	0.63	0.77	0.34	-0.25	0.35	0.68	0.92	0.84	0.87	0.81
TURKEY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UAE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
URUGUAY	2.03	1.45	1.22	1.39	1.22	2.56	2.64	2.73	2.30	2.57	2.51
USA	0.59	1.01	1.39	1.27	0.98	1.29	1.28	1.44	1.39	1.38	1.35
VENEZUELA	-0.24	0.12	0.09	0.24	0.12	0.13	0.11	0.18	0.08	0.11	0.09
VIETNAM	0.73	0.45	0.66	0.61	-0.32	0.19	0.23	0.12	-0.17	0.03	-0.03
OAFRICA	0.13	-0.08	0.06	-0.15	-0.67	-0.23	0.05	0.21	0.20	0.20	0.16
OASIA	-0.31	-0.48	-0.40	-0.57	-0.80	-0.53	-0.38	-0.26	-0.27	-0.24	-0.25
OCARIBBEAN	0.60	0.72	0.79	0.79	0.67	0.73	0.74	0.81	0.73	0.76	0.73
OEUROPE	-0.02	-0.45	-0.19	-0.45	-0.82	-0.46	-0.25	-0.12	-0.22	-0.14	-0.13
OMIDDLE EAST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OOCEANIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix Table 5: Scenario Percent Changes in LGP Production

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	2.57	2.03	1.31	2.33	1.62	1.12	1.34	2.19	2.10	2.17	2.15
AUSTRALIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BANGLADESH	0.95	0.99	0.94	0.86	0.84	0.84	0.79	0.76	0.71	0.70	0.67
BENIN	0.82	0.70	0.65	0.45	0.15	0.42	0.58	0.70	0.68	0.64	0.59
BOLIVIA	1.08	1.01	0.78	0.90	0.88	0.82	0.78	0.77	0.69	0.69	0.65
BRAZIL	0.33	1.00	1.68	1.23	0.94	1.03	1.17	1.07	0.71	1.04	1.02
BURKINA FASO	1.65	1.08	1.09	0.80	0.71	0.88	0.83	1.01	0.63	0.84	0.78
CAMBODIA	2.29	2.15	1.12	1.73	1.49	1.70	1.83	1.07	0.90	1.05	1.04
CAMEROON	6.61	4.30	4.27	3.07	2.79	2.10	3.91	3.95	3.84	3.82	3.76
CANADA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHILE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHINA	0.85	0.05	-0.19	-0.12	-0.03	0.03	-0.14	-0.05	-2.13	-0.33	-0.35
COLOMBIA	1.03	0.99	0.83	1.04	0.94	1.07	1.10	0.89	-0.16	0.98	0.95
COSTARICA	0.58	0.80	0.73	0.77	0.66	0.66	0.65	0.69	0.60	0.56	0.52
COTE D'IVOIRE	5.67	2.99	3.44	2.81	2.44	2.77	2.86	4.54	4.29	4.48	4.40
CUBA	0.79	-0.64	0.45	-0.15	-0.72	-0.04	0.23	0.47	0.18	0.51	0.52
ECUADOR	1.39	1.39	1.38	1.37	1.34	1.33	1.32	1.31	1.27	1.26	1.23
EGYPT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ELSALVADOR	-1.28	0.65	0.92	0.90	0.38	0.70	0.78	1.09	0.90	1.01	1.02
EU	1.22	0.92	0.84	0.60	0.37	0.49	0.14	0.12	0.35	-0.28	-0.91
GAMBIA	1.99	0.95	0.58	1.11	0.52	1.11	1.50	1.92	1.79	1.87	1.81
GHANA	6.95	4.11	3.84	3.16	2.67	3.08	3.35	3.21	2.75	3.25	3.18
GUATEMALA	-0.37	1.06	1.20	1.22	0.79	1.02	1.07	1.30	1.11	1.18	1.16
GUINEA	2.98	3.20	2.84	2.64	2.30	2.47	2.54	2.62	2.50	2.55	2.50
GUINEA BISSAU	1.41	1.21	1.20	1.01	0.59	0.97	1.20	1.33	1.31	1.28	1.23
GUYANA	0.24	0.27	0.27	0.28	0.25	0.26	0.26	0.27	0.25	0.25	0.24
HAITI	-0.50	0.56	1.05	0.75	-0.08	0.39	0.55	0.82	0.60	0.79	0.81
HONDURAS	-0.52	0.78	0.97	0.94	0.54	0.74	0.79	0.99	0.84	0.90	0.90
HONG KONG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
INDIA	1.42	1.03	0.93	0.88	1.22	1.09	0.85	0.70	0.73	0.71	0.70
INDONESIA	1.06	0.62	0.75	0.69	0.64	0.60	0.67	0.44	0.40	0.39	0.37
IRAN	3.18	2.41	1.99	1.63	1.54	1.54	1.51	1.59	1.08	1.49	1.46
IRAQ	-7.38	-0.21	2.27	3.64	2.03	1.94	2.48	2.70	0.55	2.74	2.63
JAPAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LAOS	0.72	0.70	0.68	0.66	0.54	0.60	0.58	0.63	0.59	0.56	0.53
LIBERIA	3.12	1.39	0.94	0.52	-0.11	0.71	1.26	1.70	1.80	1.68	1.60
MALAYSIA	1.70	1.33	1.85	2.18	0.86	1.73	1.82	2.10	1.71	1.90	1.87
MALI	3.51	3.50	3.17	2.91	2.95	3.15	2.85	2.80	2.86	2.71	2.67
MEXICO	-0.37	2.59	2.36	1.74	2.35	2.15	1.48	-0.98	1.33	0.25	0.28
MYANMAR	3.04	2.53	2.38	1.80	1.71	1.52	1.83	1.63	0.83	1.46	1.43
NICARAGUA	1.26	1.04	0.45	0.76	0.79	0.74	0.71	0.76	0.67	0.65	0.61
NIGER	3.67	3.50	3.25	2.87	2.59	2.85	3.03	3.20	3.20	3.14	3.09
NIGERIA	7.34	8.47	4.63	2.81	3.15	3.37	4.12	5.38	5.23	5.04	4.88

Appendix Appendix Table 5: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	1.20	2.59	1.95	-0.17	2.84	1.46	0.08	0.51	0.26	0.51	0.52
PANAMA	0.58	0.64	0.51	0.57	0.46	0.43	0.41	0.46	0.36	0.38	0.36
PARAGUAY	-1.09	-1.40	-2.23	-1.61	-1.58	-1.72	-1.67	-1.55	-1.93	-1.77	-1.89
PERU	0.52	0.55	0.48	0.50	0.46	0.38	0.38	0.38	0.30	0.32	0.29
PHILIPPINES	1.19	1.80	2.13	1.95	1.89	2.09	1.99	2.03	1.85	1.97	1.95
RUSSIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SAUDI ARABIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SENEGAL	3.83	3.36	3.23	2.96	3.07	2.55	2.64	2.56	2.60	2.69	2.66
SIERRA LEONE	5.07	4.27	3.10	3.04	1.85	3.91	2.99	2.57	2.51	2.50	2.46
SINGAPORE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOUTH KOREA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOUTH AFRICA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SRILANKA	0.31	0.31	0.29	0.26	0.18	0.19	0.18	0.18	0.16	0.14	0.12
SURINAME	0.52	0.52	0.50	0.48	0.45	0.43	0.41	0.40	0.39	0.38	0.36
TAIWAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TANZANIA	5.03	4.49	4.52	4.32	3.55	3.96	4.14	4.13	4.06	3.95	3.82
THAILAND	-0.15	-0.83	-0.29	-1.03	-1.80	-0.85	-0.40	0.17	2.64	0.06	0.01
TOGO	1.12	0.64	0.77	0.35	-0.25	0.36	0.69	0.93	0.85	0.88	0.82
TURKEY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UAE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
URUGUAY	2.02	1.44	1.21	1.38	1.21	2.55	2.63	2.72	2.29	2.56	2.50
USA	0.63	1.06	1.46	1.37	1.11	1.46	1.51	1.74	1.76	1.84	1.90
VENEZUELA	-0.22	0.15	0.11	0.27	0.16	0.18	0.18	0.26	0.16	0.21	0.20
VIETNAM	0.73	0.45	0.66	0.61	-0.32	0.20	0.23	0.13	-0.16	0.04	-0.02
OAFRICA	0.13	-0.08	0.06	-0.14	-0.66	-0.22	0.06	0.23	0.21	0.22	0.18
OASIA	-0.31	-0.47	-0.40	-0.57	-0.80	-0.53	-0.37	-0.26	-0.26	-0.24	-0.24
OCARIBBEAN	0.61	0.73	0.80	0.81	0.70	0.77	0.78	0.85	0.79	0.82	0.80
OEUROPE	-0.03	-0.46	-0.21	-0.47	-0.84	-0.49	-0.29	-0.16	-0.28	-0.21	-0.23
OMIDDLE EAST	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OOCEANIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix Table 6: Benchmark Percent Changes in MGP Production

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AUSTRALIA	2.5	2.4	1.9	1.3	1.2	1.5	1.4	1.7	2.0	1.8	1.8
BANGLADESH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BENIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BOLIVIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BRAZIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BURKINA FASO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAMBODIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CAMEROON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CANADA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHILE	0.6	0.9	0.9	0.8	0.7	0.7	0.7	0.7	0.7	0.6	0.6
CHINA	0.8	0.1	-0.2	0.0	0.1	0.1	-0.1	0.0	-2.1	-0.3	-0.3
COLOMBIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COSTARICA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COTE D'IVOIRE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CUBA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ECUADOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EGYPT	1.5	2.6	1.5	1.3	1.2	1.1	1.2	1.2	1.2	1.1	1.1
ELSALVADOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EU	1.1	1.1	1.2	1.1	0.8	1.0	1.6	1.5	0.5	0.8	0.8
GAMBIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GHANA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUATEMALA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUINEA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUINEA BISSAU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUYANA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HAITI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HONDURAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HONG KONG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INDIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INDONESIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IRAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IRAQ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JAPAN	-2.5	-0.5	-1.1	-0.6	-0.9	-0.3	-0.3	-0.5	-0.4	-0.8	-0.8
LAOS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LIBERIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MALAYSIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MALI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEXICO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MYANMAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NICARAGUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NIGER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NIGERIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix Appendix Table 6: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PANAMA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PARAGUAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PERU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PHILIPPINES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RUSSIA	0.5	0.6	0.6	0.6	0.5	0.5	0.4	0.5	0.4	0.4	0.4
SAUDI ARABIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SENEGAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIERRA LEONE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SINGAPORE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SOUTH KOREA	-0.5	-0.9	-0.3	0.0	-0.3	0.0	-0.4	-0.2	-0.9	-0.1	-0.1
SOUTH AFRICA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SRILANKA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SURINAME	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TAIWAN	-0.8	-0.1	-0.1	-0.5	-0.7	-0.5	-0.3	0.0	-0.9	-0.4	-0.4
TANZANIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THAILAND	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOGO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TURKEY	3.7	1.5	2.4	2.1	1.7	1.5	2.1	1.7	1.5	1.7	1.7
UAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
URUGUAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA	-0.5	2.1	1.8	1.7	1.2	1.2	1.2	1.3	1.0	1.2	1.1
VENEZUELA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VIETNAM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OAFRICA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OASIA	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.2	-0.1	-0.1
OCARIBBEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OEUROPE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OMIDDLE EAST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OOCEANIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix Table 7: Scenario Percent Changes in MGP Production

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	0	0	0	0	0	0	0	0	0	0	0
AUSTRALIA	2.50	2.39	1.86	1.27	1.19	1.53	1.47	1.68	2.01	1.80	1.79
BANGLADESH	0	0	0	0	0	0	0	0	0	0	0
BENIN	0	0	0	0	0	0	0	0	0	0	0
BOLIVIA	0	0	0	0	0	0	0	0	0	0	0
BRAZIL	0	0	0	0	0	0	0	0	0	0	0
BURKINA FASO	0	0	0	0	0	0	0	0	0	0	0
CAMBODIA	0	0	0	0	0	0	0	0	0	0	0
CAMEROON	0	0	0	0	0	0	0	0	0	0	0
CANADA	0	0	0	0	0	0	0	0	0	0	0
CHILE	0.60	0.88	0.90	0.86	0.74	0.77	0.77	0.80	0.74	0.74	0.72
CHINA	0.81	0.14	-0.18	-0.03	0.10	0.10	-0.07	0.01	-2.08	-0.26	-0.28
COLOMBIA	0	0	0	0	0	0	0	0	0	0	0
COSTARICA	0	0	0	0	0	0	0	0	0	0	0
COTE D'IVOIRE	0	0	0	0	0	0	0	0	0	0	0
CUBA	0	0	0	0	0	0	0	0	0	0	0
ECUADOR	0	0	0	0	0	0	0	0	0	0	0
EGYPT	1.47	2.56	1.45	1.26	1.21	1.14	1.16	1.16	1.21	1.15	1.13
ELSALVADOR	0	0	0	0	0	0	0	0	0	0	0
EU	0.83	0.84	0.91	0.81	0.52	0.66	1.15	1.10	0.20	0.47	0.50
GAMBIA	0	0	0	0	0	0	0	0	0	0	0
GHANA	0	0	0	0	0	0	0	0	0	0	0
GUATEMALA	0	0	0	0	0	0	0	0	0	0	0
GUINEA	0	0	0	0	0	0	0	0	0	0	0
GUINEA BISSAU	0	0	0	0	0	0	0	0	0	0	0
GUYANA	0	0	0	0	0	0	0	0	0	0	0
HAITI	0	0	0	0	0	0	0	0	0	0	0
HONDURAS	0	0	0	0	0	0	0	0	0	0	0
HONG KONG	0	0	0	0	0	0	0	0	0	0	0
INDIA	0	0	0	0	0	0	0	0	0	0	0
INDONESIA	0	0	0	0	0	0	0	0	0	0	0
IRAN	0	0	0	0	0	0	0	0	0	0	0
IRAQ	0	0	0	0	0	0	0	0	0	0	0
JAPAN	-2.48	-0.52	-1.09	-0.59	-0.93	-0.30	-0.31	-0.49	-0.39	-0.75	-0.76
LAOS	0	0	0	0	0	0	0	0	0	0	0
LIBERIA	0	0	0	0	0	0	0	0	0	0	0
MALAYSIA	0	0	0	0	0	0	0	0	0	0	0
MALI	0	0	0	0	0	0	0	0	0	0	0
MEXICO	0	0	0	0	0	0	0	0	0	0	0
MYANMAR	0	0	0	0	0	0	0	0	0	0	0
NICARAGUA	0	0	0	0	0	0	0	0	0	0	0
NIGER	0	0	0	0	0	0	0	0	0	0	0
NIGERIA	0	0	0	0	0	0	0	0	0	0	0

Appendix Appendix Table 7: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	0	0	0	0	0	0	0	0	0	0	0
PANAMA	0	0	0	0	0	0	0	0	0	0	0
PARAGUAY	0	0	0	0	0	0	0	0	0	0	0
PERU	0	0	0	0	0	0	0	0	0	0	0
PHILIPPINES	0	0	0	0	0	0	0	0	0	0	0
RUSSIA	0.55	0.62	0.57	0.55	0.47	0.45	0.44	0.48	0.37	0.41	0.40
SAUDI ARABIA	0	0	0	0	0	0	0	0	0	0	0
SENEGAL	0	0	0	0	0	0	0	0	0	0	0
SIERRA LEONE	0	0	0	0	0	0	0	0	0	0	0
SINGAPORE	0	0	0	0	0	0	0	0	0	0	0
SOUTH KOREA	-0.47	-0.85	-0.30	0.04	-0.34	-0.04	-0.36	-0.16	-0.85	-0.12	-0.11
SOUTH AFRICA	0	0	0	0	0	0	0	0	0	0	0
SRILANKA	0	0	0	0	0	0	0	0	0	0	0
SURINAME	0	0	0	0	0	0	0	0	0	0	0
TAIWAN	-0.77	-0.07	-0.11	-0.51	-0.65	-0.43	-0.28	0.00	-0.85	-0.38	-0.38
TANZANIA	0	0	0	0	0	0	0	0	0	0	0
THAILAND	0	0	0	0	0	0	0	0	0	0	0
TOGO	0	0	0	0	0	0	0	0	0	0	0
TURKEY	3.65	1.52	2.38	2.10	1.72	1.45	2.08	1.72	1.52	1.63	1.61
UAE	0	0	0	0	0	0	0	0	0	0	0
URUGUAY	0	0	0	0	0	0	0	0	0	0	0
USA	-0.42	2.19	1.96	1.80	1.36	1.39	1.36	1.51	1.11	1.22	1.16
VENEZUELA	0	0	0	0	0	0	0	0	0	0	0
VIETNAM	0	0	0	0	0	0	0	0	0	0	0
OAFRICA	0	0	0	0	0	0	0	0	0	0	0
OASIA	-0.15	-0.18	-0.23	-0.21	-0.21	-0.20	-0.15	-0.11	-0.23	-0.12	-0.12
OCARIBBEAN	0	0	0	0	0	0	0	0	0	0	0
OEUROPE	0	0	0	0	0	0	0	0	0	0	0
OMIDDLE EAST	0	0	0	0	0	0	0	0	0	0	0
OOCEANIA	0	0	0	0	0	0	0	0	0	0	0

Appendix Table 8: Benchmark Percentage Changes in LGW Production

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	2.58	0.91	2.49	1.33	1.14	1.61	1.57	2.36	2.33	2.27	2.25
AUSTRALIA	1.83	1.40	1.50	1.01	0.49	1.00	1.32	1.63	1.45	1.51	1.46
BANGLADESH	0.95	0.93	0.91	0.88	0.84	0.82	0.79	0.76	0.73	0.70	0.67
BENIN	0.82	0.69	0.64	0.45	0.15	0.41	0.57	0.69	0.67	0.63	0.58
BOLIVIA	1.12	1.04	0.83	0.94	0.92	0.86	0.83	0.81	0.74	0.74	0.70
BRAZIL	0.78	1.10	1.40	1.01	0.72	0.80	0.92	0.85	0.86	0.82	0.80
BURKINA FASO	1.65	1.08	1.09	0.80	0.71	0.88	0.83	1.01	0.62	0.84	0.78
CAMBODIA	1.50	1.42	0.77	1.16	1.01	1.14	1.23	0.72	0.57	0.68	0.66
CAMEROON	6.60	4.30	4.26	3.06	2.78	2.10	3.90	3.94	3.84	3.82	3.76
CANADA	1.85	1.53	1.62	1.46	1.39	1.37	1.45	1.56	1.59	1.48	1.49
CHILE	1.24	1.22	0.86	0.91	0.72	0.72	0.88	0.64	0.61	0.63	0.59
CHINA	-0.03	-0.15	-0.02	-0.17	-0.30	-0.21	-0.28	-0.33	-0.15	-0.33	-0.35
COLOMBIA	1.09	1.30	1.31	1.15	1.09	1.05	1.01	1.03	1.15	0.92	0.88
COSTARICA	2.00	1.91	1.81	1.84	1.85	1.76	1.78	1.73	1.68	1.54	1.48
COTE D'IVOIRE	4.67	3.92	3.09	2.89	2.42	2.63	2.83	4.76	4.83	4.46	4.38
CUBA	0.79	-0.64	0.45	-0.15	-0.72	-0.04	0.23	0.47	0.18	0.51	0.51
ECUADOR	1.39	1.39	1.38	1.37	1.33	1.33	1.31	1.30	1.26	1.25	1.22
EGYPT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ELSALVADOR	1.78	1.82	1.75	1.77	1.80	1.77	1.77	1.77	1.75	1.68	1.65
EU	0.73	0.73	0.63	0.35	0.23	0.45	-0.10	0.17	1.72	1.28	1.27
GAMBIA	1.99	0.95	0.58	1.11	0.51	1.11	1.50	1.92	1.79	1.87	1.80
GHANA	6.71	4.60	3.76	3.23	2.72	3.15	3.11	3.49	3.63	3.19	3.12
GUATEMALA	2.99	2.88	2.85	2.83	2.81	2.78	2.79	2.79	2.75	2.69	2.64
GUINEA	3.00	3.20	2.86	2.62	2.30	2.47	2.53	2.61	2.55	2.54	2.50
GUINEA BISSAU	1.41	1.21	1.19	1.01	0.59	0.97	1.20	1.33	1.30	1.28	1.22
GUYANA	0.28	0.26	0.25	0.25	0.24	0.24	0.23	0.22	0.20	0.19	0.17
HAITI	-0.57	0.48	0.95	0.64	-0.22	0.22	0.33	0.55	0.30	0.45	0.42
HONDURAS	2.93	2.65	2.58	2.58	2.57	2.50	2.48	2.46	2.41	2.34	2.29
HONG KONG	0.70	-2.12	-0.45	-2.09	-3.48	-2.04	-1.41	-0.97	-1.60	-0.88	-0.89
INDIA	1.11	0.97	1.15	1.21	1.26	1.08	0.91	0.78	0.68	0.71	0.70
INDONESIA	0.82	0.68	0.84	0.75	0.67	0.61	0.67	0.43	0.40	0.38	0.36
IRAN	0.75	1.27	1.33	1.49	1.36	1.42	1.49	1.50	1.80	1.46	1.43
IRAQ	7.41	4.87	3.91	2.89	3.43	3.25	2.96	2.99	3.62	2.72	2.61
JAPAN	-0.42	-0.13	-0.11	0.18	1.25	0.20	-1.52	-1.72	0.70	-0.02	0.02
LAOS	0.72	0.71	0.69	0.66	0.54	0.60	0.58	0.63	0.60	0.56	0.53
LIBERIA	3.11	1.38	0.93	0.51	-0.12	0.69	1.25	1.67	1.77	1.65	1.57
MALAYSIA	1.80	0.93	2.57	1.38	1.27	1.69	1.80	1.77	1.90	1.89	1.85
MALI	3.84	3.36	3.26	2.89	2.98	3.15	2.86	2.80	2.70	2.71	2.67
MEXICO	3.04	2.19	2.03	2.08	1.93	1.93	2.02	1.87	1.79	1.83	1.82
MYANMAR	2.83	2.37	2.10	2.05	1.78	1.56	1.71	1.45	1.62	1.45	1.42
NICARAGUA	2.88	2.91	2.16	2.46	2.44	2.41	2.42	2.42	2.38	2.31	2.27
NIGER	3.67	3.50	3.25	2.87	2.59	2.84	3.03	3.19	3.20	3.14	3.08
NIGERIA	7.40	8.58	4.70	2.86	3.18	3.39	4.14	5.39	5.25	5.04	4.87

Appendix Appendix Table 8: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	0.97	2.64	1.42	0.16	3.00	1.28	0.42	0.66	-0.01	0.49	0.50
PANAMA	1.78	1.25	0.93	1.05	1.09	0.93	0.88	0.86	0.77	0.77	0.75
PARAGUAY	-1.66	-1.68	-2.67	-2.03	-2.16	-2.36	-2.22	-2.18	-2.72	-2.49	-2.65
PERU	0.52	0.55	0.48	0.50	0.46	0.38	0.38	0.38	0.30	0.32	0.29
PHILIPPINES	2.36	1.99	2.17	1.93	1.92	2.08	1.97	2.01	1.98	1.96	1.94
RUSSIA	0.79	-1.52	-0.41	-2.12	-3.41	-1.42	-0.78	0.15	-0.37	0.11	0.06
SAUDI ARABIA	-1.26	-0.16	-0.71	-1.49	-3.03	-1.49	-0.50	0.39	0.49	0.30	0.13
SENEGAL	3.64	3.49	3.24	3.10	3.13	2.59	2.68	3.46	3.24	2.69	2.65
SIERRA LEONE	5.07	4.27	3.10	3.04	1.85	3.91	2.99	2.57	2.51	2.50	2.46
SINGAPORE	0.21	2.17	-0.04	0.56	0.58	0.60	0.93	1.26	1.92	1.22	1.11
SOUTH KOREA	-0.79	-0.36	-0.78	-0.70	-0.86	-0.55	-0.30	-0.10	0.04	-0.07	-0.10
SOUTH AFRICA	2.05	1.70	1.17	0.55	-0.10	1.13	1.89	2.42	2.73	2.57	2.51
SRILANKA	0.30	0.30	0.29	0.25	0.17	0.18	0.17	0.17	0.14	0.12	0.10
SURINAME	0.55	0.55	0.53	0.50	0.47	0.46	0.44	0.42	0.41	0.40	0.38
TAIWAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TANZANIA	5.06	4.51	4.53	4.34	3.56	3.97	4.15	4.15	4.08	3.96	3.83
THAILAND	0.17	-0.21	-0.21	-0.58	-1.37	-0.53	-0.03	0.31	0.17	0.31	0.26
TOGO	1.12	0.63	0.77	0.34	-0.25	0.35	0.68	0.92	0.84	0.87	0.81
TURKEY	4.03	1.68	1.08	0.90	0.94	1.18	1.83	1.69	1.34	1.43	1.44
UAE	3.26	2.49	0.63	-0.84	0.06	0.25	0.69	1.16	1.46	1.32	1.26
URUGUAY	1.72	1.62	1.43	1.53	1.41	2.66	2.74	2.79	3.15	2.69	2.63
USA	3.17	1.00	0.84	0.58	0.69	0.80	1.07	1.01	1.04	1.14	1.11
VENEZUELA	1.53	1.52	1.53	1.71	1.66	1.55	1.49	1.39	1.35	1.32	1.27
VIETNAM	-0.70	0.87	-0.46	0.49	0.95	0.31	0.15	0.17	0.06	0.04	-0.02
OAFRICA	0.29	-0.05	0.08	-0.13	-0.63	-0.20	0.09	0.25	0.25	0.24	0.20
OASIA	-0.31	-0.47	-0.40	-0.57	-0.80	-0.53	-0.38	-0.26	-0.27	-0.24	-0.25
OCARIBBEAN	0.63	0.74	0.82	0.83	0.71	0.78	0.79	0.87	0.81	0.84	0.82
OEUROPE	0.00	-0.44	-0.17	-0.44	-0.81	-0.45	-0.25	-0.11	-0.19	-0.11	-0.11
OMIDDLE EAST	0.06	0.29	-0.19	-1.06	-1.52	-0.17	0.32	0.77	1.21	0.81	0.74
OOCEANIA	2.92	0.70	1.24	0.38	0.00	0.50	0.69	0.72	0.90	0.85	0.82

Appendix Table 9: Scenario Percent Changes in LGW Production

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	2.58	0.91	2.49	1.32	1.14	1.61	1.57	2.35	2.33	2.27	2.24
AUSTRALIA	1.81	1.37	1.46	0.97	0.43	0.93	1.23	1.51	1.30	1.31	1.21
BANGLADESH	0.95	0.93	0.91	0.88	0.84	0.82	0.79	0.76	0.73	0.70	0.67
BENIN	0.82	0.70	0.65	0.45	0.15	0.42	0.58	0.70	0.68	0.64	0.59
BOLIVIA	1.12	1.04	0.83	0.94	0.92	0.86	0.83	0.81	0.74	0.74	0.70
BRAZIL	0.78	1.10	1.40	1.01	0.71	0.80	0.91	0.84	0.85	0.81	0.79
BURKINA FASO	1.65	1.08	1.09	0.80	0.71	0.88	0.83	1.01	0.63	0.84	0.78
CAMBODIA	1.50	1.42	0.77	1.17	1.01	1.14	1.24	0.73	0.59	0.69	0.68
CAMEROON	6.61	4.30	4.27	3.07	2.79	2.10	3.91	3.95	3.84	3.82	3.76
CANADA	1.84	1.51	1.60	1.43	1.35	1.33	1.39	1.49	1.50	1.38	1.36
CHILE	1.22	1.20	0.84	0.89	0.69	0.68	0.83	0.58	0.55	0.56	0.51
CHINA	-0.03	-0.15	-0.02	-0.17	-0.30	-0.21	-0.28	-0.33	-0.15	-0.33	-0.35
COLOMBIA	1.10	1.32	1.32	1.16	1.11	1.08	1.04	1.07	1.19	0.97	0.94
COSTARICA	2.00	1.91	1.80	1.83	1.83	1.74	1.75	1.70	1.63	1.49	1.42
COTE D'IVOIRE	4.67	3.93	3.09	2.90	2.42	2.64	2.84	4.77	4.84	4.48	4.40
CUBA	0.79	-0.64	0.45	-0.15	-0.72	-0.04	0.23	0.47	0.18	0.51	0.52
ECUADOR	1.39	1.39	1.38	1.37	1.34	1.33	1.32	1.31	1.27	1.26	1.23
EGYPT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ELSALVADOR	1.77	1.82	1.75	1.77	1.80	1.76	1.76	1.76	1.73	1.67	1.63
EU	0.71	0.66	0.49	0.13	-0.12	-0.09	-0.91	-1.01	-0.03	-1.02	-1.72
GAMBIA	1.99	0.95	0.58	1.11	0.52	1.11	1.50	1.92	1.79	1.87	1.81
GHANA	6.72	4.61	3.78	3.25	2.73	3.17	3.14	3.52	3.66	3.22	3.15
GUATEMALA	2.99	2.88	2.84	2.83	2.81	2.78	2.78	2.78	2.74	2.67	2.63
GUINEA	3.00	3.20	2.86	2.62	2.30	2.48	2.53	2.62	2.56	2.55	2.50
GUINEA BISSAU	1.41	1.21	1.20	1.01	0.59	0.97	1.20	1.33	1.31	1.28	1.23
GUYANA	0.28	0.26	0.25	0.25	0.24	0.24	0.23	0.22	0.20	0.19	0.17
HAITI	-0.50	0.56	1.05	0.76	-0.08	0.40	0.55	0.82	0.60	0.79	0.81
HONDURAS	2.92	2.64	2.58	2.57	2.56	2.48	2.46	2.44	2.38	2.30	2.24
HONG KONG	0.70	-2.12	-0.44	-2.09	-3.47	-2.03	-1.41	-0.96	-1.59	-0.87	-0.88
INDIA	1.11	0.97	1.15	1.21	1.26	1.08	0.91	0.78	0.68	0.71	0.70
INDONESIA	0.82	0.68	0.84	0.76	0.67	0.62	0.67	0.44	0.41	0.39	0.37
IRAN	0.76	1.27	1.34	1.50	1.37	1.43	1.50	1.52	1.82	1.49	1.46
IRAQ	7.41	4.88	3.91	2.89	3.43	3.26	2.97	3.00	3.63	2.74	2.63
JAPAN	0.24	0.66	0.81	1.26	2.55	1.80	0.58	0.83	3.63	3.51	4.16
LAOS	0.72	0.71	0.69	0.66	0.54	0.60	0.58	0.63	0.60	0.56	0.53
LIBERIA	3.12	1.39	0.94	0.52	-0.11	0.71	1.26	1.70	1.80	1.68	1.60
MALAYSIA	1.80	0.93	2.58	1.38	1.28	1.69	1.81	1.78	1.91	1.90	1.87
MALI	3.84	3.36	3.26	2.89	2.98	3.15	2.86	2.80	2.70	2.71	2.67
MEXICO	3.02	2.16	1.99	2.03	1.87	1.85	1.92	1.74	1.64	1.65	1.60
MYANMAR	2.83	2.37	2.10	2.05	1.78	1.56	1.71	1.45	1.62	1.46	1.43
NICARAGUA	2.88	2.91	2.17	2.46	2.45	2.42	2.43	2.42	2.39	2.32	2.28
NIGER	3.67	3.50	3.25	2.87	2.59	2.85	3.03	3.20	3.20	3.14	3.09
NIGERIA	7.40	8.58	4.71	2.87	3.19	3.39	4.14	5.39	5.26	5.04	4.88

Appendix Appendix Table 9: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	0.98	2.64	1.42	0.17	3.00	1.28	0.43	0.67	0.00	0.51	0.52
PANAMA	1.77	1.23	0.91	1.02	1.05	0.88	0.81	0.77	0.67	0.64	0.59
PARAGUAY	-1.70	-1.73	-2.73	-2.10	-2.24	-2.47	-2.38	-2.38	-2.96	-2.79	-3.00
PERU	0.52	0.55	0.48	0.50	0.46	0.38	0.38	0.38	0.30	0.32	0.29
PHILIPPINES	2.36	1.99	2.17	1.93	1.93	2.09	1.98	2.02	1.99	1.97	1.95
RUSSIA	0.80	-1.52	-0.40	-2.11	-3.40	-1.40	-0.76	0.17	-0.35	0.13	0.08
SAUDI ARABIA	-1.20	-0.10	-0.64	-1.41	-2.96	-1.39	-0.36	0.56	0.69	0.52	0.38
SENEGAL	3.64	3.49	3.24	3.10	3.13	2.59	2.68	3.46	3.24	2.69	2.66
SIERRA LEONE	5.07	4.27	3.10	3.04	1.85	3.91	2.99	2.57	2.51	2.50	2.46
SINGAPORE	0.19	2.15	-0.06	0.54	0.55	0.57	0.90	1.22	1.88	1.18	1.06
SOUTH KOREA	-0.79	-0.35	-0.78	-0.70	-0.86	-0.55	-0.30	-0.10	0.05	-0.07	-0.09
SOUTH AFRICA	2.03	1.68	1.14	0.52	-0.14	1.08	1.82	2.34	2.64	2.47	2.40
SRILANKA	0.31	0.31	0.29	0.26	0.18	0.19	0.18	0.18	0.16	0.14	0.12
SURINAME	0.55	0.55	0.53	0.51	0.48	0.46	0.44	0.42	0.41	0.40	0.39
TAIWAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TANZANIA	5.06	4.51	4.54	4.34	3.56	3.98	4.15	4.15	4.08	3.97	3.84
THAILAND	0.17	-0.22	-0.21	-0.58	-1.38	-0.54	-0.04	0.30	0.16	0.29	0.24
TOGO	1.12	0.64	0.77	0.35	-0.25	0.36	0.69	0.93	0.85	0.88	0.82
TURKEY	3.74	1.34	0.67	0.42	0.35	0.44	0.86	0.50	-0.12	-0.36	-0.71
UAE	3.15	2.37	0.49	-1.00	-0.13	0.02	0.36	0.76	0.99	0.76	0.63
URUGUAY	1.73	1.64	1.45	1.56	1.44	2.70	2.80	2.87	3.24	2.80	2.75
USA	3.26	1.12	0.99	0.78	0.96	1.16	1.56	1.63	1.80	2.06	2.19
VENEZUELA	1.52	1.52	1.52	1.70	1.65	1.54	1.48	1.38	1.33	1.30	1.25
VIETNAM	-0.70	0.87	-0.46	0.49	0.95	0.31	0.15	0.18	0.07	0.05	-0.01
OAFRICA	0.28	-0.05	0.08	-0.13	-0.64	-0.20	0.08	0.23	0.23	0.22	0.18
OASIA	-0.31	-0.47	-0.40	-0.57	-0.80	-0.53	-0.37	-0.26	-0.26	-0.24	-0.24
OCARIBBEAN	0.64	0.76	0.84	0.85	0.74	0.81	0.83	0.92	0.86	0.90	0.89
OEUROPE	0.00	-0.44	-0.18	-0.44	-0.82	-0.46	-0.26	-0.13	-0.22	-0.15	-0.15
OMIDDLE EAST	0.06	0.29	-0.18	-1.06	-1.52	-0.17	0.32	0.77	1.20	0.79	0.70
OOCEANIA	2.87	0.64	1.16	0.29	-0.11	0.36	0.51	0.50	0.66	0.56	0.50

Appendix Table 10: Benchmark Percent Changes in MGW Production

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AUSTRALIA	0.60	1.43	1.92	2.38	2.25	2.13	2.18	2.02	1.65	1.81	1.79
BANGLADESH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BOLIVIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRAZIL	1.13	0.59	0.50	0.48	0.54	0.50	0.56	0.49	0.40	0.38	0.36
BURKINA FASO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAMBODIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAMEROON	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CANADA	1.69	1.62	1.54	1.54	1.53	1.43	1.47	1.51	1.53	1.43	1.44
CHILE	0.61	0.87	0.88	0.84	0.72	0.74	0.72	0.74	0.67	0.66	0.62
CHINA	-0.04	-0.04	-0.03	-0.10	-0.17	-0.15	-0.20	-0.25	-0.14	-0.26	-0.28
COLOMBIA	1.17	0.97	0.91	0.88	0.89	0.84	0.80	0.75	0.72	0.70	0.67
COSTARICA	2.73	2.47	2.43	2.42	2.45	2.41	2.39	2.37	2.34	2.13	2.05
COTE D'IVOIRE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUBA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ECUADOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EGYPT	2.28	0.65	1.32	1.32	1.31	1.48	1.38	1.34	1.06	1.15	1.13
ELSALVADOR	1.76	1.84	1.78	1.79	1.82	1.79	1.79	1.80	1.77	1.70	1.67
EU	0.75	0.99	0.91	0.92	0.92	0.81	0.68	0.67	0.88	0.80	0.79
GAMBIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GHANA	3.80	6.12	4.09	3.68	3.39	2.94	2.85	2.65	2.57	2.34	2.22
GUATEMALA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GUINEA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GUINEA BISSAU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GUYANA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAITI	2.62	2.52	2.50	2.49	2.08	2.06	2.04	1.97	1.97	1.95	1.94
HONDURAS	3.04	2.76	2.71	2.70	2.69	2.63	2.60	2.58	2.54	2.45	2.40
HONG KONG	3.39	0.10	-1.01	-0.89	-0.17	-0.61	-0.01	0.13	-1.47	0.06	0.05
INDIA	0.93	0.81	0.72	0.66	0.61	0.67	0.69	0.70	0.69	0.66	0.63
INDONESIA	0.67	0.50	0.48	0.46	0.49	0.46	0.43	0.42	0.41	0.37	0.35
IRAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IRAQ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JAPAN	-0.37	-0.70	-0.65	-0.77	-0.78	-0.85	-0.80	-0.77	-0.82	-0.75	-0.76
LAOS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LIBERIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MALAYSIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MALI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEXICO	2.58	2.33	2.20	2.18	2.11	2.08	2.08	1.98	2.01	1.96	1.95
MYANMAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NICARAGUA	2.98	2.97	2.18	2.51	2.50	2.47	2.47	2.48	2.44	2.36	2.32
NIGER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NIGERIA	4.10	3.66	3.53	3.44	3.44	3.35	3.29	3.19	3.17	3.10	3.04

Appendix Appendix Table 10: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PANAMA	3.37	3.06	2.90	2.80	2.63	2.51	2.42	2.32	2.23	2.14	2.10
PARAGUAY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PHILIPPINES	2.45	2.11	2.07	2.03	2.04	2.02	2.03	1.99	1.97	1.95	1.93
RUSSIA	0.55	0.62	0.57	0.55	0.47	0.45	0.45	0.48	0.38	0.42	0.42
SAUDI ARABIA	2.30	1.39	1.42	1.30	1.27	1.27	1.19	1.13	1.07	1.06	1.04
SENEGAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIERRA LEONE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SINGAPORE	1.59	1.44	1.30	1.13	0.97	0.84	0.75	0.71	0.70	0.71	0.70
SOUTH KOREA	-0.23	-0.15	-0.26	-0.35	-0.28	-0.30	-0.15	-0.16	-0.03	-0.17	-0.16
SOUTH AFRICA	2.12	2.39	2.34	2.32	2.30	2.37	2.36	2.38	2.37	2.38	2.37
SRILANKA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SURINAME	0.76	0.64	0.60	0.58	0.58	0.55	0.52	0.49	0.49	0.47	0.45
TAIWAN	-0.81	-0.73	-0.69	-0.65	-0.60	-0.54	-0.54	-0.53	-0.48	-0.47	-0.48
TANZANIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
THAILAND	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOGO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TURKEY	1.18	2.73	1.96	1.98	1.92	2.05	1.72	1.81	1.77	1.69	1.69
UAE	1.61	-6.73	-4.78	-5.87	-6.70	-5.40	-6.76	-7.07	-9.14	-6.85	-5.98
URUGUAY	1.93	2.06	2.01	1.95	1.76	1.73	1.63	1.63	1.60	1.59	1.56
USA	1.85	2.58	1.63	1.45	1.43	1.18	1.31	1.25	1.14	1.22	1.19
VENEZUELA	1.62	1.56	1.55	1.75	1.71	1.63	1.56	1.45	1.42	1.38	1.33
VIETNAM	-0.08	-0.41	-0.44	-0.57	-0.62	-0.65	-0.75	-0.81	-0.82	-0.76	-0.78
OAFRICA	0.99	0.09	0.16	-0.12	-0.47	-0.63	-1.47	-2.52	-5.77	-6.78	-8.83
OASIA	-0.15	-0.18	-0.23	-0.21	-0.21	-0.20	-0.15	-0.11	-0.23	-0.12	-0.12
OCARIBBEAN	1.23	1.21	1.29	1.31	1.31	1.30	1.28	1.29	1.29	1.29	1.28
OEUROPE	-0.43	8.12	4.27	3.53	2.78	1.93	1.08	0.94	1.68	1.18	1.11
OMIDDLE EAST	-0.41	-9.45	-6.24	-6.34	-6.17	-4.67	-5.25	-5.08	-5.90	-4.24	-3.54
OOCEANIA	2.17	1.50	1.35	1.23	1.28	1.22	1.22	1.17	1.20	1.16	1.11

Appendix Table 11: Scenario Percent Changes in MGW Production

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AUSTRALIA	0.61	1.43	1.93	2.39	2.26	2.14	2.20	2.04	1.67	1.83	1.81
BANGLADESH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BOLIVIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRAZIL	1.08	0.53	0.42	0.38	0.42	0.35	0.37	0.24	0.08	-0.01	-0.13
BURKINA FASO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAMBODIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAMEROON	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CANADA	1.69	1.61	1.53	1.53	1.51	1.41	1.45	1.48	1.50	1.39	1.39
CHILE	0.62	0.88	0.90	0.86	0.75	0.78	0.78	0.81	0.75	0.75	0.72
CHINA	-0.03	-0.04	-0.03	-0.10	-0.17	-0.15	-0.20	-0.25	-0.14	-0.26	-0.28
COLOMBIA	1.16	0.96	0.90	0.87	0.87	0.82	0.78	0.72	0.69	0.66	0.62
COSTARICA	2.72	2.46	2.42	2.41	2.44	2.39	2.37	2.35	2.31	2.10	2.01
COTE D'IVOIRE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUBA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ECUADOR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EGYPT	2.29	0.65	1.32	1.32	1.31	1.48	1.38	1.34	1.06	1.15	1.13
ELSALVADOR	1.76	1.84	1.78	1.79	1.82	1.79	1.79	1.80	1.77	1.71	1.67
EU	0.53	0.74	0.64	0.63	0.60	0.46	0.26	0.24	0.53	0.46	0.49
GAMBIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GHANA	3.75	6.09	4.06	3.66	3.37	2.91	2.81	2.62	2.54	2.30	2.17
GUATEMALA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GUINEA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GUINEA BISSAU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GUYANA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAITI	2.61	2.52	2.50	2.48	2.08	2.05	2.03	1.96	1.95	1.93	1.92
HONDURAS	3.04	2.76	2.71	2.69	2.68	2.62	2.59	2.57	2.53	2.44	2.38
HONG KONG	3.27	-0.04	-1.19	-1.11	-0.43	-0.94	-0.44	-0.38	-2.08	-0.63	-0.73
INDIA	0.92	0.81	0.72	0.65	0.60	0.66	0.67	0.68	0.68	0.64	0.61
INDONESIA	0.66	0.49	0.47	0.44	0.47	0.44	0.40	0.39	0.37	0.33	0.30
IRAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IRAQ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JAPAN	-0.37	-0.70	-0.65	-0.77	-0.78	-0.85	-0.80	-0.77	-0.81	-0.75	-0.76
LAOS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LIBERIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MALAYSIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MALI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEXICO	2.58	2.33	2.20	2.17	2.10	2.07	2.07	1.97	2.00	1.95	1.94
MYANMAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NICARAGUA	2.98	2.97	2.19	2.51	2.50	2.47	2.48	2.48	2.44	2.37	2.33
NIGER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NIGERIA	4.08	3.64	3.50	3.41	3.41	3.31	3.24	3.12	3.10	3.01	2.94

Appendix Appendix Table 11: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PANAMA	3.37	3.06	2.89	2.80	2.63	2.51	2.42	2.31	2.22	2.13	2.09
PARAGUAY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PHILIPPINES	2.44	2.10	2.05	2.01	2.02	1.99	1.99	1.94	1.92	1.89	1.86
RUSSIA	0.55	0.62	0.57	0.55	0.47	0.45	0.44	0.48	0.37	0.41	0.40
SAUDI ARABIA	2.29	1.37	1.40	1.27	1.24	1.23	1.14	1.06	0.99	0.97	0.92
SENEGAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SIERRA LEONE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SINGAPORE	1.59	1.44	1.30	1.13	0.97	0.84	0.74	0.70	0.69	0.70	0.70
SOUTH KOREA	-0.23	-0.15	-0.26	-0.35	-0.28	-0.30	-0.15	-0.16	-0.03	-0.17	-0.16
SOUTH AFRICA	2.12	2.39	2.35	2.32	2.31	2.38	2.38	2.40	2.39	2.40	2.40
SRILANKA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SURINAME	0.76	0.64	0.59	0.57	0.57	0.53	0.51	0.47	0.47	0.45	0.43
TAIWAN	-0.81	-0.73	-0.69	-0.65	-0.60	-0.54	-0.54	-0.52	-0.47	-0.46	-0.47
TANZANIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
THAILAND	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOGO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TURKEY	1.18	2.72	1.95	1.96	1.90	2.02	1.69	1.77	1.72	1.63	1.60
UAE	1.65	-6.65	-4.67	-5.71	-6.51	-5.18	-6.50	-6.80	-8.94	-6.66	-5.81
URUGUAY	1.94	2.07	2.02	1.96	1.77	1.75	1.66	1.66	1.63	1.63	1.60
USA	2.01	2.75	1.81	1.65	1.64	1.41	1.57	1.50	1.34	1.40	1.33
VENEZUELA	1.61	1.55	1.54	1.74	1.70	1.61	1.54	1.43	1.40	1.36	1.30
VIETNAM	-0.09	-0.42	-0.45	-0.59	-0.64	-0.67	-0.78	-0.85	-0.86	-0.81	-0.84
OAFRICA	0.99	0.10	0.16	-0.11	-0.45	-0.59	-1.38	-2.37	-5.50	-6.39	-8.28
OASIA	-0.15	-0.18	-0.23	-0.21	-0.21	-0.20	-0.15	-0.11	-0.23	-0.12	-0.12
OCARIBBEAN	1.23	1.21	1.28	1.31	1.31	1.30	1.28	1.28	1.29	1.28	1.27
OEUROPE	0.02	8.59	4.76	4.04	3.35	2.61	2.02	2.03	2.67	2.35	2.36
OMIDDLE EAST	-0.36	-9.40	-6.17	-6.26	-6.09	-4.58	-5.16	-5.02	-5.91	-4.26	-3.59
OOCEANIA	2.15	1.48	1.32	1.20	1.23	1.17	1.15	1.08	1.10	1.04	0.98

Appendix Table 12: Benchmark Percent Changes in Consumption Volume

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	1.14	1.16	1.18	1.14	1.10	1.11	1.08	1.06	1.03	1.01	1.00
AUSTRALIA	1.81	1.84	2.00	2.11	2.08	1.99	2.01	1.94	1.81	1.83	1.81
BANGLADESH	0.94	0.93	0.90	0.87	0.84	0.81	0.78	0.75	0.72	0.69	0.66
BENIN	2.83	2.77	2.72	2.65	2.58	2.49	2.40	2.33	2.25	2.19	2.13
BOLIVIA	1.92	1.92	1.92	1.89	1.84	1.81	1.78	1.76	1.73	1.70	1.68
BRAZIL	0.62	0.65	0.66	0.59	0.54	0.53	0.50	0.47	0.44	0.41	0.38
BURKINA FASO	3.39	3.33	3.20	3.17	3.13	3.03	2.99	2.92	2.92	2.85	2.81
CAMBODIA	0.63	0.60	0.34	0.45	0.41	0.36	0.31	0.13	0.08	0.03	-0.02
CAMEROON	2.32	2.36	2.19	2.18	2.15	1.88	1.89	1.85	1.82	1.78	1.76
CANADA	1.62	1.62	1.56	1.57	1.55	1.44	1.47	1.51	1.52	1.42	1.43
CHILE	1.23	1.20	1.20	1.15	1.13	1.12	1.10	1.09	1.06	1.04	1.01
CHINA	0.01	-0.03	-0.04	-0.10	-0.17	-0.16	-0.20	-0.25	-0.17	-0.27	-0.29
COLOMBIA	1.05	1.03	1.00	0.94	0.91	0.87	0.84	0.81	0.83	0.75	0.72
COSTARICA	2.54	2.41	2.39	2.38	2.38	2.35	2.34	2.33	2.29	2.09	2.01
COTE D'IVOIRE	2.18	2.26	2.02	1.95	1.98	1.71	1.62	1.61	1.59	1.54	1.53
CUBA	1.37	1.61	2.08	2.27	2.24	2.22	2.19	2.18	2.17	2.13	2.13
ECUADOR	1.62	1.55	1.52	1.49	1.46	1.43	1.40	1.38	1.35	1.31	1.28
EGYPT	2.44	1.53	1.81	1.73	1.65	1.73	1.63	1.58	1.36	1.41	1.39
ELSALVADOR	1.80	1.84	1.78	1.79	1.83	1.80	1.79	1.80	1.77	1.71	1.67
EU	0.79	0.76	0.73	0.75	0.77	0.71	0.67	0.66	0.68	0.66	0.66
GAMBIA	3.42	3.42	3.40	3.34	3.32	3.28	3.24	3.20	3.18	3.14	3.10
GHANA	2.87	2.68	2.48	2.46	2.43	2.36	2.30	2.26	2.21	2.14	2.09
GUATEMALA	3.06	2.93	2.90	2.90	2.90	2.86	2.85	2.84	2.80	2.73	2.68
GUINEA	2.75	3.51	2.89	2.71	2.38	2.27	2.20	2.13	2.09	2.03	1.99
GUINEA BISSAU	2.16	2.15	2.17	2.16	2.15	2.12	2.08	2.05	2.02	2.01	1.99
GUYANA	0.29	0.28	0.27	0.26	0.26	0.25	0.24	0.23	0.21	0.19	0.17
HAITI	2.55	2.52	2.49	2.49	2.07	2.05	2.03	1.97	1.96	1.94	1.93
HONDURAS	3.02	2.75	2.70	2.69	2.68	2.62	2.59	2.57	2.53	2.44	2.39
HONG KONG	-0.16	-0.13	-0.14	-0.13	-0.13	-0.17	-0.20	-0.23	-0.27	-0.27	-0.30
INDIA	0.93	0.91	0.92	0.92	0.92	0.86	0.78	0.74	0.69	0.68	0.66
INDONESIA	0.71	0.64	0.75	0.70	0.65	0.59	0.61	0.43	0.40	0.38	0.36
IRAN	1.59	1.57	1.58	1.63	1.66	1.55	1.47	1.43	1.43	1.34	1.32
IRAQ	3.19	3.52	3.16	3.09	3.04	2.99	2.94	2.88	2.78	2.71	2.64
JAPAN	-0.57	-0.70	-0.65	-0.72	-0.73	-0.76	-0.75	-0.74	-0.74	-0.73	-0.74
LAOS	0.70	0.69	0.67	0.64	0.54	0.59	0.56	0.61	0.58	0.55	0.52
LIBERIA	2.91	2.79	2.75	2.69	2.64	2.51	2.40	2.31	2.22	2.16	2.10
MALAYSIA	1.72	1.82	1.81	1.77	1.81	1.75	1.70	1.62	1.61	1.54	1.48
MALI	3.44	3.18	3.07	2.86	2.89	2.95	2.76	2.70	2.63	2.61	2.57
MEXICO	2.57	2.33	2.20	2.18	2.11	2.08	2.08	1.97	2.00	1.96	1.94
MYANMAR	2.74	1.92	1.76	1.59	1.49	1.38	1.32	1.23	1.23	1.13	1.08
NICARAGUA	2.96	2.95	2.19	2.49	2.49	2.46	2.46	2.46	2.43	2.35	2.31
NIGER	4.58	4.37	4.17	3.97	3.92	3.88	3.84	3.79	3.75	3.70	3.66
NIGERIA	3.77	3.73	3.59	3.48	3.41	3.33	3.26	3.21	3.14	3.08	3.02

Appendix Appendix Table 12: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	1.91	1.98	1.93	1.89	1.97	1.86	1.78	1.75	1.70	1.65	1.61
PANAMA	3.31	3.04	2.89	2.80	2.61	2.50	2.41	2.31	2.22	2.13	2.09
PARAGUAY	1.89	1.91	1.86	1.79	1.69	1.65	1.62	1.58	1.56	1.52	1.49
PERU	0.98	0.99	0.98	0.95	0.93	0.92	0.89	0.87	0.84	0.80	0.77
PHILIPPINES	2.24	2.12	2.16	2.07	2.09	2.12	2.04	2.04	2.02	1.98	1.95
RUSSIA	0.74	0.80	0.75	0.75	0.70	0.65	0.60	0.61	0.60	0.57	0.57
SAUDI ARABIA	1.97	2.00	1.94	1.88	1.85	1.63	1.48	1.37	1.28	1.21	1.15
SENEGAL	2.88	2.84	2.78	2.75	2.72	2.63	2.55	2.49	2.43	2.38	2.33
SIERRA LEONE	2.83	2.73	2.56	2.46	2.29	2.41	2.29	2.20	2.18	2.14	2.11
SINGAPORE	1.57	1.50	1.35	1.22	1.08	0.91	0.79	0.74	0.73	0.73	0.73
SOUTH KOREA	-0.26	-0.21	-0.26	-0.33	-0.27	-0.27	-0.17	-0.19	-0.03	-0.19	-0.18
SOUTH AFRICA	2.24	2.33	2.40	2.43	2.48	2.50	2.45	2.43	2.42	2.43	2.43
SRILANKA	0.34	0.33	0.32	0.29	0.22	0.22	0.20	0.18	0.16	0.14	0.12
SURINAME	0.57	0.57	0.54	0.52	0.49	0.47	0.45	0.43	0.42	0.41	0.39
TAIWAN	-0.78	-0.73	-0.69	-0.65	-0.60	-0.55	-0.55	-0.54	-0.50	-0.49	-0.49
TANZANIA	4.14	4.19	4.08	4.02	3.99	3.94	3.90	3.87	3.85	3.80	3.72
THAILAND	-0.44	-0.41	-0.46	-0.48	-0.51	-0.54	-0.56	-0.59	-0.62	-0.64	-0.66
TOGO	2.79	2.76	2.72	2.69	2.65	2.56	2.48	2.42	2.36	2.30	2.25
TURKEY	1.98	2.16	1.97	1.99	1.95	1.99	1.85	1.81	1.81	1.77	1.77
UAE	2.38	2.69	2.56	2.37	2.24	1.99	1.84	1.76	1.70	1.68	1.66
URUGUAY	2.15	2.16	2.11	2.04	1.89	1.88	1.77	1.73	1.75	1.71	1.68
USA	1.05	1.08	1.04	1.02	1.07	1.05	1.07	1.06	1.03	1.06	1.00
VENEZUELA	1.51	1.54	1.55	1.74	1.68	1.61	1.54	1.44	1.40	1.37	1.31
VIETNAM	-0.41	-0.22	-0.39	-0.36	-0.37	-0.50	-0.66	-0.72	-0.71	-0.70	-0.73
OAFRICA	0.97	1.18	1.07	1.07	1.09	1.01	0.99	0.96	0.96	0.89	0.85
OASIA	-0.19	-0.17	-0.16	-0.15	-0.15	-0.14	-0.13	-0.12	-0.11	-0.11	-0.11
OCARIBBEAN	1.18	1.20	1.28	1.30	1.29	1.28	1.27	1.27	1.27	1.27	1.26
OEUROPE	0.74	0.89	0.84	0.84	0.87	0.83	0.81	0.75	0.75	0.70	0.74
OMIDDLE EAST	0.46	0.55	0.56	0.59	0.65	0.56	0.45	0.41	0.38	0.36	0.35
OOCEANIA	1.67	1.56	1.41	1.34	1.32	1.26	1.22	1.20	1.19	1.15	1.09

Appendix Table 13: Scenario Percent Changes in Consumption Volume

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	1.14	1.16	1.18	1.14	1.10	1.11	1.08	1.06	1.03	1.01	1.00
AUSTRALIA	1.81	1.84	2.00	2.10	2.07	1.99	2.00	1.93	1.80	1.82	1.80
BANGLADESH	0.94	0.93	0.90	0.87	0.84	0.81	0.78	0.75	0.72	0.69	0.66
BENIN	2.83	2.77	2.72	2.65	2.58	2.49	2.41	2.33	2.26	2.20	2.14
BOLIVIA	1.92	1.92	1.92	1.89	1.84	1.81	1.78	1.76	1.73	1.70	1.68
BRAZIL	0.62	0.65	0.66	0.59	0.54	0.53	0.51	0.47	0.45	0.42	0.39
BURKINA FASO	3.39	3.33	3.20	3.17	3.13	3.03	2.99	2.92	2.92	2.85	2.81
CAMBODIA	0.63	0.60	0.34	0.45	0.41	0.37	0.32	0.14	0.09	0.04	0.00
CAMEROON	2.32	2.36	2.19	2.18	2.15	1.88	1.90	1.86	1.83	1.79	1.77
CANADA	1.61	1.62	1.56	1.57	1.55	1.44	1.46	1.50	1.51	1.41	1.41
CHILE	1.23	1.20	1.20	1.15	1.13	1.12	1.10	1.09	1.06	1.03	1.01
CHINA	0.01	-0.03	-0.04	-0.10	-0.17	-0.16	-0.20	-0.25	-0.17	-0.27	-0.29
COLOMBIA	1.05	1.03	1.00	0.94	0.91	0.87	0.84	0.82	0.83	0.75	0.72
COSTARICA	2.54	2.41	2.39	2.38	2.37	2.35	2.34	2.33	2.29	2.09	2.01
COTE D'IVOIRE	2.18	2.27	2.03	1.96	1.99	1.72	1.64	1.63	1.62	1.57	1.56
CUBA	1.37	1.61	2.08	2.27	2.24	2.22	2.19	2.18	2.17	2.13	2.12
ECUADOR	1.62	1.55	1.52	1.49	1.46	1.43	1.41	1.39	1.35	1.32	1.29
EGYPT	2.44	1.53	1.80	1.73	1.65	1.72	1.63	1.57	1.35	1.41	1.38
ELSALVADOR	1.79	1.84	1.78	1.79	1.82	1.79	1.79	1.79	1.77	1.70	1.66
EU	0.80	0.78	0.75	0.77	0.80	0.75	0.72	0.72	0.76	0.75	0.76
GAMBIA	3.42	3.42	3.40	3.34	3.32	3.28	3.24	3.20	3.18	3.14	3.10
GHANA	2.87	2.68	2.49	2.47	2.43	2.36	2.30	2.26	2.22	2.15	2.10
GUATEMALA	3.06	2.93	2.89	2.90	2.90	2.86	2.84	2.83	2.79	2.72	2.68
GUINEA	2.75	3.51	2.89	2.72	2.38	2.27	2.21	2.14	2.10	2.04	2.00
GUINEA BISSAU	2.16	2.15	2.17	2.16	2.15	2.12	2.08	2.05	2.02	2.01	1.99
GUYANA	0.29	0.28	0.27	0.26	0.26	0.25	0.24	0.23	0.21	0.19	0.17
HAITI	2.55	2.52	2.49	2.48	2.07	2.05	2.03	1.97	1.95	1.94	1.92
HONDURAS	3.02	2.75	2.70	2.69	2.67	2.62	2.58	2.56	2.52	2.43	2.38
HONG KONG	-0.16	-0.13	-0.14	-0.13	-0.13	-0.17	-0.20	-0.23	-0.27	-0.27	-0.30
INDIA	0.93	0.92	0.92	0.92	0.92	0.87	0.79	0.75	0.70	0.69	0.67
INDONESIA	0.71	0.65	0.75	0.70	0.65	0.59	0.62	0.44	0.41	0.39	0.36
IRAN	1.59	1.56	1.58	1.63	1.66	1.54	1.47	1.42	1.43	1.33	1.31
IRAQ	3.19	3.52	3.16	3.09	3.04	2.99	2.94	2.88	2.78	2.71	2.64
JAPAN	-0.57	-0.70	-0.65	-0.72	-0.73	-0.76	-0.75	-0.74	-0.74	-0.73	-0.74
LAOS	0.70	0.69	0.67	0.64	0.54	0.59	0.56	0.61	0.58	0.55	0.52
LIBERIA	2.91	2.80	2.75	2.69	2.64	2.52	2.41	2.31	2.23	2.17	2.11
MALAYSIA	1.73	1.83	1.82	1.78	1.82	1.76	1.71	1.64	1.63	1.55	1.50
MALI	3.44	3.18	3.07	2.86	2.89	2.95	2.76	2.70	2.63	2.61	2.57
MEXICO	2.57	2.33	2.20	2.18	2.10	2.07	2.07	1.97	2.00	1.95	1.93
MYANMAR	2.74	1.92	1.76	1.59	1.49	1.38	1.32	1.23	1.23	1.13	1.08
NICARAGUA	2.96	2.95	2.19	2.50	2.49	2.46	2.46	2.46	2.43	2.35	2.32
NIGER	4.58	4.37	4.17	3.97	3.92	3.88	3.84	3.79	3.75	3.70	3.66
NIGERIA	3.77	3.73	3.59	3.48	3.41	3.33	3.27	3.22	3.15	3.09	3.03

Appendix Appendix Table 13: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	1.91	1.98	1.93	1.90	1.97	1.87	1.79	1.75	1.70	1.66	1.62
PANAMA	3.31	3.04	2.89	2.80	2.61	2.50	2.41	2.31	2.22	2.13	2.09
PARAGUAY	1.89	1.91	1.86	1.79	1.69	1.65	1.62	1.59	1.56	1.52	1.49
PERU	0.98	1.00	0.98	0.96	0.93	0.93	0.90	0.87	0.85	0.81	0.78
PHILIPPINES	2.24	2.13	2.16	2.08	2.09	2.13	2.05	2.05	2.03	1.99	1.97
RUSSIA	0.74	0.80	0.75	0.75	0.70	0.65	0.60	0.61	0.60	0.57	0.57
SAUDI ARABIA	1.97	2.01	1.94	1.89	1.85	1.64	1.49	1.38	1.29	1.22	1.16
SENEGAL	2.88	2.84	2.78	2.75	2.72	2.63	2.56	2.50	2.44	2.39	2.34
SIERRA LEONE	2.83	2.73	2.56	2.46	2.29	2.41	2.29	2.20	2.17	2.14	2.11
SINGAPORE	1.57	1.50	1.36	1.22	1.08	0.91	0.80	0.74	0.73	0.74	0.74
SOUTH KOREA	-0.26	-0.21	-0.26	-0.33	-0.27	-0.28	-0.18	-0.20	-0.03	-0.19	-0.18
SOUTH AFRICA	2.24	2.33	2.40	2.43	2.49	2.50	2.46	2.44	2.43	2.45	2.45
SRILANKA	0.34	0.33	0.32	0.30	0.23	0.22	0.21	0.19	0.17	0.15	0.13
SURINAME	0.57	0.57	0.54	0.52	0.49	0.47	0.45	0.43	0.42	0.41	0.40
TAIWAN	-0.78	-0.73	-0.69	-0.65	-0.60	-0.55	-0.55	-0.54	-0.51	-0.49	-0.49
TANZANIA	4.14	4.19	4.08	4.02	4.00	3.95	3.91	3.88	3.85	3.80	3.73
THAILAND	-0.44	-0.41	-0.46	-0.48	-0.51	-0.54	-0.56	-0.59	-0.61	-0.63	-0.66
TOGO	2.79	2.77	2.72	2.70	2.66	2.57	2.49	2.43	2.37	2.31	2.26
TURKEY	1.98	2.16	1.97	1.99	1.95	1.99	1.85	1.81	1.81	1.77	1.78
UAE	2.39	2.70	2.56	2.37	2.24	2.00	1.85	1.77	1.71	1.70	1.68
URUGUAY	2.16	2.17	2.12	2.05	1.89	1.89	1.78	1.74	1.76	1.72	1.69
USA	1.05	1.08	1.04	1.02	1.07	1.05	1.07	1.06	1.03	1.05	1.00
VENEZUELA	1.50	1.54	1.55	1.74	1.68	1.60	1.54	1.44	1.40	1.36	1.31
VIETNAM	-0.41	-0.21	-0.39	-0.36	-0.36	-0.49	-0.65	-0.71	-0.70	-0.69	-0.72
OAFRICA	0.97	1.18	1.07	1.07	1.09	1.01	0.99	0.96	0.96	0.89	0.86
OASIA	-0.19	-0.17	-0.16	-0.15	-0.15	-0.14	-0.13	-0.12	-0.11	-0.11	-0.11
OCARIBBEAN	1.18	1.20	1.28	1.30	1.29	1.28	1.27	1.28	1.28	1.27	1.27
OEUROPE	0.74	0.89	0.84	0.84	0.87	0.83	0.81	0.75	0.75	0.70	0.73
OMIDDLE EAST	0.47	0.55	0.56	0.59	0.66	0.56	0.46	0.41	0.38	0.36	0.35
OOCEANIA	1.67	1.56	1.42	1.35	1.32	1.26	1.23	1.21	1.19	1.16	1.10

Appendix Table 14: Benchmark Percent Changes LGW Retail Consumption Price

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	-0.59	-0.30	-0.75	-0.43	-0.43	-0.48	-0.41	-0.49	-0.55	-0.48	-0.49
AUSTRALIA	-0.34	-0.42	-0.33	-0.45	-0.57	-0.45	-0.37	-0.27	-0.31	-0.28	-0.28
BANGLADESH	-1.23	-1.01	-1.15	-1.18	-1.25	-1.05	-0.94	-0.95	-0.97	-0.97	-0.97
BENIN	-0.15	-0.20	-0.21	-0.29	-0.43	-0.28	-0.17	-0.09	-0.08	-0.08	-0.09
BOLIVIA	0.41	0.38	0.22	0.33	0.34	0.31	0.30	0.31	0.26	0.27	0.25
BRAZIL	-0.48	-0.84	-1.16	-0.79	-0.65	-0.67	-0.67	-0.54	-0.62	-0.55	-0.55
BURKINA FASO	0.27	-0.02	0.03	-0.13	-0.17	-0.03	-0.04	0.10	-0.15	0.02	0.00
CAMBODIA	-2.45	-2.39	-1.26	-1.92	-1.90	-1.80	-1.71	-1.02	-1.04	-1.01	-1.00
CAMEROON	-0.44	-0.54	-0.45	-0.59	-0.77	-0.51	-0.46	-0.36	-0.39	-0.34	-0.35
CANADA	-1.07	-0.28	-0.15	-0.18	-0.44	-0.30	-0.28	-0.16	-0.26	-0.22	-0.23
CHILE	-0.36	-0.32	-0.53	-0.36	-0.40	-0.39	-0.32	-0.32	-0.37	-0.32	-0.32
CHINA	0.11	-0.25	-0.54	-0.51	-0.51	-0.52	-0.25	-0.03	-0.81	-0.13	-0.13
COLOMBIA	-0.89	-0.90	-0.92	-0.67	-0.81	-0.73	-0.70	-0.78	-1.28	-0.74	-0.75
COSTARICA	0.06	0.32	0.26	0.31	0.21	0.21	0.21	0.26	0.16	0.15	0.12
COTE D'IVOIRE	-0.42	-0.62	-0.49	-0.71	-0.92	-0.63	-0.48	-0.45	-0.51	-0.44	-0.45
CUBA	0.01	-0.55	-0.25	-0.50	-0.70	-0.45	-0.35	-0.26	-0.37	-0.24	-0.23
ECUADOR	0.66	0.69	0.72	0.75	0.76	0.80	0.82	0.85	0.86	0.89	0.91
EGYPT	-0.60	-0.48	-0.72	-0.92	-1.21	-0.77	-0.46	-0.22	-0.14	-0.19	-0.21
ELSALVADOR	-0.90	-0.16	-0.05	-0.06	-0.29	-0.17	-0.17	-0.06	-0.15	-0.12	-0.14
EU	-0.33	-0.39	-0.38	-0.47	-0.66	-0.46	-0.22	-0.13	-0.37	-0.29	-0.29
GAMBIA	-0.28	-0.48	-0.55	-0.44	-0.55	-0.43	-0.34	-0.25	-0.27	-0.25	-0.26
GHANA	-0.71	-0.86	-0.43	-0.71	-0.96	-0.69	-0.55	-0.49	-0.62	-0.44	-0.44
GUATEMALA	-0.79	-0.17	-0.09	-0.08	-0.28	-0.18	-0.17	-0.06	-0.15	-0.12	-0.14
GUINEA	-0.54	-0.43	-0.60	-0.74	-0.97	-0.75	-0.63	-0.50	-0.60	-0.54	-0.57
GUINEA BISSAU	0.09	0.03	0.03	-0.03	-0.19	-0.03	0.08	0.16	0.17	0.17	0.17
GUYANA	0.15	0.18	0.18	0.18	0.16	0.17	0.17	0.18	0.16	0.16	0.15
HAITI	-0.74	-0.30	-0.10	-0.22	-0.51	-0.31	-0.26	-0.15	-0.26	-0.19	-0.20
HONDURAS	-0.93	-0.15	-0.03	-0.05	-0.29	-0.17	-0.16	-0.05	-0.15	-0.12	-0.14
HONG KONG	-0.13	-0.72	-0.32	-0.69	-1.00	-0.67	-0.52	-0.40	-0.52	-0.37	-0.36
INDIA	-0.70	-0.55	-0.85	-1.10	-1.44	-0.90	-0.53	-0.24	-0.15	-0.20	-0.23
INDONESIA	-1.70	-1.14	-1.69	-1.55	-1.42	-1.07	-1.39	-0.28	-0.31	-0.33	-0.34
IRAN	0.12	-0.06	-0.21	-0.34	-0.38	-0.36	-0.34	-0.28	-0.52	-0.32	-0.33
IRAQ	-0.35	-0.27	-0.28	-0.26	-0.29	-0.29	-0.26	-0.24	-0.27	-0.24	-0.24
JAPAN	-0.28	-0.27	-0.23	-0.25	-0.26	-0.25	-0.24	-0.21	-0.21	-0.21	-0.21
LAOS	-1.29	-1.25	-1.21	-1.18	-0.76	-1.12	-1.10	-1.44	-1.43	-1.41	-1.39
LIBERIA	-0.53	-0.39	-0.57	-0.74	-0.99	-0.62	-0.36	-0.17	-0.11	-0.14	-0.16
MALAYSIA	-0.27	-0.61	-0.67	-0.72	-1.03	-0.82	-0.72	-0.54	-0.70	-0.59	-0.59
MALI	-2.65	-1.63	-1.53	-0.63	-1.26	-1.96	-1.10	-1.06	-0.95	-1.17	-1.23
MEXICO	-1.03	-0.27	-0.15	-0.18	-0.43	-0.30	-0.27	-0.14	-0.17	-0.16	-0.18
MYANMAR	-0.49	-1.32	-1.09	-1.44	-1.45	-1.03	-1.04	-0.64	-1.22	-0.76	-0.78
NICARAGUA	0.52	0.35	-0.02	0.22	0.26	0.23	0.21	0.27	0.20	0.21	0.18
NIGER	-0.18	-0.17	-0.18	-0.21	-0.26	-0.20	-0.16	-0.12	-0.11	-0.11	-0.11
NIGERIA	-0.75	-0.86	-0.57	-0.48	-0.70	-0.49	-0.42	-0.43	-0.39	-0.40	-0.41

Appendix Appendix Table 14: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	-0.30	-0.74	-0.45	-0.38	-1.14	-0.57	-0.24	-0.12	-0.09	-0.09	-0.11
PANAMA	-0.07	0.05	-0.05	0.04	-0.05	-0.06	-0.07	0.00	-0.09	-0.06	-0.08
PARAGUAY	-0.32	-0.40	-0.60	-0.40	-0.37	-0.37	-0.34	-0.29	-0.34	-0.29	-0.28
PERU	0.16	0.19	0.14	0.17	0.15	0.10	0.10	0.11	0.06	0.08	0.07
PHILIPPINES	-0.57	-0.28	-0.40	-0.27	-0.57	-0.61	-0.31	-0.32	-0.42	-0.32	-0.32
RUSSIA	-0.33	-0.76	-0.56	-0.88	-1.15	-0.77	-0.59	-0.38	-0.52	-0.39	-0.40
SAUDI ARABIA	-0.70	-0.44	-0.53	-0.67	-0.98	-0.63	-0.41	-0.21	-0.18	-0.20	-0.22
SENEGAL	-0.46	-0.46	-0.57	-0.67	-0.88	-0.56	-0.37	-0.27	-0.24	-0.21	-0.23
SIERRA LEONE	-1.50	-1.35	-0.90	-0.89	-0.47	-1.41	-0.84	-0.52	-0.54	-0.52	-0.52
SINGAPORE	-0.39	-0.64	-0.55	-0.86	-1.18	-0.77	-0.52	-0.32	-0.33	-0.29	-0.30
SOUTH KOREA	-0.32	-0.41	-0.36	-0.50	-0.64	-0.47	-0.36	-0.26	-0.27	-0.25	-0.25
SOUTH AFRICA	-0.41	-0.38	-0.47	-0.60	-0.78	-0.54	-0.37	-0.22	-0.19	-0.20	-0.21
SRILANKA	0.32	0.33	0.31	0.28	0.18	0.20	0.19	0.19	0.16	0.14	0.12
SURINAME	0.35	0.36	0.35	0.34	0.32	0.32	0.31	0.30	0.29	0.29	0.28
TAIWAN	-0.31	-0.72	-0.38	-0.72	-0.94	-0.71	-0.60	-0.44	-0.52	-0.42	-0.42
TANZANIA	-0.72	-0.83	-0.69	-0.65	-0.93	-0.63	-0.43	-0.31	-0.25	-0.23	-0.22
THAILAND	-0.32	-0.32	-0.27	-0.29	-0.30	-0.29	-0.28	-0.25	-0.25	-0.25	-0.25
TOGO	-0.16	-0.32	-0.26	-0.41	-0.62	-0.38	-0.24	-0.14	-0.15	-0.13	-0.13
TURKEY	-0.68	-0.32	-0.30	-0.35	-0.57	-0.40	-0.25	-0.14	-0.31	-0.25	-0.26
UAE	-0.53	-0.53	-0.66	-0.89	-1.21	-0.76	-0.47	-0.25	-0.20	-0.21	-0.23
URUGUAY	-0.43	-0.35	-0.42	-0.35	-0.38	-0.54	-0.49	-0.42	-0.54	-0.43	-0.43
USA	-1.14	-0.29	-0.15	-0.18	-0.46	-0.31	-0.29	-0.16	-0.26	-0.22	-0.24
VENEZUELA	-0.52	-0.20	-0.23	-0.13	-0.23	-0.20	-0.20	-0.12	-0.21	-0.17	-0.18
VIETNAM	0.07	-1.03	-0.31	-0.98	-1.44	-0.90	-0.68	-0.52	-0.71	-0.46	-0.44
OAFRICA	-0.13	-0.28	-0.19	-0.29	-0.54	-0.31	-0.18	-0.09	-0.10	-0.08	-0.09
OASIA	-0.15	-0.25	-0.21	-0.30	-0.42	-0.27	-0.19	-0.12	-0.14	-0.11	-0.12
OCARIBBEAN	0.02	0.07	0.09	0.09	0.05	0.08	0.09	0.13	0.10	0.12	0.11
OEUROPE	-0.17	-0.58	-0.34	-0.56	-0.87	-0.55	-0.37	-0.25	-0.33	-0.25	-0.25
OMIDDLE EAST	-0.43	-0.41	-0.49	-0.64	-0.85	-0.57	-0.38	-0.23	-0.20	-0.21	-0.22
OOCEANIA	-0.25	-0.44	-0.27	-0.44	-0.59	-0.44	-0.36	-0.29	-0.34	-0.27	-0.27

Appendix Table 15: Scenario Percent Changes in LGW Retail Consumption Price

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	-0.59	-0.30	-0.75	-0.43	-0.43	-0.48	-0.41	-0.49	-0.54	-0.48	-0.48
AUSTRALIA	-0.34	-0.42	-0.34	-0.46	-0.59	-0.46	-0.38	-0.29	-0.34	-0.32	-0.33
BANGLADESH	-1.23	-1.01	-1.15	-1.18	-1.25	-1.05	-0.94	-0.95	-0.97	-0.97	-0.97
BENIN	-0.15	-0.20	-0.21	-0.29	-0.43	-0.28	-0.17	-0.09	-0.08	-0.08	-0.09
BOLIVIA	0.41	0.38	0.22	0.33	0.34	0.31	0.30	0.31	0.26	0.27	0.26
BRAZIL	-0.48	-0.84	-1.16	-0.79	-0.65	-0.67	-0.67	-0.54	-0.62	-0.55	-0.55
BURKINA FASO	0.27	-0.02	0.03	-0.13	-0.17	-0.03	-0.04	0.10	-0.15	0.02	0.00
CAMBODIA	-2.44	-2.39	-1.26	-1.92	-1.90	-1.80	-1.71	-1.02	-1.04	-1.01	-1.00
CAMEROON	-0.44	-0.54	-0.45	-0.59	-0.76	-0.50	-0.46	-0.35	-0.39	-0.34	-0.34
CANADA	-1.03	-0.23	-0.10	-0.12	-0.36	-0.20	-0.14	0.01	-0.07	0.00	0.02
CHILE	-0.36	-0.32	-0.53	-0.36	-0.40	-0.39	-0.33	-0.32	-0.37	-0.32	-0.32
CHINA	0.11	-0.25	-0.54	-0.51	-0.51	-0.52	-0.25	-0.03	-0.81	-0.13	-0.13
COLOMBIA	-0.89	-0.89	-0.91	-0.66	-0.80	-0.71	-0.68	-0.76	-1.25	-0.71	-0.72
COSTARICA	0.08	0.34	0.28	0.34	0.25	0.25	0.27	0.32	0.24	0.24	0.22
COTE D'IVOIRE	-0.42	-0.62	-0.49	-0.71	-0.92	-0.63	-0.48	-0.45	-0.51	-0.43	-0.44
CUBA	0.01	-0.55	-0.25	-0.50	-0.70	-0.45	-0.35	-0.26	-0.37	-0.24	-0.23
ECUADOR	0.66	0.69	0.72	0.75	0.77	0.80	0.83	0.86	0.87	0.90	0.92
EGYPT	-0.59	-0.48	-0.71	-0.92	-1.21	-0.77	-0.46	-0.22	-0.14	-0.18	-0.20
ELSALVADOR	-0.86	-0.11	0.01	0.01	-0.21	-0.07	-0.03	0.11	0.04	0.11	0.13
EU	-0.46	-0.55	-0.58	-0.71	-0.96	-0.85	-0.74	-0.80	-1.20	-1.34	-1.60
GAMBIA	-0.28	-0.48	-0.55	-0.44	-0.55	-0.43	-0.34	-0.25	-0.27	-0.25	-0.25
GHANA	-0.71	-0.85	-0.42	-0.70	-0.95	-0.68	-0.53	-0.47	-0.59	-0.42	-0.41
GUATEMALA	-0.76	-0.13	-0.05	-0.03	-0.21	-0.09	-0.05	0.08	0.01	0.07	0.08
GUINEA	-0.54	-0.43	-0.60	-0.74	-0.97	-0.74	-0.63	-0.50	-0.60	-0.54	-0.56
GUINEA BISSAU	0.09	0.03	0.03	-0.03	-0.19	-0.03	0.08	0.16	0.17	0.18	0.17
GUYANA	0.15	0.18	0.18	0.19	0.17	0.18	0.18	0.19	0.17	0.18	0.17
HAITI	-0.71	-0.27	-0.05	-0.17	-0.44	-0.24	-0.16	-0.03	-0.12	-0.02	-0.01
HONDURAS	-0.89	-0.10	0.03	0.02	-0.21	-0.06	-0.02	0.12	0.05	0.12	0.14
HONG KONG	-0.12	-0.72	-0.32	-0.69	-0.99	-0.67	-0.52	-0.39	-0.52	-0.36	-0.36
INDIA	-0.70	-0.55	-0.85	-1.09	-1.44	-0.90	-0.53	-0.24	-0.14	-0.20	-0.22
INDONESIA	-1.70	-1.14	-1.69	-1.54	-1.42	-1.07	-1.39	-0.28	-0.31	-0.32	-0.34
IRAN	0.13	-0.05	-0.20	-0.33	-0.37	-0.34	-0.33	-0.26	-0.50	-0.30	-0.30
IRAQ	-0.35	-0.27	-0.28	-0.26	-0.28	-0.29	-0.26	-0.24	-0.27	-0.24	-0.24
JAPAN	-0.28	-0.27	-0.23	-0.25	-0.26	-0.25	-0.24	-0.21	-0.21	-0.21	-0.21
LAOS	-1.29	-1.25	-1.21	-1.18	-0.76	-1.12	-1.10	-1.44	-1.43	-1.41	-1.39
LIBERIA	-0.53	-0.38	-0.57	-0.74	-0.99	-0.61	-0.36	-0.16	-0.10	-0.13	-0.15
MALAYSIA	-0.27	-0.61	-0.67	-0.72	-1.03	-0.82	-0.72	-0.54	-0.70	-0.58	-0.59
MALI	-2.65	-1.63	-1.53	-0.63	-1.26	-1.96	-1.10	-1.06	-0.95	-1.17	-1.22
MEXICO	-0.99	-0.22	-0.09	-0.12	-0.35	-0.20	-0.14	0.02	0.02	0.05	0.07
MYANMAR	-0.49	-1.31	-1.09	-1.44	-1.45	-1.03	-1.03	-0.63	-1.22	-0.76	-0.78
NICARAGUA	0.52	0.36	-0.02	0.22	0.26	0.24	0.22	0.28	0.21	0.22	0.20
NIGER	-0.18	-0.17	-0.18	-0.21	-0.26	-0.20	-0.16	-0.11	-0.11	-0.11	-0.11
NIGERIA	-0.74	-0.86	-0.57	-0.48	-0.70	-0.49	-0.41	-0.43	-0.39	-0.40	-0.40

Appendix Appendix Table 15: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	-0.29	-0.73	-0.44	-0.37	-1.13	-0.56	-0.23	-0.11	-0.07	-0.07	-0.08
PANAMA	-0.06	0.07	-0.03	0.06	-0.02	-0.02	-0.02	0.06	-0.03	0.01	0.00
PARAGUAY	-0.33	-0.41	-0.60	-0.40	-0.37	-0.38	-0.35	-0.30	-0.35	-0.30	-0.30
PERU	0.16	0.19	0.14	0.17	0.15	0.10	0.10	0.11	0.06	0.08	0.07
PHILIPPINES	-0.57	-0.28	-0.40	-0.27	-0.56	-0.61	-0.30	-0.32	-0.41	-0.31	-0.31
RUSSIA	-0.33	-0.76	-0.56	-0.88	-1.15	-0.76	-0.59	-0.38	-0.52	-0.39	-0.40
SAUDI ARABIA	-0.69	-0.43	-0.51	-0.65	-0.96	-0.61	-0.38	-0.17	-0.13	-0.14	-0.16
SENEGAL	-0.46	-0.46	-0.57	-0.67	-0.88	-0.56	-0.37	-0.27	-0.23	-0.21	-0.22
SIERRA LEONE	-1.50	-1.35	-0.90	-0.89	-0.47	-1.41	-0.84	-0.52	-0.54	-0.52	-0.52
SINGAPORE	-0.39	-0.64	-0.55	-0.86	-1.18	-0.76	-0.52	-0.32	-0.33	-0.28	-0.30
SOUTH KOREA	-0.32	-0.41	-0.36	-0.50	-0.64	-0.47	-0.36	-0.26	-0.27	-0.25	-0.25
SOUTH AFRICA	-0.41	-0.38	-0.47	-0.60	-0.78	-0.54	-0.37	-0.22	-0.18	-0.20	-0.21
SRILANKA	0.33	0.33	0.31	0.28	0.19	0.20	0.20	0.20	0.18	0.15	0.13
SURINAME	0.35	0.36	0.35	0.34	0.32	0.32	0.31	0.30	0.30	0.29	0.28
TAIWAN	-0.31	-0.72	-0.38	-0.72	-0.94	-0.71	-0.60	-0.44	-0.51	-0.42	-0.42
TANZANIA	-0.72	-0.83	-0.69	-0.65	-0.92	-0.62	-0.42	-0.30	-0.25	-0.22	-0.21
THAILAND	-0.32	-0.32	-0.27	-0.29	-0.30	-0.29	-0.28	-0.25	-0.25	-0.25	-0.25
TOGO	-0.16	-0.32	-0.26	-0.41	-0.61	-0.38	-0.24	-0.14	-0.15	-0.12	-0.13
TURKEY	-0.70	-0.34	-0.32	-0.38	-0.61	-0.44	-0.30	-0.21	-0.40	-0.38	-0.43
UAE	-0.53	-0.53	-0.65	-0.89	-1.20	-0.76	-0.47	-0.24	-0.19	-0.21	-0.22
URUGUAY	-0.44	-0.36	-0.42	-0.35	-0.39	-0.55	-0.49	-0.42	-0.54	-0.44	-0.44
USA	-1.10	-0.24	-0.09	-0.11	-0.37	-0.19	-0.14	0.03	-0.05	0.02	0.05
VENEZUELA	-0.50	-0.18	-0.20	-0.10	-0.19	-0.15	-0.14	-0.05	-0.13	-0.07	-0.08
VIETNAM	0.07	-1.03	-0.31	-0.98	-1.44	-0.90	-0.68	-0.52	-0.71	-0.46	-0.44
OAFRICA	-0.13	-0.28	-0.19	-0.28	-0.54	-0.31	-0.17	-0.08	-0.09	-0.07	-0.08
OASIA	-0.15	-0.25	-0.21	-0.30	-0.42	-0.27	-0.19	-0.12	-0.14	-0.11	-0.11
OCARIBBEAN	0.03	0.08	0.10	0.10	0.06	0.10	0.11	0.15	0.13	0.15	0.15
OEUROPE	-0.18	-0.59	-0.35	-0.57	-0.89	-0.57	-0.40	-0.28	-0.38	-0.31	-0.33
OMIDDLE EAST	-0.43	-0.42	-0.49	-0.64	-0.85	-0.58	-0.38	-0.23	-0.21	-0.22	-0.23
OOCEANIA	-0.24	-0.44	-0.27	-0.44	-0.59	-0.43	-0.36	-0.28	-0.33	-0.27	-0.26

Appendix Table 16: Benchmark Percent Changes in MGW Retail Consumption Price

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AUSTRALIA	0.33	-0.01	-1.01	-1.86	-1.94	-1.41	-1.51	-1.11	-0.63	-0.92	-0.94
BANGLADESH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENIN	-2.32	-0.47	-0.24	-0.28	-0.81	-0.56	-0.54	-0.30	-0.53	-0.44	-0.47
BOLIVIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRAZIL	-2.44	-0.52	-0.28	-0.32	-0.90	-0.62	-0.57	-0.31	-0.59	-0.49	-0.52
BURKINA FASO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAMBODIA	-2.36	-0.48	-0.24	-0.28	-0.82	-0.56	-0.55	-0.31	-0.53	-0.45	-0.48
CAMEROON	-2.33	-0.47	-0.24	-0.28	-0.81	-0.56	-0.54	-0.30	-0.53	-0.44	-0.47
CANADA	-2.62	-0.53	-0.27	-0.31	-0.91	-0.63	-0.61	-0.34	-0.59	-0.50	-0.53
CHILE	0.47	0.95	1.01	0.98	0.80	0.87	0.87	0.93	0.84	0.84	0.80
CHINA	0.23	-0.44	-1.09	-0.99	-0.96	-1.02	-0.46	-0.03	-1.64	-0.23	-0.24
COLOMBIA	-2.38	-0.48	-0.25	-0.28	-0.83	-0.57	-0.55	-0.31	-0.54	-0.45	-0.48
COSTARICA	-2.62	-0.53	-0.27	-0.31	-0.91	-0.63	-0.61	-0.34	-0.59	-0.50	-0.53
COTE D'IVOIRE	-2.37	-0.48	-0.24	-0.28	-0.82	-0.56	-0.55	-0.31	-0.53	-0.45	-0.48
CUBA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ECUADOR	-2.57	-0.52	-0.27	-0.31	-0.89	-0.61	-0.60	-0.34	-0.58	-0.49	-0.52
EGYPT	-1.08	11.76	7.64	7.90	7.57	6.30	7.71	8.50	11.18	9.40	9.15
ELSALVADOR	-2.63	-0.53	-0.27	-0.31	-0.91	-0.63	-0.61	-0.34	-0.59	-0.50	-0.53
EU	-0.73	-0.76	-0.67	-0.84	-1.32	-0.87	-0.08	0.04	-1.10	-0.76	-0.78
GAMBIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GHANA	-2.06	0.93	0.42	0.25	-0.40	-0.30	-0.32	-0.13	-0.37	-0.36	-0.41
GUATEMALA	-2.62	-0.53	-0.27	-0.31	-0.91	-0.63	-0.61	-0.34	-0.59	-0.50	-0.53
GUINEA	-2.39	-0.48	-0.25	-0.28	-0.83	-0.57	-0.56	-0.31	-0.54	-0.46	-0.48
GUINEA BISSAU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GUYANA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAITI	-2.56	-0.52	-0.26	-0.30	-0.89	-0.61	-0.60	-0.34	-0.58	-0.49	-0.52
HONDURAS	-2.59	-0.52	-0.27	-0.31	-0.90	-0.62	-0.60	-0.34	-0.58	-0.49	-0.52
HONG KONG	-1.04	-0.41	-0.67	-0.65	-0.90	-0.81	-0.51	-0.16	-1.14	-0.34	-0.36
INDIA	-2.56	-0.52	-0.26	-0.30	-0.89	-0.61	-0.60	-0.34	-0.58	-0.49	-0.52
INDONESIA	-2.59	-0.52	-0.27	-0.31	-0.90	-0.62	-0.60	-0.34	-0.58	-0.49	-0.52
IRAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IRAQ	-0.54	5.88	2.65	2.06	1.32	0.52	0.81	0.92	-0.60	0.22	0.06
JAPAN	-2.97	-0.85	-1.54	-1.05	-1.15	-0.44	-0.66	-0.71	-0.65	-0.85	-0.83
LAOS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LIBERIA	-2.41	-0.49	-0.25	-0.29	-0.84	-0.57	-0.56	-0.31	-0.54	-0.46	-0.49
MALAYSIA	-2.59	-0.52	-0.27	-0.31	-0.90	-0.62	-0.60	-0.34	-0.58	-0.49	-0.52
MALI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEXICO	-2.64	-0.53	-0.27	-0.31	-0.92	-0.63	-0.62	-0.35	-0.60	-0.50	-0.53
MYANMAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NICARAGUA	-2.60	-0.53	-0.27	-0.31	-0.90	-0.62	-0.61	-0.34	-0.59	-0.50	-0.53
NIGER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NIGERIA	-2.51	-0.51	-0.26	-0.30	-0.87	-0.60	-0.59	-0.33	-0.57	-0.48	-0.51

Appendix Appendix Table 16: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	-2.44	-0.49	-0.25	-0.29	-0.85	-0.58	-0.57	-0.32	-0.55	-0.46	-0.49
PANAMA	-2.64	-0.53	-0.27	-0.31	-0.92	-0.63	-0.62	-0.35	-0.60	-0.50	-0.54
PARAGUAY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERU	-2.59	-0.52	-0.27	-0.31	-0.90	-0.62	-0.60	-0.34	-0.59	-0.49	-0.53
PHILIPPINES	-2.59	-0.52	-0.27	-0.31	-0.90	-0.62	-0.60	-0.34	-0.59	-0.50	-0.53
RUSSIA	0.57	0.69	0.64	0.63	0.53	0.52	0.53	0.60	0.44	0.53	0.53
SAUDI ARABIA	-2.10	1.63	0.68	0.40	-0.35	-0.29	-0.31	-0.13	-0.39	-0.38	-0.44
SENEGAL	-2.34	-0.47	-0.24	-0.28	-0.81	-0.56	-0.54	-0.31	-0.53	-0.44	-0.47
SIERRA LEONE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SINGAPORE	-2.57	-0.52	-0.26	-0.31	-0.89	-0.61	-0.60	-0.34	-0.58	-0.49	-0.52
SOUTH KOREA	-0.92	-1.20	-0.73	-0.46	-0.78	-0.54	-0.76	-0.58	-1.18	-0.54	-0.53
SOUTH AFRICA	-2.27	-0.39	-0.21	-0.25	-0.78	-0.53	-0.52	-0.29	-0.51	-0.43	-0.46
SRILANKA	-2.51	-0.51	-0.26	-0.30	-0.87	-0.60	-0.58	-0.33	-0.57	-0.48	-0.51
SURINAME	-2.65	-0.54	-0.27	-0.32	-0.92	-0.63	-0.62	-0.35	-0.60	-0.51	-0.54
TAIWAN	-0.83	-0.43	-0.37	-0.86	-1.22	-1.27	-1.13	-0.88	-1.42	-1.08	-1.06
TANZANIA	-1.78	2.43	1.07	0.72	-0.03	-0.09	-0.13	-0.01	-0.26	-0.29	-0.36
THAILAND	-1.13	10.04	6.20	6.01	5.11	3.80	4.03	3.75	3.53	1.96	1.16
TOGO	-2.62	-0.53	-0.27	-0.31	-0.91	-0.63	-0.61	-0.34	-0.59	-0.50	-0.53
TURKEY	2.80	-0.46	1.05	0.60	-0.10	-0.57	0.74	0.10	-0.30	-0.04	-0.05
UAE	-1.75	4.23	2.05	1.55	0.57	0.29	0.21	0.27	-0.03	-0.18	-0.31
URUGUAY	-2.57	-0.52	-0.27	-0.31	-0.89	-0.61	-0.60	-0.34	-0.58	-0.49	-0.52
USA	-2.69	-0.54	-0.27	-0.32	-0.93	-0.64	-0.63	-0.35	-0.61	-0.51	-0.55
VENEZUELA	-2.63	-0.53	-0.27	-0.31	-0.92	-0.63	-0.61	-0.35	-0.60	-0.50	-0.53
VIETNAM	-2.51	-0.51	-0.26	-0.30	-0.87	-0.60	-0.59	-0.33	-0.57	-0.48	-0.51
OAFRICA	-1.06	11.24	7.24	7.39	6.93	5.62	6.67	7.01	8.22	6.04	4.87
OASIA	-0.21	-0.31	-0.32	-0.38	-0.47	-0.35	-0.24	-0.16	-0.27	-0.16	-0.16
OCARIBBEAN	-2.62	-0.53	-0.27	-0.31	-0.91	-0.63	-0.61	-0.34	-0.59	-0.50	-0.53
OEUROPE	-1.29	2.16	0.74	0.30	-0.49	-0.39	0.02	0.11	-0.70	-0.56	-0.62
OMIDDLE EAST	-1.89	3.04	1.35	0.92	0.05	-0.06	-0.12	0.00	-0.28	-0.32	-0.40
OOCEANIA	-2.45	-0.50	-0.25	-0.29	-0.85	-0.59	-0.57	-0.32	-0.55	-0.47	-0.50

Appendix Table 17: Scenario Percent Changes in MGW Retail Consumption Price

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
ARGENTINA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AUSTRALIA	0.35	0.01	-0.99	-1.84	-1.92	-1.37	-1.47	-1.06	-0.58	-0.86	-0.87
BANGLADESH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BENIN	-2.24	-0.36	-0.11	-0.12	-0.62	-0.32	-0.24	0.06	-0.12	0.04	0.07
BOLIVIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BRAZIL	-2.37	-0.42	-0.16	-0.19	-0.73	-0.41	-0.30	0.01	-0.26	-0.11	-0.10
BURKINA FASO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAMBODIA	-2.27	-0.37	-0.11	-0.12	-0.63	-0.33	-0.24	0.06	-0.12	0.04	0.08
CAMEROON	-2.25	-0.36	-0.11	-0.12	-0.62	-0.32	-0.24	0.06	-0.12	0.04	0.08
CANADA	-2.52	-0.41	-0.12	-0.13	-0.70	-0.36	-0.27	0.07	-0.13	0.04	0.08
CHILE	0.50	0.98	1.05	1.03	0.87	0.95	0.98	1.07	1.00	1.04	1.03
CHINA	0.23	-0.44	-1.09	-0.99	-0.96	-1.02	-0.46	-0.02	-1.64	-0.23	-0.24
COLOMBIA	-2.29	-0.37	-0.11	-0.12	-0.64	-0.33	-0.24	0.06	-0.12	0.04	0.08
COSTARICA	-2.52	-0.41	-0.12	-0.14	-0.70	-0.36	-0.27	0.07	-0.13	0.04	0.08
COTE D'IVOIRE	-2.28	-0.37	-0.11	-0.12	-0.63	-0.33	-0.24	0.06	-0.12	0.04	0.08
CUBA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ECUADOR	-2.47	-0.40	-0.12	-0.13	-0.69	-0.36	-0.26	0.07	-0.13	0.04	0.08
EGYPT	-1.06	11.79	7.67	7.92	7.59	6.32	7.74	8.54	11.24	9.48	9.22
ELSALVADOR	-2.53	-0.41	-0.12	-0.14	-0.70	-0.37	-0.27	0.07	-0.13	0.04	0.09
EU	-1.09	-1.19	-1.17	-1.41	-1.98	-1.67	-1.14	-1.21	-2.39	-2.30	-2.53
GAMBIA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GHANA	-1.98	1.04	0.55	0.40	-0.22	-0.07	-0.01	0.24	0.05	0.13	0.14
GUATEMALA	-2.52	-0.41	-0.12	-0.14	-0.70	-0.36	-0.27	0.07	-0.13	0.04	0.08
GUINEA	-2.30	-0.37	-0.11	-0.12	-0.64	-0.33	-0.25	0.06	-0.12	0.04	0.08
GUINEA BISSAU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GUYANA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAITI	-2.47	-0.40	-0.12	-0.13	-0.69	-0.36	-0.26	0.07	-0.13	0.04	0.08
HONDURAS	-2.49	-0.40	-0.12	-0.13	-0.69	-0.36	-0.27	0.07	-0.13	0.04	0.08
HONG KONG	-0.99	-0.35	-0.60	-0.57	-0.81	-0.71	-0.36	0.02	-0.97	-0.11	-0.10
INDIA	-2.47	-0.40	-0.12	-0.13	-0.68	-0.36	-0.26	0.07	-0.13	0.04	0.08
INDONESIA	-2.49	-0.40	-0.12	-0.13	-0.69	-0.36	-0.27	0.07	-0.13	0.04	0.08
IRAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IRAQ	-0.53	5.89	2.65	2.06	1.32	0.52	0.80	0.91	-0.61	0.22	0.06
JAPAN	-2.97	-0.84	-1.54	-1.05	-1.14	-0.44	-0.66	-0.71	-0.65	-0.85	-0.83
LAOS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LIBERIA	-2.32	-0.37	-0.11	-0.12	-0.64	-0.33	-0.25	0.07	-0.12	0.04	0.08
MALAYSIA	-2.49	-0.40	-0.12	-0.13	-0.69	-0.36	-0.27	0.07	-0.13	0.04	0.08
MALI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MEXICO	-2.54	-0.41	-0.12	-0.14	-0.71	-0.37	-0.27	0.07	-0.13	0.04	0.09
MYANMAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NICARAGUA	-2.50	-0.41	-0.12	-0.13	-0.69	-0.36	-0.27	0.07	-0.13	0.04	0.08
NIGER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NIGERIA	-2.42	-0.39	-0.12	-0.13	-0.67	-0.35	-0.26	0.07	-0.13	0.04	0.08

Appendix Appendix Table 17: Continued

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PAKISTAN	-2.34	-0.38	-0.11	-0.13	-0.65	-0.34	-0.25	0.07	-0.12	0.04	0.08
PANAMA	-2.54	-0.41	-0.12	-0.14	-0.71	-0.37	-0.27	0.07	-0.13	0.04	0.09
PARAGUAY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERU	-2.49	-0.40	-0.12	-0.13	-0.69	-0.36	-0.27	0.07	-0.13	0.04	0.08
PHILIPPINES	-2.49	-0.40	-0.12	-0.13	-0.69	-0.36	-0.27	0.07	-0.13	0.04	0.08
RUSSIA	0.57	0.69	0.64	0.63	0.52	0.52	0.53	0.60	0.42	0.51	0.50
SAUDI ARABIA	-2.03	1.74	0.81	0.56	-0.15	-0.05	0.00	0.25	0.04	0.12	0.13
SENEGAL	-2.25	-0.36	-0.11	-0.12	-0.62	-0.32	-0.24	0.06	-0.12	0.04	0.08
SIERRA LEONE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SINGAPORE	-2.47	-0.40	-0.12	-0.13	-0.69	-0.36	-0.26	0.07	-0.13	0.04	0.08
SOUTH KOREA	-0.91	-1.20	-0.72	-0.45	-0.77	-0.53	-0.75	-0.56	-1.16	-0.52	-0.51
SOUTH AFRICA	-2.18	-0.28	-0.08	-0.10	-0.59	-0.31	-0.23	0.07	-0.11	0.04	0.07
SRILANKA	-2.41	-0.39	-0.12	-0.13	-0.67	-0.35	-0.26	0.07	-0.13	0.04	0.08
SURINAME	-2.55	-0.41	-0.12	-0.14	-0.71	-0.37	-0.27	0.07	-0.13	0.04	0.09
TAIWAN	-0.82	-0.42	-0.35	-0.84	-1.20	-1.25	-1.10	-0.84	-1.38	-1.04	-1.01
TANZANIA	-1.71	2.52	1.18	0.86	0.14	0.12	0.14	0.32	0.12	0.15	0.14
THAILAND	-1.10	10.08	6.25	6.08	5.21	3.95	4.28	4.11	4.06	2.56	1.84
TOGO	-2.52	-0.41	-0.12	-0.14	-0.70	-0.37	-0.27	0.07	-0.13	0.04	0.09
TURKEY	2.80	-0.47	1.05	0.59	-0.12	-0.59	0.72	0.07	-0.35	-0.11	-0.15
UAE	-1.69	4.32	2.17	1.71	0.76	0.53	0.53	0.67	0.42	0.34	0.28
URUGUAY	-2.48	-0.40	-0.12	-0.13	-0.69	-0.36	-0.26	0.07	-0.13	0.04	0.08
USA	-2.59	-0.41	-0.12	-0.14	-0.72	-0.37	-0.28	0.07	-0.14	0.04	0.09
VENEZUELA	-2.53	-0.41	-0.12	-0.14	-0.70	-0.37	-0.27	0.07	-0.13	0.04	0.09
VIETNAM	-2.42	-0.39	-0.12	-0.13	-0.67	-0.35	-0.26	0.07	-0.13	0.04	0.08
OAFRICA	-1.03	11.26	7.26	7.41	6.96	5.66	6.73	7.12	8.40	6.29	5.20
OASIA	-0.21	-0.31	-0.32	-0.37	-0.47	-0.35	-0.24	-0.16	-0.26	-0.16	-0.16
OCARIBBEAN	-2.52	-0.41	-0.12	-0.14	-0.70	-0.37	-0.27	0.07	-0.13	0.04	0.09
OEUROPE	-1.38	2.01	0.55	0.06	-0.78	-0.75	-0.44	-0.46	-1.40	-1.41	-1.65
OMIDDLE EAST	-1.83	3.14	1.47	1.08	0.24	0.18	0.20	0.39	0.15	0.18	0.16
OOCEANIA	-2.36	-0.38	-0.12	-0.13	-0.66	-0.34	-0.25	0.07	-0.12	0.04	0.08