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Agricultural and Food Trade in the Commonwealth of Independent States: Assessing the impact of Alternative Trade Arrangements

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1. Introduction

In the context of its European Neighbourhood Policy (ENP)[1], the European Union (EU) seeks to intensify its trade and investment relations with its eastern neighbours. One of the main goals of this policy is to achieve regulatory convergence beyond its new borders (Commission of EC, 2004). More specifically, the adoption of the EU acquis and market rules is a key element of an Association Agreement (AA) the EU offers its neighbours under the ENP, whilst the specifics of bilateral trade arrangements within the AA to encompass not only tariff liberalisation, but also non-tariff measures (NTM) and trade regulatory harmonisation, are dealt with under the auspices of a Deep and Comprehensive Free Trade Agreement (DCFTA).

In 2012, political tension arose between the EU and Russia in the wake of the Ukraine government's AA with the EU in the first half of the year, whilst relations hit a low as the Ukraine fell into a political crisis. By the Summer of 2014, increasing strains between the EU and Russia culminated in the imposition of trade sanctions by Russia on imports of EU food products, which are still in place to this day, whilst the ongoing Ukrainian crisis continues to cast a shadow over East-West integration. As a counterweight to the EU's ENP, on the first of January 2015, Russia, Kazakhstan and Belarus ratified the Eurasia Economic Union (EEU); a customs union with the aim of extending regional market integration to both current and former signatory members of the Commonwealth of Independent States (CIS)[2]. At the current time, the EEU also includes Armenia and Kyrgyzstan.

[1] The ENP framework is proposed to EU's 16's closest neighbours in the east and the south of the Union, regionally divided into the Eastern Partnership and a Euro-Mediterranean Partnership (EUROMED). The Eastern Partnership includes the countries Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.

[2] Commonwealth of Independent States (CIS), established in December 1991, is a regional organization whose participating countries are former Soviet Republics, formed during the breakup of the Soviet Union. Ukraine (since March 2014) and Georgia (since 2008) are no CIS member anymore, yet for the sake of simplicity we keep the indication 'CIS' for all 8 countries we are talking about in this paper.

With an increasing complexity of trade arrangements characterising economic relations between Eastern and Western Europe, the aim of the current paper is to quantify the potential medium term trade effects of the current trade agreements, with a specific focus on agricultural and food trade. In addition, three alternate trade futures between the CIS and EU are implemented and compared with a carefully designed 'business as usual' baseline. With an unparalleled level of global coverage, a useful starting point for any regional trade impact analysis is the Global Trade Analysis Project (GTAP) database. As a principal tool of analysis, an advanced neoclassical multi-region computable general equilibrium (CGE) model variant is employed. The rest of this paper is structured as follows. Section 2 discusses the data and model framework, section 3 describes the implementation of the scenarios. Section 4 presents the results whilst section 5 concludes.

2. Data and Methodology

2.1 Data

In its latest incarnation, release 9 of the GTAP data (Narayanan, et al., 2015) provides information on cost and demand structures, supplemented by gross bilateral data on trade flows, transport costs, and trade protection for 57 activities in 140 regions, for three discrete time periods (i.e., 2004, 2007, 2011). Given the purpose of this study, the 2007 benchmark year is favoured due to the availability of detailed observations of first and second pillar Common Agricultural Policy (CAP) payments data taken from the CATS (Clearance Audit Trail System) database of the European Commission (Boulanger and Philippidis, 2015).[3] This data source was also employed to implement a CAP baseline for the time periods in this study (see section 3.2 below).

To enhance the credibility of the analysis, a detailed update of the 2007 GTAP benchmark is required which takes account of subsequent change in trade patterns and trade policy. Trade protection data from release 9 of the GTAP database for the year 2011 is employed to update the applied tariff rates, whilst a time series of bilateral trade flows at GTAP commodity and regional concordance to 2013 is also available.. To capture the recent agri-food trade bans imposed by the Russian Federation secondary data observations of cost insurance freight (c.i.f.) import values by thousand US dollars (real prices) for the years 2007 and 2014 (the latest available) from the COMTRADE (2015) database were aggregated to GTAP concordance. As the COMTRADE data only covers the period up to September 2014, it is expected to reflect Russian import patterns after the cattle meat ban on Canadian and US exports (early 2014), as well as the African swine fever ban on EU pig meat exports (February 2014), although it does not capture the full implications of the political ban imposed on a number of agri-food products from the EU, Australia, Canada, Norway and the USA (August 2014).[4] As a result, further adjustments to the data were made using estimates of the proportion of EU, Australian, Canadian and US exports in 2014 affected by the ban

[3] The EU domestic agricultural support structure for the 2007 database is recalibrated following the procedure outlined in Malcolm (1998).
[4] Namely, fruits and vegetables, fish, cattle meat, pork and poultry meat and dairy.

(Boulanger et al., 2016). The modelling required to implement these updates is discussed in section 3.2.

2.2 Model framework

This study uses a neoclassical multi-region CGE model known as MAGNET (Modular Applied GeNeral Equilibrium Tool (Woltjer et al., 2014). The model employs constrained optimisation to characterise agent's behaviour (i.e., intermediate-, final- and investment demands), whilst the assumptions of homothetic separability and consistent aggregation permit a parsimonious 'nested' representation of flexible behaviour on the part of economic agents. Producers are assumed to operate under conditions of perfect competition and constant returns to scale, whilst a series of market clearing and accounting equations ensure that for a given economy, all markets clear and income, expenditure and output are equal. It is assumed that savings rates are a fixed share of changes in regional income, whilst investment to each region is allocated as a function of relative changes in regional rates of return. A neoclassical closure rule is assumed such that imbalances on the capital account (i.e., regional savings less investment) are compensated by the current account (exports minus imports), such that the balance of payments nets to zero.

Given its modular structure, the MAGNET model allows the user to switch on and off specific modules, subject to the requirements of the study at hand. Thus, for the current study, the model includes a detailed land supply module based on bio-physical data from IMAGE (Eickhout et al., 2009); explicit CAP modelling consisting of a representation of agricultural factor market rigidities, first pillar (decoupled and coupled) and second pillar payments (including productivity effects), production quotas on raw milk and sugar, and a detailed CAP budget module. Finally, a biofuel module is included to impose mandated blending limits which, it is assumed, are financed by taxes paid by final users of blended fuels.[5]

3. Scenario Design

3.1 Aggregation

Table 1 details the regional disaggregation employed in this study. At the outset, eight available CIS countries from the GTAP database are separated, along with a 'rest of the CIS' composite region. The EU is split into five geographical blocs, whilst large 'players' on world agri-food markets are also included (see Table 1). A 'rest of the World' region captures all residual trade and production flows.

Figure 1 depicts the commodity aggregation. Again the focus being on agricultural and food trade, all non-agricultural traded commodities are broadly grouped together as non-agricultural; while a distinction is made for agricultural products as primary crop products, primary animal products, and processed products (see Figure 1).

[5] A full discussion of these modules is provided in Woltjer et al., (2014), whilst the implementation of the CAP follows Boulanger and Philippidis (2015).

Table 1: Regional Aggregation[6]

Commonwealth of Independent States (CIS)	European Union (EU)	America and Oceania (AMOC)	Brazil-India-China (BIC)	Rest of the World (ROW)
Russian-Federation Kazakhstan Belarus Ukraine Armenia Azerbaijan Georgia Moldova CIS: *Kyrgyzstan, Rest of former Soviet Union*	European Midwest (EMW): *Austria, Belgium, Germany, France, Luxembourg, Netherlands* European North (ENO): *Denmark, Finland, United Kingdom, Ireland, Sweden* European Central and East (ECE): *Bulgaria, Czech Republic, Croatia, Hungary, Poland, Romania, Slovakia, Slovenia* European Baltic (EBA): *Estonia, Lithuania, Latvia* European South (ESO): *Cyprus, Spain, Greece, Italy, Malta, Portugal*	United States of Americas and Canada Australia New-Zealand Rest of Americas Rest of Oceania	Brazil India China	Japan Korea Rest of Asia Middle East and North Africa Turkey Africa Rest of the World

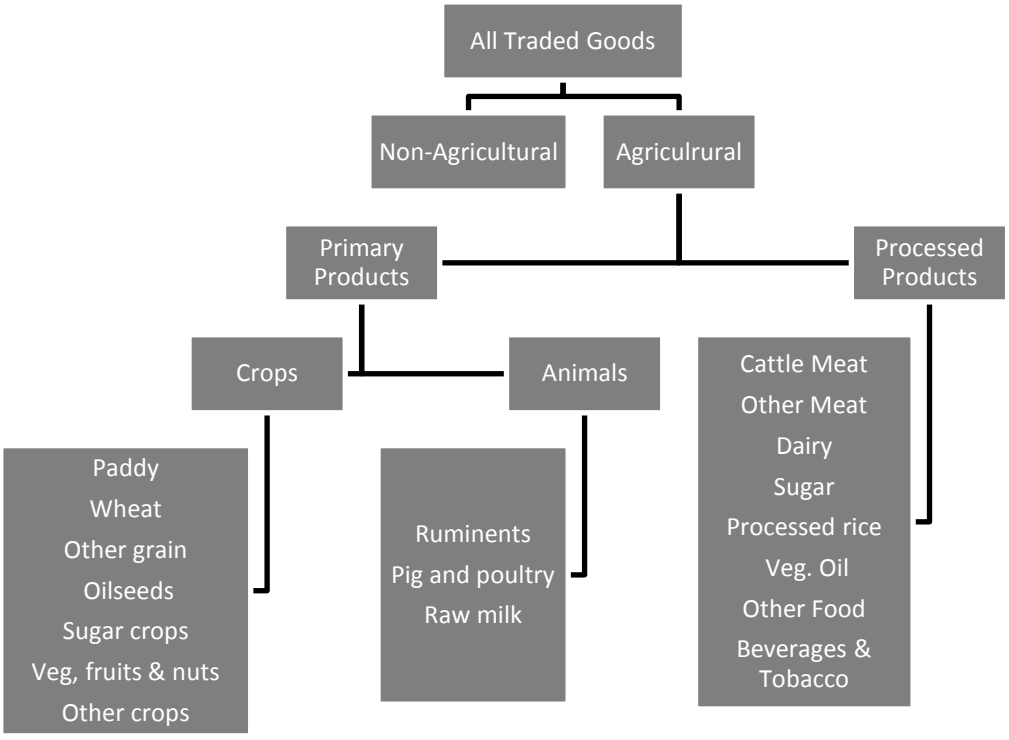

Figure 1: Commodity classification

[6] Standard font defines those regions which are explicitly disaggregated from the GTAP database. Italic font denominates aggregated GTAP regions within a regional composite.

3.2 Baseline Scenario Design

Taking the recalibrated 2007 GTAP benchmark data as a starting point, the world economy is projected over three discrete time periods: 2007-2015; 2015-2020 and 2020-2030. The 2015-2020 period is broadly consistent with EU's Multiannual Financial Framework period 2014-2020, whilst the end point of this period also coincides with the conclusion of the European Neighbourhood Instrument (ENI) which aims to help finance the EU's policy towards its Neighbourhood countries in the East and the South of Europe.

A full description of the relevant economic, demographic, productivity and policy shocks is provided in Table 2. In the current research project, the baseline or 'business as usual' (BaU) scenario borrows estimates of developments in real GDP growth and population trends from AGMEMOD (Chantreuil at al., 2012) and shared socio-economic pathway 2 (SSP2) (von Lampe et al., 2014), which reflects a *status quo* vision of the world. Annual rates of population and real growth consistent are compounded and implemented into MAGNET, whilst labour projections are assumed to follow regional population trends, capital endowment growth rates[7] are assumed equal to regional macro growth forecasts (i.e., fixed medium to long-run capital-output ratio) and natural resources are assumed to grow at one quarter the rate of the change in the capital stock. Further projections shocks are implemented to simulate changes in energy prices taken from World Bank Commodity Markets website[8].

In addition to the projections shocks, additional policy shocks are implemented into our baseline to capture the most pertinent historical and expected policy developments over the time horizon of the simulation. Furthermore, as part of the ongoing work in MAGNET to develop a credible Common Agricultural Policy baseline (Boulanger and Philippidis, 2015), a full set of CAP baseline shocks are implemented for the periods 2007-2015 and 2015 to 2020. Using CATS data of actual expenditures up to 2011 and planned expenditures to 2020 (European Commission, 2013), these CAP baseline shocks contemplate the split between first and second pillar payments; coupled and decoupled first pillar payments; and different types of second pillar payment schemes, CAP Health Check changes in the milk quota (2008), and EU milk (2015) and sugar (2017) quota abolition. In addition, first generation biofuels blending rates are imposed. The historical data for 2014 from World Energy Council[9] website are taken as a proxy for 2015. For 2020, 7% biofuel target for the EU is assumed.

[7] In three regions with negative savings (UKR, MDA and GEO) capital endowments are endogenous and exogenous investments changes are equal to macro growth forecasts.

[8] http://www.worldbank.org/en/research/commodity-markets. For 2007-2015 historical period, World Bank Commodity Price Data (The Pink Sheet) have been used (Updated on February 04, 2016). For projections, World Bank Commodities Price Forecast (constant US dollars) have been used (Released: January 20, 2016)

[9] https://www.wec-indicators.enerdata.eu/share-of-biofuels.html

Table 2: Baseline Assumptions

Macroeconomic and demographic assumptions

Population and GDP development in EU and CIS countries/regions from AGMEMOD projections (Chantreuil at al., 2012), shown below

	GDP, volume (% change) (2015-2030)	Population (% change) (2015-2030)
EU	32.5	1.58
DCFTA	70.9	-10.56
EEU	29.1	-1.64
ROCIS	104.9	10.72

Population and GDP development in remaining countries/regions taken from Shared Socioeconomic Pathway 2 (SSP2) (von Lampe et al., 2014).

Fossil fuel prices assumptions

World Fossil fuel price changes for energy and oil sectors (%):
2007-2015: energy (-37.15) ; oil (-35.54)
2015-2020: energy (-8.7); oil (6.7)
2020-2030: energy (10.5); oil (29.5)

Policy assumptions

2007-2015

Agricultural Policy (including 2008 Health Check reforms)

• Phasing in of decoupled payments for 2004 and 2007 accession members

• Targeted removal of specific pillar 1 coupled support payments: Arable crops, olives and hops to be fully decoupled from 2010; Seeds, beef and veal payments (except the suckler cow premium) decoupled by 2012, Protein crops, rice and nuts will be decoupled by 1 January 2012, Abolish the energy crop premium in 2010

• Re-coupling of support under the article 68 provision: Member states may use up to 10 per cent of their financial ceiling to grant measures to address disadvantages for farmers in certain regions specialising in dairy, beef, goat and sheep meat, and rice farming

• Pillar 2 payments to the EU27 under the financial framework

• Abolition of the Milk quota

• Projected reduction in CAP expenditure share of the EU budget

Biofuels Policy

• For the main first generation biofuel producers, exogenously targeted blending limits are imposed based on observed data from 2014

Trade Policy

• EU enlargement to 28 members through exogenous shocks to border support

• Exogenous tariff shocks to update applied tariffs to 2015 (based on 2011 tariff rates) to take into account EU FTAs, Russian Accession to the WTO, the Everything But Arms deal

• Trade flow shocks to capture the Russia ban, and the structure of Extra-EU and Intra-CIS trade in agri-food commodities.

2015-2020

Agricultural Policy

• Projected reduction in CAP expenditure share of the EU budget consistent with 15.2% cut in nominal CAP budget reduction

• Pillar 1 and pillar 2 nominal expenditures are cut 13% and 18%, respectively (European Council, 2013). This corresponds to a 15.2% cut in nominal CAP budgetary funding.

• Greening of 30% of first pillar payments, represented as pillar two agro-environmental payments

• Abolition of the sugar quota

Biofuels Policy

• Biofuel mandates of 7% for the EU by 2020

Trade Policy

• Applied tariff finishing shocks between South Korea and the EU27 (agreement enacted in 2010)

• Removal of the Russian ban on agri-food imports

2020-2030

Biofuels Policy

• Biofuels mandates for the EU as in 2020

In the case of trade policy, exogenous shocks are imposed on the *ad valorem* equivalent (AVE) applied tariff rates in the model. In the absence of a consistent database of AVE tariff rates for any subsequent years beyond 2011, it is assumed that targeted 2011 AVE's serve as a proxy for the end of the first period (2015). In the case of the EU-Korea FTA signed in 2011, a cursory review of the agreement reveals that the tariff reductions were frontloaded in the year of the agreement. Without specific tariff line information for this GTAP aggregation, it is assumed that the 2011 AVEs already include many of these developments. In the 2015-2020 period, all remaining AVEs between Korea and the EU are eliminated. A remaining consideration was that of the EBA deal between a number of Less Developed Countries (LDCs) and Afro-Caribbean Pacific (ACPs) and the EU. In principle, the EBA deal was implemented in 2001, with only bananas (2006), sugar (July 2009) and rice (September 2009) being subsequently amended. Once again, it is assumed that the 2011 AVE tariffs fully capture these tariff shocks. In addition to the above, the 2007-2015 tariff update shocks also include enlargement of the EU to Croatia whilst export subsidy rates are also eliminated on all EU exports.

Further shocks for the period 2007-2015 are implemented to capture changes in the pattern of trade flows on agri-food products (including the Russian ban) and the extra-EU28 trade balance.[10] To accomplish this, some additional behavioural elements are added to the Armington import demands in the CES functions of the MAGNET model. To control import values, we depart from the traditional 'closure swap approach' where an (endogenous) tariff adjusts to accommodate trade changes. With an array of exogenous shocks to AVE tariffs, this approach cannot be implemented. Moreover, in the case of banned commodities, AVE tariff rates would have to rise to prohibitively high levels to target exogenous reductions in imports. The underlying hypothesis is that tariff driven import price rises cause the fall in imports – which is not an accurate depiction of a ban.

Instead, changes in trade flows are represented by adjustments to aggregate consumer utility in the importing region (Boulanger et al., 2016). For example, the effect of Russia's self-imposed ban and the subsequent loss of access to preferred import trade routes, would be translated as a loss of utility to Russian consumers. More specifically, in log linear terms, equation (1) represents cost minimising bilateral (Armington) import demands for 'i', from export region 'r' to import region 's' ($q_{i,r,s}$), as a function of aggregate utility in region 's' ($u_{i,s}$), the bilateral import price ($p_{i,r,s}$), the composite price per unit of utility ($p_{i,s}$), the elasticity of substitution (σ_i) and (exogenous) bilateral consumer utility ($z_{i,r,s}$).[11]

$$q_{i,r,s} = u_{i,s} - \sigma_i [p_{i,r,s} - p_{i,s}] + \sigma_i z_{i,r,s} \qquad [1]$$

The composite price (equation 2) is a trade weighted share ($S_{i,r,s}$) of bilateral import prices and utility, as well as the (negative) elasticity parameter, ρ_i.

[10] An initial run of the model revealed that the EU28 agri-food trade balance remained negative in 2015, which does not correspond with historical data.
[11] The derivations behind these equations are available upon request.

$$p_{i,s} = \sum_r S_{i,r,s}\left[p_{i,r,s} + \left[\frac{1}{\rho_i}\right] z_{i,r,s} \right] \qquad [2]$$

Swapping $q_{i,r,s}$ and $z_{i,r,s}$ in the model closure , one may target reductions in Russian imports (i.e., 's' = Russia) associated with the ban by associated falls in Russian consumer bilateral utility, which also implies that the per unit cost of utility on banned good 'i', rises (equation [2]). In this study, subject to data availability from GTAP (see section 2.1), targeted changes are exogenously imposed on the bilateral value of commodity imports at cif prices rather than import quantities.

It should be noted that in attempting to faithfully recreate a comprehensive picture on the structure of trade flows for a number of CIS and EU countries, given the accounting assumptions of the model and the Armington elasticities, it was not possible to target all values, due to negative numbers or unrealistic trade diversion outcomes in the updated database. As a result, multiple simulation runs were conducted until a final set of shocks were arrived at which produced a reasonable outcome. In addition, in the 2015-2020 period reverse exogenous shocks to the *zxs* variable on Russian import routes were imposed to simulate the recuperation of pre-ban Russian consumer preferences.[12]

Finally, in the 2015-2020 and 2020-2030 periods, two trade agreements characterise increased trade co-operation both between the CIS members and the EU (DCFTA) as well as between the CIS members (EEU). The specific shocks are fully described in Table 3, where the Ukraine, Georgia and Moldova are classified as DCFTA countries, and Belarus, Russia and Kazakhstan are EEU countries, subsequently joined by Armenia in the 2020-2030 period. In addition to tariff rate shocks, NTM harmonisation shocks are represented by changes in 'iceberg' (Samuelson, 1952) type per-unit purchase costs within the Armington function of the recipient country, 's'. The notion is that an increase in trade facilitation through greater harmonisation of regulatory measures implies that for every unit of sales from export region 'r' now generates higher utility in the importing region.[13]

Additional trade policy shocks are incorporated to capture greater trade integration, both between CIS members, and between the CIS and the EU. Two trade agreements are included here as the DCFTA and EEU agreements. DCFTAs assume full liberalization of bilateral trade and a decrease of NTMs between the EU and Ukraine, Georgia and Moldova, which are signatories of DCFTAs. The EEU agreement creates a customs union between Belarus, Russia, and Kazakhstan by 2020, whilst Armenia joins in the period 2020-2030. All external border support implemented by signatory members of the EEU follows the structure adopted by the Russian Federation. In addition, NTM trade costs between EEU members are reduced.

[12] In the initial database, utility from bilateral preferences is benchmarked to a value of 1 and updated by corresponding changes in the variable zxs. To recover pre-ban Russian preferences, reverse shocks were implemented to the (now) exogenous variable zxs(i,r,"RUS"), to return to the initial value of 1.

[13] In other words, less imports are required to generate the same level of utility in import region 's'

Table 3: Baseline assumptions shaping the DCFTA and EEU agreements

DCFTA agreement with the EU	EEU agreement
2015-2020	
Ukraine, Georgia and Moldova: zero tariffs and subsidies (imports and exports) for all commodities with EU. Decrease of NTMs by 10% on all trade between the DCFTA and EU countries.	Belarus, Russia, and Kazakhstan: elimination of intra-bloc tariffs and subsidies (imports and exports), decrease of NTMs by 10% on all trade between the countries. The three establish a common external tariff policy and external tariffs and subsidies (imports and exports) for the EEU equal to those of Russia.
2020-2030	
Decrease of NTMs by a further 25% between the DCFTA and EU countries on all trade.	Armenia eliminates all border tariffs with Belarus, Russia, and Kazakhstan. And the four see a 25% reduction in NTMs on all trade within the block. Armenian border tariffs with rest of the non-EEU world are aligned with those of Russia.

3.3 Alternate trade scenarios

To characterise a progressive stance with respect to increased trade co-operation, a 'Deeper Integration' (DI) scenario is designed. In practise, this scenario further reduces DCFTA-EU and intra EEU trade facilitation costs by ten percentage points compared with the baseline and introduces modernisation shocks to the DCFTA and EEU regions' agri-food sectors through increases in services input efficiency. Furthermore, it is envisaged that Russia's relations with the West improve, characterised by increased trade integration between the EEU and EU regions through trade facilitation cost and tariff cost reductions; as well as lower tariffs on EEU-rest of the world trade (see Table 4).

The 'Liberalisation' (LB) scenario takes this vision of trade integration to a higher level, by envisaging a utopian vision of multilateral trade co-operation. More specifically, this scenario contemplates all of the trade shocks included within the Deeper Integration scenario, but further extends the remit of trade access to all countries in the world through tariff and NTM trade costs reductions (see Table 5). Finally, the 'Trade Blocks' (TB) scenario assumes that Russia takes a much more introspective approach to foreign trade policy. Thus, tariffs and

NTM related costs of foreign trade with the EEU customs union are raised in both periods of the simulation experiment between 2015 and 2030 (see Table 6).

Table 4: Deeper Integration scenario trade policy assumptions

DCFTA	EEU	WTO and other international agreements
2015-2020		
Ukraine, Georgia and Moldova: zero tariffs and subsidies (imports and exports) for all commodities with EU. Decrease of NTMs by 20% between DCFTA and EU countries on all trade. A 3% increase in the efficiency of "services" inputs used in ag-food industry in DCFTA countries.	Belarus, Russia, and Kazakhstan: elimination of intra-bloc tariffs and subsidies (imports and exports), decrease of NTMs by 20% on all trade. The three establish a common external tariff policy and external tariffs and subsidies (imports and exports) for the EEU equals those of Russia. A 3% increase in efficiency in "services" used in ag-food industry in EEU countries.	Decrease of NTMs by 10% on all trade between EEU and EU countries. Import tariffs on all traded goods, between EEU and EU are reduced by 60%, and between EEU and non-EU countries are reduced by 50% in 2015-2030 period. One third of this reduction is implemented in 2015-2020 period.
2020-2030		
Decrease of NTMs by 35% between DCFTA and EU countries on all trade. A 6% increase in efficiency in "services" used in ag-food industry in DCFTA countries	Armenia eliminates all border tariffs with Belarus, Russia, and Kazakhstan. And the four see a 35% reduction in NTMs on all trade within the block. Armenian border tariffs with rest of the non-EEU world are aligned with those of Russia. A 6% increase in efficiency in "services" used in ag-food industry in EEU countries	Decrease of NTMs by 10% on all trade between EEU and EU countries. Import tariffs on all traded goods, between EEU and EU are reduced by 60%, and between EEU and non-EU countries are reduced by 50% in 2015-2030 period. Two thirds of this reduction is implemented in 2020-2030 period. As Armenia joins EEU in 2020, all of the tariff and NTM reductions for Armenia-EU (60%) and Armenia-non-EU (50%) is undertaken in period 2020-2030.

Table 5: 'Liberalisation' scenario trade policy assumptions

DCFTA	EEU	WTO and other international agreements
2015-2020		
Ukraine, Georgia and Moldova: zero tariffs and subsidies (imports and exports) for all commodities with EU. Decrease of NTMs by 20% between DCFTA and EU countries on all trade. A 3% increase in efficiency in "services" used in ag-food industry in DCFTA countries.	Belarus, Russia, and Kazakhstan: elimination of intra-bloc tariffs and subsidies (imports and exports), decrease of NTMs by 20% on all trade. The three establish a common external tariff policy and external tariffs and subsidies (imports and exports) for the EEU equals those of Russia. A 3% increase in efficiency in "services" used in ag-food industry in EEU countries.	Decrease of NTMs by 7% on all trade between all countries. An additional 10% NTM reduction on all trade between EEU and EU. Import tariffs on all traded goods, between EEU and EU are reduced by 60%, and between EEU and non-EU countries are reduced by 50% in a period 2015-2030. One third of this reduction is implemented in 2015-2020 period. Decrease in worldwide tariffs on all trade for all remaining countries by 50% in a period 2015-2030. One third of this reduction is implemented in 2015-2020 period.
2020-2030		
Decrease of NTMs by 35% between DCFTA and EU countries on all trade. A 6% increase in efficiency in "services" used in ag-food industry in DCFTA countries	Armenia eliminates all border tariffs with Belarus, Russia, and Kazakhstan. And the four see a 35% reduction in NTMs on all trade within the block. Armenian border tariffs with rest of the non-EEU world are aligned with those of Russia. A 6% increase in efficiency in "services" used in ag-food industry in EEU countries	Decrease of NTMs by 16% on all trade between all countries. An additional 10% NTM reduction on all trade between EEU and EU. Import tariffs on all traded goods, between EEU and EU are reduced by 60%, and between EEU and non-EU countries are reduced by 50% in 2015-2030 period. Two thirds of this reduction is implemented in 2020-2030 period. As Armenia joins EEU in 2020, all of the reduction for Armenia-EU (60%) and Armenia-non-EU (50%) is undertaken in period 2020-2030. Decrease in worldwide tariffs on all trade for all remaining countries by 50% in a period 2015-2030. Two thirds of this reduction is implemented in 2020-2030 period

Table 6: 'Trade Blocs' scenario trade policy assumptions

DCFTA	EEU	WTO and other international agreements
2015-2020		
Ukraine, Georgia and Moldova: zero tariffs and subsidies (imports and exports) for all commodities with EU. Decrease of NTMs by 10% on all trade between DCFTA and EU countries.	Belarus, Russia, and Kazakhstan: elimination of intra-bloc tariffs and subsidies (imports and exports), decrease of NTMs by 10% on all trade between the countries. The three establish a common external tariff policy and external tariffs and subsidies (imports and exports) for the EEU equals those of Russia.	Increase in NTMs for all trade between EEU and rest of the world by 8% Increase in import tariffs between EEU and rest of the world by 50% by the end of year 2030. One third of this increase is implemented in 2015-2020 period.
2020-2030		
Decrease of NTMs by 25% between DCFTA and EU countries on all trade.	Armenia eliminates all border tariffs with Belarus, Russia, and Kazakhstan. And the four see a 25% reduction in NTMs on all trade within the block. Armenian border tariffs with rest of the non-EEU world are aligned with those of Russia.	Increase in NTMs for all trade between EEU and rest of the world by 16% Increase in import tariffs between EEU and rest of the world by 50% by the end of year 2030. Two thirds of this increase is implemented in 2020-2030 period. As Armenia joins EEU in 2020, all of the 50% increase in Armenia import tariffs for rest of the world, is undertaken in 2020-2030.

4. Results

4.1 Baseline 2015-2030

Within the formatting requirements of a scientific paper, the focus is principally on the main agri-food activities[14] and the three regional groupings of CIS countries. Thus, in discussing the baseline, CIS regions are aggregated into the signatory countries of the 'DCFTA' (i.e., Ukraine, Georgia and Moldova); participating members of the EEU agreement (i.e., Belarus, Kazakhstan, Russia and Armenia) and a residual 'RoCIS' region (Azerbaijan, rest of CIS). To provide additional insight, the part-worth (or 'subtotal') of the model results which corresponds to the isolated impacts of the DCFTA and EEU trade agreements, is also presented.[15] As the discussion below reveals, whilst the structural projections are dominant is shaping market trends (as expected), trade policy is also found to have important implications for those affected countries.

[14] Given the high degree of vertical integration in the sugar and milk industries, the upstream and downstream sectors have been aggregated for the purposes of the exposition.

[15] This calculation is based on a facility known as 'subtotals' which is employed by the model software (GEMPACK). See Harrison et al. (2000) for a further discussion.

4.1.1 Baseline Production

Table 7 shows the changes in production and real macro growth for the three composite CIS regions over the time frame 2015-2030. Under the assumptions of economy-wide productivity growth and an increasing labour force and capital stock, both agri-food and non agri-food production improve in all three CIS regions.[16] The higher growth rate in non-food activity output is, in part, attributed to the real income effect. As shrinking populations are characteristic of many CIS countries, income per capita rises rapidly leading to falling income elasticities of demand for agri-food products (i.e., slower rates of demand driven growth). Furthermore, as capital accumulation keeps pace with very high projected growth rates in CIS regions (especially, DCFTA and RoCIS), more highly capital intensive manufacturing and services sectors benefit significantly, which draws resources (i.e., labour) away from agri-food sectors.

Table 7: Production volume and real market prices according to baseline projections (% changes) (2015-2030)

	Production volumes by CIS region			Market prices by CIS region		
	DCFTA	EEUext	RoCIS	DCFTA	EEUext	RoCIS
Grains	4.3	11.5	11.6	5.5	-4.5	46.9
Oilseeds	36.0	20.4	10.3	9.5	-4.1	-2.9
Horticulture	1.3	1.3	10.5	0.7	-7.8	53.5
Ruminants	9.6	14.1	24.6	11.1	-0.7	233.4
Pig and poultry	3.9	4.0	65.1	3.5	-8.0	-13.2
Dairy	-4.3	3.8	-4.6	7.6	-2.9	34.9
Sugar	28.2	10.1	31.7	10.8	-0.5	1.6
Cattle meat	-2.0	5.7	3.5	3.6	-8.1	48.1
Other meat	-26.5	4.6	53.2	2.9	-8.1	-8.9
veg. Oils & fats	120.8	27.9	22.9	3.7	-4.9	-3.6
Bev. & tobacco	23.4	10.9	58.3	3.6	-6.5	-0.6
AgriFood (Total)	13.8	7.9	22.0	4.5	-5.8	76.2
AgriFood (due to DCFTA)	8.7	-0.2	-0.1	5.8	0.0	-0.6
AgriFood (due to EEUext)	-0.5	-1.0	0.0	0.0	0.4	0.1
NonFood (Total)	53.4	25.6	81.1	7.5	-0.4	-0.3
NonFood (due to DCFTA)	18.7	0.0	0.0	2.9	0.0	0.3
NonFood (due to EEUext)	-0.5	1.1	-0.2	0.1	-0.7	0.3
Macro growth (Total)	70.9	29.3	104.9	-	-	-
Macro growth (due to DCFTA)	20.1	0.0	-0.2	-	-	-
Macro growth (due to EEUext)	-0.1	1.2	0.0	-	-	-

[16] Note that the larger percentage rises in the 'RoCIS' region are calculated from a smaller base, whilst projected real GDP increases for the CIS (see Table 1) over the period in the model are very high.

In the case of the DCFTA region, the subtotals show that in general, the DCFTA trade deal plays an important role in generating output growth. By and large, the elimination of border support and partial removal of trade facilitation costs with the EU is a key driver of output growth in the DCFTA region. In the agri-food sectors, with lower collective levels of tariff and NTM border protection compared with the EU, the DCFTA deal is expected to generate benefits in the majority of activities, with notably high rates of growth witnessed in the vegetable oils (including primary production of oilseeds) and sugar sectors. In three cases (i.e., grains, ruminants, other meat), the DCFTA deal has a negative impact for the DCFTA region. Importantly, increased trade co-operation between the DCFTA and EU regions does not imply significant trade diversion effects for the EEU and RoCIS regions, suggesting that trade integration between these three groupings of CIS regions is relatively weak.

In the case of the EEU agreement, the establishment of a customs union has a negative impact of just below one percent for aggregate agri-food output in the EEU region. An explanation for this is the adoption of generally lower agri-food common external tariffs imposed by Russia.[17] As a result, there is greater import substitution in Belarus, Kazakhstan and Armenia leading to reduced agricultural and food output in many sectors. This effect is particularly noticeable in the other meat sector, where for example, Russian tariffs on EU trade are noticeable lower than Kazakhstan and Belarus. With the contraction in other meat production, lower purchases of upstream 'pigs and poultry' in the EEU leads to production falls in that sector. A similar line of reasoning can also be applied to explain the EEU agreement's impact on dairy output in the EEU region.

Despite the adoption of Russian export tax rates for crude oil, energy and manufacturing by the remaining three EEU members, non agri-food sector output is still expected to rise under the EEU deal. To some degree, this is attributed to resource reallocation from contracting agri-food activities into non agri-food sectors. Once again the trade diversion effect on DCFTA and RoCIS agri-food activity, arising from the EEU agreement, is found to be small.

4.1.2 Baseline Market Prices

Turning to the market price effects in Table 7, market prices fall in the EEU region for all agri-food sectors. In Russia and Belarus, assumptions of strong land productivity improvements depress land rental rates with the result that via price transmission, the market price of primary agriculture, and ultimately, agri-food commodities fall in the EEU region. In the RoCIS region, despite very high rates of economic growth resulting from economy-wide productivity improvements, market price rises in many agri-food sectors are very strong in the agriculture and food sectors. This is due to the rapid rise in land rents in the 'rest of the CIS' region, motivated by very high (fixed) capital-output growth rates. Thus, in those agri-food commodities where the 'rest of the CIS' produces a greater output share (e.g., ruminants, horticulture, milk/dairy, cattle meat, overall agri-food activity), the market price rises. By contrast, land rents in Azerbaijan are projected to fall (due to land productivity growth),

[17] The GTAP data reveals that there are no tariffs on trade between the four countries of Russia, Belarus, Kazakhstan and Armenia.

where in oilseeds and vegetable oils sectors (more dominated by Azerbaijan), market prices fall. Finally, for pigs and poultry, as a highly capital intensive activity, it is assumed that no land factor is employed in this sector, such that the market price fall is driven by economy-wide productivity growth.

4.1.3 Baseline Real Trade Balances

The change in the 'real' trade balances (constant 2015 prices) are reported in Table 8 On the one hand, export trends are generally correlated with output changes, whilst real income growth increases the marginal propensity to import. In the case of the DCFTA region, there is a major improvement in its agri-food trade balance of $2,508 million. On a sector-by-sector basis, the largest proportion of this gain originates from 'vegetables oils and fats', 'oilseeds' and 'grains' sectors. On the other hand, the largest DCFTA region trade balance deteriorations occur in 'milk/dairy', 'beverages and tobacco', both meat sectors and 'horticulture'. Further examination of the DCFTA agri-food trade balance result reveals that it is strongly driven by the subtotal for the DCFTA agreement ($2,847 million), much of which comes from the vegetable oils and fats sector. This is a result of high (and much higher than for other sectors) decrease of NTMs between the EU and Ukraine for this sector. For the non-food sectors in the DCFTA, the net trade balance deteriorates $10,864 million,[18] despite the non-food trade balance improvement of $16,570 resulting from the DCFTA agreement.

Table 8: Trade Balance volume changes per region, at 2015 world prices (million USD) (2015-2030)

	DCFTA	EEUext	RoCIS
Grains	276	1233	-577
Oilseeds	796	69	-27
Horticulture	-151	68	-2405
Ruminants	25	-6	-2010
Pig and poultry	-9	13	-15
Dairy	-424	827	-726
Sugar	182	227	-27
Cattle meat	-115	985	-312
Other meat	-193	212	-28
veg. Oils & fats	2549	943	-199
Bev. & tobacco	-297	387	-377
AgriFood (Total)	2508	8333	-8057
AgriFood (due to DCFTA)	2847	-65	36
AgriFood (due to EEUext)	-83	-868	-40
NonFood (Total)	-10864	156649	36652
NonFood (due to DCFTA)	16570	-638	1250
NonFood (due to EEUext)	-275	-725	-109

[18] Internal non-food consumption rises 68% in the DCFTA (not shown) compared with a corresponding production increase of 53% (Table 7).

In the EEU region, both agri-food and non agri-food trade balances exhibit strong growth over the 2015-2030 period. Both agri-food and non agri-food results are dominated by the trade balance improvements from the largest economy in this group, Russia. In Russia, with slower rates of projected growth (particularly in the 2015-2020 period), the current account balance improves as imports slow down, whilst on the Russian capital account (result not shown), there is a deterioration in the balance due to capital flight (investment drops) in the 2015-2020 period. Furthermore, as noted previously, the imposition of (generally lower) Russian tariffs and export taxes on energy exports by Armenia, Belarus and Kazakhstan implies increasing imports from third countries resulting in a trade balance deterioration from the EEU deal. Indeed, the subtotal for the EEU deal reveals a $868 million dollar agri-food trade balance deterioration in the EEU region between 2015and 2030.

Finally, rapid economic growth rates (particularly in the 'rest of the CIS' region) in the RoCIS region promote both rapid export rises (arising from output growth) and import rises (from rapidly rising incomes per capita). The result of these structural assumptions is that the agri-food trade balance deteriorates $8,057 million (with particularly notable trade balance deteriorations in horticultural products ($2,405 million), ruminants ($2,010 million) and dairy ($726 million)), whilst in the non-food sector the trade balance improves significantly by $36,652 million.

4.1.4 Baseline Welfare

In Table 9 are presented the welfare results for the baseline, decomposed into terms of trade (ToT), allocative efficiency (Alloc), endowment accumulation (Endw), technical change (Tech), population growth (Pop) and trade preference (Pref) effects. Under conditions of projected economic growth, real income rises over the fifteen year time period by $50,502 million (DCFTA), $368,283 million (EEU) and $106,704 million (RoCIS), which in per capita income terms translates as a rise of 75%, 34% and 73%, respectively.

The ToT is calculated as a money metric measure of the unit rate of exchange between exports and imports. In the DCFTA and EEU composite regions, terms of trade is affected by a mix of (i) factor price changes resulting from resource reallocation between activities which generate real exchange rate changes and (ii) policy changes at the border (i.e., tariff reductions and NTM shocks) which affect both c.i.f. and f.o.b. prices simultaneously. For the DCFTA region, the ToT deteriorates $5,038 million, whilst in the EEU, there is a marked improvement of $67,336 million. In the RoCIS, in the absence of any significant border policy shocks, the terms of trade improvement of $7,765 million is driven by real exchange rate appreciations.

Employing tax/subsidy distortions as a proxy, allocative efficiency is a money metric measure of market efficiency compared with a pareto optimum (i.e., no distortion) market situation (Huff and Hertel, 2001). Since a tax penalises production or consumption compared with a pareto market, then an increase in a taxed activity or consumption generates positive allocative efficiency. The same logic applies in the opposite direction for subsidised activities or consumption. Much of this change is motivated by changes in tariff rates and trade flows. Indeed, under conditions of elastic import demands, tariff reductions or eliminations (price

effects) generate cumulative improvements in allocative efficiency owing to the larger import quantity effect. In all three CIS regions, increases in (taxed) imports through lower trade facilitation costs imply allocative efficiency gains of $11,933 million (DCFTA), $33,457 million (EEU) and $9,160 million (RoCIS). Examining the subtotals, approximately 20% of the allocative efficiency gain in the DCFTA region is due to the DCFTA agreement, whilst 25% of the allocative efficiency gain in the EEU region results from the EEU deal.

Table 9: Welfare decomposition in the three CIS regions (baseline 2015-2030, million USD)

	DCFTA	EEUext	RoCIS
ToT (Total)	-5038	67336	7765
ToT (due to DCFTA)	-2398	11	250
ToT (due to EEUext)	28	3145	-302
ALLOC (Total)	11933	33457	9160
ALLOC (due to DCFTA)	2506	-105	-241
ALLOC (due to EEUext)	73	8461	44
ENDW (Total)	30615	227280	34062
ENDW (due to DCFTA)	8348	-3	8
ENDW (due to EEUext)	-131	34	-6
TECH (Total)	28432	64107	42874
TECH (due to DCFTA)	6169	-5	-1
TECH (due to EEUext)	-1	15177	-14
POP (Total)	-15440	-24800	12843
POP (due to DCFTA)	0	0	0
POP (due to EEUext)	0	0	0
PREF (Total)	0	903	0
PREF (due to DCFTA)	0	0	0
PREF (due to EEUext)	0	0	0
EV TOT (Total)	50502	368283	106704
EV TOT (due to DCFTA)	14625	-102	16
EV TOT (due to EEUext)	-31	26817	-278
Per cap U (%) (Total)	75.28	34.04	72.93
Per cap U (%) (due to DCFTA)	24.81	1.72	-9.66
Per cap U (%) (due to EEUext)	11.76	2.86	-9.61

As expected, with capital accumulation and a larger labour force, regional factor incomes increase (positive endowment effects) in all three CIS regions. The welfare increases associated with technical change give a money metric measure of the rightward shift of the economy-wide production possibility frontier (greater output potential employing the same inputs). In the DCFTA and EEU regions, additional real income improvements associated with technical change are recorded due to the reduction in bilateral trade facilitation costs, which grant importers in these regions additional utility through greater access to imports. With increases (decreases) in population, the amount of aggregate real income within the economy rises (falls). As a result, with projected population falls in the DCFTA and EEU regions, there are associated real income falls of $15,440 million and $24,800, respectively. In

RoCIS, where population is projected to rise, the opposite effect occurs. Finally, the trade preference effect measures the change in utility due to the abolition of the Russian import ban. With the post-ban restoration of trade preferences in Russia (2015-2020 period), the associated real income (utility) gain to the EEU region is $903 million.

4.2 Trade Futures 2015-2030

This section examines the impacts of three different trade futures (Deeper Integration ("DI"), Liberalisation ("LB") and Trade Blocs ("TB")) by comparing with the baseline scenario over the period 2015 to 2030. To keep the exposition within manageable proportions, results are presented for the entire aggregate of CIS regions and the EU aggregate region.

4.2.1 Production and Consumption 2015-2030

The impacts of different trade futures on production and consumption compared with the baseline are presented in Tables 10 and 11, respectively. Greater market access in the 'Deeper Integration' scenario through further tariff and NTM reductions benefits real growth (Table 10) for the CIS (4.25%) and EU (0.54%) regions, where the gain for the former is larger given the EU's larger partner status within the CIS region's trade portfolio. Examining the impact on production by sectors (Table 10), the benefits Deeper Integration largely accrue to the CIS and EU regions' non-food sectors (1.45% and 0.14%, respectively), whilst the agri-food sector aggregate contracts slightly (-0.19% and -0.56%, respectively). This contraction in CIS agri-food production is reflected most strongly in 'other meat' (-5.73%), 'dairy' (-1.89%), 'horticulture' (-1.24%) and 'grains' (-1.18 %). Interestingly, there is a very strong relative production rise in 'vegetables oils and fats' in the CIS region of approximately 30% in both trade scenarios, which is largely due to significant Ukrainian and (to a lesser extent) Russian exports to the EU. In the EU, the largest relative production falls are observed for 'vegetable oils and fats' (-8.77%), 'sugar' (-1.28%) and 'oilseeds' (-1.03%).

Table 10: Production volume (% change) (2015-2030) compared with the baseline

	CISReg DI	CISReg LB	CISReg TB	EU DI	EU LB	EU TB
Grains	-1.2	-8.7	1.0	-0.4	-12.9	0.9
Oilseeds	2.5	-21.2	7.7	-1.0	-25.0	0.5
Horticulture	-1.2	-9.0	10.7	-0.3	-16.3	0.2
Ruminants	2.1	3.0	1.9	-0.4	-11.5	0.1
Pig and poultry	-1.0	-9.0	6.7	-0.4	-3.5	0.1
Dairy	-1.9	-9.0	4.5	-0.4	-3.2	0.2
Sugar	0.3	-7.2	12.4	-1.3	-30.5	0.9
Cattle meat	-0.2	-8.6	6.3	-0.6	-16.5	0.2
Other meat	-5.7	-43.5	26.4	-0.4	-3.0	0.1
Veg. oils & fats	30.3	31.7	6.3	-8.8	-30.6	1.4
Bev. & tobacco	0.8	-2.8	6.5	-0.5	-8.0	0.2
AgriFood	-0.2	-7.3	6.2	-0.6	-9.7	0.4
NonFood	1.5	7.5	-0.3	0.1	-0.6	-0.0
Macro growth	4.5	22.0	-6.5	0.5	12.3	-0.5

A similar result to the 'Deeper Integration' scenario is observed when examining the impacts of the 'Liberalisation' scenario. In this particular case, since the relative macro gains to both regions are even more striking, given the world-wide coverage of tariff and NTM cuts, the magnitude of the trends on agri-food (and non-food) production in the CIS and EU regions is also amplified. For example, agri-food production in the CIS and EU regions falls by a significant 7.26% and 9.74%, respectively, compared with the baseline, with sectoral production falls in the CIS region as high as 43.4% ('other meat') and for the EU, approximately 30% ('vegetable oils and fats', 'sugar').

Taken in isolation, and with few exceptions (i.e., vegetables oils and fats) the production results for the Deeper Integration and Liberalisation scenarios reveal a surprisingly pessimistic medium-term outlook for agri-food markets in the CIS and EU regions. On the other hand, a cursory glance at the consumption results (Table 11) for both regions reveals that private consumers actually benefit considerably more in both these trade scenarios, when compared with the baseline.

Table 11: Private consumption volume (% change) (2015-2030) compared with the baseline

	CISReg DI	CISReg LB	CISReg TB	EU DI	EU LB	EU TB
Grains	-0.4	-0.6	0.8	-0.1	-0.1	0.1
Oilseeds	0.0	0.9	1.3	-0.0	0.1	0.1
Horticulture	0.1	3.6	0.5	-0.2	-1.6	0.1
Ruminants	-0.4	7.9	-0.2	-0.1	4.8	-0.1
Pig and poultry	0.4	1.2	-0.2	-0.2	2.6	-0.1
Dairy	1.3	4.5	1.6	-0.3	1.0	0.1
Sugar	0.1	2.6	-2.3	-0.1	9.9	0.0
Cattle meat	1.0	1.5	1.9	-0.2	7.5	0.1
Other meat	1.7	11.1	2.4	-0.3	4.9	0.1
Veg. oils & fats	6.8	21.2	-6.5	2.7	16.4	-0.1
Bev. & tobacco	2.7	8.1	-1.9	-0.3	-1.9	0.1
AgriFood	1.4	5.1	0.4	-0.2	1.2	0.1
NonFood	8.1	32.1	-12.2	0.6	18.1	-0.3

This apparent contradiction between production and consumption trends can be reconciled by the fact that trade transactions are considerably more efficient under both these futures (i.e., reduced trade facilitation costs from a greater alignment of trading standards). As the trade costs from administration (i.e., reduced paperwork due to greater regulatory harmonisation) and transport (i.e., reduced delays lowers refrigeration costs, animal feed and welfare costs and food wastage) are lowered on each journey, a greater proportion of high quality produce reaches the end consumer. Furthermore, with reduced 'leakage' from the trading system requiring less production per unit of consumption, there is the added benefit that greenhouse gas emissions are also curbed. If the pattern of trade is reasonably symmetrical (i.e., inter-

industry trade in both directions), then rising consumption is met by increased trade efficiency in both partners. On the other hand, if trade is already asymmetrical (significant exports supplied by a particular country or region), then the consumption needs of a large trading partner (i.e., EU) in addition to domestic absorption may exceed the trade efficiency gains, which in turn require further increases in production from that competitive exporter. [19]

In the 'Trade Bloc', the raising of trade barriers by the EEU region leads to falling real macro GDP growth in the CIS of -6.5%. Through reduced access to foreign trade in the EEU region, the resulting rise in trade costs acts as a brake on overall CIS economic growth, whilst final consumption costs also rise, which reduces consumer utility (see welfare discussion below). By unilaterally protecting EEU domestic industries, the EU faces lost export opportunities, leading a small relative contraction in its real GDP of 0.5%. In the CIS region, greater tariff protection increases relative agri-food production by 6.2%, with percentage increases in (*inter alia*) 'other meat' (26.4%), 'sugar' (12.4%) and 'horticulture' (10.7%). Although this also translates into rising private consumption of agri-food products (0.4%), it is still below the corresponding relative improvement registered in the 'Deeper Integration' and 'Liberalisation' scenarios, whilst in some CIS agricultural and food sectors (e.g., 'vegetable oils and fats', 'beverages and tobacco', 'sugar') private consumption levels are below those of the baseline, due to heavier restrictions on trade access to the EEU region. Indeed, in the case of non-food sector products, CIS region consumption levels are 12.1% lower than those of the baseline.

4.2.2 Market prices 2015-2030

The relative impact on market prices for each of the trade scenarios compared with the baseline is shown in Table 12. In comparison with the baseline, additional reductions in NTM trade facilitation costs in both the Deeper Integration and Liberalisation scenarios generates an additional utility gain to consumers in the importing regions. With relative rises in regional real income, there is a demand increase for both domestic (and imported) produce, which bids up the returns to land, labour and capital factors. In the CIS region, the index of factor prices in the agri-food sectors rises in relative terms by 4.0% and 7.7% under the 'Deep Integration' and 'Liberalisation' scenarios, respectively (not shown). In the Liberalisation scenario, factor price rises are stronger because the NTM reductions are geographically more widespread, leading to greater real income driven demand effects. Similarly, in the EU, corresponding agri-food factor prices rises are 0.7% and 11.2% for the 'Deep Integration' and 'Liberalisation' scenarios, respectively (not shown), respectively.[20]

The other driver of relative changes in market prices is the reduction in the tariff rates in both scenarios. In the agri-food sectors where tariff protection is typically much higher (vis-à-vis non agri-food sector trade), the tariff reduction effect appears to dominate such that CIS and

[19] In the 2015 GTAP trade data, the Ukraine region has a very large positive trade balance with the EU in 'vegetable oils and fats' and a large 'vegetable oils and fats' sector. In this particular case, a further simultaneous cut in trade costs by CIS and EU partners increases the degree of trade asymmetry in favour of the Ukraine, such that production rises even further in the CIS region aggregate.

[20] In the non agri-food sectors, CIS aggregate region factor price rises compared with the baseline are 3.4% (Deeper Integration) and 5.8% (Liberalisation), whilst for the EU, corresponding factor price appreciations are 0.8% (Deeper Integration) and 18.8% (Liberalisation).

EU region market prices more generally fall when compared with the baseline. With a stronger rising factor price effect in the Liberalisation scenario, the relative market price fall for agri-food is smaller compared with the Deep Integration scenario.

In the Trade Bloc scenario, under the assumption of greater isolationism in the EEU region, the loss in real income arising from rising trade facilitation costs depresses agri-food and non agri-food factor prices in the CIS region by -12.7% and -13.2%, respectively (not shown). Overall, non agri-food market prices in the CIS region fall by -2.0%, whilst once again, the (rising) tariff effect prevails in the case of the agri-food sectors, leading to a weighted 2.7% market price rise in the CIS region. It is worth noting that in specific CIS agri-food sectors where tariff support is increased significantly from 2015 levels (e.g., 'horticulture', 'oilseeds', 'pigs and poultry', 'ruminants', 'sugar') , market price rises are stronger.

Table 12: Real market prices (% change) (2015-2030) compared with the baseline

	CISReg DI	CISReg LB	CISReg TB	EU DI	EU LB	EU TB
Grains	-0.6	-1.5	3.8	-0.6	-11.0	0.8
Oilseeds	0.8	-2.3	7.6	-1.0	-16.2	0.9
Horticulture	-1.8	-5.0	8.0	-0.1	-9.7	0.4
Ruminants	-6.9	-16.8	13.3	-0.3	-9.0	0.3
Pig and poultry	-1.5	-1.3	4.5	-0.2	-6.6	0.2
Dairy	-1.8	0.2	0.6	0.1	-2.6	-0.0
Sugar	-1.6	-6.5	10.9	0.1	-0.7	-0.1
Cattle meat	-2.4	0.6	-2.9	0.1	-2.2	-0.1
Other meat	-0.9	2.4	-1.9	0.2	-2.0	-0.1
Veg. oils & fats	-2.8	-0.9	5.0	0.4	0.4	-0.4
Bev. & tobacco	-2.7	0.1	2.8	0.1	1.0	-0.1
AgriFood	-2.2	-1.8	2.7	0.0	-2.1	0.0
NonFood	0.5	5.8	-2.0	-0.0	3.3	-0.1

4.2.3 Real Trade Balances 2015-2030

The relative changes in the trade balances (in constant prices) for each trade scenario are presented in Table 13. At the margin, the relative changes compared with the baseline are heavily influenced by additional changes in trade facilitation costs at the border, the relative competitiveness of EU and CIS region border protection (i.e., tariff and NTM costs), and the pattern of trade between both blocs. In the Deeper Integration scenario, which focuses on greater trade integration between the CIS and EU regions, and the Liberalisation Scenario (which also includes third country market access), the trade balance appears to favour the CIS region (vis-à-vis the EU). For example, in the CIS region, the relative trade balances for agri-food products improve $1,982 million (Deeper Integration) and $2,600 million (Liberalisation). For the CIS region, these results are heavily influenced by the trends in the 'vegetable oils and fats' sector (see discussion in section 4.2.1) which undergoes matching trade balance improvements in both scenarios. On the other hand, CIS agri-food balances deteriorate strongly on 'other meat' and dairy' trade, where reported CIS production falls

from large bases (Table 10) in both these sectors owing to rises in trade efficiency. With increasing real incomes in both the CIS and EU regions (see next section), the positive real income effect (rising marginal propensity to import) leads to an overall trade balance deterioration in both trade scenarios, compared with the baseline.

Under the 'Trade Blocs' scenario, the raising of tariff and trade costs by the EEU region on all imports improves the overall CIS region trade balance. This results is driven by the price effect (rising import costs reduces import quantities), and the effect of falling real incomes in the EEU region (see next section) on the marginal propensity to import. The agri-food sector trade balance in the CIS deteriorates $1,118 million, with a concomitant improvement in the EU of $3,431 million.

Table 13: Trade Balance volume changes at 2015 world prices (2015-2030) compared with the baseline

	CISReg DI	CISReg LB	CISReg TB	EU DI	EU LB	EU TB
Grains	-191	-1,024	-1,091	92	-214	575
Oilseeds	130	-691	34	263	1,790	-138
Horticulture	21	490	-405	64	2,743	34
Ruminants	0	-367	131	6	897	-24
Pig and poultry	16	59	-24	-31	-103	-1
Dairy	-358	-825	131	-130	8,234	113
Sugar	111	469	-119	-129	-2,590	122
Cattle meat	98	-826	637	-214	-4,385	24
Other meat	-383	-2,426	1,499	-80	4,337	-102
Veg. oils & fats	2,081	2,724	-47	-1,302	-3,392	177
Bev. & tobacco	-108	119	315	-312	-2,080	153
AgriFood	1,982	2,600	-1,118	-2,557	-12,771	3,431
NonFood	-28,315	-31,102	143,550	-34,842	-1,368,380	-18,020

4.2.4 Equivalent variation (EV) 2015-2030

The welfare changes relative to the baseline are presented in Table 14. The underlying trend is that the change in real income in both the CIS and EU regions rises in both scenarios where further liberalisation occurs. For example, in comparison with the baseline, in the Deep Integration and Liberalisation scenarios, the CIS region gains $87,026 million and $311,173 million, respectively, equivalent to a corresponding per capita income gain of 5.8% and 21.2%. Similarly, with greater trade protectionism within the EEU region, per capita incomes in the CIS aggregate region fall by 11.7% compared with the baseline.

Table 14: Welfare changes (2015-2030, million USD) compared with the baseline

	CISReg DI	CISReg LB	CISReg TB	EU DI	EU LB	EU TB
ToT	23,905	26,628	-54,076	1,334	238,570	17,463
ALLOC	15,362	53,172	-25,711	24,060	231,564	-9,365
ENDW	11,148	44,903	-15,529	7,138	152,150	-3,936
TECH	38,441	192,052	-67,938	55,105	1,683,976	-58,604
POP	-1,877	-5,711	3,119	456	22,874	-209
PREF	47	129	-58	0	0	0
EVTOT	87,026	311,173	-160,193	88,093	2,329,134	-54,651
u (%)	5.8	21.2	-11.7	0.6	15.3	-0.4

As expected, at the margin, a significant share of the EV change compared with the baseline is attributed to policy induced changes in trade facilitation costs (Tech). In the EU, Tech accounts for between 63% and 72% of the total EV gain in the Deep Integration and Liberalisation scenarios, respectively, and over 100% of the EV loss in the Trade Bloc scenario. For the CIS region, tech effects also explain a large proportion of the overall EV change, although the share is less than the EU. This is because changes in CIS trade integration/protectionism policies with a larger partner such as the EU, generates bigger economy-wide impacts on CIS region industry output and factor prices, resulting in proportionally larger Alloc, ToT, Endw and Pop effects. For example, with further falls in trade facilitation costs, resulting real income driven rises in demand bids up factor prices further resulting in rising endw incomes, improvements in the terms of trade (real exchange rate appreciation), higher allocative efficiency (greater demand for tariffed imports) and steeper falls in population income (projected population falls based on larger real income gains).

5. Conclusions

This paper employs a state of the art computable general equilibrium (CGE) model based on the Global Trade Analysis Project (GTAP) database, to quantitatively assess the impacts of different trade arrangements on agri-food activities within the economies of the Commonwealth of Independent States (CIS). On the one hand, a contemporary baseline scenario is carefully designed to accommodate key structural economic changes, whilst considerable efforts are made to generate a plausible set of non-tariff measure (NTM) *ad valorem* equivalents (AVEs), which in tandem with the tariff rate AVEs from GTAP, are used to generate changes in trade policy. A further feature of the baseline is that it accommodates envisaged relevant trade arrangements such as the Deep and Comprehensive Free Trade Agreement (DCFTA) between Georgia, Moldova and Ukraine and the EU, as well as the creation of the Eurasia Economic Union (EEU) between Russia, Belarus and Kazakhstan subsequently extended to include Armenia.

As expected, in the baseline the structural supply side (productivity growth, capital and labour stocks) and demand side (endowment income and population) drivers typically dominate agri-food market trends, although policy is still found to have an important impact. In particular, the DCFTA deal has a beneficial impact for the agri-food activities of Georgia, Moldova and Ukraine. On the other hand, by adopting Russia's generally lower common external tariff structure, agri-food activity in Armenia, Belarus and Kazakhstan is found to be adversely affected. Interestingly, the trade diversion effects of the EEU and DCFTA deals on non-signatory CIS regions are not found to be strong, which indicates that as a whole, the degree of trade integration in the CIS region is relatively low.

Examining the impacts of different trade futures by comparing to the baseline reveals two clear pathways. On the one hand, in those scenarios in which greater reductions in trade facilitation costs are envisaged (i.e., 'Deeper Integration', 'Liberalisation'), there are benefits for all countries involved in terms of higher real macroeconomic growth and real incomes. Furthermore, in the context of agri-food markets, private consumption rises above baseline levels, whilst reduced frictions/wastage in the trading system imply lower levels of necessary production to satisfy demand, higher profitability per unit of production (in terms of increased per unit primary factor returns) and lower emissions, due to reduced production. In the 'Trade Bloc' scenario, these above mentioned trends are reversed, owing to increased trade protectionism on the part of the EEU.

Whilst the trade options explored in the current study clearly quantify the possible gains to the CIS region from greater trade openness, a degree of caution should be exercised. Indeed, in modelling the reduction in trade facilitation costs, one assumes that the necessary behind-the-border trade harmonisation that accompanies such adjustments is costless to producers, who hitherto, may be operating under different trade regulations and product specifications. As a result, the estimates taken here should be considered as upper bound, whilst further research should examine a methodological approach to adapt industry cost functions to changes in the way trade is regulated. Finally, on examining trade competitiveness in differentiated agri-food markets, some consideration of product variety, scale and the process of self-selection by firms across domestic and export markets would provide useful additional insight to the analysis. A possible avenue to explore would therefore follow relatively recent applied developments in this arena (i.e., Melitz, 2003).

6. References

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