EU Common Agricultural Policy Post-2020: Exploring the Effects of Safety-Net Policy Instruments

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1 Introduction

Following a succession of reforms of the EU's Common Agricultural Policy (CAP) over the past quarter-century, EU agriculture has become much more market-oriented. Although high tariff protection remains for some commodities, for many commodities EU market prices now move in line with world market prices (Matthews, Salvatici, & Scoppola, 2017). As a result, the variability of farm producer prices has increased compared to the earlier period when EU markets were relatively isolated from world markets due to the operation of variable import levies (on imports) and variable export subsidies (on exports).

The last CAP reform, which was agreed in 2013 and implemented since 2015, recognized the need to do more to limit farm income variability. In the EU, direct payments (now largely decoupled from production) make a significant contribution both to the level and to stability of farm incomes. In addition, the EU retains intervention mechanisms for several key commodities which allow the public purchase of surplus production when prices fall below safety-net levels. Unlike in the United States (US), risk management measures play a relatively minor role in the EU (Bardaji & Garrido, 2016). Two initiatives introduced in the 2013 reform were a crisis reserve (financed by withholding a percentage of direct payments to farmers to create an annual reserve which, if not used, is returned to farmers in the following year), and greater scope for individual Member States to finance risk management instruments through their Rural Development Programmes, RDPs (often referred to as Pillar 2 of the CAP).

Specifically, the new risk management rules allowed Member States to make financial contributions to premiums for crop, animal and plant insurance against economic losses to farmers caused by adverse climatic events, animal or plant diseases, pest infestation, or an environmental incident; financial contributions to mutual funds to pay financial compensations to farmers, for economic losses caused by adverse climatic events or by the outbreak of an animal or plant disease or pest infestation or an environmental incident; or financial contributions to mutual funds, providing compensation to farmers for a severe drop in their income (income stabilisation tool). This support was required to be consistent with WTO rules on the eligibility of crop insurance and income insurance schemes for green box status, so contributions could be made only to schemes which made payments when production or income losses were greater than 30% and, in the case of income insurance, payments by the mutual fund could not exceed 70% of the income loss suffered by producers. Very few Member States made use of the possibility to include one or more of these risk management measures in their RDPs.[1]

The debate on the shape of the CAP post 2020 has already begun with the publication of the Commission's White Paper "The Future of Food and Farming" in November 2017. In the years since the new CAP was implemented, a number of farm sectors have continued to experience high levels of income variability, partly due to external factors (the Russian embargo on imports of foodstuffs from the EU in August 2014 led to sharp price falls for pig meat and fruits and vegetables), and partly due to world market conditions (the sharp fall in world dairy product prices in 2015). The EU responded to these crises by making available significant amounts of ad hoc aid to producers. It was noticeable that the crisis reserve, intended to be the first line of defence in the event of low market prices, was not brought into use.[2] There is a general agreement among stakeholders that the next CAP reform should put greater emphasis on measures to support farm incomes during periods of particularly low prices.

However, there is as yet no agreement on what these measures might be. The Commission White Paper recognises the need "to set up a robust framework for the farming sector to successfully prevent or deal with risks and crises, with the objective of enhancing its resilience and, at the same time, providing the right incentives to crowd-in private initiatives". Its main concrete proposal is to set up a permanent EU-level platform on risk management to provide a forum for farmers, public authorities and stakeholders to exchange experiences and best practices, with the objectives of improving implementation of the current tools and informing future policy developments.

Others are tempted to look across the Atlantic at the US farm safety net and would like to see the EU adopt elements of the US approach. The US farm safety net has three pillars: federal crop insurance, farm commodity programmes, and disaster assistance. Federal crop insurance is now the centrepiece of the US farm safety net, having overtaken commodity programmes some years ago. It makes available subsidised crop insurance to producers who purchase a policy to protect against losses in yield, crop revenue, or whole farm revenue (including livestock producers to a limited extent). The 2014 Farm Bill also replaced direct payments with two new counter-cyclical programmes for crop producers. Producers have a choice between a Price Loss Coverage (PLC) and an Agricultural Risk Coverage (ARC) programme, depending on their preference for protection against a decline in either (a) crop prices or (b) crop revenue. Under the PLC, participating producers receive a payment when national season average farm prices fall below fixed reference prices. Payments are limited to base acres and are fully decoupled from the producer's planting decision. Under the ARC, payments make up the difference between a county revenue guarantee (based on five-year average crop prices or statutory minimums) and actual crop revenue. As for the PLC programme, a producer does not

[1] To encourage Member States to make greater use of these risk management possibilities, various changes were introduced in the Omnibus Agricultural Provisions Regulation (EU) 2393/2017 with effect from 1 January 2018. Specifically, production and income losses greater than 20% are now eligible for Member State support, while the income stabilisation tool can now be implemented for specific sectors and not only for whole farm income. At the same time, the limit on aid intensity was raised from 65% of the cost of insurance to 70%.

[2] The main reason for this is that using the crisis reserve implies that one group of farmers effectively transfer part of their direct payments to another group. The use of the crisis reserve must be sanctioned by the Council of Agricultural Ministers, and they find it very difficult to agree on measures which redistribute payments within the farm sector.

actually have to plant the crop to receive a payment. Any payments are made on 85% of historical base acres, not actual planted acres.

What would be the implications of introducing instruments similar to the US counter-cyclical payments into the CAP? The objective of this study is first to develop a modelling framework that enables the analysis of different instruments included in the safety-net program and second to explore the effects of these instruments on the EU CAP budget, farm income, farm output and world food prices, as wells as international trade. Particularly, we aim to address the following questions considering stochastically determined exogenous supply shocks:

- How, and to what extent can discussed safety net instruments protect from downside risks and stabilize agricultural incomes?
- How much will these flexible payments increase the CAP budget costs?
- How effective are those instruments to protect from downside risks? And how budget-efficient?
- Are the current U.S. safety net policies a suitable model for designing such policies for the CAP post 2020?

This article is organized as follows. Section 2 introduces the extension to the standard GTAP modelling framework. Subsequently, we explain our experiment design and the stochastically determined shocks and finally, present the results and conclusion.

2 Method

Answering the questions raised in section 1 requires an approach that enables the analysis of different policies under varying economic conditions to quantify the effects on different markets. This study specifically aims to:

1. assess the effects of global agricultural production shocks on EU farm income
2. compare the costs and budget efficiency of different policy instruments

Here, it is of particular importance to consider feedback effects between all product, intermediates and factor markets, as well as between EU and world markets. To assess the effects of policy reforms or the options of different proposal e.g., for the future design of the EU CAP, policy analysts often apply and extend partial (PE) and general equilibrium (AGE) models. While PE models often depict the agricultural sector at a more disaggregated level than GE models and thus account for more detailed policy instruments, GE models enable the thorough representation of worldwide economic and policy effects in all sectors as well as all relevant interdependencies and resulting repercussions in particular on factor markets and thus income. Examples for the extension of AGE models to capture detailed domestic support and for the analysis of domestic support or specifically the EU CAP using these AGE approaches can be found in Boulanger & Philippidis (2015), Boysen et al., (2016), Nowicki et al.,(2009) and Urban et al. (2016). However, to our best knowledge, safety net instruments have not been analysed using AGE model as yet. First approaches for the incorporation of safety net instrument could build upon the modelling of intervention prices (Walsh, Brockmeier, & Matthews, 2007) as well as the implementation of stockholding under consideration of market volatility based on exogenous supply shocks (Fémenia, 2010; Hertel, Reimer, & Valenzuela, 2005).

Against this background, this study applies an extended version of the Global Trade Analysis Project (GTAP) model called GTAP_AGPOL. GTAP is a comparative-static, multi-regional general equilibrium model, which is well documented in Hertel (1997). Features of the GTAP model are the representation of the global economic activities considering a detailed depiction of agricultural and food sectors, manufacturing and services as well as factor markets in all economies of the world. In addition, accounting for international trade via bilateral trade flows, enables the representation of interdependencies within and between economies. It represents all policy instruments as ad valorem tax equivalents that create wedges between the agents and market prices. Accordingly, the standard GTAP model mirrors agricultural policy instruments related to domestic support (budgetary transfers) in the form of five price wedges: output, intermediate inputs, land, capital, and labour. Market price support is implicitly included in border measures.

Adopting the approach of Urban et al. (2014; 2016) the GTAP_AGPOL model depicts a much more detailed representation of the EU CAP policy instruments. Additional policy instruments further subdivide the existing five price wedges to consider the production requirements and thus the effect on farm level output decisions of EU CAP policy instruments based on four different payment categories – product specific support, group specific support, all commodity support and other transfer to producers according to the Producer Support Estimate (PSE) concept of the OECD. This way, we achieve a detailed representation of the EU CAP in the underlying value flows and price linkage equations that accounts for the extent to which EU CAP policy instruments stimulate production and affect farmers decisions.

In addition, the GTAP_AGPOL model depicts new policy instruments to protect the agricultural sector in case of price, revenue and income losses. The integration of these safety nets instruments into the GTAP_AGPOL model requires three new policy instruments to further split the price linkage equations. In contrast to the existing policy instruments, safety net instruments are only active if a specific condition is fulfilled. The implementation of complementarities allows the incorporation of the mechanism of each specific instrument. Table 1 provides an overview about the three policy instruments covered in this study. Using PLC as an example the following paragraph explains the modelling of safety net instruments.

Table 1: Mechanism of Safety Net Instruments

Policy instrument	Condition	Subsidy value
PLC	$P_M < P_{REF}$	$TF_{PLC} = VFM - [P_{REF} - P_M] \times 0{,}85\ \overline{QO}/EVFA$
ARC	$AREV < BREV$	$TF_{ARC} = VFM - [BREV - AREV] \times 0{,}85\ QFE \times QFE_{base}/EVFA$
IST	$RINC < AINC$	$TF_{IST} = VFM - [RINC - AINC] \times 0{,}7/EVFA$

Note: With P_{REF} = reference price, P_M = market price, TF_{PLC} = PLC-instrument, TF_{ARC} = ARC-instrument, TF_{IST} = IST-instrument, QO = output quantity, QFE = area, QFE_{base} base area, VFM = land value at market prices, EVFA = land value at agents prices; BREV = benchmark revenue, AREV = actual revenue; RINC = reference income, AINC= actual income

Source: Authors elaboration.

As introduced in chapter 2, PLC protects agricultural producers against price losses. Accordingly, a ratio of reference price to market price less than 1 (i.e. the market price falls below the reference price) activates the PLC-instrument and the sector obtains a deficiency payment. The value of this subsidy equals 85% of the price difference ($P_{REF} – P_M$) times a base output quantity (fixed program yield) and times base area (compare section 2). The linkage to base area and a fixed program yield assures that this instrument creates only limited production incentives and can be regarded as partially decoupled from farm level output decisions. To consider this in the model, the policy instrument TF_{PLC} (i,j,r) distributes the subsidy payment to the area (i) currently used by sector (j) in region (r). This increases the wedge between market and agents price for land used in sector (j) in region (r). This approach accounts for the production incentives created by other coupling channels as described in section 2 as follows. If the area (i) used in sector (j) increases, the deficiency payment per area unit decreases and consequently restricts the area expansion of a specific sector caused by the deficiency payment. The product-specific implementation on land creates production incentives, however, these effects are clearly mitigated compared to output subsidies. The model considers ARC- and IST-instruments accordingly.

3 Experiment design

This section introduces the scenario set-up and the generation of stochastic shocks.

3.1 Scenario set-up

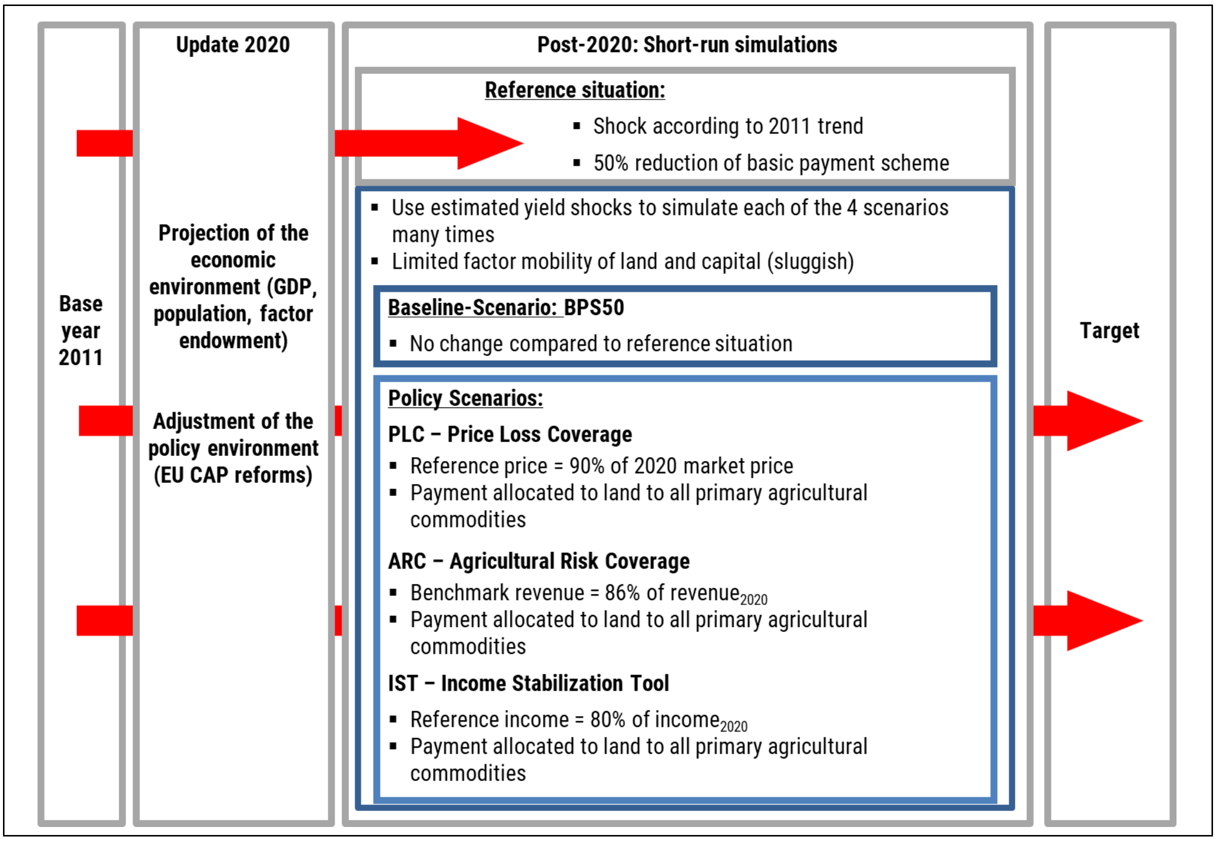
Version 9.2 year 2011 of the GTAP database (Aguiar, Narayanan, & McDougall, 2016) serves as starting point for the quantitative analysis. The 140 countries and regions and 57 sectors are aggregated to a 26 region and 22 sector database. This aggregation considers 27 EU member states of which Belgium and Luxembourg (BLUX) as well as Cyprus and Malta (CM) are aggregated. Due to a lack of domestic support data for Croatia, Croatia can only be considered in the aggregate of all non-EU countries and regions (rest of the world)[3]. This database depicts all primary agricultural commodities (12) and processed food (8) sectors as disaggregated as possible, and aggregates all others to “Manufacturing” and “Services”.

Based on the approach of Urban et al. (2014, 2016) as described in section 3 we utilize data from the Producer Support Estimate (PSE) Database of the OECD (2017) and the EU CATS database provided by Boulanger, Philippidis & Jensen (2016) to incorporate a detailed representation of the EU CAP policy instruments into the standard GTAP database. A complex update procedure based on the Altertax program (Malcolm, 1998) enables the detailed depiction of policy instruments according to their eligibility criteria and production requirements.

The base year 2011 of the extended GTAP database requires an update of the economic and political framework. Figure 1 shows the structure of baseline and policy simulations. Based on projections for GDP, population, and factor endowments (Fouré, Bénassy-Quéré, & Fontagné, 2013) the macro-economic environment of all economies in the GTAP database is projected to 2020. Simultaneously, the changes in the structure and budget of the EU CAP based on the policy reforms 2007 to 2013 and 2014 to 2020 are updated in the model and database utilizing EU financial reports for EAGF and EAFRD fonds and the multiannual financial framework (MFF) for the period 2014 to 2020. According to the MFF the EU CAP budget spend for the 1 pillar is reduced by 13% and for the 2. Pillar by 18% in nominal terms (European Council 2013). In addition, coupled payment for e.g., seeds, beef and veal and protein crops are decoupled in 2012 and shifted into the basic payment scheme (BPS). Payments are (partially) re-coupled to production according to article 68 VO (EC) No. 73, 2009. Gocht et al. (2017) state no significant effects of the CAP “greening” on farm income at the aggregated level, therefore, this baseline does not specifically consider “greening”.

[3] All non-EU regions and countries are considered as „rest of the world“. The very likely exit of the United Kingdom from the EU (Brexit) is not considered in our baseline. At the time this study was conducted, there has been no concrete proposal about how the Brexit will be put into effect. Assumptions about the different forms of the Brexit would clearly have influenced the results of the study.

Figure 1: Baseline and Policy Simulations



Source: Authors elaboration.

The policy scenarios simulate three options of risk coverage of farm income as part of the future EU CAP. Together with the baseline scenario this analysis considers four different scenarios.

The GTAP database, updated to depict a detailed representation of the EU CAP and projected to 2020 serves as reference situation. First, this database is corrected/ adjusted to remove deviations from the 2011 trend. Then, a 50% reduction of the basic payment scheme creates financial scope for the implementation of safety net instruments (compare Mahé & Bureau, 2016). There are different possibilities to provide funding for these instruments e.g., contributions to mutual funds or insurance payments to support risk coverage, or in the form of deficiency payments to eligible agricultural producers. The latter could be regarded as an expansion of the national reserve for disaster aid. However, the discussion of how the funding of this type of payment could look like is beyond the scope of this article.

Baseline Scenario:

(1) BPS50: Change compared to GAP 2014 to 20202 = 50% reduction of the BPS (as reference situation).

Policy Scenarios:

(2) PLC – price loss coverage: Introduction of "Price Loss Coverage" according to the 2014 US farm bill

- Reference price = 90% of market price in 2020 (pre-simulation)
- Program yield = yield in 2020 (pre-simulation)
- Subsidy if actual market price < reference price
- Subsidy value = (reference –market price) x 85% x bases area x program yield

(3) ARC – revenue loss coverage: Introduction of "Agricultural Risk Coverage" according to the 2014 US farm bill

- Benchmark revenue = 86% of sector revenue in 2020 (pre-simulation)
- Subsidy if actual revenue < benchmark revenue
- Subsidy value = (benchmark revenue/ha – actual revenue/ha) x 85% x base area

(4) IST – income stabilization: Introduction of "Income Stabilization Tool" according to the 2014 to 2020 EU CAP and the Omnibus Regulation 2017

- Reference income = 80% of sector income in 2020 (pre-simulation)
- Subsidy if actual income < reference income (i.e. 20% income loss)
- Subsidy value = (reference – actual income) x 70%

A stochastic component affects production and prices and thus income based on exogenous global yield shocks and enables the assessment of the income stabilising effect of the different scenarios. Therefore, we simulated each of the four scenarios many times using the GTAP_AGPOL model and considering the full range of yield shocks. This set-up allows us to assess the effects of safety net instruments on income stabilization and budget cost. The next section describes the approach and results of the conducted yield estimations.

3.2 Estimation of yield shocks

The observed yield variability of arable crops and livestock of the period 1961 to 2011 serves as basis for the assessment of safety net instruments and their effects on different economic variables. After deriving yield based on FAO data (FAOSTAT, 2017), we isolate general productivity trends determined by technological changes, productions systems and climate to obtain yield fluctuations caused by severe whether events, catastrophes/disasters and other unexpected events.

Usually, yield equals production quantity divided by area planted for arable crops and production quantity divided by the number of animals for livestock. The aggregation level of AGE models requires the aggregation of specific product yield according to product groups or regions. For this purpose, we determine for each product in the year 2011 a world reference price that equals the ratio of value of production measured in constant international dollars (2004 to 2006) and the production quantity. This reference price weights the 2011 reference production quantity, which is then divided by the area planted or the animal number respectively, to obtain the Laspeyres yield index for each triple of product group, region and year. This assures that the yield index measures only yield changes does not account for composition effects caused by price- and quantity changes. This results in a database for yield indices for 26 regions and 10 product groups. [4]

An Ordinary Least Squares regression estimates the following model to determine the general productivity trend for each product group and region for the period 1961 to 2011.

$$Y_{irt} = \beta_0 + \beta_1 X_{irt} + \beta_2 Z_{rt} + \beta_3 X_{irt} Z_{rt} + \epsilon_{irt} \quad \forall i \in I, r \in R$$

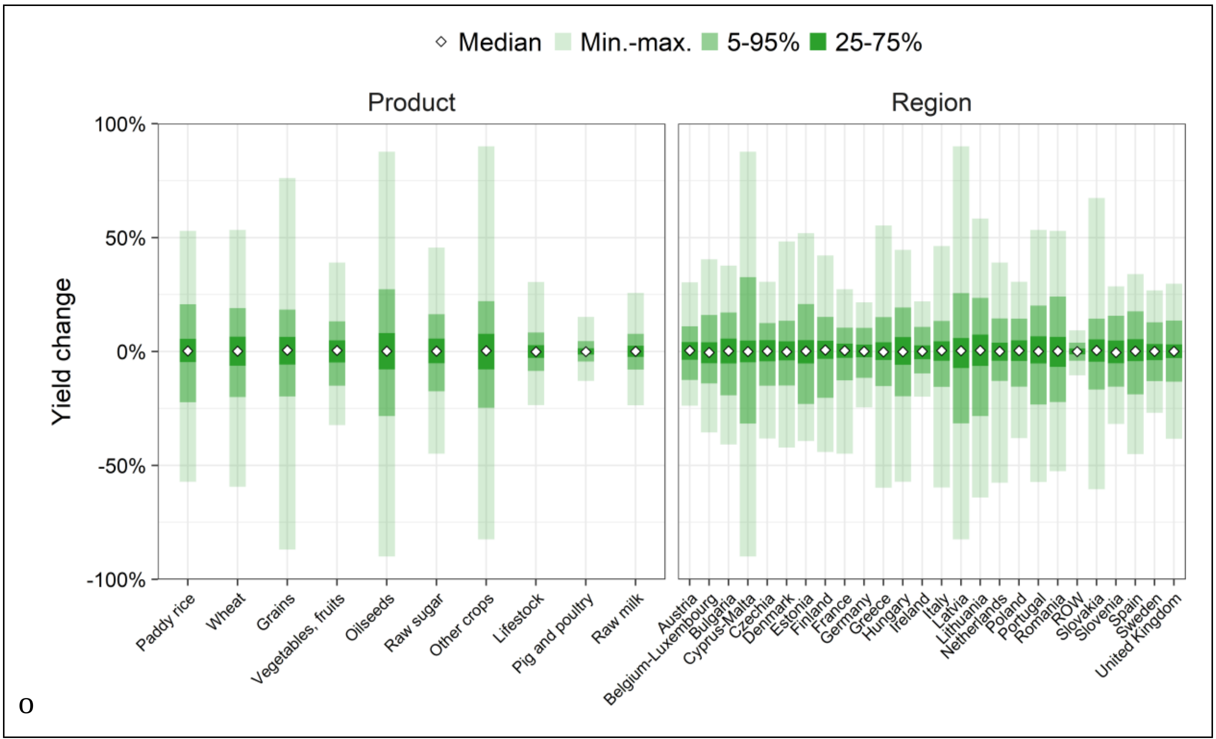
The trend variable X_{irt} determines the yield index Y_{irt} of product group i, region r and year t . The dummy-variable Z_{rt} equals 1 if a specific region belonged to a nprecursor nation in year t, e.g., the Czech Republic belonged to Czechoslovakia until 1992, otherwise zero. Adding the dummy variables Z_{rt} and their interaction with the yield index enables the consideration of a fundamental change of constant and slope of the general productivity trend caused by such a structural break and related changes in the underlying database. In addition, we estimate this model second and third degree fully interacting polynomial forms. The lowest value of Aikake information criterium selects the "best" out of three estimations, which is then used to estimate the yield trend. The estimates of the error term ϵ_{irt} represents the trend adjusted yield

[4] Insufficient data for "plant based fibres" and "wool" led to an exclusion of these two product groups.

distribution or „yield deviation“ from the general trend that is caused, among others, by weather events, disasters, pest infestations or animal- and plant diseases.

Figure 2 shows the distribution of yield shocks. Both diagrams depict the minimum and maximum value of yield deviation, the 5 to 95 % interquantile (IQNI) – and interquartile interval/distance (IQI) and the median. The left diagram summarizes the variability over time and regions for products, whereas the right diagram the variability over time and products for regions. While yield deviations for most of the arable crops in the left diagram lie between +/- 10 % in the middle 50 % of the observation (IQI), increases the range for 90 % of the observation (IQNI) to more than +/- 30 %. The extreme case (10 % of the observations) show deviations for wheat of more than +/- 50 % and for oilseeds and other crops of more than +/- 80 %. The variability for livestock products and vegetables and fruits tends to be much lower.

Figure 2: Yield shocks



Source: Authors elaboration

According to the right diagram, the extent of yield variability is different between regions. While some countries such as Lithuania, Latvia and Cyprus and Malta often are affected by yield losses of 30 % or higher, other countries such as Germany and Ireland less exposed to yield variability. However, average yield variability tend to equalize when aggregating larger regions or product groups compared to smaller ones.

To simulate these estimated yield variabilities in a CGE model, we use the estimated percentage yield deviations from the general trend to individually shock the efficiency parameters of the production function of each product group and region. In doing so, the estimated yield deviations of an actual year are applied together to obtain the real world correlation of the variability across products and regions. The yield variability data of 51 years therefore result in 51 yield scenarios which are simulated independently of one another.

The underlying GTAP database with base year 2011 depicts the economic situation including the yield variability of the year 2011. The application of a shock equal to the reciprocal of the yield deviation in 2011 creates the point of departure for the four simulations. This reference situation is in line with the general yield trend.

4 Results

This section introduces first the results of the baseline scenario (BPS50) and then discusses the effects of the other three scenarios in comparison with the baseline scenario. Statistical indicators such as median, interquantile intervals between 5 and 95 % quantiles (IQNI), interquartile intervals between 25 and 75 % quantiles (IQI), minima and maxima and others help to present and interpret the results of this stochastic analysis. The short-term perspective of the simulations requires the following adjustments of the model's closure.

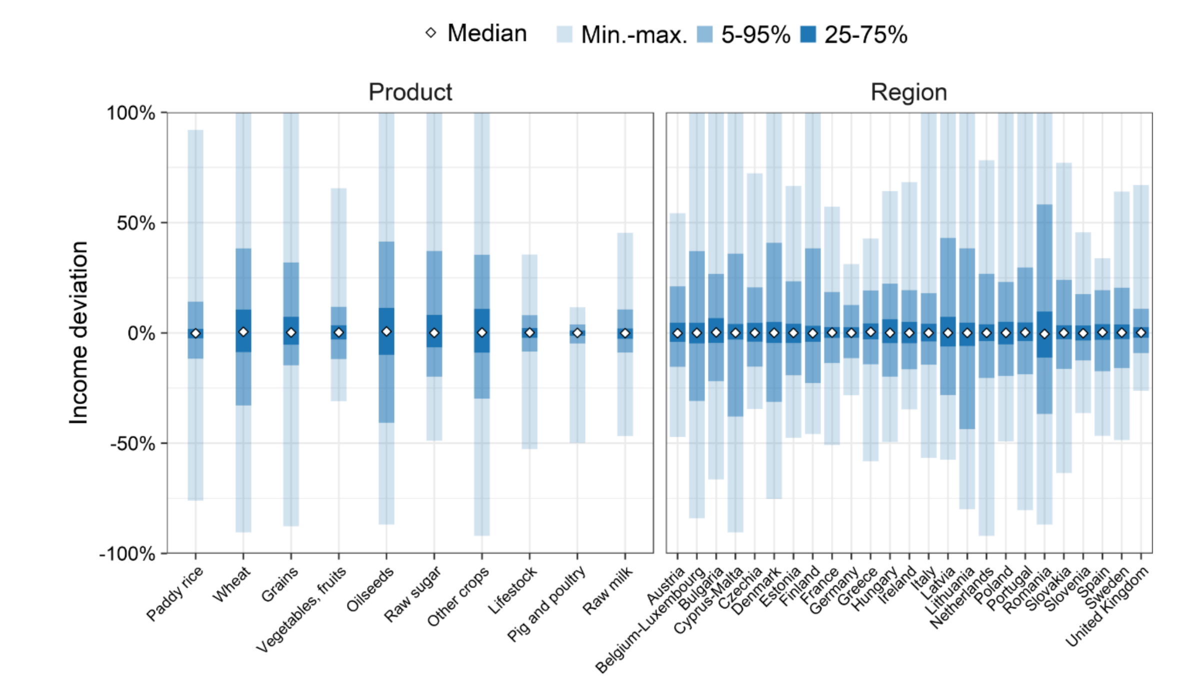
- Labour is the only mobile factor
- Capital, land and natural resources are sluggish so that the mobility of these endowment factors between sectors is limited in the simulations with the lowest limitations for capital and the highest for natural resources.

4.1 Baseline scenario

Starting from the reference situation that represents the economy in the year 2020 considering yields on the trend line, the model simulates each of the 51 yield scenarios. Due to the abundance of results, the presentation of results focus strongly on the objective, the coverage of income risks, in particularly the extreme downside risk and the related budget effects. Section 4.2 has already revealed that the extent to which regions and sectors differs strongly and can reach number equal to 90 % in the extreme case. Several factors determine the effect of a negative yield shock. A yield reduction tends to disproportional price increase if the demand for a specific product is little price elastic and can therefore lead to a revenue increase. By contrast, an inelastic demand, tends to cause a revenue reduction. Furthermore, factor markets, the tradability of products, other countries' and other products markets as well as other factors contribute to the effects of yield fluctuations. This shows the necessity of an empirical modelling framework to provide answers to the posed questions. Furthermore, might e.g., considerable global yield increases affect national market prices negatively due to international trade. Figure 3 shows the simulated distribution of yield variability across all yield scenarios. The statistics are calculated based on the percentage income changes compared to the baseline under the assumption that each sector in each region represents an individual agricultural producer. The left diagram shows the income changes of a sector across all regions and yield scenarios, whereas the right diagram shows the changes of a region for all sectors and yield scenarios. In comparison to the underlying yield shocks presented in Figure 3, indicate the bars in Figure 4 for IQI and IGIN in general similar magnitudes, but the range of the income fluctuations differs.[5] The extreme fluctuation of income changes is often higher compared to the yield changes. This is particularly prominent in the wheat, oilseeds and other crops sector, especially with regard to negative changes. This emphasizes that the natural protection mechanism based on a reverse price effect is not very effective or rather that prices even move in the same direction. By contrast, for paddy rice and fruits and vegetables the observed effects tend to be less in the negative area indicating a natural protection, however, not able to completely absorb the shock. The price effect clearly depends on the tradability of the products and the market development of a product in other regions of the world, in particular, whether a yield loss is a local event or whether it covers several other regions. The comparison according to regions (right diagram) displays income variability that exceeds the corresponding yield variability. This indicates that all regions have sectors in which yield changes disproportionally affect income.

[5] To increase the visibility, the scala of the ordinate is limited to +/- 100 %. This affects only a few positive extreme numbers that are beyond the scope of this study.

Figure 3: Income variability in the baseline



Source: Authors elaboration.

4.2 Policy simulations

While the actual BPS provides a guaranteed income support that does not react on yield reductions or market price drops, the investigated options aim only on the coverage of downside risks. Therefore, each of the policy instruments take a different indicator as basis to determine the risk event. IST considers farm income and hence includes negative effects on up- and downstream markets. Consequently, it fundamentally differs from the other two instruments. ARC accounts for product revenue per hectare and therefore covers price and yield changes. Utilizing this indicator ensures that first the natural protection is effective, because according to the price mechanism an increase in prices usually at least partly offsets yield reductions. This instrument clearly depends on the functioning of the price mechanism on a particular market. The highest payments arise for products that reveal a low correlation between output quantity and market price. PLC is based exclusively on prices, whereas production changes have no influence. Accordingly, it protects farmers in case of negative price shocks, but not explicitly in case of yield reductions. However, negative yield changes are partly offset by the natural protection mechanism. In case of high yields that usually are associated with low prices, PLC potentially increases farm income without a risk event. PLC seems to be beneficial for agricultural producers in markets, which show a high correlation between price and output quantity and in times of low prices.

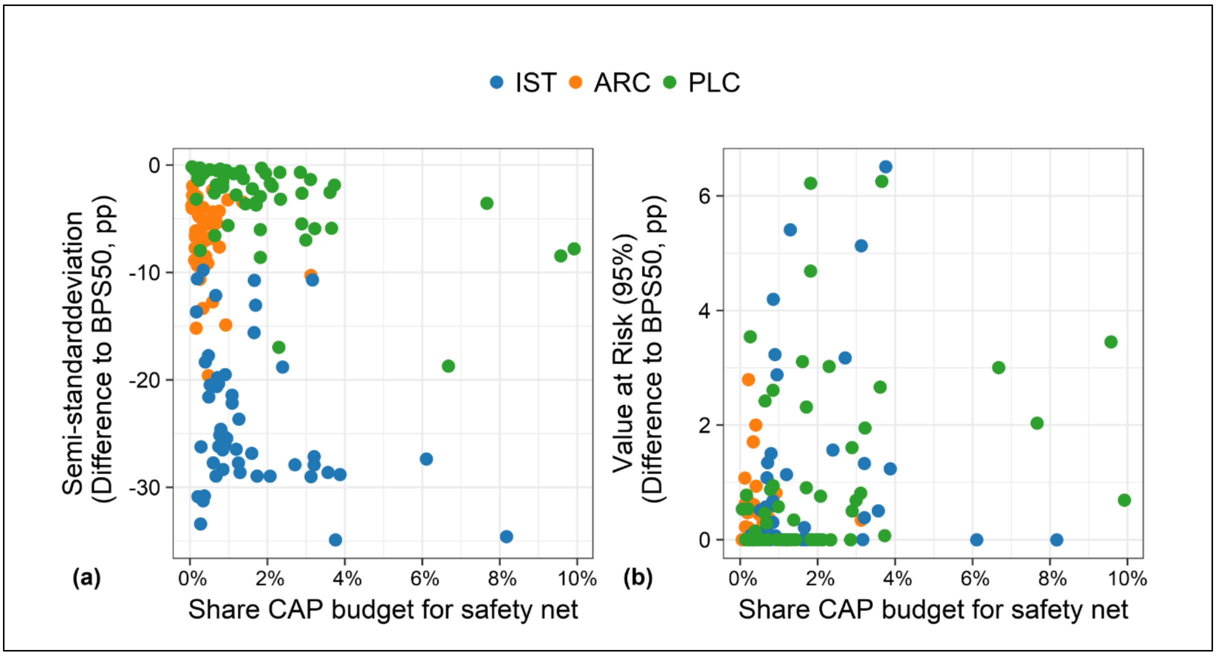
How effective these instruments are to protect from downside risks and how much they affect the EU CAP budget in the long-run or in the extreme case in the short-run clearly depends on their parameters (i.e., the mechanism used to determine the reference values and thresholds). This study applies policy parameters based on the 2014 US farm bill and the actual EU CAP.

For each of the three policy scenarios the model simulates the 51 yield shocks. The results are discussed in comparison to the changes in the baseline scenario that includes no safety net instruments.

Figure 4 and 5 present three measures to analyse the change of the downside risk and one for the average income. One point in the diagram equally represents all producers in all EU countries for each yield scenario. The X-axis depicts the budget used for the simulated safety net as share of total EU CAP budget, whereas the Y-axis shows the different measures. Total EU CAP budget correspond to the budget in the scenario BPS50 equal to 71% of the budget of the EU CAP including 100 % of the BPS.

Diagram (a) shows the semi-standard deviation. The difference of the negative income variation in the policy scenarios and the BPS50 scenario highlights that the extent to which IST reduces negative income variation at the same budget expenses compared to ARC and PLC is much higher. In most of the scenarios budget costs related to IST are lower than 4 % of the total EU CAP budget. However, the diagram also reveals that a relatively high budget reserve is required to account for the two extreme cases equal to 6 % and 8 %, respectively. ARC exhibits budget costs lower than 1 % and tends to reduce the variance less than IST but clearly more than PLC. The latter displays the lowest efficiency with regard to the reduction of the income variance and in addition potentially the highest budget costs equal up to 10 % of total EU CAP budget. Therefore, diagram (a) allows a clear ordering of the budget efficiency of the three safety net policies with regard to their reduction of income variance.

Figure 4: Budget efficiency I



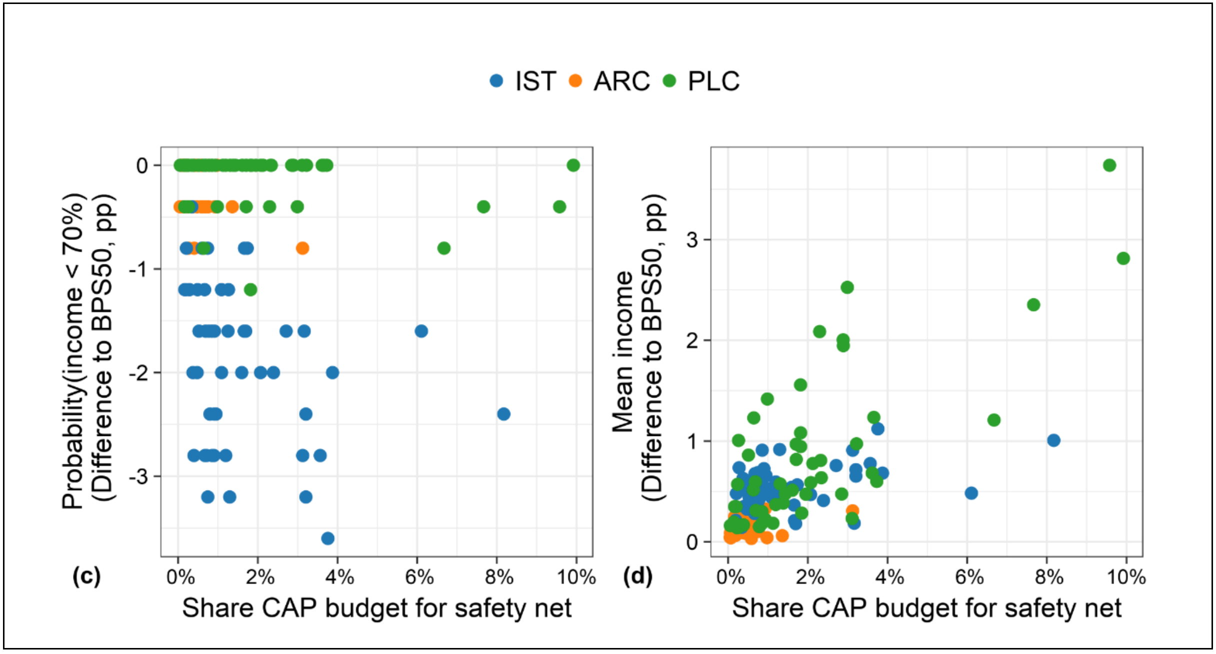
Source: Authors elaboration.

In addition, diagram (b) illustrates the efficiency of the three policy instruments using the value at risk (VaR) in comparison to the BPS50 scenario. This diagram emphasizes that no policy is able to effectively reduce the potential income loss that is exceeded with a probability of 5 %. Although PLC tends to have the highest effect on the VaR with an increase of 0.53 percentage points at the median (IST 0.13 and ARC 0.07), none of the three instruments shows a clear correlation between budget expenses and an improvement of the VaR.

Diagram (c) measures the change in the probability that the income decreases more than 30 % compared to the BPS50 scenario. From this graph it become obvious that IST leads by far to the greatest improvements at the same budget expenses compared to ARC and PLC, which are ineffective with regard to this measure.

By contrast, diagram (d) analyses the effect of the policy instruments on the general average income of the considered sectors compared to the BPS scenario. Here, PLC features a strong positive correlation between budget expenses and the change in average income, with a string effect. The corresponding effect is much less distinct for IST and particularly for ARC. This highlights the much stronger, and general income supporting effect of PLC and clearly points out the lacking target orientation with regard to the coverage of downside risks.

Figure 5: Budget efficiency II



Source: Authors elaboration.

5 Conclusion

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