Incentives for Climate Change Mitigation across the Agri-food Value Chain
Workshop 3 - Competitiveness[1]

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[1] Main authors: Julia Bognar & Krystyna Springer (Institute for European Environmental Policy). The purpose of this paper is to enrich workshop discussions and gather input from multiple perspectives to shape the exploratory study. The paper does not represent the views of the European Commission.

1: Introduction

The theme of this paper, and its corresponding technical workshop is "**competitiveness**." The aim is to present the previously explored market-based policy options and discuss their potential micro-economic and macro-economic impacts. At the workshop, participants will be encouraged to explore together solutions to minimise negative impacts and maximise positive ones.

Different design options will have implications for on-farm input and output prices, as well as costs associated with mitigation actions and transaction costs for on-farm actors participating in the policy options – in particular, there will be differences in costs for monitoring, reporting, and verification (MRV). Other actors along the value chain will also be impacted financially, which should be taken into consideration as well.

Each of the design options has implications for **net farm income**. Impacts on production costs and revenue can vary among farming types. Farmers may adopt cost-efficient actions or practices that could potentially increase their income in the long-term, though this may sometimes bring with **high upfront costs** for shifting to more climate-friendly practices due to required investments. In particular, small-scale farms may potentially lack the resources to be able to transition. There are also potential opportunities for farm income benefitting from **new business opportunities**. Depending on the design of the policy, farmers could benefit from additional sources of income – if they are non-obligated parties, they could gain additional income through the supply of CRCF units.

Costs will vary for different supply chain actors under each policy option, moreover these differences interact with the **market power distribution** in agri-food supply chains, which in turn shapes the distribution of costs and risks across the chain, due to differences in **bargaining power**. Currently, farmers receive the smallest share of added value in the agri-food supply chain. Furthermore, many small and medium-sized farms are facing thin profit margin and the risk of operating below their cost level when imbalances in agri-food value chains materialize. While the EU is addressing such imbalances through legislation on producer cooperation, contractualisation and unfair trading practices, there is a risk that market-based incentives further **undermine the position of the farmer** if the burden of extra costs is shifted from upstream or downstream intermediaries back onto the farm, at no or insufficient compensation. The proposed policy options may positively or negatively affect the **bargaining power** of different supply chain actors (particularly farmers), and the relationships between other actors in the supply chain. Stakeholders are asked to reflect on how the design of the options could affects the bargaining power of supply chain actors (particularly farmers) and the ability of actors to negotiate prices, with the aim to improve the competitiveness dynamics within the supply chain.

Administrative costs such as MRV (monitoring, reporting and verification), transaction and compliance costs should also be considered, especially for farmers that operate in the absence of a robust MRV, but are still required to monitor and report emissions. Transaction costs for each of the options could include information gathering, the trading and/or purchasing of carbon farming units (certified under the Carbon Removal and Carbon Farming (CRCF) Regulation), and the management of the procurement of carbon farming units. Potential costs associated with MRV could include cost associated with monitoring and reporting of emissions for relevant stakeholders, record keeping, and verification of emissions reported for the Commission. MRV costs will vary depending on the compliance entity. There are also costs to consider for administrative costs for implementing and operating abatement technologies, with costs arising from identifying techniques, staff training, additional communication, and maintenance requirements. Compliance costs associated with enforcement should also be considered, with particular attention to smaller farms.

Affordability of food should also be taken into consideration. Each of the policy options could **affect consumer food prices,** and purchases. The ability to sustain such effects may differ across income levels, socio-economic status and food consumption profiles. Stakeholders are asked to reflect on how the policy options may affect households across Member States.

The policy options could also impact agricultural costs of production, as well as **agricultural outputs** in terms of volume, with implications for Utilised Agricultural Area, as well as crop and livestock outputs.

Finally, much of the agri-food sector's dynamics are demand-driven. There are potential risks of **increasing imports from third countries** to compensate for higher costs of production and higher food prices in the EU, leading to carbon leakage, whereby emission reductions occurring from production changes in the EU result in increasing emissions outside the EU. If consumers do not change their dietary behaviour, there is a potential scenario in which consumers will instead consume more imported foods. Some of these imported foods may be more emission-intensive and cost less than EU-produced goods. There is also risk of **export substitution** – the EU remains the largest exporter of agri-food products globally; a decrease in the competitiveness of its exports may mean demand in international food markets could be met by cheaper agri-food goods in other regions. There are variabilities in GHG intensities by product and region: some imported products may result in net-GHG savings if a product has lower GHG emissions per unit compared to production in the EU, whilst over products may be associated with higher GHG intensities per unit. As a reminder to workshop participants, the policy options that will be assessed include:

1. Carbon Farming Procurement
2. Mandatory Climate Standard with a point of obligation for feed producers and/or food processors
3. Mandatory Climate Standard with a point of obligation for retailers
4. Agri-Food ETS with a point of obligation for feed producers and food processors
5. Agri-Food ETS with a point of obligation on-farm

2: Micro-economic impacts

2.1 Farm income and market power distribution

Background on farm income

Over time, European farm incomes have become increasingly vulnerable to global market fluctuations, with their share of value added becoming closely tied to shifts in global commodity prices (Swinnen et al., 2021). Reforms to the CAP in the 1990s altered subsidy mechanisms for agricultural producers, replacing commodity price controls and import tariffs with direct income support. As a result, farmers' incomes became more dependent on global market trends and fluctuations in global commodity prices for crops, such as wheat, corn and soy, which can be influenced by global demand, weather events, and geopolitical factors (ibid). These changes were followed by significant volatility in global agri-food markets after 2006, marked by sharp price spikes and declines, with commodity price fluctuations impacting farmers more intensely than those in the processing and retail sectors. Similarly, volatility in energy and input costs have also added to income volatility for farms. Fertiliser prices have been particularly unstable in recent years, partly due to supply chain disruptions and energy price increases. Other types of external shocks, such as climate change impacting yields and disrupted input supply chains due to geopolitical conflicts have also impacted farm income. Notably external shocks such as the COVID-19 pandemic and the War in Ukraine are affecting revenues for farms more severely than in the past.

Farm Net Value Added[2] (FNVA) is a measure used to assess the value generated by a farm operation after accounting for the costs of intermediate goods and services. FNVA reflects the farm's ability to add economic value through production. According to DG Agri (2023), as reported by the Farm Accountancy Data Network, the average FNVA per worker in the EU is approximately 28,800 EUR.[3] Trends in farm income indicate a continuous increase for the past ten years, with a slowdown in 2020 caused by the pandemic. Compared to 2013, EU farm income is 56% higher, outpacing inflation (9.4%). This trend is attributed to faster growth in the value of production compared to the growth of costs, leading to a higher total income. It can also be attributed to a decrease in the number of farm workers. While high income farms (above the 90th percentile) earn, on average, >60,000 EUR per worker, low-income farms (below the 10th percentile), face challenges in breaking even with an average income of < 800 EUR per worker.

Farm incomes are highly variable across Member States, types of farms, and size of farm. North-western Member States tend to have higher incomes, while Romania, Croatia, and Eastern Poland tend to have the lowest. However, income trends vary across Member States as well, with Bulgaria experiencing the most substantial increase in farm income (46%) while Cyprus experienced an overall decrease of 16%. Income from pig and poultry livestock farms are the highest (43 400 per worker) while income in the horticulture, field crops, wine and dairy sectors are also above the EU average. Regardless of the sector, farm size influences the income of a farm, with larger farms being more profitable due to higher levels of production.

Drivers of fluctuations in farm income

Farm income shows large fluctuations over time due to changes in yields, output prices, input prices and other on-farm costs (Vrolijk et al., 2010). The volatility of income in some sectors is larger than in others – for example, dairy farms tend to have more stable income compared to other types of livestock farms. Changes affect the farm income through the income margin. In general, **the income margin between returns and costs is quite small** for many farms but has variations between types of farms. Variations between farms can depend on the cost structures of

[2] FNVA is calculated by subtracting certain operating expenses, such as feed, seeds, fertilizers, and other farm inputs, from the gross output (total value of agricultural production)
[3] DG Agri (2023) notes that Eurostat data estimates a lower agricultural factor income per annual work unit (AWU) to be approximately 19 900 EUR in 2021. This is due to the fact that the coverage of FADN is different as only commercial farms above a certain income threshold are surveyed.

the farm, such as direct cost, overhead costs, etc., other types of revenues, and extra ordinary benefits or costs. Because margins are typically small, even small changes in prices can result in strong fluctuations in farm income.

The **economic size of a farm** is often the main driver of income differences between farms. Farms with a standard output of 250,000 EUR or more are responsible for approximately 56% of the EU's total agricultural output, while in contrast the smallest farms with a standard output below 2000 EUR accounted for approximately 1% of total agricultural output.[4] Thus, because they contribute to a smaller share to the overall agricultural output, small farms typically earn less income per farmer compared to larger farms. For many small farms, CAP subsidy payments are often effectively the family farm income (Matthews 2024). Each of the policy options will likely lead to uneven impacts between farms due to size differences, as they can lead to varying costs (Cooper et al 2013; González-Ramírez et al., 2012; Pérez Domínguez & Fellmann, 2015; Van Doorslaer et al., 2015; Grosjean et al 2016).

Agricultural terms of trade refer to the ratio between the prices that farmers receive for their agricultural products (output prices) and the prices they pay for inputs required to produce these products, such as seeds, fertilizers, fuel, and equipment. It is an indicator used to assess the economic conditions and purchasing power of farmers within the agricultural sector.[5] Changes in terms of trade directly affect farm incomes and profitability. For example, if input prices rise faster than output prices, farmers may struggle to maintain profitability, which can affect their livelihoods and financial sustainability. Favourable terms of trade allow farmers to reinvest in their operations, enabling improvements in productivity, technology, or expansion. Factors such as global commodity prices, input cost fluctuations, and trade policies all affect terms of trade.

Fluctuations in prices of inputs may result in larger changes in income on certain types of farms. Fertiliser prices have a particularly acute impact on the income of arable farms. External events can have not only strong direct impacts but also indirect impacts on farm income due to market reactions. Input prices experienced a steep rise over 2022 subsequent to the Russian invasion of Ukraine. The rise of input prices was notable for fertiliser prices, as sanctions and trade restrictions limited Russia's ability to export fertilisers, causing a supply shortage. Output prices for agricultural goods, which were already rising in response to the Covid pandemic, also experienced a steep rise over 2022 – the invasion had a particularly significant impact on wheat prices. Agricultural prices peaked by the end of 2023 but have slowly declined since. Input prices have fallen more steadily compared to output prices. According to the EU's "Short-Term Outlook for EU Agricultural Markets", affordability remains a concern for farmers, primarily due to declining arable crop prices: "(t)he evolution of the ratio between fertiliser and cereals prices (maize, wheat and barley) as a proxy for fertilisers affordability shows that while until June 2023 the ratio bottomed at 1.3, afterwards it fluctuated between 1.3 and 1.5, indicating fertilisers' low affordability for farmers this year."

Access to financing and changes in interest rates can also have impacts on the level of incomes on farms. Farms rely on bank loans, in part, due to high upfront costs for inputs, seasonal revenue cycles causing delayed income and cash flow management issues, investments in equipment and infrastructure to improve productivity, adoption of new technologies and practices, as well as adaptation to market volatilities. Financial institutions could play a substantive role in the transition towards on-farm climate-friendly practices. Increasingly financial institutions are placing a greater emphasis on investments in sustainability, particularly for those with ESG rules and objectives. Financing new business models based on CRCF credits could potentially be an attractive investment for financial institutions, leading to more favourable lending conditions for farmers. The same opportunity may exist for insurance, as more sustainable practices could decrease the risk of natural disturbances and other impacts from climate change, such as soil erosion.

However, some of the climate mitigation actions highlighted in the previous input paper will require large-scale investments, which may be more accessible to larger farms due to **economies of scale** (Grosjean et al 2016). As of 2022, nearly a quarter of agricultural firms relied on external bank financing (Fi-Compass report, 2023). The Fi-Compass report highlights substantial financial needs and high uncertainty in the agriculture and agri-food sectors, despite recent investment growth. Compliance with environmental and safety standards is a primary driver of agricultural investment, spurred by the need to address environmental impacts including greenhouse gas emissions, biodiversity loss, and air pollution. Financial institutions play a selective role in lending, focusing on borrowers who meet specific creditworthiness criteria, often favouring larger farms due to their commercial viability and collateral potential. Smaller farms face greater challenges accessing finance due to limited assets, lack of collateral, and often incomplete financial documentation. Key barriers for farmers include high-risk factors such as

[4] https://ec.europa.eu/eurostat/statistics-explained/SEPDF/cache/73319.pdf

[5] However, as Matthews (2024) points out, a deterioration in the terms of trade for agriculture does not necessarily reflect a deterioration in farm incomes – even if input prices increase, it is still possible for farm incomes to increase. Matthews (2024) recommends a calculation for "income-related terms of trade" which describes the percent change in income arising from the combined effect of output and input price changes, assuming constant volumes.

volatile weather, market crises, and animal diseases, as well as low profit margins and variable cash flow. Many EU farms rely on overdrafts during income fluctuations. DG Agri (2023) identifies a **financing gap**[6] of around €62 billion, with €19 billion needed specifically for green transition initiatives. Notably, 68% of this gap affects small and medium-sized farms, which dominate the EU's family farm model, limiting these farms' ability to invest in sustainable practices and technology for reducing greenhouse gas emissions.

Background on market power distribution

The potential impacts of the different policy options on farm income will depend on various interacting factors, including changes in outputs, the level of policy costs expected for farms, the financial costs associated with adopting on-farm mitigation actions, the potential impacts on input prices, and changes in prices for farm outputs based on changes in demand further downstream. For the costs associated with each of the policy options, the impacts on farms will be shaped by **cost pass-through**; this refers to the extent to which companies that incur costs from policies such as carbon pricing or mandatory standards can pass these costs on to their customers by raising the prices of goods and services. It is a mechanism by which businesses **transfer the financial burden** of these costs to the next stage in the supply chain or to the end consumer. Full pass-through occurs when the entirety of additional carbon costs is passed on to consumers, and partial pass-through occurs if obligated entities absorb a portion of the carbon costs themselves and only partially pass costs onto consumers. This may occur due to competitiveness pressures, regulatory constraints, or price elasticities. In some cases, obligated entities may absorb the entirety of costs (no-pass through) if they cannot increase prices due to market conditions.

In the case of the policy options under consideration, there will be variations in how costs may be passed through the value chain. While the expectation is that a proportion of the costs will be passed onto consumers, for options where the point of obligation is off-farm, there are risks of obligated parties passing on a substantial proportion of the costs onto farmers directly, as all of the policy options aim to incentivise the reduction of on-farm emissions. Thus, even when farms are the non-obligated entity, they will be faced by demands from downstream actors (processors or retailers). Such risks of **cost pass-through for farms are highly influenced by market power distribution in the supply chain**. Firms with significant market power are better able to pass through costs through the value chain. Higher market power shapes price (in)elasticity – with less competition, firms can set prices without concern for loss of market share, as consumers will have fewer alternatives, and thus demand remains constant. For firms in competitive markets, raising prices may lead to a loss of market share through product substitution or increasing imports, and thus there are pressures to keep prices low.

As farms produce often a limited number of products which are perishable, they are generally expected to have limited ability to pass through costs, especially in open economies in smaller Member States (Kerr & Sweet 2008). Particularly for small and medium-sized farms, farms are often operating in highly competitive markets with fluctuating profit margins. In addition, prices for many agricultural goods are determined on commodities exchanges setting benchmark prices based on global supply and demand. Agricultural prices are also influenced by future contracts and speculative trading, wherein buyers and sellers agree to prices in advance, which are often driven by expectations of future supply and demand, making it challenging for farmers to influence prices.

Measuring market power distribution

There are various means for measuring market power in the food supply chain, including turnover, concentration ratios, and the Herfindahl-Hirschman Index (HHI). Turnover is utilised as an indicator under the Unfair Trading Practices Directive; using a stepwise approach to the imbalance of power, a buyer is considered to have market power in relation to its suppliers if its turnover is considered to be larger than that of its suppliers according to pre-defined size classes (European Commission 2019). Company turnover is used as an indicator as it reflects a firm's ability to generate sales and capture market share. **High turnover implies high market share**, influence over pricing, economies of scale, consumer preferences and industry trends. Concentration ratios measure the degree of control that the largest firms hold within an industry, indicating how competitive or monopolistic a market is. A concentration ratio calculates the percentage of the market controlled by the largest companies (usually the top 4 or top 8); a high ratio indicates that a small number of firms dominate. The HHI provides a measure of market concentration by accounting for both the number and relative size of firms in an industry.[7] HHI values range from 0 to 10,000, with higher values indicating more concentration. A value > 2500 indicates a highly concentrated market (potential oligopoly or monopoly), while a value < 1500 indicates a competitive market.

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[6] A financing gap is defined in the report as the "unmet credit demand due to constrained or absent access to bank financial products." Unmet demand includes loans applied for but not obtained, financing refused by the potential borrower, or a loan not applied for due to fear of rejection.

[7] Unlike concentration ratios, which only consider the largest firms, the HHI squares each firm's market share and sums them, thus placing a greater weight on larger firms.

A JRC report (2021) provides an overview of various market power indicators within the food supply chain in selected[8] Member States. The report finds that large firms dominate the turnover in the manufacturing, wholesale, and retail sectors, with most transactions carried out by larger firms, with the retail sector particularly having turnover skewing towards larger firms, and the manufacturing sector having less prominent turnover distribution. In all of the Member States, the most concentrated sector is the retail sector: “between 30 % and 70 % of the total turnover in the retail sector is generated by the four largest firms, while in the wholesale and manufacturing sectors it varies between 10 % and 40%” (p.1). Nevertheless, the HHI values are below 1500 for the sector across all Member States, suggesting that markets are competitive.

However, when the sector is disaggregated into sub-sectors, the HHI indicators present a different picture. In the food manufacturing subsector, 35% of the sub-sector combinations are considered highly concentrated, 14% are moderately concentrated, and 51% are unconcentrated (p.15). The sugar, tobacco, beer, and malt sectors are highly concentrated, while animal feed, bakery, and fruit and vegetables are not considered concentrated in any of the Member States. Meat, fish, oils, dairy, grain and starch, spirits, wine, cider are only considered concentrated in some of the selected Member States. Finland, Sweden and Hungary demonstrated the greatest level of concentration in food manufacturing. Compared to manufacturing, the concentration in the wholesale markets across the subsectors and selected Member States appears to be less intense.

Asymmetrical price transmission is also utilised as an indicator of market power in supply chains where pricing behaviour across different levels can reveal insights about competitive dynamics. Price transmission assesses how price changes at one stage of the market are reflected at other stages, and whether these changes have asymmetric effects in that they are transmitted differently in their magnitude on the downstream levels. Asymmetry in price transmission occurs when prices are more likely to be transmitted in one direction upward or downward) than the other. **Asymmetrical price transmission can indicate that firms are manipulating price adjustments to sustain higher profits**, which is typically easier in markets with low competition. While farm prices demonstrate severe fluctuations for the past 15 years, over this same period, fluctuations in processor and consumer prices are much smoother, to the extent that farm prices, processor prices and consumer prices demonstrate diverging trends, indicating that price fluctuations are not transmitted in proportionally downstream (see Rezitis & Tsionas 2019; Swinnen et al., 2021; Swinnen et al., 2014). Food price pass-through varies largely depending on the product category, and also differs across countries (see Rezitis & Tsionas, 2019; Lukáš et al., 2014; EC 2009). Consumer prices for certain food products (e.g. wheat to bread and oils and fats food chains) tend to rise only slightly in response to raw material price increases (DG Agri 2017).

Asymmetric price transmission is partly due to the fact that raw materials reflect only a certain proportion of the cost of a final consumer good. However, when prices for raw materials fall, consumer prices tend to remain unaffected by this change (DG Agri 2017). Imperfect competition in the processing and retail sectors are often provided as the source of such asymmetric price transmission. However, there is evidence that asymmetry also occurs in competitive markets as well (Azzam 1999). Studies suggest that retailers enjoy a certain advantage over farmers because of an increase in the margins between consumer prices and farm prices (EC, 2009; Saitone and Sexton, 2012). Rezitis & Tsionis (2019) argue that while the market power of retailers may be widening the gap between retailer and the farm prices for a wide variety of food products, “additional factors might have contributed to the widening of gross margins, such as the increase of agricultural and food imports, which have benefited food retailers, and the higher productivity growth in the farm sector compared to that of the retail sector, among others” (p.224).

Evidence has demonstrated that while market power indicators show concentration increasing over time in the United States (Traina, 2018; De Loecker et al., 2020), the evidence for Europe is less conclusive, with concentration indicators showing few changes over the past few decades (Cavalleri et al., 2019). According to the HHI indicator, concentration in the wholesale and retail sectors has remained constant for most Member States, although with some variation across the years (JRC 2017). Two exceptions to this are Czechia and Spain, where a significant increase in retail concentration can be observed more recently (ibid).

In a review of competition issues in agri-food value chains, Swinnen (2020) notes that there is “mixed” evidence of a systematic problem of buyer power at the expense of farmers. Several theoretical and empirical studies indicate that when factor markets are imperfect or search costs are high, farmers may benefit from dealing with concentrated downstream agents. Sexton et al. (2016) highlight that under these conditions, key features of modern agricultural markets include vertical coordination, contract production, and strong ties between farmers and downstream firms (Adjemian, Saitone, & Sexton, 2016; Crespi, Saitone & Sexton, 2012; Mérel & Sexton,

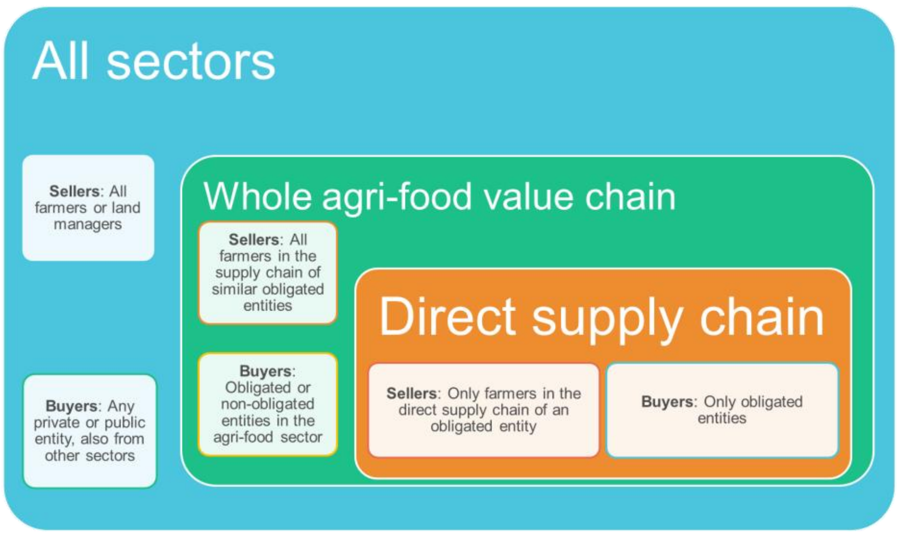
[8] Bulgaria, Czechia, Spain, Finland, France, Hungary, Italy, Portugal, Romania, Sweden

2017; Sexton, 2013). Such structures reduce the incentive for downstream companies to exploit market power at the expense of their suppliers (Swinnen, 2020).

Design Choices for the Policy Options Relevant to Farm Income and Market Power

Each of the policy options entail design choices which will have implications for farm income and market power distribution. Particularly for the policy options where the point of obligation is off-farm (MCS – Processors; MCS Retailers, ETS – Processors), there are design choices for how a compliance market for CRCF units could potentially work if the obligated parties are downstream parties, but for downstream policy options, the reduction of Scope 3 emissions is reliant on the voluntary participation of farms. For the on-farm ETS option, the reduction of emissions could potentially also rely on the voluntary participation of non-obligated farms. The intention of the policy options is to develop a market in which farmers can gain income that is separate from the production of agricultural goods – thus participation is contingent on the creation of a liquid CRCF market providing farmers with the ability to earn additional profits. Furthermore, the obligated parties should have access to a high number of suppliers and a well-functioning market for the buying and selling of CRCF units. To prevent food processors from leveraging their market power within the product market, it will be crucial to ensure robust demand from public procurement.

Figure 1: Design choices for the selling and buying of CRCF units for the policy options



Thus, potential impacts on market power warrants consideration of design choices on the buying and selling of CRCF units in such a market. As figure 1 illustrates, the buying and selling of CRCF units can happen at different scales. In the narrowest option ("Direct-supply chain" design), the trade of CRCF units for compliance purposes could only happen between farmers and obligated entities who are in direct contact in their supply chain, and they could only sell CRCF units related to the reduction of emissions in the scope of the policy (e.g. reduction of livestock or fertiliser emissions). One could also consider a broader market where all farmers in the supply chain of similar obligated entities could sell units to any company in the agri-food sector, so that obligated and non-obligated agri-food companies would be in competition for the procuring of CRCF units ("Whole agri-food chain" design). Finally, the CRCF market could be even further expanded to allow for all farmers or land managers (including farmers that reduce other types of emissions, by rewetting peatland, improving soil management…) to sell CRCF units that can be used to comply with the policy to any private or public entity, so that obligated entities would compete with companies from other sectors for the procuring of CRCF units ("All sectors" design). Beyond the illustrative examples in Figure 1, there could also be mixtures of these design choices; for instance, farmers in the direct supply chain of obligated entities could sell CRCF units only to other obligated downstream actors, but not necessarily those in their direct supply chain; the purchasing of units could be limited to a company's own supply chain, but allow for the purchasing of units outside of their supply chain if obligated entities are short of CRCF units. Choices about who can sell or buy units that can be used for compliance could provide flexibility and liquidity to the obligated entities (processors and retailers).

In addition to the design considerations for the buying and selling of CRCF units, **there needs to be consideration for how trading will occur between non-obligated farmers and obligated entities**. For trading between farmers and downstream actors, contracts for food production prices could also include agreements on carbon delivery; alternatively, there could be separate contracts, one for food production and the other for carbon delivery.

Another option for all obligated entities is, similar to the procurement option, the purchasing of CRCF units from a centralised pool, at the national or EU level. Under this option, Member States or the EU would create a pool of CRCF units through public procurement mechanisms as described under the first option (e.g. reverse auction, feed-in-tariffs) and companies buy units from the pool instead of directly from farmers. Units in the pool could correspond to emission reductions covered by the scope of the policy or include also other types of emission reductions (e.g. from peatland restoration) or carbon removals.

Figure 2: Design choices for trading of CRCF units for the policy options

We highly encourage stakeholders to consider both the risks and opportunities associated with the different design choices for the buying, selling and trading of CRCF units in a market-based compliance policy.

Enhancing farm income and market bargaining power

Farm income

With the costs associated with mitigation being spread across the value chain, each of the policy options poses varying potential impacts on farm income. The on-farm ETS option will place any resulting costs of compliance on obligated farms, thus potentially decreasing farm income for obligated parties, either through costs associated with the purchasing of allowances in the trading system, or from costs associated with the adoption of climate-friendly mitigation actions to reduce emissions. The mandatory nature of the ETS options and the Mandatory Climate Standard options mean that costs will be placed on the agri-food value chain in order to meet obligated emission reductions under either policy type. Previous studies modelling for Emissions Trading (Isemeyer et al 2021; Stepanyan et al 2023; Perez Dominguez et al 2012) and Emission Standards (Perez Dominguez et al 2012) have observed varying impacts on income in both positive and negative ways. Carbon pricing, emissions trading, and standards could potentially lead to reductions in production and thus leading to income losses; but, at the same time, increases in income per production unit (or per ha of UAA) could occur due to increasing prices, although this will also be dependent on potential changes in imports. Impacts on farm income will differ across farm types, and regions, and are dependent on the emissions scope of the policy option, with some farms experiencing income losses and others benefitting from income gains.

For the policy options for which farms are the non-obligated entities, the impacts on farm income will vary from the on-farm ETS, due to the voluntary nature of participation in the CRCF market. Initial costs of on-farm mitigation under these options will be borne by farms. However, **farms will be motivated to adopt mitigation options as long as they have sufficient access to finance, and the price of CRCF units is higher than the costs incurred for adopting mitigation actions**. Eventually the **costs of adoption will be incurred by purchasers of these units**. Market-based instruments can also lead to potential savings in the long-term as efficiency and technological improvements could potentially reduce on-farm costs for farmers. However, such savings will require long-term investments, wherein a farmer may be required to take on additional costs before the cost-saving impacts come to fruition.

However, to ensure that the impacts on farm income are net positive, **the CRCF market must be sufficiently competitive.** Therefore, stakeholders should consider which of the design choices outlined in figures 1 and 2 will facilitate net positive impacts. **A broader market for units will likely increase demand and the level of compensation** received for CRCF units – allowing for the sale of CRCF units outside of a farmer's direct supply chain, to both obligated and non-obligated entities, could raise the level of compensation due to higher demand for units as well as facilitate cost-efficient mitigation. However, such policy design choices could also increase the administrative complexity for farmers due to participation in separate markets, especially if they have separate contracts for food production and carbon delivery within their own supply chain. Small and medium farmers would also be at a disadvantage in their ability to navigate such complexities, as they will inevitably involve upfront administrative costs. A possible mitigation measure could involve allowing for farm operators to sell units as groups, to allow for easier access to the CRCF market. Therefore, **we highly encourage stakeholders to**

consider the potential opportunities and risks to farm income of the different design considerations for the policy options as well as potential means of mitigating such risks.

If CRCF units are traded from a centralised pool rather than through contracts covering carbon delivery, impacts on farm income are more likely to be positive. Procurement either by the Commission or Member States would likely entail the purchase of CRCF units at a price which would cover the costs of on-farm mitigation. The price of CRCF units which are procured could factor in both direct and indirect costs associated with on-farm climate mitigation, thus limiting the impacts associated with the costs of adopting climate-friendly practices which could potentially impact farm income in the medium term. Thus, farms with the capital or access to financing have the advantage of recouping the costs associated with adopting on-farm mitigation actions, as well as gain additional income in the sale of CRCF units. However, this would put farms (particularly small and medium farms) without the ability to access financing at a disadvantage for being able to participate in such an option and increase their income. Discussions in previous workshops included the **possibility of using public funds to purchase CRCF 'futures' (units to be delivered in several years' time) as a way of supporting small and medium-sized farms with start-up costs**.

Market bargaining power

For the sectors under the ETS1, evidence suggests that in most cases, costs from standards and carbon pricing policies are usually passed downstream towards consumers in the supply chain. De Bruyn et al. (2015) find that for most EU ETS sectors, significant pass-through carbon costs in a downstream direction are observed for a number of products, in particular for cement, iron & steel, and refineries, although the rates of pass-through vary between products. For several industries, approximately 70% of energy-driven changes in input prices from carbon prices are passed through to consumers in the short- to medium-term (Ganapati et al 2020). For some products, such as gasoline subject to carbon taxes, 100% of costs are passed through to consumers (Erutku 2019). The level of pass-through of carbon costs for these products is related to elasticity of demand – for goods that are relatively inelastic in demand, consumers are found to bear most of the costs. However, whether such evidence is applicable to the agri-food sector and the differing balance of market power compared to, for example, the energy sector, remains to be seen. Particularly for the on-farm ETS, the ability of farms to pass through such costs through the supply chain is shaped by a number of factors, including competition type, shape and elasticity of the demand curve for different goods, international opening of the market, and substitutability between domestic and foreign goods (Quiron 2009; Grosjean 2018; de Bruyn et al 2015).

Indeed, **the mechanisms for purchasing CRCF units have large implications for the bargaining power of farms** under the policy options. Theoretically, the trading of CRCF units could increase the bargaining power of farms. However, the selling of CRCF units in a farm's direct supply chain of buyers would be very limited, so demand would not be as high, potentially limiting the market bargaining power of farms. Thus, if CRCF units are directly purchased by downstream actors from farms in their direct supply chain, means of limiting the impacts of pass-through costs towards farms should be considered. One potential design approach is the possibility of **tripartite contracts being a required component** for the purchasing of CRCF units by downstream actors. Tripartite contracts are agreements typically including farmers (or groups of farmers, such as cooperatives or producer organisations), processors, and a third party (often a retailer or intermediary). Such contracts aim to establish reliable, long-term supply relationships and secure benefits for each party, specifying supply quantities and quality standards, along with pricing structures. Some tripartite contracts include minimum price guarantees and provisions for risk-sharing. Many tripartite contracts are now including sustainability standards and certifications. Rules for the purchasing of CRCF units for the purposes of meeting obligated reductions under the MCS could mandate that tripartite contracts must include fair pricing mechanisms that reflect the true production costs for farmers. Indeed, some EU Member State governments already mandate that tripartite contracts in food supply chains include provisions for fair pricing; under France's Egalim Law, supply contracts must include fair pricing mechanisms to reflect the true costs of production, which are adjusted for fluctuations in raw material and energy prices and that such costs must form the basis for negotiations with processors and retailers.

Allowing for **trading beyond the farm's supply chain may allow farmers to seek the highest price for certified units and therefore allow for them to maximise their bargaining position** within their supply chain if they are allowed to sell to entities both within and outside their system. However, 'between-system' trading could have trade-offs between climate objectives and income generation for farmers – allowing for obligated parties to purchase units outside their own supply chain may disincentivise needed actions within a particular supply chain. Another risk of allowing for the purchasing of units outside a direct supply chain, is that Scope 3 emissions which are more expensive to mitigate may not be reduced if obligated entities are allowed to purchase units from outside their supply chain. One consideration could be separate purchasing programmes for downstream actors, wherein a certain percentage of units must be purchased within the supply system, but a limited number of different types of CRCF units could be available for purchase from a centralised pool that is a 'balanced' bundle of different types of units.

Another means of mitigating pass-through costs in an ETS could be **linking the price for allowances to a prevailing premium price** to ensure that farmers benefit financially from reducing the GHG intensity of their agricultural products. In their recent report which provides an in-depth analysis of the potential design features of a downstream ETS, Concito (2024) recommend the establishment of rules for a potential price premium for downstream actors that is linked to the prevailing allowance price. This potential price premium could be set at a rate relative to the allowance price which leaves both a strong incentive for farmers to mitigate, but also to processors to utilize on-farm mitigation. Further the price premium could be linked to the allowance price by automatically adjusting it as the allowance price fluctuates. It is likely that processors will establish positive incentives towards their farmers for delivering mitigation activities, due to the positive outcome for the processors themselves. However, tying rewards to the allowance price as a regulatory measure can address farmers' concerns of downstream processors abusing their stronger position in their value chain through the ETS with regulatory measures. On the other hand, processors could reduce the base price for non-mitigated foods to adjust for new costs through the price premiums and regulation of reward schemes could distort the market and its ability to operate efficiently given new circumstances.

For the ETS options, in particular the on-farm option, the issue of pass through is also closely related to the level of free allocation of allowances. In the ETS for energy and industry, firms that pay for allowances via auction will pass this cost through to consumers. Firms that receive free allowances (i.e. in the existing ETS this includes industrial sectors at risk of carbon leakage) might still be able the maintain higher prices if market power allows. Since the allowance is a financial asset that could otherwise be sold (e.g. to aviation or the power sector), the difference between free allocation and surrendered allowances represents a potential mitigation incentive and profit opportunity for farmers.

The ability to sell surplus free allowances could therefore act as incentive for to reduce emissions, helping to scale up mitigation measures and reduce their cost. However, the free allocation would have to be calculated carefully (and dynamically) to avoid becoming a subsidy for standard production practices. Furthermore, "flanking measures" would probably be required to ensure that farmers take up this financial opportunity. Empirical evidence from the ETS for energy and industry suggests that firms that receive free allowances are less likely to engage in mitigation action than those who required to pay for their emissions, even though the incentives are theoretically identical.

In an upstream or downstream ETS, the other obligated entities (e.g. food processors, retailers) would determine the extent of cost pass through to consumers. The ability of farmers to profit from mitigation would depend on largely on relative market power.

Discussion Questions

- What are the potential advantages and disadvantages of the different design choices for the design of a market-based policy (e.g. choices on who can sell/buy CRCF units for compliance, and how these units are traded)? How can risks be mitigated?
- What are the impacts of these design choices on farm incomes and on the bargaining power of farms?

2.2: Administrative Impacts

Costs associated with MRV

A key component of the administrative costs of a policy targeting agricultural emissions will be the costs associated with monitoring, reporting, record-keeping, and verification, both by public authorities and the obligated entities. Under all policy options, the provision of CRCF units will be governed by the rules set forth in the CRCF regulation, as well as the approaches outlined in the relevant delegated acts. This will imply some **MRV costs due to the high level of accuracy required for certification**; however, farmers may also receive support to help offset these costs through other policy interventions, for instance public policies to provide "MRV as a public service" or tailored advisory services. **We encourage stakeholders to consider how public policies could reduce MRV costs linked to the generation of CRCF units.**

An important design choice in this context is the level of MRV required for the emissions of farmers that do *not* engage in climate mitigation activities. Under the procurement option, clearly, these farmers would not have to incur any MRV cost. Under the on-farm ETS, on the other extreme, all obligated farmers would have to incur MRV costs, whether they decide to take action to decrease their emissions or just to continue their business as usual and buy allowances to cover their emissions; however, in an on-farm ETS, the number of obligated farmers can be kept low by focusing only on the largest farmers, therefore the majority of farmers would not incur any MRV cost. In the other options, where a downstream actor is made responsible for its scope-3 emissions, two approaches can be envisaged:

1. The downstream company computes its total emissions and shows emission reductions based on the monitoring of the emissions of *all* its suppliers;
2. The downstream company computes its total emissions based on default emission factors, and shows emission reductions by purchasing CRCF units.

Under the first approach, the company has more information to design its mitigation strategy, but the administrative costs would be quite high as a significant number of farmers (including small and medium-sized farmers) would have to perform on-farm climate assessment. Such an MRV system could potentially be overseen by the downstream company, constituting an additional cost[9]. If this is combined with the market design called "Direct supply chain" in figures 1 and 2 above, whereby the provision of food and of CRCF units are combined in the same contractual arrangement, the company may have incentives to comply with the policy by changing the sourcing of its food ingredients, i.e. it may decide to change suppliers and buy food from farmers with lower emissions per unit of output. This would also have impacts for the bargaining power of farmers who have already adopted practices that are good for the climate, as it would increase demand for the food that they produce.

Under the second approach, the advantage is that MRV costs would be drastically reduced, as MRV would only be needed for farmers that voluntarily generate CRCF units, while for all other farmers there would be no additional administrative burden. This setting is more apt to be combined with the market designs called "Whole agri-food value chain" or "All sectors" in figures 1 and 2 above, whereby there is a separation between the provision of food and the provision of CRCF units. A company would then choose its food suppliers based on market considerations not linked to their climate performance, compute its total scope 3 emissions based on default factors, and then decide whether to buy CRCF units from its own suppliers, from farmers in the supply chain of other obligated entities, or even from any land manager (e.g. through a pool).

We highly encourage stakeholders to consider design choices related to MRV and potential cost savings.

For downstream actors subject to mandatory standards and emissions trading system requirements, **the administrative impact on businesses will vary significantly based on the type and size of the obligated entities, as well as the design of the MRV approach**. **Existing requirements under the CSRD and CSDDD will influence the degree of additional burden.** The extent to which the MRV approach builds on existing reporting practices will determine the magnitude of additional administrative costs.

The Commission will also incur costs related to record-keeping and verifying the reports submitted by the obligated entities. Although these efforts will have been initiated under the CSRD and CSDDD, more detailed and frequent verification may be necessary to ensure the credibility of the policy.

Overall, the stringency and alignment of the MRV system with the CRCF and CSRD will be a critical factor in determining the MRV costs for both the Commission and industry actors.

Transaction costs

The primary advantage and objective of the carbon farming procurement option is that it reduces transaction costs for farmers compared to participation in the Voluntary Carbon Market. By setting minimal prices through centrally determined reverse auctions and providing clear requirements, transaction costs related to participating in the sale or trade of carbon credits are reduced, particularly in terms of information gathering. However, other transaction costs will persist, such as those associated with submitting bids in reverse auctions.

The public buyer responsible for organizing the procurement of carbon credits will bear some of the associated costs, including the expenses of running the auctions. This may be mitigated by utilizing infrastructure developed under the CRCF, which is intended to ensure the integrity of the certification process. The public buyer must also ensure that the policy does not distort carbon prices, by monitoring market trends, and the costs of adopting mitigation practices to guarantee that public funds are used appropriately. This includes setting minimum prices and determining the volume of finance.

While for most of the policy options, farms can voluntarily participate in the generation of CRCF units, there are transaction costs related to market entry for the selling of units, as well as operational changes related to modifying their processes or systems to meet requirements for certification under the CRCF. Moreover, the annual processes

[9] Such a system could be similar to existing examples such as Arla's Sustainability Incentive Model.

of purchasing and surrendering allowances, as well as managing allowance banking and trading, will require obligated entities to allocate additional resources. In addition, as indicated above, if requirements for tripartite agreements are included in the policy options, such agreements could increase administrative costs and complexity for farmers. Particularly for small and medium sized farms, such upfront transaction costs may be a barrier to participation in a CRCF market. Farms within **cooperatives** could potentially save on such transaction costs, which could assist farmers in navigating the market. However, horizontal coordination is heterogeneous across the EU, with such organisational types being more common in some Member States compared to others. **We highly encourage stakeholders to consider potential enabling structures which could alleviate transaction costs for small and medium-sized farms**.

Mandatory climate standards require that obligated actors engage in emission reductions in their supply chain and **acquire the necessary information to demonstrate compliance on an annual basis**. This approach necessitates the collection of information and thus **raises operational costs**. This challenge will be even more pronounced within an agri-food ETS, especially given the current lack of similar systems for agri-food actors and the significant learning curve involved.

For public authorities, the transaction costs associated with an ETS will involve the development of appropriate infrastructure to facilitate the auctioning, trading, and surrendering of permits. Insights can be drawn from existing mechanisms under the EU ETS, and the Commission may leverage the CRCF Registry, which could be expanded to cover functions currently recorded in the European Union Transaction Log. Other transaction costs might include price management, similar to the Market Stability Reserve.

The potential establishment of a European Carbon Central Bank to support any of the three options would likely incur substantial setup and operating costs, particularly due to the lack of precedent for such an institution. However, the CRCF registry could serve as a significant foundational element for the infrastructure supporting the bank's activities.

Compliance costs

Compliance costs refer to all costs that an operator incurs order to comply with the policy and that the public authority incurs to ensure compliance. These costs are particularly pertinent in the context of mandatory standards and emissions trading systems, where both private actors and public entities face distinct burdens. **For farmers and other downstream actors, compliance costs are likely to be associated with the identification of relevant mitigation strategies.** These costs can include the identification of appropriate abatement techniques, training staff to implement them effectively, and additional communication efforts, all of which may require adjustments to existing business structures. These changes may involve reorganization or investment in new technologies, processes, and expertise. Similar to MRV costs, farmers will need increased advisory services to support them in the navigation of both identifying abatement technologies and coordinating their maintenance.

For public authorities, the compliance costs primarily relate to policy enforcement. For the mandatory standards, this can build on processes established to manage penalties under the corporate sustainability directives. Alignment at the EU and national levels will also be required, with potential costs for the EU Commission to communicate with Member State authorities.

Overall, the costs that regulated entities will have to bear to meet their obligations will also significantly depend on the approaches to public support for on-farm mitigation that may emerge in the intervening period, such as financing on-farm MRV, participation in certification schemes, or significant financial support for enhanced, targeted knowledge and advisory services. For public authorities, the number of obligated entities will be a key factor influencing costs.

Discussion Questions

- What is your preferred approach in relation to MRV requirements for scope-3 emissions (all farmers in the supply chain vs those who generate CRCF units)?
- What kinds of actions will impact administrative costs, including transaction costs, MRV costs, and compliance costs? Which actions will be a one-off cost, and which will be recurring?
- Who will be affected by transaction, MRV, and compliance costs?
- What kinds of solutions could bring down administrative costs? What are potential enabling conditions to reduce costs?
- To what extent can we rely on existing systems between farms and downstream actors?

2.3: Consumer prices and household incomes

Recent trends in food prices

Starting in 2022, food prices rose sharply, with the monthly rate of food inflation reaching its peak in March 2023 at 19.19%. Since April of 2023, the rate of inflation for food has been decreasing. Driving such increases have been a combination of energy cost increases, drought and animal disease outbreaks, but mainly due to the Russian invasion of Ukraine at the beginning of 2022 (Matthews 2023). Global prices for various commodities increased in response to the war, with oils and fats and butter, and bread increasing particularly faster; eggs, fresh milk, and sugar also rose more quickly than overall food price inflation (ibid). Prices of meat and vegetables rose, but no more so than general food price increases, while fruit moderated the overall increase (ibid). Previous to the war, food supply chain interruptions caused by the Covid-19 pandemic had been driving higher consumer food prices as well. However, this impact largely reversed as supply chains were able to adapt to pandemic impacts. While much of these consumer price increases have been attributed to the impacts of exogenous events, claims of price increase profiteering leading to inflation have also been investigated as a causal factor, with retailers and packaged food companies being accused of abnormal markups (see Matthews, 2023; Acre et al., 2023; Donovan, 2023, Allianz Research, 2023).

The war in Ukraine and the resulting price hikes following the COVID-19 crisis, have led to shifts in consumer behaviour. Many consumers began preparing more meals at home, there was a rise in online purchases of food and ready-to-eat meals, and people increasingly engaged in cooking and dining with their families. Additionally, some consumers showed a greater mindfulness in their food choices (Grunert et al., 2021). According to Grunert et al (2023), different strategies were adopted by consumers in reaction to the price increases: they buy less, opt for a cheaper brand, shop in a different store, or stop buying certain food products. According to the authors, almost 4 in 10 consumers (36.8%) indicate that they are purchasing less red meat, while a third are buying less fish (33.4%) and poultry (32.5%). Additionally, some consumers have completely stopped buying specific items; for instance, 9.8% have ceased purchasing alcoholic beverages, and 12.4% have stopped buying convenience foods. Regarding cereals and dairy products, about a third of participants (35.2% and 33.3%, respectively) reported switching to more affordable brands.

Food prices and low-income households in the EU

Rising food prices affect all households, but the **impact of inflation affects lower-income households to a greater degree**, as a larger proportion of their monthly income is spent on food costs. For such households already managing tight food budgets and have limited options to trade down, food insecurity has worsened. Recent high inflation levels are impacting low-income and high-income households in two primary ways: through their effective inflation rates, which vary based on spending habits, and their capacity to mitigate rising living costs using savings or borrowing. According to the ECB (2022), the difference in effective inflation rates between the lowest and highest income quintiles—based on household consumption data—is the largest it has been since 2006, and this gap is being mainly driven by energy and food prices. High income households are able to buffer such increases in food prices through product substitution with cheaper versions of the same product, whilst low-income households are already buying such cheaper alternatives, and are therefore less able to limit the impacts of inflation through substitution. **Low-income households are also less able to buffer sharp price increases** through savings, as they have the lowest median value of liquid financial assets.

In 16 out of 24 EU countries, at least 10% experience financial constraints to eating healthily - especially in Eastern and Southern European countries, particularly in Bulgaria, Romania and Greece, a large share of the (sub)urban population lacks sufficient income to access a healthy diet in accordance with national dietary guidelines (Penne & Goedeme 2021). According to EU SILC data on food-related deprivation items, in 2023, 9.5% were unable to afford a meal with meat, chicken, fish (or vegetarian equivalent) every second day, which is a 1.2% increase compared with 2022. For those at risk of poverty, the share of those unable to afford a meal with meat was 22.3% in 2023, indicating a 2.6% increase compared with 2022. The highest share of people at risk of poverty unable to afford a proper meal was recorded in in Slovakia (45.7%), followed by Hungary (44.9%) and Bulgaria (40.2%). Conversely, the lowest share was recorded in Ireland (4.2%), followed by Cyprus (5.0%) and Portugal (5.9%).

Using microdata from the most recent wave of the EU Household Budget Survey (EU-HBS) conducted in 2015, the JRC (see Menyhert, 2022) analyses consumer spending across various product categories (such as food, energy, industrial goods, and services) within the EU, and finds that **recent consumer price inflation has disproportionately affected households in poorer EU Member States and households with below-median income**. The report reveals that below-median incomes may allocate up to twice the proportion of their total budget to food and energy compared to higher-income segments of the European population. Specifically, the combined share of spending on food and energy ranges from 23% to 66% across different EU countries and can vary by as much as 20 percentage points between income quintiles within those countries. Between August 2021 and August

2022, rising living costs are estimated to have increased material social deprivation (MSD) by about 2% in the EU and up to 6% in certain Member States. The effects on absolute poverty are even greater, rising by 4.4% across the EU and as much as 19% in specific countries.

Potential impacts on consumer budgets

As discussed in the original exploratory study (Trinomics, 2023), **distributional impacts on household incomes are dependent on price elasticities**. While traditionally economists have considered the demand for basic food products to be relatively inelastic, with price fluctuations having relatively little impact on consumer demand, more recent research indicates that demand elasticities are highly variable across different food products. A more recent meta-analysis of food demand elasticities from over 400 studies conducted by Bouyssou et al. (2024), finds that beef elasticities are larger than elasticities for other types of meat, indicating the status of beef as a more luxurious product, while white meat and eggs are relatively less elastic, and staple products such as grains and flours are inelastic. Empirical evidence also demonstrates the impacts of rising prices and consumer behaviour for some types of food products: According to the Defra Family Food Survey in the UK, a 26% decrease in consumption over the past 10 years has been partly attributed to rising costs of beef and pork, with consumers shifting from red meat to white meat consumption (see Stewart et al., 2021). While the highest 10% of earners are eating 10% less meat a week compared to 10 years ago, the lowest 10% earners are eating 19% less. This dietary shift is partly attributed to increasing prices (Vonderschmidt et al., 2024): roasted chicken prices fell from 304 pence kg^{-1} in 2008 to 278 pence kg^{-1} in 2018, whereas over the same period, beef mince prices rose from 595 pence kg^{-1} in 2008 to 671 pence kg^{-1} in 2018 (Office for National Statistics, 2024). Poultry prices decreased due to advancements in production efficiencies, with shortened production cycles allowing for the scaling up of operations.

The original exploratory study examined previous research on potential impacts of emissions trading on consumer budgets and welfare (see Trinomics, 2023). A moderate burden of price increases from an ETS is expected to be passed on to consumers, although prices will vary across goods, with minimal impacts expected for vegetables and cereals. eggs, poultry and pork, and butter and beef expected to rise more significantly (see Perez-Dominguez et al., 2016). A price of emissions between 56-140 EUR per toCO2e is expected to lead to food price increases between 4.5-11.2% (see Cavaillet 2019), with a welfare loss of 0.7% of total household expenditure with a price of 50 EUR/tCO2e (Garcia Muros et al., 2016). However, impacts on consumer budgets are markedly lower if only livestock products are subject to pricing, with a 1.59-3.98% increase in food prices (Cavaillet 2019). However, it should be noted that such impacts do not take into consideration the allocation of free allowances in an ETS.

Means of mitigating potential impacts on low-income household incomes

There are design aspects of an ETS related to revenue generation that could have implications for impacts on the food budgets of low-income households. Under an ETS policy, there is the option to **recycle revenues** from generation of revenue from the selling of allowances in auctioning towards various negative impacts, such as consumer prices. For instance, the EU Social Climate Fund is designed to support vulnerable households and micro-enterprises to adapt to rising costs from the extension of the ETS. Thus, revenues generated from an agri-food ETS can be utilized towards many different objectives; they can be primarily reinvested into farms, particularly small and medium-sized farms, to further uptake climate-friendly actions, but they could also be used to help vulnerable households face possible price increases. Another design aspect of an ETS which could potentially alleviate distributional impacts on consumers is the **free allocation of allowances**, as this can be targeted to specific agri-food sub-sectors to limit impacts on consumers, particularly for goods and services with inelastic demand or essential consumption. However, the amount of free allocation for such purposes needs to be considered. For example, under the recently adopted Danish livestock tax a 60% tax deduction is being applied to mitigate financial impacts. In addition, which sub-sectors would be targeted for such free allocation also needs to be considered, especially for those more vulnerable to potential carbon leakage effects. It is important to note that while free allowances allow a direct targeting of obligated entities (e.g. farms in an on-farm ETS), it means that less revenues are at disposal for other types of redistribution. If the aim is to support farmers, free allowances could save administrative efforts and costs while achieving the same effect as ex-post redistribution of revenues.

From the literature review conducted for the original exploratory study, there was a general consensus that negative distributional impacts on consumer budgets can be alleviated through a combination of carbon pricing with **subsidies or exemptions for fruits and vegetables** (see Nnoaham et al., 2009; Damon et al., 2014; Cleghorn et al., 2022). Cavaillet (2019) models a revenue-neutral carbon tax scenario, where tax revenue is used to subsidize two plant protein-rich food groups, namely "fresh fruits and vegetables" and "starchy foods," resulting in no net impact on consumer budgets. This suggests that directing ETS revenues to promote consumption of lower-carbon products could help minimize negative effects on consumer budgets. Klenert et al. (2023) find that uncompensated taxation on meat products is slightly regressive, although the impacts on social inequality are mild. Furthermore, the impacts on social inequality can be reversed through revenue recycling via **uniform lump**

sum transfers to low-income households. Contrary to Cavaillet (2019), Klenert et al. (2023) find that the use of revenues towards reducing the costs of vegetable-based products only partially offsets regressive impacts, and therefore a combination of subsidisation and some form of social transfers will be needed.

In the case of a mandatory climate standard, revenue streams only go from companies to farmers (either directly or through a pool). As food companies have to pay only for the mitigation costs, the risk for consumer price increases is significantly lower under a mandatory climate standard compared to an ETS without free allocation where the food processors have to buy allowances for their total emissions. **Penalties for downstream companies** who fail to meet their reduction target could be a means for generating revenue which could be utilised to support low-income households. Another consideration for the mandatory climate standard is whether, in the same vein as the option under a carbon pricing system which can subsidise less emission intensive foods, is whether **certain basic products could be exempted from the calculation of emission reduction obligations** in order to mitigate potential rises in costs of food products more likely to be consumed by lower income households, or conversely placing the obligation of emission reductions only on products with higher emissions intensity. If such a design feature were feasible, how could such products be designed? **We highly encourage stakeholders to consider potential design choices for the mandatory climate standard which could potentially alleviate disproportionately burdensome increases in costs for low-income households**.

Consumer prices for sustainably sourced food will likely be affected by demand and supply for products which have been certified under the CRCF. There is a great deal of scientific literature demonstrating a willingness among consumers to pay for food products with lower emissions intensity (see for example Denver et al., 2023; Feucht and Zander et al., 2017; Ishaq et al., 2023; Tait et al., 2016; Bastounis et al, 2021; Yue et al, 2024). However, consumer choice for such products is influenced by the level of trust in the claim being communicated by a company on its product. Greenwashing can increase scepticism towards the climate claims in advertising, which can in hinder the intention to buy products that have lower emissions intensity. However, **the use of labels certifying products by a third-party certification scheme can positively affect trust in the climate claims of a product** (Gorton et al., 2021; Lang & Conroy 2022; D'Souza et al., 2019; Rupprecht et al., 2020). Therefore, obligated downstream companies could potentially advertise products with materials coming from farms that have reduced their emissions certified under the CRCF, which in turn will facilitate consumer demand. However, bundling products and CRCF credits could increase the market power of food processors. An option to avoid this could be to define a label based on a certificate of compliance under the CRCF, for example, where a food processor must have a certain percentage of their products from farms that are CRCF certified.

Discussion Questions

- Of the potential design options to reduce negative impacts on consumers, which do you think will be the most effective?
- How can potential revenues be utilised in a manner to limit impacts on low-income households?
- How could free allocation of allowances be designed in a manner to alleviate negative impacts on low-income households?

3: Trade impacts

Design choices for policy options relevant to trade

The policy options can affect trade in different ways depending on their point of obligation as this determines whether the on-farm emissions associated with imports and exports are covered under the policy option. Table 1 shows an overview of the trade-related on-farm emissions that are covered and not covered under each policy option. From the perspective of the impact on trade and carbon leakage risks:

- **For imports from outside the EU (extra-EU imports)**, the possibility to cover the embedded on-farm emissions of imported products is considered positive as this helps to prevent carbon leakage
- **For exports outside the EU (extra-EU exports):** treatment of exports is considered sensitive and will require further reflection to ensure compliance with the EU's international obligations

In Sections 3.2 and 3.3, these design-related aspects and potential means for mitigating negative impacts on imports and exports are discussed, respectively.

Table 1: Trade-related on-farm emissions potentially covered under each policy option

Policy options under discussion	Embedded emissions in extra-EU imports	Embedded emissions of extra-EU exports
Mandatory Climate Standard for feed producers and/or food processors	**Covers imports** by including importers of these products as obligated entities	The consideration of exports is relevant as the standard would apply to EU exporters but not their competitors in third countries
Mandatory Climate Standard for retailers	**Covers imports by design** as point of obligation includes all products consumed in the EU irrespective of their country of origin	The consideration of exports is not necessarily applicable as the point of obligation limits the coverage to products for domestic consumption
Agri-Food ETS for feed producers and food processors	**Does not cover imports** as coverage is limited to emissions from feed producers and food processors	The consideration of exports is relevant as the standard would apply to EU exporters but not their competitors in third countries
Agri-Food ETS on-farm	**Does not cover imports in the ETS** as coverage is limited to emissions from EU farmers	Exports are concerned as the agri-food ETS would apply to EU exporters but not their competitors in third countries

Context on EU trade in agri-food products

The EU plays a significant role in global agri-food trade, engaging extensively in both imports and exports. The EU stands as the largest exporter of agri-food products, and is the third largest importer after China and the United States. In 2023, the total value of EU agri-food trade with non-EU countries reached EUR 411 billion, with exports amounting to EUR 229 billion and imports valued at EUR 182 billion, resulting in a trade surplus of EUR 46 billion. Between 2013 and 2023, EU agri-food trade experienced an average annual growth rate of 4.6%, with exports growing slightly faster than imports (4.7% versus 4.4%). The EU is the largest partner in international trade of agricultural products. Agricultural products can be classified into four categories: animal products, vegetable products, fats and oils, and foodstuffs. In 2023, based on value, foodstuffs were the largest category in exports, accounting for 54%, followed by animal products and vegetable products at 22% each, and fats and oils at 4%. On the import side, foodstuffs also constituted the largest share at 37%, followed by vegetable products at 36%, animal products at 20%, and fats and oils at 7%.

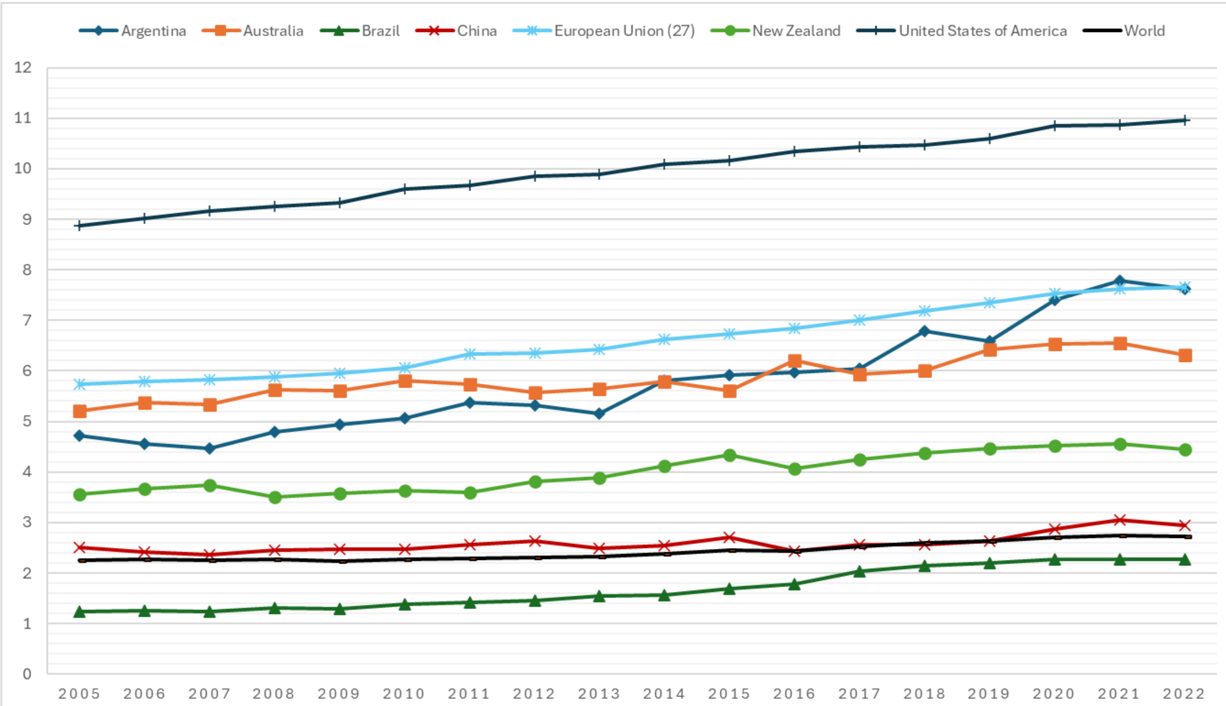
EU agri-food trade operates within a complex framework that is designed to regulate imports and exports while ensuring food safety requirements are abided, sustainable practices and products are promoted, and fair trade practices are maintained. EU policies are designed to **align with WTO rules**, particularly regarding tariffs and subsidies. The EU also reaches preferential trade arrangements under bilateral trade agreements. Imports must comply with relevant EU regulations and standards relating to safety and health. **The EU applies customs duties on many agricultural products but may grant tariff reductions under preferential trade agreements or through generalised schemes**, such as the Generalised System of Preferences for developing countries. **Tariff rate quotas may also apply to specific agri-food imports**, which combine the use of tariffs and quantitative limits to regulate imports of specific goods, allowing a limited quantity of a product to be imported at a reduced or zero tariff rate (in-quota tariff), while imports exceeding this quantity are subject to higher tariffs (out-of-quota tariff). TRQs are established to allow for market access whilst protecting sensitive domestic industries, stabilising prices in domestic markets. The EU negotiates bilateral TRQs under its Free Trade Agreements with its trading partners, but also establishes autonomous TRQs unilaterally for specific purposes, such as ensuring the stability of supply. In addition, there are also WTO TRQs for agricultural products as well. Common agri-food imports to the EU that are often subject to TRQs include beef, pork, poultry, cheese, butter, milk powder, wheat, maize, barley, and some processed foods such as prepared meats or dairy-based products. The EU also establishes safeguard measures within trade agreements to protect the agricultural sector from sudden surges in imports which surpass an agreed-upon threshold in case they cause, or threaten to cause, serious disturbance on the EU market.

3.1 Agri-Food Production

Background on EU agri-food production

The EU remains the world's largest milk producer, accounting for approximately 20% of global supply in 2022 (FAOSTAT, 2022). In terms of dairy cattle productivity, it ranks among the most productive regions globally, second only to the United States, which operates with an exceptionally intensive milk production model.

Fig. 2. Milk yields for key milk producing countries and regions (2005-2022) (kg/animal)



Source: FAOSTAT, 2022

The past increase in milk yields is projected to continue in the coming years, although at a slower pace than previously. Many factors that contributed to the highly specialized and efficient EU dairy production system are either reaching a tipping point (such as the closing productivity gap between EU countries) or could be counterbalanced by new factors (such as extensive, low-input, organic, and other alternative livestock production systems that would limit growth in average milk yields). However, yield growth is expected to slow down (0.9 % per year), reaching only half the growth rate observed in the past decade.

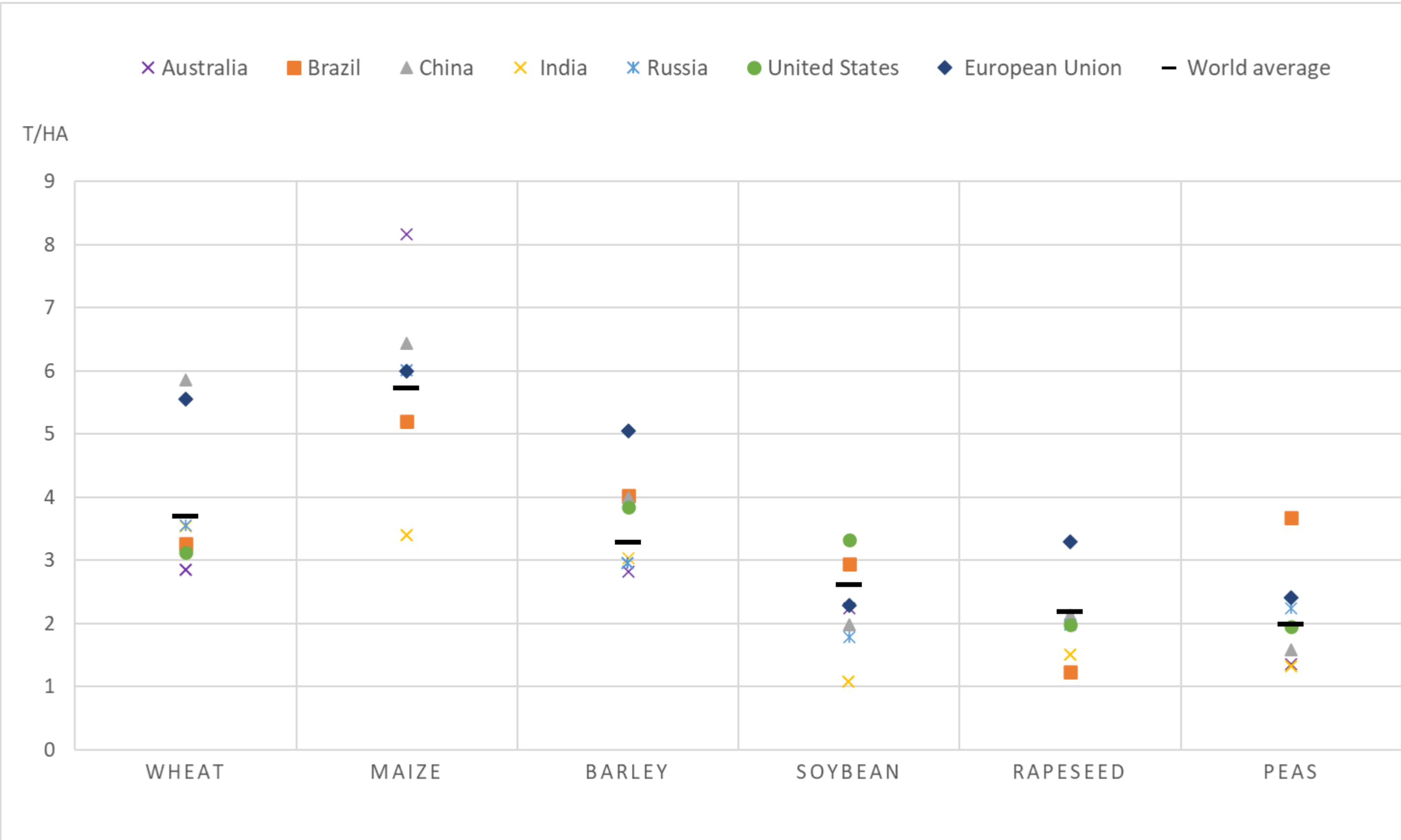
The EU Agricultural Outlook 2023-2035 (EC, 2024) anticipates that the EU dairy herd will decrease by 13% by 2035, due to stricter EU and national environmental policies. With factors driving milk yields in the past becoming less significant, EU milk production could decrease by an average of 0.2% annually between now and 2035.

The EU is also one of the largest livestock producers globally. In 2022, it ranked as the world's third-largest beef producer, the second-largest pork producer, and the fifth-largest poultry producer (FAOSTAT, 2022). However, as with milk production, shifting consumer preferences, societal concerns, profitability challenges, and regulatory frameworks are expected to drive a continued decline in EU meat production (with the exception of poultry) (EC, 2023). EU beef production is projected to decrease by 0.6 million tons by 2035, representing a 9.2% reduction compared to the 2021–2023 average. Similarly, EU pigmeat production is anticipated to fall by 0.9% annually through 2035, amounting to a decrease of nearly 2 million tons relative to 2021–2023 levels. Production of sheep and goat meat is also expected to decline slightly, with an annual reduction of 0.3%, reaching approximately 607,000 tons by 2035 (ibid.).

Poultry production, however, is expected to grow, although at a slower pace. Following a decline in 2022, EU poultry production rebounded quickly in 2023, with a 3.3% year-on-year increase. Rising domestic demand and some export opportunities are projected to raise poultry production at an annual growth rate of 0.4% from 2023 to 2035 – this rate of expansion will be slower than the 1.9% growth seen in the previous decade (ibid.).

Agricultural crop yields in the European Union, when compared to global counterparts, demonstrate that European yields are generally high, particularly in the cereal sector. This advantage can be attributed to the EU's access to advanced technologies, the implementation of efficient farming practices, and the support of policies that collectively sustain its competitive edge in global agriculture.

Fig 3. Yields of key crops in the main production regions (t/ha, 2022)



Source: Own elaboration based on https://ourworldindata.org/crop-yields

The EU Agricultural Outlook 2023-2035 (EC, 2024) projects that cereal and oilseed yields in the EU will remain stable through 2035. Gains in efficiency resulting from more sustainable practices, such as crop rotation, and advances in technology are expected to be broadly offset by the adverse effects of climate change and limitations on the availability and affordability of certain agricultural inputs, such as plant protection products. Additionally, the expansion of organic farming, on average, may further constrain growth in yields.

Historically, a significant portion of productivity growth in agriculture, as measured by yields, was driven by the process of convergence between newer EU member states (those joining after 2004) and their more established counterparts. Although productivity disparities between EU member states persist, the medium-term outlook suggests that the yield gap for maize, rapeseed, and soybeans will continue to narrow across EU countries. By 2035, wheat yields in countries that joined the EU in 2004 and beyond are expected to approach parity with those in older member states. However, these structural changes are expected to decelerate in the coming years, resulting in slower overall productivity growth within EU agriculture.

Despite the constraints on yield improvements, EU crop production is expected to experience modest growth, with oilseed production being a key driver. The production of oilseeds and protein crops is anticipated to increase, with soybean production projected to rise by 30% (from 2.7 million tons in 2021-2023), and pulses expected to grow by 42.2% (from 4.5 million tons in 2021-2023). These increases are driven by factors such as rising demand for plant-based proteins, the adoption of crop rotations, and a push for deforestation-free soybean cultivation. Meanwhile, the EU’s use of cereals in animal feed is projected to decrease to 152.1 million tons by 2035, a decline of 3% compared to the 2021-2023 period, while human consumption of cereals is expected to rise to 61.5 million tons by 2035, marking a 1.4% increase.

While the EU Agricultural Outlook (EC, 2024) highlights several challenges to the competitiveness of domestic production, the EU continues to generate production surpluses. While agricultural growth in the EU is expected to slow down in the coming years, it is projected that the EU will remain a net exporter of various agricultural products. This trend will be influenced in part by shifting consumption patterns within the EU, such as a reduction in meat consumption. As a result, the EU's export capacity, as indicated by self-sufficiency rates, is likely to be sustained, particularly for animal products. Animal products, particularly pork and dairy, are expected to remain profitable.

Potential impacts on agricultural production

If EU-based companies are permitted to demonstrate emissions reductions across the entire supply chain (both EU and non-EU), downstream actors could be incentivised to switch to suppliers with lower GHG production intensities, while maintaining consistent output. This shift could benefit EU producers at large by boosting demand for their products. Some companies with good access to their suppliers in other regions may opt to engage and incentivise reductions in those parts of their supply chain where greatest efficiency gains in terms of GHG intensity can be achieved. However, as indicated in section 2.1, this is dependent on how standard emission values are set in the policy options, and whether emissions values are differentiated at the regional level.

For the policy options in which obligations are placed on food processors or retailers with meat and dairy in their manufacturing portfolios, there remains considerable technical mitigation potential in relation to livestock which can be realized at near-zero marginal abatement costs through strategies such as selective breeding and farm-scale anaerobic digestion with biogas recovery both within the EU (EC, 2024) and globally (WRI, 2019). As a result, downstream actors incentivizing these changes directly among their suppliers are likely to enhance the efficiency of agricultural production in regions they select to encourage these practices, due to improvements in productivity and the additional savings or income generated through biogas production.

The overall impacts on crop production are more likely to be driven by changing supply and demand dynamics related to livestock products, with knock-on effects on overall crop production and its profile, rather than being directly impacted by downstream actors targeting N_2O emissions from fertilizers as the most significant source of emissions in crop production. Further impacts on crop production may arise from increased demand for plant-based alternatives, especially if an MCS introduces obligations for retailers, who are more likely to engage in product portfolio interventions and other strategies that impact consumer behaviour, compared to actors further upstream, such as processors. These counteracting dynamics may align with the already observed trends in EU livestock production and their knock-on effects on feed production.

In the case of a mandatory climate standard for retailers, the dynamics described above are likely to apply to a more limited degree, as they are more distantly connected to primary producers, depending on their visibility into the supply chain, as well as the nature of their relationships and requirements for direct suppliers (e.g., for traceability and engagement further up the value chain). In general, off-farm mitigation strategies, such as reducing the share of high-emission products and ingredients in their portfolio, may be the most feasible approach. An efficient approach for food processors could involve reducing the proportion of products containing meat and dairy ingredients sourced from regions outside the EU, where GHG intensities are higher. This would prioritize EU farmers over many other regions of the world. Such an outcome would align with an existing trend, where the US is expected to strengthen its position as a global dairy exporter, though it is not expected to challenge the EU's leading position by 2035 (EC, 2024).

A limited body of research examines the effects of GHG targets or carbon pricing on EU agricultural production levels. These studies quantify the potential outcomes of carbon pricing policies that could mimic the effects of an agri-food emissions trading system. They do not capture the potential outcomes of targeting specific actors, emission sources, or the specific dynamics within the LULUCF sector. Despite these limitations, the studies provide valuable insights into the expected changes associated with the introduction of carbon pricing, whether implemented directly through an explicit carbon price or indirectly via the imposition of a mitigation target.

Regarding impacts on production, Perez-Dominguez et al. (2016) demonstrate that **agricultural production in the EU is more affected in scenarios that do not include subsidies for mitigation technologies**. At the EU level, the **largest production effects occur in the livestock sector, particularly in beef cattle production**, followed by sheep and goat-related activities. A compulsory mitigation target of -20% without subsidies for mitigation technologies would result in a 16% decrease in the EU-27+UK beef cattle herd and a 9% reduction in beef production. **When subsidies are provided for mitigation technologies, the impact is reduced**, with the beef herd decreasing by 10% and beef production by 6%. The dairy sector is less affected than the beef sector, with the EU dairy herd size declining by 3.5% without subsidies and 2.5% with subsidies. While milk production decreases by 2% without additional subsidies, subsidies for breeding programs aimed at increasing dairy cow yields result in no change to the total EU milk supply. Effects on crop production within the EU are relatively moderate in both scenarios. Specifically, the agricultural area in the EU-28 decreases by between 3% (without subsidies) and 1% (with subsidies). Cereal production and cultivated area in the EU-28 decline by 4% (without subsidies) to 2% (with subsidies). Notably, in scenarios where subsidies are provided for mitigation technologies, the reductions in both production and area are smaller. In some cases, results suggest that such subsidies could even lead to an increase in cereal production relative to the reference scenario.

In a more recent assessment, Stepanyan et al. (2023) model a scenario in which a €100/tCO2 eq. tax is applied to agricultural activities in the EU-27, considering the effect of mitigation technologies. In this scenario, EU herd sizes decrease, leading to an 11.1% reduction in beef production and a slightly smaller decrease in sheep and goat meat production (-8.98%). The model shows a much smaller impact on pork production (-2.4%) and minimal impact on poultry production (0.55%). The scenario assumes that beef is substituted by poultry, and under the EU-wide implementation scenarios, beef is also substituted by pork. In the context of crop production, the results indicate that the area of set-aside and fallow land in the EU increases by approximately 17%, or 1.57 million hectares. With the decrease in UAA, the production of cereals and oilseeds in the EU is reduced by 3.46% and 2.86%, respectively, suggesting a decline in the competitiveness of EU cereal producers and a drop in exports. Additionally, fodder production decreases by 14.11%.

3.2 Imports

Background on EU agri-food imports

The EU's main countries of origins for agri-food goods include Brazil, the UK, China, the United States, Ukraine, Norway, and Turkey. Norway is the largest origin of EU meat imports (mainly fish), followed by the UK, China, Morocco, Argentine, Iceland, and the United States. Brazil is the largest origin of imported vegetable products, followed by Ukraine, United States, Turkey, Morocco, Vietnam, and Peru. and Indonesia is the largest origin of imports of oils and fats, followed by Ukraine, Malaysia, China, Guatemala, the UK, and Tunisia. The EU imports foodstuffs mainly from the UK, Brazil, China, the United States, Cote d'Ivoire, Turkey, and Switzerland.

While the EU is largely self-sufficient in dairy production, imports from various countries complement domestic production[10]. As the world's largest exporter of dairy products, New Zealand is a significant supplier of products such as butter, cheese, and milk powders to the EU. The United States is a source of whey products, while Switzerland is a source for specialty cheeses and other dairy products. Projections indicate that EU dairy imports will remain low and stable through 2035. An anticipated slowdown in global dairy product imports is expected to primarily impact milk powders. The domestic market is projected to remain the primary outlet for EU milk, accounting for 88% of production in 2035.

The EU sources its beef imports primarily from Brazil, Argentina, and Uruguay. Poultry imports mainly come from Brazil, Ukraine and Thailand, while New Zealand and the UK are the largest source of lamb and mutton imports. EU imports of pork are very low. Projections indicate that the EU's meat imports will experience modest changes in the coming years, influenced by various factors including trade agreements, consumer preferences and sustainability initiatives. The EU's beef imports are expected to decline in the near future, as demand for high-quality beef remains subdued post-COVID-19. Poultry meat imports are projected to remain stable, and consumption to increase slightly by 2030. Nevertheless, changing consumer preferences towards poultry meat is expected to be met primarily with domestic production, with imports remaining stable. Similarly, the EU Is expected to remain a significant exporter of pigmeat, with imports constituting a minor proportion. Projections estimate imports will remain low and stable, as domestic production will also meet intra-EU demand.

The EU is anticipated to remain a net importer of oilseeds and protein crops through to 2035, although the rate of import growth is expected to slow down. Net imports of oilseeds are predicted to decline, primarily due to increased domestic production and reduced domestic demand. Similarly, imports of pulses are expected to decrease from an average of 1.3 million tonnes during 2021-2023 to small-scale exports of 0.1 million tonnes by 2035, driven by greater domestic production. Overall, the demand for animal feed in the EU is expected to decline by 3.5% by 2035, while human consumption of pulses is projected to increase by 61% over the same period, yet animal feed will remain the predominant use.

Potential impacts for imports into the EU and risks of carbon leakage

The mandatory climate standard options and the ETS options could have implications for agri-food imports into the EU. These implications stem from the competitive dynamics between EU producers and foreign suppliers, the structure of global trade, and the carbon footprint of different agricultural practices. Should the policy options lead both shifts in EU agricultural production and increasing costs for consumers, depending on the elasticity of the particular product, the level of market access for imported goods allowed by EU tariffs, as well as whether

[10] Notably, over 98% of fluid milk imports come from the UK (imported from Northern Ireland for processing in Ireland).

consumers shift their consumption behaviour, there are risks of increasing imports if such agri-food products from countries outside the EU are more competitive in terms of price compared to domestically produced goods. Thus, **EU consumers and businesses may increasingly favour imports over EU-produced products, especially for price-sensitive commodities, for imported products not covered under the policy options.**

By covering importers under the mandatory climate standard options, the risk of higher imports of products that compete with the products from EU entities would be avoided. However, it will be important to test the feasibility of including importers as an obligated party, including its compliance with the EU's international commitments. Under the policy option for mandatory climate standard on retailers, this risk would not be present as the final products to EU consumers and business, irrespective if they are produced in the EU or imported from outside of the EU, would be covered.

However, under the ETS option where the point of obligation is with feed producers and food processors or on-farm, the risk of higher imports for some products might be shifted further downstream rather than mitigated. This could occur for products that require further processing downstream of the covered entities, with EU consumers and businesses circumventing the costs due to the ETS by favouring products from importers further downstream of the point of obligation.

Table 2 presents the estimated impacts on imports based on a 20% GHG reduction target for the agricultural sector by 2030 (compared to 2005), as outlined by Witzke et al. (2015) and Perez Dominguez et al. (2016). It outlines the impacts under two scenarios: 1) with voluntary technological mitigation options available to farmers, and 2) with voluntary technological mitigation options available to farmers, supported by an 80% subsidy. Within the sector, there are potentially disparate impacts on imports of beef and pork, while imports of vegetable and permanent crops increase only slightly, and imports of other arable crops decrease. The modelling results indicate that the impacts of imports are notably less severe when subsidies for technological mitigation are provided to EU farmers, compared to the no-subsidy scenario.

Increased imports could shift emissions abroad of products are sourced from countries with less stringent climate objectives. Given the EU's integration into global agri-food and commodity markets, **an increase in the stringency of agriculture-relevant climate policy may result in carbon leakage, undermining the effectiveness of the policy measures taken**. Carbon leakage can be defined as "the additional amount of GHG emissions generated in non-implementing countries[11] caused by the implementation of stricter climate policies to reduce GHG emissions in the implementing country or countries" (Matthews, 2023). This may occur when the policy increases production costs, reducing the competitiveness of domestic production and prompting consumers to opt for cheaper imported alternatives, or prompting demand in third countries to switch to cheaper, more greenhouse-gas intensive alternatives than the exports from the implementing country or countries. Consequently, this could result in heightened agricultural production outside the EU, offsetting some of the domestic emission reductions achieved.

Table 2: Impacts of EU-wide GHG reduction on imports, with and without subsidies for technology application in agriculture

		2030 20% GHG reduction target		
		Technological mitigation options available but not subsidised		80% subsidy for the voluntary application of mitigation technologies
		Witzke et al (2015)	Perez-Dominguez et al (2016)	Perez-Dominguez et al (2016)
Veg. and perm. Crops	Imports	0.8%	1.3%	1.3%
Other arable crops	Imports	-2.5%	-3.1%	-8.2%
Cereals	Imports	28.6%	2.8%	5.1%
Beef	Imports	64.3%	28.5%	22.5%
Dairy	Imports	9.9%	11.6%	1.0%
Pork	Imports	64.4%	51.3%	15.0%

[11] Countries where producers and/or exporters are not obligated to meet the requirements of a policy.

Source: Own elaboration based on Witzke et al (2015) and Perez-Dominguez et al (2016)

Furthermore, the GHG intensity of products varies across different geographies due to climatic and agronomic differences (for example, according to a report by the FAO, the life cycle analysis of beef per kilo of protein demonstrates GHG emissions twice as high in Latin America than in Western Europe on average – see Opio et al., 2013). Therefore, **a shift in production elsewhere could theoretically not only negate the domestic emission savings but also set back global climate mitigation efforts**, even as the EU meets its own targets. It is important to note that the risk of carbon leakage applies regardless of whether the climate policy introduces carbon pricing (Gabela et al., 2024). Studies simulating carbon pricing in agriculture find carbon leakage rates[12] ranging from 16% to 153%, indicating that **the risk of carbon leakage in agriculture could be higher than in energy-intensive sectors** (Perez Dominguez et al., 2012; Frank et al., 2021; Golub et al., 2013; Himics et al., 2018; Key & Tallard, 2012; OECD, 2019; van Doorslaer et al., 2015; in: Gabela et al., 2024). A more recent study by the JRC (see Ricci et al., 2024) estimates that supply side pricing leads to a leakage rate of over 40%, and leaves EU producers at a competitive disadvantage. However, demand-side pricing (i.e. food consumption taxes) generates positive leakage by increasing the export of greener EU producers. The positive leakage of demand-side measures is a result of the fact that the price is applied to all products consumed domestically, regardless of their country of origin (ibid). The policy option of a mandatory climate standard on retailers that will be assessed in this study could achieve similar effects, as retailers need to take measures to meet the standards, irrespective of where they source their products from.

Most studies on carbon leakage generally do not account for mitigating design features, such as free allocation in the case of an emissions trading system, or the use of revenues generated by the policy. They also fail to capture competitive advantages stemming from improved sustainability credentials in certain markets. Grosjean et al. (2016) argue that the literature on emissions trading systems has often overestimated carbon leakage in modelling predictions compared to ex-post evidence. While empirical studies confirm the existence of carbon leakage, they do not demonstrate a corresponding overall increase in total global emissions (Arvanitopoulos et al., 2021; Barreiro-Hurle et al., 2021; in: Matthews, 2023). In many instances, the underlying assumption in the modelling is that a reduction in EU production resulting from climate policy will lead to an increase in imports, thus causing carbon leakage, while consumer demand remains unaffected (Matthews, 2023). In addition, the implications of policy options to mitigate GHG emissions on imports do not incorporate considerations of tariff rate quotas (TRQs) for certain types of products, particularly high tariffs for animal products.

Means of mitigating potential impacts on imports

For both the mandatory climate standard and the downstream ETS option on feed producers and food processors, **covering corresponding importers** in the options and putting the point of obligation as close as possible to final consumer could potentially be explored, provided this is designed to comply with the EU's international commitments. Additional policy measures may still be required to address the risk of carbon leakage due to imports of products further downstream than the ones produced or imported by the entities covered under the policy option. Additional measures against carbon leakage from imports would also be required in the option where the point of obligation lies on-farm. For the option with a point of obligation on retailers, the risk of imports is very limited as it would only occur if final consumers would import products themselves to circumvent increased cost of products instead of buying from retailers.

There are various potential means for addressing risks of increasing imports and carbon leakage. For instance, under the existing EU-ETS, free allocation of emission allowances to industrial installations has been applied from the start and reduced over time. While free allocation will be phased out over time, the EU's Carbon Border Adjustment Mechanism (CBAM) will be phased in. The CBAM confirms that a price has been paid for the embedded carbon emissions generated in the production of certain goods imported into the EU, ensuring that the carbon price of imports is equivalent to the carbon price of domestic production to prevent carbon leakage. The CBAM is designed to be compatible with WTO-rules

The CBAM will apply in its definitive regime from 2026, while the current transitional phase lasts between 2023 and 2025. The CBAM will initially apply to imports of certain goods and selected precursors whose production is carbon-intensive and at most significant risk of carbon leakage: cement, iron and steel, aluminum, fertilisers, electricity and hydrogen. With this scope, the CBAM will, when fully phased in, capture more than 50% of the emissions in sectors covered by the current EU-ETS.

[12] The formula for calculating carbon leakage rates is typically measured by dividing the total increase in emissions (CO_2e) in unregulated regions by the reduction in emissions (CO_2e) in regulated regions (multiplied by 100).

Considering a policy to address carbon leakage risks for agri-food imports and/or exports would require more analysis. Depending on the final policy that may be chosen to incentivise emission reductions in the EU, this would need to determine more precisely the carbon leakage risks and the amount of emissions concerned, and assess the feasibility of policies addressing carbon leakage. Issues to consider may include the **complexity of calculating the carbon footprint of agri-food products**. For instance, agri-food supply chains often span multiple countries, making it difficult to trace and account for GHG emissions.

When it comes to an MCS, since it imposes compliance costs on domestic producers, estimating the economic impact on domestic production and applying a comparable adjustment to imports could be explored to address carbon leakage. However, unlike emissions trading, which provides clear pricing, **the costs resulting from an MCS can be indirect, variable, and more challenging to quantify in monetary terms**. Thus, ensuring equivalence between domestic and foreign practices could be challenging.

Possible design variants beyond a CBAM could be considered for the mandatory climate standard. If the Scope 3 emissions reduction requirements imposed on downstream actors align with current practices, they could encompass the **full range of Scope 3 emissions, including those arising from both EU-based and non-EU-based suppliers** – in particular, scope 3 emissions could include raw materials from outside of the EU. Expanding obligations beyond EU-based Scope 3 emissions could prevent food processors in particular from shifting their sourcing to non-EU suppliers. However, if Scope 3 emissions from raw materials sourced outside of the EU are included, consistency with existing international standards as well as EU legislation on how scope 3 emissions are calculated will need to be ensured. It is also important to note that the EU can only regulate with respect to products on its internal market.

For the ETS policy options, there is also the possibility for the use of free allocation of allowances to mitigate carbon leakage risks. The main purpose of free allocation is to provide transitional assistance to sub-sectors at risk of carbon leakage. By allocating a portion of emissions allowances for free for sectors that are at risk of carbon leakage, effectively firms do not need to pay the full carbon price. Free allowances thus help align the cost of domestic production with that of competitors in regions without carbon pricing. Companies receiving free allowances can still benefit if they reduce their emissions below their allowance, as they can sell surplus allowances. In the EU ETS, free allocation is focused on sectors deemed at the highest risk of leakage based on their trade exposure and carbon intensity. However, the use of free allocation presents risk of over-allocation; if allowances exceed actual emissions or if obligated parties pass the costs to consumers, free allocation can result in windfall profits for the obligated operators. The EU ETS introduces measures that aim to mitigate those risks to a certain degree, including by ensuring annual adjustments to reflect production levels, and basing free allocation on performance benchmarks, which reflect average emissions intensity per unit of product of the 10% most efficient installation in a sector. Ultimately, however, free allocation is a transitional measure, and reliance on it must decrease over time in order to ensure adequate emission reductions incentives. Thus, there is the potential to utilise free allocation for a limited time-period whilst more long-term solutions to address carbon leakage are developed.

The original exploratory study (Trinomics, 2023) discussed other potential types of environmental measures to lower risks of carbon leakage. One approach is **leveraging mechanisms and commitments under multilateral agreements** to encourage greater climate ambition in other countries. For example, mechanisms established by the Paris Agreement, such as the Financial Mechanism and Technology Mechanism – the first of which provides funding for climate mitigation projects and the second of which provides technological expertise to assist developing countries in mitigating climate change and adapting to its impacts – could play a significant role in the context of agri-food trade. Another example is the EU's Global Gateway initiative, which plays a crucial role in promoting green agriculture in developing countries by providing financial aid, technology transfers, and policy support to foster sustainable, climate-resilient food production and promote sustainable farming techniques.

Research indicates that **the risk of carbon leakage decreases substantially as more countries adopt carbon pricing mechanisms or more ambitious climate policies** (Henderson & Verma, 2021), underscoring the importance of climate diplomacy in this area. Therefore, promoting more progressive climate policies targeting agricultural emissions domestically and in other countries is important. For instance, the EU could offer reduced or zero tariffs on imports of specific products from countries that commit to implementing ambitious policies to lower the carbon intensity of their production (see Matthews, 2022). While such measures may face challenges under WTO rules, they could be justified in certain circumstances (ibid). However, these theoretical ideas in practice are complex and require proper assessment in terms of, industry interest, incentive for reducing emissions as well as ensuring compliance with the EU's international commitments.

Discussion Questions

- For the Mandatory Climate Standard with the point of obligation on feed producers and food processors, what are workable options to reduce the GHG risks of carbon leakage?
- For ETS with the point of obligation on feed producers and food processors, what approach towards minimising the GHG risks of carbon leakage will be the most effective?

3.3 Exports

Background on EU agri-food exports

The EU's main destinations for agri-food exports include the UK, the United States, China, Switzerland, Japan, Russia, and Norway. The UK is the largest export destination for both animal and vegetable products. Exports of animal products also go to China, the United States, Japan, Switzerland, South Korea and Saudi Arabia. Vegetable products are exported to Switzerland, the United States, China, Morocco, Norway, and Russia. The United States is the largest EU export destination for fats and oil, followed by the UK, Norway, Brazil, Morocco, Japan, and China. The EU exports foodstuffs mainly to the UK, United States, Switzerland and China.

The EU Agricultural Outlook 2023-2035 (EC, 2024) projects that the EU will maintain its role as a top dairy exporter up until 2035, sustaining high export volumes despite a decline in milk production. Alongside New Zealand, the EU will continue to dominate the global dairy export market, each capturing roughly a quarter of the global share, while US dairy production is expected to surge, solidifying its position as the world's third-largest dairy exporter, claiming a 20% share of global exports by 2035.

Cheese, the EU's flagship export, is projected to witness continued growth, with exports increasing by 0.8% annually through 2035, and domestic consumption rising in parallel. EU butter consumption and exports are expected to remain relatively stable, driven by strong demand from the processing industry, with increased competition from alternative fats, such as olive oil, in both household cooking and foodservice sectors impacting domestic demand. Strong global demand, fuelled by increasing food applications and the development of new nutritional and health-focused products, is set to bolster EU whey powder production.

Although EU beef production is projected to decline, EU beef exports are expected to grow modestly, at an average annual rate of 0.2% through 2035. This growth will be driven largely by sustained or increasing demand from trade partners and declining EU domestic consumption. The EU is anticipated to continue exporting primarily to high-value markets in nearby countries (such as the UK, Switzerland, and Norway) and to nations with which it has established free trade agreements, including Japan and Canada. Meanwhile, EU exports of live animals are forecasted to decrease gradually at a rate of 3.1% per year over this period. EU beef imports are projected to decline by 2035, caused by decreases in domestic consumption, strict import quotas which are generally expensive, and stricter environmental regulations, such as the EU Deforestation regulation.

The profile of the EU pigmeat export portfolio is expected to shift by 2035, as the destination countries for these exports change. Although EU pigmeat exports saw substantial growth over the past decade, according to the EU Agricultural Outlook (2024) projections indicate a decline in the coming years, followed by stabilization at a moderately lower level by 2035 – a decrease of approximately 620,000 tonnes compared to the period of 2021-2023. Meanwhile, EU pigmeat imports are anticipated to remain minimal and steady over this period.

For poultry, following recent declines, EU exports are projected to rebound in the next few years, supported by increased production. The EU is expected to focus on exporting products where it holds a competitive advantage globally and where there is less domestic demand, such as wings, legs, and offal. By 2035, poultry imports to the EU are expected to have risen slightly from current high levels, reaching around 910,000 tonnes.

Looking ahead, the growth rates for EU agricultural exports for crops between now and 2035 are expected to be slower than the average growth observed between 2013 and 2023. This deceleration can be attributed to several factors, including increasing self-sufficiency in major import-dependent countries, intensifying competition from producers in other regions (particularly for basic commodities), and generally lower demand growth rates in key import markets, such as China and other middle-income countries.

Potential impacts on exports

The policy options could present risks to EU exports if **additional costs of agri-food production could prompt the substitution of EU exports with goods produced outside the EU**. As the mandatory climate standard on retailers applies only to EU consumption and does not include exports, there is no negative effect on exports. Under the mandatory climate standard on feed producers and food processors, and under ETS options, export-dependent producers could potentially be harmed. However, if exports are excluded from the compliance obligations, these harmful effects on export-dependent producers can be avoided. Therefore, it is worth reflecting on whether excluding exports from the compliance obligation under those policy options is feasible to implement in practice. There are various key factors to be considered for exports, particularly the difficulty of ensuring alignment with the EU's international commitments and the policy's environmental integrity (i.e. the risk of "exporting" embedded emissions elsewhere).

Table 3: Impacts of EU-wide GHG reduction on imports, with and without subsidies for technology application in agriculture

		2030 20% GHG reduction target		
		Technological mitigation options available but not subsidised		80% subsidy for the voluntary application of mitigation technologies
		Witzke et al (2015)	Perez-Dominguez et al (2016)	Perez-Dominguez et al (2016)
Veg. and perm. Crops	Exports	-0.8%	-1.0%	-1.3%
Other arable crops	Exports	-1.7%	-1.5%	-1.3%
Cereals	Exports	-9.2%	-4.0%	-4.4%
Beef	Exports	-62.1%	-65.3%	-46.5%
Dairy	Exports	-7.2%	-8.4%	-1.5%
Pork	Exports	-21.7%	-38.0%	-13.6%

Source: Own elaboration based on Witzke et al (2015) and Perez-Dominguez et al (2016)

Under GHG reduction scenarios and emissions pricing scenarios, net agricultural exports are expected to go down, with Fellman et al. (2015), Witzke et al. (2015) and Perez Dominguez et al. (2016) finding that almost all agricultural exports decrease under different scenarios.

Table 3 displays the potential impacts on different agricultural sub-sectors as outlined by Witzke et al. (2015) and Perez Dominguez et al. (2016) under two scenarios: 1) with voluntary technological mitigation options available to farmers, and 2) with voluntary technological mitigation options available to farmers, supported by an 80% subsidy. Similar to impacts on imports, there are potentially disparate impacts on beef and pork exports, while exports of vegetable and permanent crops, as well as other arable crops decrease only slightly. Similar to imports, the modelling results indicate that the impacts on exports are notably less severe when subsidies for technological mitigation are provided to EU farmers, compared to the no-subsidy scenario.

Means of mitigating potential impacts on EU agri-food exports

The most effective means of addressing carbon leakage risks associated with exports is to **exempt the embedded emissions associated with exported products** from the policy option. While this is already the case for the mandatory climate standard option on retailers by design, there are various practical complexities to do so under the mandatory climate standard on feed producers and food processors and the ETS options as mentioned above, as well as WTO compliance issues. Instead, other policy measures may be required.

The effectiveness of a possible measure taken on imports of agri-food products in addressing carbon leakage in the EU may be substantially diminished given the high-export nature of EU agricultural production, compounded by the relatively high price elasticity of food exports. A measure only applicable to food imports would not address the replacement of EU exports by commodities produced in regions with higher GHG intensity of production. However, the EU could explore mechanisms to ensure that EU-produced goods are not at a disadvantage in markets without similar policies. This could **involve rebates or adjustments for carbon costs embedded in exported products**. Export rebates could reflect the costs of allowances under an ETS that were incurred during production; this could be implemented through a measure which would account for not just imports but also exports. Exporters would need to submit evidence of costs incurred and **receive compensation based on verified data**. Nevertheless, **export subsidies are not WTO compatible** and rebates are likely to be seen as an unfair subsidy. Therefore, such a rebate will most likely not work. Export rebates could potentially provoke retaliation from trading partners who may perceive the rebates as unfairly shielding EU agri-food industries.

As a potential solution for an ETS policy option, Marcu et al. (2022) recommend a **benchmark-based export adjustment** to balance GHG effectiveness which according to the author would have minimised risks of violating WTO rules. This would involve the issuing of non-transferable export adjustment certificates based on the average emissions intensity of the 10% least carbon-intensive producers in the EU. These certificates could then be used for compliance in place of EU allowances. Such a mechanism could preserve a dynamic incentive for exporters to lower the carbon intensity of their products. For the Mandatory Climate Standard, rebates could be based on calculations of indirect costs in a similar manner as for imports; however, estimating indirect costs will be administratively challenging. Both these options would also raise WTO compatibility questions.

For the ETS options, **free allocation of allowances** again is a potential means for the carbon leakage protection of goods that are predominantly exported. Free allocation can provide a buffer to manage compliance costs with lower risk of carbon leakage. Free allocation can facilitate greater cost stability for companies, enabling them to plan for investments in changing practices while complying with an ETS. However, similar to an export rebate, free allocation could potentially be viewed as an export subsidy, leading to trade disputes if not carefully designed. Ultimately, similar to imports, free allocation can act as a temporary measure to protect exporters under an ETS, but can be complemented with broader strategies, such as the incorporation of climate policies in bilateral and multilateral trade agreements.

Discussion Questions

- What approach towards minimising negative impacts on EU agri-food exports will be the most effective? Which of these approaches is most feasible?

4: Approach to assessing macro, micro, and administrative impacts

This section provides an overview as to how the research consortium will approach the assessment of the policy options in determining their potential impacts on farm income, market bargaining power, consumer budgets, administrative costs, yields, production, consumption, and trade.

Stakeholders are encouraged to review the indicators and approaches towards the assessment approaches and provide feedback should they have any.

4.1: Assessing micro-economic impacts

The micro-economic impact assessment will focus on the influence of the different policy options on micro-level decision-making in the agri-food value chain. The indicators used in the assessment will explore the changes in market power distribution along agri-food supply chains, which can significantly influence cost pass-through and consumer prices. The impact on farmers' income, input and food prices, and the influence on household income will also be analysed to understand how the different policy options will affect farmers, other value chain actors (manufacturers of food products, distributors and retailers) and final consumers. The indicators for the impacts are provided in Annex III (Proposed indicators, sources of data, and assessment approach per micro-economic impact)

The main limitation of the microeconomic assessment will be the availability of the required data for the indicators across different stages of the value chain. The diverse nature of commodities transacted in agri-food value chains and the wide range of processing done before it reaches final consumers, complicates the impact assessment. While prices for raw agricultural products are generally publicly available, prices of food processors and retailers are opaquer, which makes measuring the degree of price transmission more difficult. In most cases, wholesale price data is virtually non-existent, aggregating the distribution sector's impact into the final consumer price indicators. It is therefore difficult to distinguish between the effects of the wholesale and retail sectors in price transmission analysis (COM, 2009). Stakeholder consultation will be used to fil these data gaps by mapping the value chain for the major crops or livestock produced and identify the most affected value chain stage and actors.

Market power, supply, and demand for commodities across the value chain significantly influence the consumer price. To understand and establish this relationship, the impact of policy options on profit margins, price transmission, and bargaining power of value chain actors will be assessed through stakeholder consultation. Quantitatively, concentration ratios (measuring market share held by the largest firms within each segment of the value chain) and the Herfindahl-Hirschman Index (HHI) (measuring the degree of market concentration within agri-food sectors) can be used to assess the market structure and power. Estimating these indicators will be dependent on the quality and availability of relevant data

As price takers, farmer producers are most impacted by market-based policy changes in agri-food value chains. The influence of the policy options may differ across farm size, farm types, the nature of commodities transacted, the length of the value chain, and the number of actors involved. Stakeholder inputs will be used to assess the impact of policy options on farmers depending on the factors mentioned above.

The input price index and price indices along the agri-food supply chain, such as the consumer price index, processor price index, and producer price index, can be used to determine the baseline for the price movements along the value chain. Stakeholder views on the anticipated price transmission and profit margin, incremental costs and benefits will aid in understanding how the policy will impact producers and consumers. Further, stakeholder suggestions can help us understand demographic and geographical factors to consider when assessing the impact on household income.

4.2: Assessing administrative impacts

To assess the administrative burden associated with the implementation of the proposed policies the study will employ a Standard Cost Model (SCM). This approach provides a clear and simple framework to follow to assess the net cost of information obligations imposed by EU policies. Under this approach administrative costs will be defined as 'Costs incurred by enterprises, the voluntary sector, public authorities and citizens in meeting legal obligations to provide information on their activities, either to public authorities or to private parties'.

To estimate administrative costs the model will follow the equation - combining: number of activities required, with the time required per activity and the cost per unit of time spent. Based on this, administrative costs will be calculated per change in activity and aggregated according to the type of stakeholder impacted. A key challenge, and potential barrier to the SCM approach, is the reliance on specific cost (EUR or time) estimates. As such, data is being sought through stakeholder engagement (as described in the section below) and drawn from desk-based reviews including comparable policy assessments. A further limitation of the SCM for future policy proposals is the challenge in determining the baseline scenario (i.e. existing administrative burden). In this study baseline administrative costs will be determined primarily through stakeholder engagement. We are therefore focusing on collecting data to identify a 'change' in costs as a result of the policies, rather than the total cost of the administrative burden. Through this method baseline administrative burden will be incorporated into the estimation of future costs.

Data will be sought from stakeholders to understand the change in administrative burden as a consequence of the implementation of the proposed policy options. Administrative costs can be incurred across different stakeholder groups depending on the new, or amended, activity required for compliance with the policy. The three main impacted groups expected to incur administrative burden are categorised as the European Commission, Member State Competent Authorities, and Industrial Actors (including farmers, feed processors, and retailers). Administrative costs are typically grouped into transaction, MRV (monitoring, reporting, verification), and compliance costs.

4.3: Assessing macro-economic impacts

The macro-economic or sectoral impacts will focus on the impact of the different policy options on specific agricultural sectors, such as the arable sector, various livestock sectors and fruit and vegetable sector. The indicators used for the assessment will be impacts on yields, production, consumption, trade and prices, as well as impacts on animal herds and land use (e.g. changes in crop mix). These impacts will be calculated using two simulation models, the economic model AGMEMOD and the agronomic-environmental model MITERRA (including the RotC carbon fixation module). The economic model has as its strengths that it models producer and consumer behaviour based on economic incentives (e.g. prices, taxes, subsidies), whereas the agronomic-environmental model models emissions associated with specific land use and farmer management measures (e.g. fertilization). Both models have a focus on primary agriculture but only to a limited extent include supply chains (e.g. processing industry), although the feed (input stage) part is to some extent included, and also costs for other inputs (e.g. fertilizer, pesticides, energy) are accounted for, be it often in an aggregated way.

The approach will be to run simulations of stylized policy options. This will require to formulate the policy options into a typical scenario. On the one hand this will require sufficient detail in the design in the scenarios because otherwise translation into model-terms (e.g. parameter changes) will be impossible. On the other hand it will require a number of assumptions to be made, because of the lack of information. For that information from stakeholders will be needed (e.g. about the plausibility of having farmers adopting certain practices allowing them to supply CRCF-certificates). Partly the information gap could be filled by insights from the micro-economic assessment (see details below) and by reference to literature and expert knowledge.

In order to 'channel' the assessment and structure the analysis a specific module will be made for assessing the scenarios that will be simulated, which links information at farm level (e.g. adoption of specific practices and technologies) to 'shift-parameters' in the modelling tools (shifters in yield, supply and demand curves as a result of specific policy interventions).