ADEQUACY AND ACCURACY OF PAYMENT CALCULATION FOR CAP ECO-SCHEMES

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ABSTRACT

Based on experience from the danish preparation of cap strategic plans under regulation (eu) 2021/2115, this paper reviews the role of the functionally independent body that has to perform fair, equitable and verifiable payment calculation in advance of commitment or eco-scheme implementation for the 2023-2027 cap. The payment calculations should be made on the basis of additional costs and income foregone (article 82), but also taking into account the target set for the commitment (article 70) or for the eco-scheme (article 31).

The paper reviews the different selected approaches to payment calculations of selected eco-schemes from the danish cap strategic plan and the difficulties with reaching adequacy and accuracy in the light of asymmetric information.

Key words: Payments schemes for environmental services, Asymmetric information, Payment calculations, CAP Strategic Plans, Eco-schemes, Commitments

Purpose

The purpose of this paper is to present insights into design problems in the Danish CAP Strategic Plans for 2023-2027. Furthermore, it is to share reflections on CAP payment calculations for commitments and eco-schemes based on additional costs and income foregone. These reflections come from the perspective of a body that is functionally independent from the authorities responsible for the implementation of the CAP Strategic Plan.

In the coming CAP plan period from 2023-2027, EU Member States shall establish voluntary schemes for the climate, the environment and animal welfare, under Article 31 of regulation (EU) 2021/2115, the so-called eco-schemes, and EU Member States shall include agri-environment-climate commitments among the interventions in their CAP Strategic Plans under Article 70 of regulation (EU) 2021/2115.

A main difference between eco-schemes (Article 31) and commitments (Article 70) is the duration of the farm management commitment. Where eco-schemes are one-year voluntary commitments of active farmers to observe agricultural practices beneficial for the climate, the environment, animal welfare, and combatting antimicrobial resistance. The commitments in Article 70 shall be undertaken for a period of five to seven years and focus on environmental, climate-related and other management commitments.

With respect to payment calculations, payments under both types of commitments are to compensate active farmers for all or part of the additional costs incurred and income foregone as a result of the commitments made, taking into account the targets set. Payments shall be calculated in an adequate and accurate manner, established in advance of implementation and on the basis of a fair, equitable, and verifiable calculation method.

Bodies that are functionally independent from the authorities responsible for the implementation of the CAP Strategic Plan and possess the appropriate expertise should perform the payment calculations or should confirm the adequacy and accuracy of the calculations.

In the author's position as a researcher and project leader for a number of payment calculations carried out for the Danish Agricultural Agency, at a functionally independent institution (University of Copenhagen, Department of Food and Resource Economics), the author has gained insight into the design of selected voluntary payment schemes for agri-environmental services including climate related schemes.

The aim of this paper is to share some of these insights and reflections on policy and mechanism design. The paper is structured as follows: In the following theory section a brief theoretical walk-through of mechanism design under asymmetric information is presented with focus on some central design issues. This is followed by a review of the approach to payment calculations of selected eco-schemes from the Danish CAP Strategic Plans. Finally, the ability to perform adequate and accurate payment calculation in the light of asymmetric information is discussed followed by concluding remarks.

Theory

Ferraro (2008) identifies three general types of payments schemes for environmental services:

Fixed rate payments based on costly-to-fake signals

Screening contracts

Procurement auctions

The voluntary commitments made under Article 31 or 70 can be viewed as fixed rate payments schemes for environmental (or other agricultural) services (PES) delivered by the farmer to the public and paid for by government agencies.

In a perfect world with no information gaps and no tax distortions, government agencies should buy these public goods as long as the marginal benefit of the public good is above the marginal cost of the public good (Samuelson,1954).

In a perfect world with no information gaps, the individual farmers' cost of supplying the public good would be compensated exactly plus a minimal incentive payment (μ), shifting the low cost farmers from being indifferent between the choice of suppling the public good or not (left panel of figure 1), too definitely supplying the public good (middle panel of figure 1). The area of the dotted triangle represents the total budget for government expenditure on the scheme.
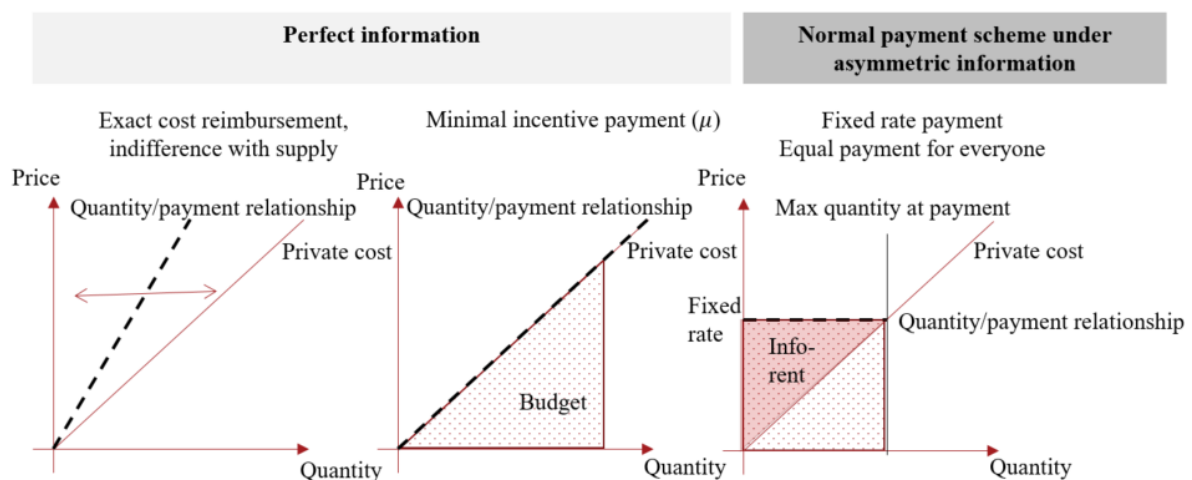

Figure 1: Illustration of PES under perfect and asymmetric information with uniformly distributed private costs

In the real world, there are serious information gaps between farmers and government bodies (asymmetric information). Payment schemes are most often set at a fixed rate payments based on costly-to-fake signals (Ferarro, 2008) per some objective input variable e.g. per hectare. This is the type of payment schemes the EU regulation is targeting and it is also how it is implemented in most cases under the CAP.

Fixed rate payment schemes results in a selection effect, where farmers with cost above the fixed rate will opt out of the scheme. Farmers with cost below the fixed rate will opt in the scheme with varying degrees of profit, called information rents (pink triangle), calculated as the difference between the fixed rate and the opportunity cost of enrolling the specific hectare by the specific farmer (right panel of figure 1). The area of the dotted square represents the total budget for government expenditure on the scheme and equals the area of the dotted triangle in the middle panel. The figure illustrates that in case of asymmetric information quantity, and therefore effect, of the scheme is reduced, while information rent and therefore income (re)distribution is increased.

From an economic welfare perspective, the government should not pay more for additional public goods than the public benefit of the marginal public good. In practice, however, the relation

between the marginal cost and the marginal benefit from environmental schemes is unclear as the marginal benefits are seldom quantified in economic terms.

In the face of asymmetric information, PES programs may be used as instruments of income redistribution and focus on reduction of informational rents may have implications for other goals (Ferraro, 2008) of the broader CAP, e.g. income supplements to the Basic Income Support for Sustainability (BISS).

While the government has incomplete information, it is possible that the government have some information about different types of farmers and the heterogeneity of their cost of supplying public goods from agri-environmental schemes. The design of the scheme thus holds a potential for reduction of informational rents in many cases. On the other hand, the design also hold the potential to mask income redistribution as environmental policy for the ill-informed public and politicians.

Many of the commitments or eco-schemes under the coming CAP are payment schemes promoting agricultural practises that many farmers practice to some degree, even in the absence of payment. What the PES does in these cases is increase the level of the activity that is already there without the scheme. The level of activity already there before the PES is called deadweight.

While paying farmers for activities they would have done anyway may seem inefficient, it may not be possible to identify the farmers that would have done the activities anyway do to asymmetric information. Even if it is possible to identify these farmers, it may be counterproductive, not to pay these farmers. This is because the farmers doing the activity on a voluntary, non-compensated basis may change behaviour, so the total amount of the beneficial activity in a worst-case scenario may fall. It may also be problematic from a fairness point of view, if farmers doing the same thing get very different payment. On the other hand, the fairness of paying the same compensation to farmers with very different costs can also be questioned.

Figure 2 illustrates a distribution of private cost of a beneficial activity in three panels. The left panel illustrates that some farmers may have the beneficial activity without a payment, they may in fact have the activity event in case of a (small) negative payment (a tax). This is the amount called deadweight. The panel also illustrates the possible effect on the beneficial activity, from a payment scheme.

The middle panel of figure 2 illustrates a worst-case scenario of a case where discrimination against deadweight activity is implemented. If farmers with deadweight activity are excluded from payment, but they have the possibility to change their activity, it is likely they will do so, at least on a temporary basis, to break out of the deadweight discrimination.
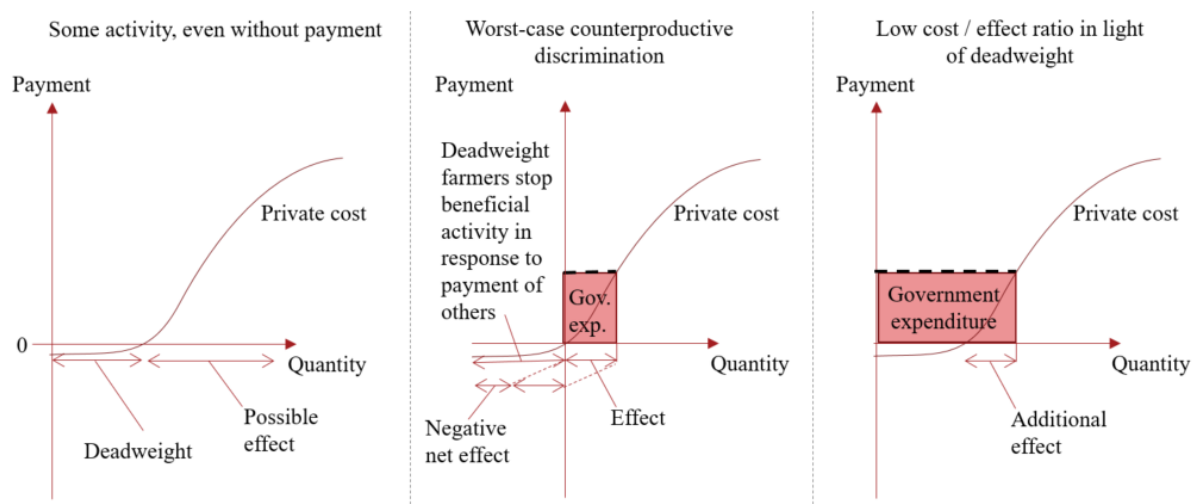
Figure 2: Illustration of deadweight based on normally distributed private costs.

This means that discrimination may be counterproductive, as it - in extreme cases - can result in (temporary) negative net effects. This can especially be a problem when the public value of a beneficial activity is time dependent. For example; the value of biodiversity in permanent grasslands and set-aside are likely to increase over time (Dalgaard, et al, 2020). Discrimination of permanent grasslands, where the farmer has the option to take the land in to agricultural rotation, may incentivise farmers to destroy biodiversity of a higher value (old permanent grasslands), because farmers are incentivized to establish biodiversity of a low value (new set-aside areas or new permanent grasslands).

The right panel of figure 2 illustrates that, if deadweight farmers are payed, the total government expenditure of the scheme will be relatively high, compared to the additional effect of the scheme. It is important to note that information rents are not social costs (assuming no tax distortions), but income redistributions. If the government's main objective of the scheme is effect on the climate, the environment and animal welfare, and not income (re)distribution, the government should try to avoid schemes with large deadweight.

The government could evaluate the benefit of the additional activity divided by the total government expenditure on a scheme. Comparison of this ratio with the ratio of other alternative schemes could be a crude measure of the efficiency of potential schemes. This ratio could also be used in a comparison with estimates of the marginal benefit of the additional activity.

Measuring and comparing benefits between different schemes is not trivial and is beyond the scope of this paper (Schou and Thorsen, 2018). However, even though it is difficult and it relies on value judgements of different dimensions, it is also an important step towards an effective use of government resources for the climate, the environment and animal welfare.

Eco-schemes and payment calculations

According to regulation, (EU) 2021/2115, payment calculations are to focus on compensating active farmers for all or part of the additional costs incurred and income foregone as a result of the commitments made, taking into account the targets set.

Article 82 of regulation (EU) 2021/2115 states that payments shall be calculated in an adequate and accurate manner, established in advance of implementation and on the basis of a fair, equitable and verifiable calculation method.

There are good reasons for establishing the payments in advance, but in a world of risk and uncertainty, this means that compensating additional costs incurred and income foregone should be understood in an approximate manner in respect to expected opportunity costs. This cannot be done in a very accurate manner before the fact. In the light of asymmetric information, this is not even possible after the fact.

Both article 31 and 70 of regulation (EU) 2021/2115 mention payment calculations should be based on additional costs incurred and income foregone as a result of the commitments made, taking into account the targets for the commitments. This is interpreted as a recognition that the payment must compensate the expected opportunity cost of the marginal enrolled hectare in a voluntary scheme, and a recognition of an information rent to the intra marginal hectares in such schemes, where the marginal costs are increasing.

This recognition is new in regulation (EU) 2021/2115 compared to the previous EU regulation, but it does not change the economics of enrolment in voluntary PES type schemes. It has always been the marginal hectare that was compensated due to self-selection. The addition of the "taking into account the targets" phrase in the regulation is seen as an acknowledgement of this economic understanding.

In the light of asymmetric information and uncertainty, fixed rate payment schemes with fixed budgets and targets set are sensitive to inaccurate estimation marginal costs. This is illustrated in figure 3. The left panel illustrates the best case for a fixed rate scheme where the estimated and the actual cost are aligned. In the middle panel cost are under estimated which results in a under utilization of the budget. In the right panel cost are overestimated which results in an over enrolment in the scheme and insufficient funds in the budget leading to problem with who should receive what payment. There are rules for handling these situations in the EU regulation, but it is beyond the scope of this paper.
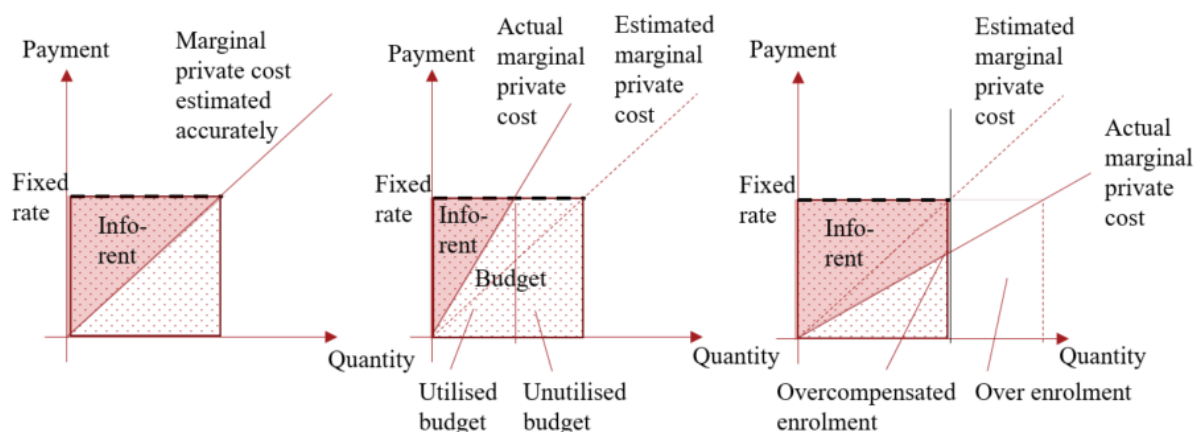
Figure 3: Illustration of sensitivity to inaccurate payment calculations.

Table 1 on the next page presents a comparison of the approaches to the payment calculations of selected eco-schemes from the Danish CAP Strategic Plan.

Table 1. Comparison of the approaches to the payment calculations

Eco-scheme:	*Area payments for organic production*	*Climate and environmentally friendly grasslands*	*Biodiversity and sustainability*
Goal	To promote organic production in Denmark	To promote grassland management that increase the rotation cycles of grasslands (grass for a longer time).	To promote non-productive areas (set-aside) in addition to the 4 % minimum share of arable land devoted to non-productive areas in the GAEC 8
Design	The Danish area payments for organic production is divided in four distinct area payments: A base area payment, A conversion payment, A reduced nitrogen payment and A fruits and vegetables payment.*	Fixed area payment per hectare grassland that is more than two years in the rotation	Fixed area payment per hectare non-productive area above the GAEC 8 requirement. Where farmers commit to devote at least 7 % of arable land to non-productive area the share to be attributed to compliance with the GAEC 8 standard shall be limited to 3 %.
Payment calculation *Request*	What is the additional costs incurred and income foregone as a result of the scheme – "taking into account the target set"? The current organic area was mentioned, but the target was not specified.	What is the additional costs incurred and income foregone as a result of the scheme? – no target mentioned.	What is the additional costs incurred and income foregone as a result of the scheme? – no target mentioned

Payment calculation Method	*Here, focus is on the base area payment and the reduced nitrogen payment.* Statistical / econometric analysis of farm accounting data to identify historical income differences between conventional vs. organic dairy farms and conventional vs. organic crop farms (aside from the subsidy).	Adjusted farm budget estimates for grassland. Farm budget estimates showing average results for the first three years of rotation grass crops were adjusted to year on year farm budget estimates to reflect decrease in yield etc. over time for grass cross and the marginal cost of keeping a field in grass an extra year.	Reporting of other estimates / calculations of the cost of setting arable land aside across different soil and farm types from previous publications
Payment calculation Remarks	Large relevant empirical dataset. Large year on year variation in estimated additional costs incurred and income foregone. Information rent reduced with different payments	Large variation in cost of an additional year across intensive short rotation grasslands and extensive semi-permanent grasslands. Large deadweight.	Lange variation in the opportunity cost of non-productive areas. Fixed rate apparently set without the target in mind.
Source	Pedersen (2020)	Pedersen (2021a) and Pedersen (2021b)	Pedersen (2021a)

Organic area payments

While there is very good data for payment calculations of area payments for organic production, the variation in time is very high which makes prediction of cost differences very uncertain. Organic production operates on rather thin markets, which means that subsidies that stimulate supply, while keeping demand constant, will have an adverse price effect on producers, which actually could increase the additional costs incurred and especially the income foregone, due to lower product prices.

This market integration means that very high political targets may not be viable with production subsidies alone, unless the market for organic products (a market with higher product prices) is virtually destroyed. This means the subsidy rates and the additional costs incurred and the income foregone are dependent on each other in a dynamic way (Pedersen, 2020).

Climate and environmentally friendly grassland management payments

For the eco-scheme "Climate and environmentally friendly grasslands" The Danish Agricultural Agency designed an eco-scheme promoting climate and environmentally friendly grassland management. The scheme targets grassland that is more than two years in the rotation and the objective of the scheme is to extend the rotation cycles of grasslands i.e. the number of years an area is in grass before it is ploughed.

Grassland management in Denmark is generally somewhere between the following two extremes: Intensive rotation grass, with grass for silage in two or three years followed by one to three years

with grain cash corps or corn silage. At the other extreme permanent grasslands that are never rotated or ploughed and reseeded with grass.

In contrast to the organic payment calculations, accounting data could not be used for this analysis. Organic or conventional production affects the entire farm and will be reflected in the farm accounting. Grassland management on the contrary is not reported in accounting, need not be uniform across all fields of the farm, and financial effects in accounting may be masked by variations e.g. stocks of grass silage which may be measured in an imprecise manner in farm financial reports.

Because of this, the payment calculation for this eco-scheme was based on adjusted farm budget estimates for grassland. Farm budget estimates showing the expected average results for the first three years of rotation grass crops (SEGES innovation, 2021) were adjusted to year on year farm budget estimates to reflect the development in yield and protein content of the crop and production costs over time (Pedersen, 2021a, Pedersen 2021b).

Incentivising farmers to increase the age of intensive grasslands is quite expensive. Meanwhile incentivising farmers with extensive grasslands to increase the age of their grassland is quite inexpensive, as this is the management behaviour, they have to begin with.

However introducing a high payment for intensive areas, may incentivise farmers with extensive areas to take these areas into rotation, if the subsidy was exclusive to rotation grasslands (see discussion at figure 2). Large deadweight payments are necessary in this eco-scheme to avoid making counterproductive incentives.

Biodiversity and sustainability

The objective of the biodiversity and sustainability eco-scheme is to promote non-productive areas (set-aside) in addition to the 4 % minimum share of arable land devoted to non-productive areas in the GAEC 8.

In line with results from other commissioned work, the cost of taking different qualities for land out of production was reported. The target level was not communicated in the request so a broad range for costs was reported.

In the Danish CAP Strategic Plan the target for the eco-scheme is set at 50.000 hectares (approximately 2%), on top of the 4% non-productive areas in GAEC 8. However, the payment is set above the average cost of setting aside agricultural land across all qualities of land. This seems a very high payment, taking into account, the target set and it seems likely that this scheme will see over enrolment. The current very high grain prices after the Russian invasion of Ukraine may moderate this.

Discussion and conclusion on adequacy and accuracy in payment calculations

As I (the author) have been involved in the payment calculations, I do not feel in a position to comment on the adequacy of the payment calculation. On the accuracy of the payment calculations, however, I feel it is important to stress that asymmetric information also applies to the functionally independent body that has to perform payment calculation for the national paying agencies. On top of asymmetric information, there is also uncertainty associated with many aspects of the payment calculations. Furthermore, interactions between different payment schemes may affect the opportunity costs of a specific payment scheme. If the information rent is higher in another payment scheme, this affects the opportunity cost of the scheme in question. However, payment calculations are made in advance, without full knowledge of the rates set in other parts of the CAP strategic plan.

The accuracy of the payment calculations, therefore, cannot be high. There are limits to the abilities to predict the farm product prices and farmer response to these prices and policy in the medium term.

Asymmetric information means, that there inevitably is some level of informational rent, but the level of this rent can be mitigated by design of the schemes. This does not seem to have been a key focus in the design of schemes for the Danish CAP Strategic Plan.

In general, governments should not intervene if the market does the job, in the above cases the market does some of the job. This complicates PES design and reduces efficiency. If the government wants effect on climate, environment and animal welfare for the eco-scheme money, then a focus on things that the market does not already partly provide could be recommended to avoid distorting the things that are market is doing, although at a lower level than wanted. Schemes that do something entirely different than the farmer does in the first place, yet contribute to climate, environment or animal welfare may be alternatives that hold great potential.

References

Danish Agricultural Agency (2022). The Danish Strategic CAP Plan 2023-2027
https://lbst.dk/fileadmin/user_upload/NaturErhverv/Filer/Tvaergaaende/CAP2020/Temaside/Den_danske_strategiske_CAP-plan_af_2023-2027.pdf

Dalgaard, T., Jacobsen, M, N., Odgaard, V. M., Pedersen, F. B., Strandberg, B., Bruus, M., Ejrnæs, R., Schmidt, K. I., Johansen, K. V., Callesen, M. G., Pedersen, F. M., Schou, S. J. 2020. Biodiversitetsvirkemidler på danske landbrugs- og skovrejsningsarealer. Aarhus Universitet. DCA – Nationalt Center for Fødevarer og Jordbrug. 198 s. - DCA rapport nr. 178
https://dcapub.au.dk/djfpdf/DCArapport178.pdf

Ferraro, P. J. (2008). Asymmetric information and contract design for payments for environmental services. Ecological Economics, Vol. 65 pp. 810-821.

SEGES Innovation (2020) https://farmtalonline.dlbr.dk/Navigation/NavigationTree.aspx

Schou, J. S., & Thorsen, B. J. (2018). Metoder til værdisætning af miljøgoder. I J. S. Schou, J. Jensen, & B. J. Thorsen (red.), *Sæt pris på naturen* (s. 164-173). Institut for Fødevare- og Ressourceøkonomi, Københavns Universitet. https://www.e-pages.dk/ku/1379/

Pedersen, M. F., (2020). Baggrundsberegninger til brug for fastsættelse af tilskudssatser til økologisk arealtilskud i CAP 2020, 36 s., IFRO Udredning Nr. 2020/06

Pedersen, M. F., (2021a). Beregning af indkomsttab og meromkostninger ved eco-schemes, 42 s., IFRO Udredning Nr. 2020/19

Pedersen, M. F., (2021b). Opdaterede beregninger for kompensationsbehovet under eco-scheme for miljø- og klimavenlig græs i CAP 2020, 19 s., IFRO Udredning Nr. 2021/20

REGULATION (EU) 2021/2115 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013

Samuelson, P. A. (1954) The Pure Theory of Public Expenditure, Review of Economics and

Statistics, 36 (4), pp. 387–89.

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