

Farm income in European agriculture: new perspectives on measurement and implications for policy evaluation

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Abstract

Viable farm households contribute to the resilience of agricultural and food systems. Farm income is a policy-relevant proxy for this viability. Here, we address three key aspects of farm income: first, the *income issue*, focusing on (average) income levels; second, the *variability issue*, focusing on income risks faced by farmers; and third, the *inequality issue*, focusing on the heterogeneity and (in-)equalities of farm incomes. This special issue presents new perspectives on measurement, modelling, development and policies related to the income of farm families in Europe, especially in the light of increasing complexity of farms and policies and risk exposure.

Keywords: Farm income, agricultural income, agricultural policy

JEL Code: Q10, Q12, Q14, Q18

Viable farm households contribute to the resilience of agricultural and food systems (e.g. Darnhofer, 2014; Meuwissen *et al.*, 2019). More precisely, economically and socially viable farms and farm households are a prerequisite to provide a wide range of desired services from agriculture, ranging from the provision of food, environmental goods and services to cultural services such as agricultural landscapes (Swinton *et al.*, 2007). Therefore, governmental support for European agriculture focuses both on the provision of multiple ecosystem services and on ensuring a decent standard of living for farmers (e.g. Erjavec and Lovec, 2017; Matthews, 2013). Thus, appropriate and stable agricultural income levels are policy targets that also reflect the well-being of farm families (Mishra *et al.*, 2002).

In the European Union (EU), the 1992 MacSharry reform constituted a major step in the support of farm incomes in that product support (through prices) was shifted towards producer support (through income support, e.g. via direct payments). Subsequent reform steps of the Common Agricultural Policy (CAP) of the EU increasingly coupled support to specific objectives or functions, for example with respect to environmental and social aspects.

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(e.g. OECD, 2011; Matthews, 2018). Yet, the current policy framework has been found to not adequately address key sustainability issues and to not meet societal demands for environmental performance (e.g. Pe'er *et al.*, 2019). Environmental, social and income goals are inherently interwoven and thus need to be addressed jointly. To monitor different facets of farm incomes and to evaluate the effects of policy interventions on the agricultural sector, agricultural economists have developed a large and sophisticated toolbox and databases (e.g. Esposti and Sotte, 2013; European Court, 2016). This comprises statistical and experimental approaches, various farm-level, agent-based as well as sector models, and a dedicated comprehensive collection of micro-economic data such as the farm accountancy data network (FADN) that covers more than 80,000 farms in the EU (see, e.g., Britz and Witzke, 2012; Reidsma *et al.*, 2018; Thoyer and Préget, 2019).

Following the common perspective in economics, agricultural income can be looked at from two standpoints (e.g. Hill, 2019). First, income can be seen as the value-added amount generated in return for the use of production factors such as labour, land and capital. This summarises surpluses and profits ranging from the farm level to the sector level and reflects the production side of agriculture. Second, income in the agricultural sector can be seen from a farm-household-level perspective, with farm household income determining consumption possibilities of the farm family. Farm household income usually comprises both agricultural and non-agricultural income components, but despite the fact that the disposable income of the farm household would be a key element for assessing the standard of living, such an income indicator does not yet exist (European Court, 2016).

Taking the farm-household-level perspective on agricultural incomes implies that the heterogeneity of farm households must be considered when developing new policies. Income opportunities and thus consumption levels differ across farm households due to heterogeneous endowments with production factors and abilities and skills but also because of the differences in the biophysical environment and national and regional institutions and policies (Hill, 2019) (Figure 1). Overall, strong interlinkages exist between policy measures, external factors and farm-household-level decision, affecting the degree of achievement of the objectives of the agricultural policy and farm household well-being. Not only changes in political and institutional framework conditions, market, weather and climate conditions but also changes in off-farm employment opportunities can lead to highly farm-specific responses (e.g. Reidsma *et al.*, 2010, 2018).

The need to focus on the farm-household-level perspective is also motivated by the social demands on the objectives of agricultural policy measures. For instance, on the part of the public society, it is often supposed that farmers' incomes are structurally lagging behind salaries in other sectors, justifying transfers of payments to the farm community from the general population also in a rural development perspective (e.g. Katchova, 2008; Rocchi *et al.*, 2021). Thus, equity is part of societal preferences for agricultural policies. For example, citizens have been found to prefer subsidising small family farms over very

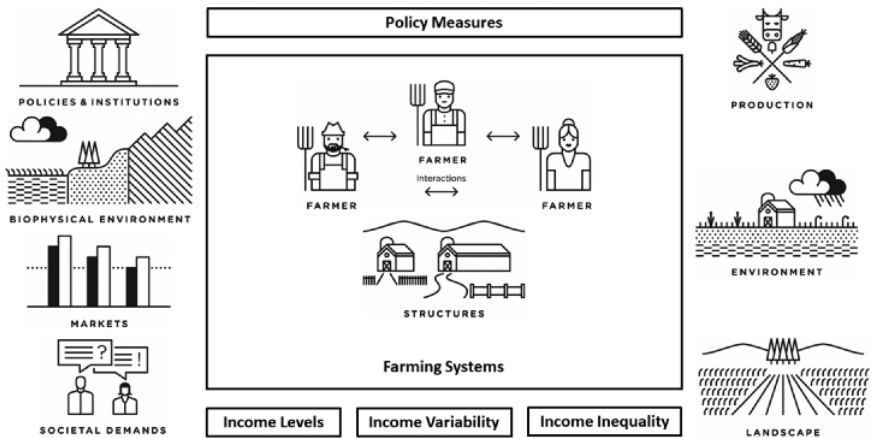


Fig. 1. Farming systems and facets of farm income.

large farms, and there are ongoing discussions on the strong concentration of direct payments (Ellison, Lusk and Briggeman, 2010; Espinosa *et al.*, 2020). A crucial question is whether governmental support and intervention are justified in terms of efficacy in providing outcomes in correspondence with societal demands. In this context, the symbiosis between levels of farm income, the desired farm structure and farm structural change is also worth mentioning. For example, structural gaps in the return to labour effort in the farm vs. the non-farm sector contribute to a continued outflow of labour from agriculture (e.g. Neuenfeldt *et al.*, 2019). While this structural change may partly reduce the farm income problem for the remaining farms, it reduces the number of small farms and thus counters some of the equity goals society asks for. Thus, structural policies and the farm income problem are closely interlinked and require a dynamic appraisal.

Three different facets of farm incomes are especially relevant in the context of agricultural policies (Figure 1).

First, *the income issue*: (average) income levels are a frequently used indicator to proxy the general well-being of farms and the farming sector. Average income levels are often used to assess developments over time and to compare income with non-agricultural households. Sufficiently high and stable incomes are a prerequisite for farms' abilities to provide private and public benefits. In fact, a prosperous agricultural sector encourages technological advances, capacities to adjust production systems and enables conservation (e.g. Sunding and Zilberman, 2001; Hill, 2019).

Second, *the variability issue*: the variability of income over time reflects the income risks faced by farmers. Volatile income levels reduce the well-being of risk-averse farmers and reduce farmers' incentives to produce, invest and innovate (e.g. Sunding and Zilberman, 2001; Gardebroek, 2006; Iyer *et al.*, 2020; Cerroni, 2020). Accordingly, the assessments of risk exposure and risk management is of key interest for researchers and policymakers

(see e.g. Bardaji *et al.*, 2016; Meuwissen, Mey and van Asseldonk, 2018; European Commission, 2017).

Third, *the inequality issue*: the distribution of income across the farm population is relevant to assess the heterogeneity and (in-)equalities of incomes. The inequality issue includes two components. First, income inequality within the farm population. Second, comparisons to non-agricultural sectors. How income inequality is affected by changes in market, environmental and policy conditions is of relevance for the holistic assessment of the sector's well-being and agricultural policies (e.g. Allanson, 2008; Piet *et al.*, 2012; Deppermann, Grethe and Offermann, 2014).

1. New perspectives on farm income needed for appropriate policy evaluation

This special issue aims to provide new perspectives on farm incomes in European agriculture, their measurement, development and policies. New perspectives are needed because farm structures as well as market, biophysical and political framework conditions have changed in a way that results and tools used from the past will result in biased policy inference today. Here we highlight three aspects. First, the increasing complexity of farms. Second, the increasing risk exposure. Third, the increasing complexity of agricultural policies and policy measures.

1.1. First: farms are becoming more complex economic entities

Farms are increasingly characterised by multiple income sources and can be highly heterogeneous in terms of structure, technologies and goals. For example, income sources beyond the production and marketing of agricultural goods such as farm-connected 'nonfarm' activity (e.g. from agri-tourism and energy production) as well as off-farm work are of high and increasing importance for many European farm households (e.g. Kimhi, 2009; Hyytiä, 2013; El Benni and Finger, 2013; Meraner *et al.*, 2015). Moreover, cooperation across farms and along value chain creates new types of business models. In fact, farms increasingly are multi-business operations and may consist of multiple legal entities. The term 'Complex Farms' is used in this context to describe situations of increasing complexity of farming meaning that the assumption of 'a farm has one location, one farmer that supports one household' is an outdated concept (National Academies of Sciences, Engineering, and Medicine, 2019; Poppe and Vrolijk, 2019). Along these lines, multiple ownership (one person owns multiple farm) and dispersed ownership (several owners of one farm) situations as well as geographical dispersion of farms (including operations in different countries) and more complex labour use situation (e.g. farm managers that are not the owner, increasing role of contracted work) also emerge increasingly in Europe (e.g. Offermann, Forstner and Weiss, 2013; Poppe and Vrolijk, 2019). On the other hand, very small farms are also highly relevant in many parts of Europe, including a wide range of farm types such as subsistence,

part-time and hobby farms (see [Guarín *et al.*, 2020](#), for a recent classification). This contributes to a high and increasing complexity of farms.

More generally, farm structures have also developed in highly heterogeneous systems. For example, the use of technologies differs substantially across farms, affecting the ability of farms respond to climatic, market and policy stimuli (e.g. [Sauer and Morrison, 2013](#)). The increasing heterogeneity leads to a co-existence of firms with different goal functions, priorities and strategies (e.g. production focusing on niche markets vs. producing high quantities) and different organisational structures.

This increasing complexity of farm and farm structures require new data, methods and tools for measuring incomes and evaluate policies. Currently used standard measurements of farm income from agricultural production are neither sufficient to infer the economic well-being of farms and farm families nor sufficient to compare it with the non-agricultural population (e.g. [de Mey *et al.*, 2016](#); [European Court, 2016](#)). More specifically, information on the disposable income of agricultural households from different income sources are lacking in databases such as the FADN. Yet, these are needed to compare income levels, income distribution and income risk with the non-agricultural population using the same system boundaries ([Poppe and Vrolijk, 2019](#)). Moreover, the currently used incomplete income information may lead to misleading policy conclusions (e.g. [Ahearn \(2013\)](#), [European Court of Justice, 2016](#)). Additional data would also allow to better analyse the spillovers from agricultural income generation to economies in rural areas at large, e.g. via competition on labour markets. Increasing farm complexity and heterogeneity of farming systems and technologies must also be considered in the design of policies. This is because farm responses to specific policies, like direct payments or agri-environmental policies, are increasingly heterogeneous (e.g. [Gocht and Britz, 2011](#)).

1.2. Second: increasing risk exposure of European farms

The increasing risk exposure of European farms affects farms' economic well-being, increases the demand for innovation in the field of risk management instruments and stimulates policy intervention in this field ([Chavas, 2011](#)). For example, climate change leads to a higher frequency and magnitude of extreme weather events relevant for European agriculture such as heat waves, droughts and heavy rainfalls (e.g. [Trnka *et al.*, 2014](#); [Webber *et al.*, 2018](#)). Moreover, market risks and volatile prices as well as uncertainties due to agricultural and environmental policy environments (policy risk) are crucial for European farms (e.g. [Tangermann, 2011](#); [Meraner and Finger, 2019](#)). As a response, the last CAP reforms strongly emphasised the policy interest in supporting farmers' risks management and introduced new support measures (e.g. [El Benni, Finger and Meuwissen, 2016](#); [Di Falco *et al.*, 2014](#); [Bardaji *et al.*, 2016](#); [European Commission, 2017](#); [Meuwissen *et al.*, 2018](#)) Several new insurance mechanisms have been developed and mainstreamed in countries like the United States and Canada in recent years (e.g. revenue and margin insurance,

area yield and weather index insurance, income insurances) (Glauber, 2013; Turvey, 2012). Yet, the emergence of new insurance mechanisms in Europe is slow and there is a lack of efficient insurance solutions to cope with systemic but increasingly relevant climatic risks such as droughts and heat waves (Bardaji *et al.*, 2016; Meuwissen, Mey and van Asseldonk, 2018; Vroege, Dalhaus and Finger, 2019).

To better understand farmers' responses to risks and potential adoption risk management tools, the effective risk exposure at farm and farm-household level as well as risk perception and preferences need to be considered. In fact, farmers often do require high subsidisation to buy insurance (e.g. Babcock, 2015; Menapace, Colson and Raffaelli, 2015), which may partly be explained by the high diversity of income sources in many European farming systems that contributes to a lower demand for insurance solutions (Enjolras and Sentis, 2011). Moreover, shocks in one income source are often 'balanced' with adjustments in other non-agricultural household income components and consumption (e.g. de Mey *et al.*, 2016). Furthermore, the interdependencies of increasing policy intervention in risk management and other relevant policy dimensions must be considered. For example, subsidising insurance solutions may affect environmental performance of farms, e.g. by increasing fertiliser and pesticide use (e.g. Möhring *et al.*, 2020a, 2020b; Weber, Key and O'Donoghue, 2016). Moreover, the potential distributional implications of changing risk exposure in combination with policy measures must be taken into account in policy evaluation. For example, the subsidisation of risk management solutions also affects income levels and income inequality (e.g. Finger and El Benni, 2014).

1.3. Third: increasing complexity of agricultural policies and policy measures

Agricultural policies and policy measures became increasingly complex. Compared to previously used market and price support measures, policies are increasingly more targeted to specific policy goals and tailored to specific farms. For instance, with the 2013 reform, direct payments in the Common Agricultural Policy of the EU were partly coupled to specific environmental objectives or functions and also comprise *redistributive payments* granting farmers additional support for the first hectares of farmland and aim for more equity in the distribution of support. In Switzerland, cross-compliance became an obligation to receive direct payments as early as 1999, and since 2014, all direct payment programmes are explicitly targeted to specific policy objectives (Mann and Lanz, 2013). More generally, agricultural policy measures are increasingly aimed at incentivising certain types of farm and farm-household behaviours such as agri-environmental payments targeting the provision of ecosystem services (Plieninger *et al.*, 2012).

Even though the relevance of governmental support via direct payments, market support and border protection for agricultural incomes in Europe is decreasing, it is still substantial. For example, the Producer Support Estimate

for the EU at large is ca. 20 per cent on average. While there is some range within the EU (e.g. ranging from 7 per cent in the Netherlands to 32 per cent in Latvia), other European countries outside of the EU like Switzerland (52 per cent) and Norway (62 per cent) have substantially higher Producer Support Estimates (Mitchell and Baker, 2019).

It is crucial to understand the interlinkages of different policy measures with farm-level (e.g. input allocation decisions) and farm-household-level decisions (e.g. off-farm labour allocation) when evaluating the effects of policies. For example, the effect of direct payments on income levels has been found to be highly context-specific, e.g. whether coupled or decoupled payments are assessed (e.g. Biagini, Antonioli and Severini, 2020). Also the effect of agricultural support on income inequality can be ambiguous. For instance, while some direct payments may favour income generation at large vis-à-vis smaller farms (e.g. if the cost for providing some services or adopting certain practices is lower at larger farms due to scale effects), smaller farms may also benefit from specific policies.

To evaluate the effect of the complex agricultural policy system on farm incomes, perspective changes are needed. For example, farm incomes shall be increasingly looked at from the consumption perspective. This implies that data on farm households' disposable incomes must be collected in order to assess the economic and social well-being of farm families (European Court, 2016). Along these lines, taking wealth instead of income perspectives can shed different lights on consumption, inequality and stability issues (Gallusser and Krapf, 2019). Increasing complexity of policies and farm and farm-household behaviours also needs to be considered in modelling approaches at farm, regional and sector levels (e.g. Reidsma *et al.*, 2018; Huber *et al.*, 2018). Qualitative and experimental approaches add valuable perspectives not only for policy assessments but also for the improvement and enrichment of statistical and modelling tools (see, e.g., Thoyer and Préget, 2019; Colen *et al.*, 2016). Finally, income-related assessments of policies need to be expanded, accounting also for additional sustainability indicators, especially tapping on environmental and social dimensions. To this end, for example, the FADN, model assessments and other sources shall be expanded (e.g. Uthes, Kelly and König, 2020). Furthermore, while all policy measures taken together should allow farm families a decent standard of living, the formulation of clear income targets and appropriate evaluation frameworks would allow assessing the specific income transfer effect of all these measures and should therefore be developed.

2. Paper in this special issue

Based on this background, the papers presented in this special issue make novel contributions to the measurement, development and policies regarding farm income in European agriculture. The proposed papers add to the literature by (i) proposing new methodological and conceptual approaches, (ii) presenting new cross-country comparisons and (iii) providing new insights into

farm-level behaviours and responses to policies as well as sector-level implications. The papers advance conceptual, methodological and policy perspectives with relevance for European agriculture.

More specifically, papers in this special issue propose valuable methods to analyse the heterogeneity of farm performance across farms and time (Renner, Sauer and El Benni, 2021) and the respective heterogeneity of farm-level response to policies (Los, Gardebroek and Huirne, 2021). These contributions provide new methodological insights into how the heterogeneity of farms and farm technologies can be accounted for in policy analysis using case studies from Switzerland and the Netherlands. Moreover, this special issue provides insights into the EU-wide redistributive impacts of CAP reforms across the EU (Hanson, 2021) as well as the redistributive impacts of CAP payments in France (Piet and Desjeux, 2021). These contributions propose new methods to redistributive impacts of direct payments and provide novel large-scale assessments on how policy reforms affected income inequality within the agricultural sector. Furthermore, this special issue provides a new perspective on the interdependency of farm structure and rural labour markets (Wuepper, Wimmer and Sauer, 2021). More specifically, this paper uses a German case study to investigate if family farms reduce rural unemployment. Finally, this special issue shows how new insurance solutions based on satellite imagery can help farmers to cope with an increasing drought risk exposure (Vroege *et al.*, 2021).

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Conflict of Interest

The authors declare that they have no conflict of interest.

References

- Ahearn, M. (2013). Challenges in collecting data from complex farm operations: review of perspectives from an international conference. In: *Pacioli 20: Complex Farms and Sustainability in Farm Level Data Collection*, The Hague: LEI Wageningen UR, pp. 51–63.
- Allanson, P. (2008). On the characterisation and measurement of the redistributive effect of agricultural policy. *Journal of Agricultural Economics* 59: 169–187.

- Babcock, B. A. (2015). Using cumulative prospect theory to explain anomalous crop insurance coverage choice. *American Journal of Agricultural Economics* 97: 1371–1384.
- Bardaji, I., Garrido, A., Blanco, I., Felis, A., Sumpsi, J. M., García-Azcárate, T., Enjolras, G. and Capitanio, F. (2016). Research for agri committee; state of play of risk management tools implemented by member states during the period 2014–2020: National and European frameworks. [https://www.europarl.europa.eu/RegData/etudes/STUD/2016/573415/IPOL_STU\(2016\)573415_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2016/573415/IPOL_STU(2016)573415_EN.pdf) (accessed 08 February 2021).
- Biagini, L., Antonioli, F. and Severini, S. (2020). The role of the common agricultural policy in enhancing farm income: a dynamic panel analysis accounting for farm size in Italy. *Journal of Agricultural Economics* 71: 652–675.
- Britz, W. and Witzke, P. (2012). CAPRI model documentation 2012. In: *Institute for Food and Resource Economics*. Bonn: University of Bonn.
- Cerroni, S. (2020). Eliciting farmers' subjective probabilities, risk, and uncertainty preferences using contextualized field experiments. *Agricultural Economics* 51: 707–724.
- Chavas, J. P. (2011). Agricultural policy in an uncertain world. *European Review of Agricultural Economics* 38: 383–407.
- Colen, L., Gomez Y Paloma, S., Latacz-Lohmann, U., Lefebvre, M., Préget, R. and Thoyer, S. (2016). Economic experiments as a tool for agricultural policy evaluation: insights from the European CAP. *Canadian Journal of Agricultural Economics/Revue Canadienne D'agroeconomie* 64: 667–694.
- Darnhofer, I. (2014). Resilience and why it matters for farm management. *European Review of Agricultural Economics* 41: 461–484.
- de Mey, Y., Wauters, E., Schmid, D., Lips, M., Vancauteren, M. and Van Passel, S. (2016). Farm household risk balancing: empirical evidence from Switzerland. *European Review of Agricultural Economics* 43: 637–662.
- Deppermann, A., Grethe, H. and Offermann, F. (2014). Distributional effects of CAP liberalisation on western German farm incomes: an ex-ante analysis. *European Review of Agricultural Economics* 41: 605–626.
- Di Falco, S., Adinolfi, F., Bozzola, M. and Capitanio, F. (2014). Crop insurance as a strategy for adapting to climate change. *Journal of Agricultural Economics* 65: 485–504.
- El Benni, B. and Finger, R. (2013). The effect of agricultural policy reforms on income inequality in Swiss agriculture—an analysis for valley, hill and mountain regions. *Journal of Policy Modeling* 35: 638–651.
- El Benni, N., Finger, R. and Meuwissen, M. P. (2016). Potential effects of the income stabilisation tool (IST) in Swiss agriculture. *European Review of Agricultural Economics* 43: 475–502.
- Ellison, B. D., Lusk, J. L. and Briggeman, B. C. (2010). Taxpayer beliefs about farm income and preferences for farm policy. *Applied Economic Perspectives and Policy* 32: 338–354.
- Enjolras, G. and Sentis, P. (2011). Crop insurance policies and purchases in France. *Agricultural Economics* 42: 475–486.
- Erjavec, E. and Lovec, M. (2017). Research of European Union's Common Agricultural Policy: disciplinary boundaries and beyond. *European Review of Agricultural Economics* 44: 732–754.
- Espinosa, M., Louhichi, K., Perni, A. and Ciaian, P. (2020). EU-wide impacts of the 2013 cap direct payments reform: a farm-level analysis. *Applied Economic Perspectives and Policy* 42: 695–715.
- Esposti, R. and Sotte, F. (2013). Evaluating the effectiveness of agricultural and rural policies: an introduction. *European Review of Agricultural Economics* 40: 535–539.

- European Commission. (2017). Risk management schemes in EU agriculture; dealing with risk and volatility. https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/trade/documents/agri-market-brief-12_en.pdf (accessed 08 February 2021).
- European Court. (2016). Is the Commission's system for performance measurement in relation to farmers' incomes well designed and based on sound data? Special report of the European Court of Auditors, Luxembourg. https://www.eca.europa.eu/Lists/ECADocuments/SR16_01/SR_FARMERS_EN.pdf. (accessed 08 February 2021).
- Finger, R. and El Benni, N. (2014). A note on the effects of the income stabilisation tool on income inequality in agriculture. *Journal of Agricultural Economics* 65: 739–745.
- Gallusser, D. and Krapf, M. (2019). Joint income-wealth inequality: an application using administrative tax data. Working Paper 7876. CESifo.
- Gardebroek, C. (2006). Comparing risk attitudes of organic and non-organic farmers with a Bayesian random coefficient model. *European Review of Agricultural Economics* 33: 485–510.
- Glauber, J. W. (2013). The growth of the federal crop insurance program, 1990–2011. *American Journal of Agricultural Economics* 95: 482–488.
- Gocht, A. and Britz, W. (2011). EU-wide farm type supply models in CAPRI—how to consistently disaggregate sector models into farm type models. *Journal of Policy Modeling* 33: 146–167.
- Guarín, A., Rivera, M., Pinto-Correia, T., Guiomar, N., Šūmane, S. and Moreno-Pérez, O. M. (2020). A new typology of small farms in Europe. *Global Food Security* 26: 100389.
- Hanson, A. (2021). Assessing the redistributive impact of the 2013 CAP reforms: an EU-wide panel study. *European Review of Agricultural Economics*. This special issue. <https://doi.org/10.1093/erae/jbab006>
- Hill, B. (2019). *Farm Incomes, Wealth and Agricultural Policy*. London: Routledge.
- Huber, R., Bakker, M., Balmann, A., Berger, T., Bithell, M., Brown, C., Grêt-Regamey, A., Xiong, H., Le, Q. B., Mack, G., Meyfroidt, P., Millington, J., Müller, B., Polhill, J. G., Sun, Z., Seidl, R., Troost, C. and Finger, R. (2018). Representation of decision-making in European agricultural agent-based models. *Agricultural Systems* 167: 143–160.
- Hyttiä, N. (2013). Farm diversification and regional investments: efficient instruments for the CAP rural development targets in rural regions of Finland? *European Review of Agricultural Economics* 41: 255–277.
- Iyer, P., Bozzola, M., Hirsch, S., Meraner, M. and Finger, R. (2020). Measuring farmer risk preferences in Europe: a systematic review. *Journal of Agricultural Economics* 71: 3–26.
- Katchova, A. (2008). A comparison of the economic well-being of farm and nonfarm households. *American Journal of Agricultural Economics* 90: 733–747.
- Kimhi, A. (2009). Demand for on-farm permanent hired labour on family holdings: a comment. *European Review of Agricultural Economics* 36: 447–452.
- Los, E. J., Gardebroek, C. and Huirne, R. B. M. (2021). Climate policies and the importance of firm specific responses: an application in Dutch horticulture. *European Review of Agricultural Economics*. This special issue. <https://doi.org/10.1093/erae/jbab004>
- Mann, S. and Lanz, S. (2013). Happy Tinbergen: Switzerland's new direct payment system. *EuroChoices* 12: 24–28.
- Matthews, A. (2013). Greening agricultural payments in the EU's Common Agricultural Policy. *Bio-based and Applied Economics* 2: 1–27.
- Matthews, A. (2018). *The EU's Common Agricultural Policy Post 2020: Directions of Change and Potential Trade and Market Effects*. Geneva: International Centre for Trade and Sustainable Development (ICTSD).

- Menapace, L., Colson, G. and Raffaelli, R. (2015). A comparison of hypothetical risk attitude elicitation instruments for explaining farmer crop insurance purchases. *European Review of Agricultural Economics* 43: 113–135.
- Meraner, M., Heijman, W., Kuhlman, T. and Finger, R. (2015). Determinants of farm diversification in the Netherlands. *Land Use Policy* 42: 767–780.
- Meraner, M. and Finger, R. (2019). Risk perceptions, preferences and management strategies: evidence from a case study using German livestock farmers. *Journal of Risk Research* 22: 110–135.
- Meuwissen, M. P., Mey, Y. D. and van Asseldonk, M. (2018). Prospects for agricultural insurance in Europe. *Agricultural Finance Review* 78: 174–182.
- Meuwissen, M. P. M., Feindt, P. H., Spiegel, A., Termeer, C. J. A. M., Mathijs, E., de Mey, Y., Finger, R., Balmann, A., Wauters, E., Urquhart, J., Viagini, M., Zawalińska, K., Herrera, H., Nicholas-Davies, P., Hansson, H., Paas, W., Slijper, T., Coopmans, I., Vroege, W., Ciechomska, A., Accatino, F., Kopainsky, B., Poortvliet, P. M., Candell, J. J. L., Maye, D., Severini, S., Senni, S., Soriano, B., Lagerkvist, C. J., Peneva, M., Gavrilescu, C. and Reidsma, P. (2019). A framework to assess the resilience of farming systems. *Agricultural Systems* 176: 102656.
- Mishra, A. K., El-Osta, H. S., Morehart, M. J., Johnson, J. D. and Hopkins, J. W. (2002). Income, wealth, and the economic well-being of farm households. Agricultural Economic Report No. (AER-812). US Department of Agriculture.
- Mitchell, I. and Baker, A. (2019). New estimates of EU agricultural support: an “Un-Common” agricultural policy. <https://www.cgdev.org/publication/new-estimates-eu-agricultural-support-un-common-agricultural-policy>, accessed 24 December 2019.
- Möhring, N., Dalhaus, T., Enjolras, G. and Finger, R. (2020a). Crop insurance and pesticide use in European agriculture. *Agricultural Systems* 184: 102902.
- Möhring, N., Ingold, K., Kudsk, P., Martin-Laurent, F., Niggli, U., Siegrist, M., Studer, B., Walter, A. and Finger, R. (2020b). Pathways for advancing pesticide policies. *Nature Food* 1: 535–540.
- National Academies of Sciences, Engineering, and Medicine. (2019). *Improving Data Collection and Measurement of Complex Farms*. National Academies Press, Washington, DC.
- Neuenfeldt, S., Gocht, A., Heckelei, T. and Ciaian, P. (2019). Explaining farm structural change in the European agriculture: a novel analytical framework. *European Review of Agricultural Economics* 46: 713–768.
- OECD. (2011). *Evaluation of Agricultural Policy Reforms in the European Union*. OECD Publishing, Paris.
- Offermann, F., Forstner, B. and Weiss, M. (2013). Increasing importance of ‘new forms’ of agricultural holdings in Germany and its impact on collection of information for labour use in FADN. In: *21st PACIOLI Workshop*. Sweden, 22–25 September 2013.
- Pe’er, G., Zinngrebe, Y., Moreira, F., Sirami, C., Schindler, S., Müller, R., Bontzorlos, V., Clough, D., Bezák, P., Bonn, A., Hansjürgens, B., Lomba, A., Möckel, S., Passoni, G., Schleyer, C., Schmidt, J. and Lakner, S. (2019). A greener path for the EU Common Agricultural Policy. *Science* 365: 449–451.
- Piet, L., Latruffe, L., Le Mouél, C. and Desjeux, Y. (2012). How do agricultural policies influence farm size inequality? The example of France. *European Review of Agricultural Economics* 39: 5–28. <https://academic.oup.com/erae/article/39/1/5/412701?login=true>
- Piet, L. and Desjeux, Y. (2021). New perspectives on the distribution of farm incomes and the redistributive impact of CAP payments. *European Review of Agricultural Economics*. This special issue. <https://doi.org/10.1093/erae/jbab005>

- Plieninger, T., Schleyer, C., Schaich, H., Ohnesorge, B., Gerdes, H., Hernández-Morcillo, M. and Bieling, C. (2012). Mainstreaming ecosystem services through reformed European agricultural policies. *Conservation Letters* 5: 281–288.
- Poppe, K. J. and Vrolijk, H. C. J. (2019). How to measure farm income in the era of complex farms. In: *Paper Prepared for Presentation at the 171th EAAE Seminar 'Measuring and Evaluating Farm Income and Well-Being of Farm Families in Europe - Towards a Shared and Broader Approach for Analysis and Policy Design?'*. Taenikon, Switzerland, 5th–6th September 2019. <https://library.wur.nl/WebQuery/wurpubs/fulltext/500005>. accessed 23 April 2020.
- Reidsma, P., Ewert, F., Lansink, A. O. and Leemans, R. (2010). Adaptation to climate change and climate variability in European agriculture: the importance of farm level responses. *European Journal of Agronomy* 32: 91–102.
- Reidsma, P., Janssen, S., Jansen, J. and van Ittersum, M. K. (2018). On the development and use of farm models for policy impact assessment in the European Union—a review. *Agricultural Systems* 159: 111–125.
- Renner, S., Sauer, J. and El Benni, N. (2021). Why considering technological heterogeneity is important for evaluating farm performance. *European Review of Agricultural Economics*. This special issue. <https://doi.org/10.1093/erae/jbab003>
- Rocchi, B., Marino, M. and Severini, S. (2021). Does an income gap between farm and nonfarm households still exist? The case of the European Union. *Applied Economic Perspectives and Policy*. <https://doi.org/10.1002/aepp.13116>
- Sauer, J. and Morrison, C. J. (2013). The empirical identification of heterogeneous technologies and technical change. *Applied Economics* 45: 1461–1479.
- Sunding, D. and Zilberman, D. (2001). The agricultural innovation process: research and technology adoption in a changing agricultural sector. *Handbooks of Agricultural Economics* 1: 207–262.
- Swinton, S. M., Lupi, F., Robertson, G. P. and Hamilton, S. K. (2007). Ecosystem services and agriculture: cultivating agricultural ecosystems for diverse benefits. *Ecological Economics* 64: 245–252.
- Tangemann, S. (2011). Risk management in agriculture and the future of the EU's Common Agricultural Policy. International Centre for Trade and Sustainable Development. Issue Paper, 34.
- Thoyer, S. and Préget, R. (2019). Enriching the CAP evaluation toolbox with experimental approaches: introduction to the special issue. *European Review of Agricultural Economics* 46: 347–366.
- Trnka, M., Rötter, R. P., Ruiz-Ramos, M., Kersebaum, K. C., Olesen, J. E., Žalud, Z. and Semenov, M. A. (2014). Adverse weather conditions for European wheat production will become more frequent with climate change. *Nature Climate Change* 4: 637.
- Turvey, C. G. (2012). Whole farm income insurance. *Journal of Risk and Insurance* 79: 515–540.
- Uthes, S., Kelly, E. and König, H. J. (2020). Farm-level indicators for crop and landscape diversity derived from agricultural beneficiaries data. *Ecological Indicators* 108: 105725.
- Vroege, W., Dalhaus, T. and Finger, R. (2019). Index insurances for grasslands—a review for Europe and North-America. *Agricultural Systems* 168: 101–111.
- Vroege, W., Bucheli, J., Dalhaus, T., Hirschi, M. and Finger, R. (2021). Insuring crops from space: the potential of satellite retrieved soil moisture to reduce farmers' drought risk exposure. *European Review of Agricultural Economics*. This special issue.
- Webber, H., Ewert, F., Olesen, J. E., Müller, C., Fronzek, S., Ruane, A. C., Bourgault, M., Marte, P., Ababaei, B., Bindi, M., Ferrise, R., Finger, R., Fodor, N., Gabaldón-Leal, C.,

- Gaiser, T., Jabloun, M., Kersebaum, K. C., Lizaso, J. I., Lorite, I. J., Manceau, L., Moriondo, M., Nendel, C., Rodríguez, A., Ruiz-Ramos, M., Semenov, M. A., Siebert, S., Stella, T., Stratonovitch, P., Trombi, G. and Wallach, D. (2018). Diverging importance of drought stress for maize and winter wheat in Europe. *Nature Communications* 9: 4249.
- Weber, J. G., Key, N. and O'Donoghue, E. (2016). Does federal crop insurance make environmental externalities from agriculture worse? *Journal of the Association of Environmental and Resource Economists* 3: 707–742.
- Wuepper, D., Wimmer, S. and Sauer, J. (2021). Does family farming reduce rural unemployment? *European Review of Agricultural Economics*. This special issue. <https://doi.org/10.1093/erae/jbab002>