Cathal O'DONOGHUE‡[1], Simon DEVISME*[2], Mary RYAN*[3], Ricky CONNEELY, Patrick GILLESPIE*[4] and Hans VROLIJK[5]**

Farm economic sustainability in the European Union: A pilot study

The measurement of farm economic sustainability has received intermittent academic interest in recent times, while the conceptual discussions are often quite limited. Moreover, this concept receives more attention at periods of difficulty for the sector. The measurement of farm viability is an important precondition to enrich these discussions. Therefore, it is necessary to develop more comprehensive and detailed measurement techniques to provide more clarity on viability and vulnerability levels in the sector. This paper refocuses attention on this issue, using a pilot dataset collected at farm level across a range of EU Member States which facilitates the assessment of an additional category of viability, namely that of economically sustainable farms, i.e. farms that are economically vulnerable but which are deemed sustainable by the presence of off-farm income. Differences in viability and economic sustainability across the eight surveyed Member States are shown. The analysis is sensitive to the factors included in the measurement of viability as well as to the threshold income used to define viability. Although this is a pilot study, it enhances our understanding of the factors affecting cross-country evaluation of viability and sustainability, and the policy instruments that could improve viability levels.

Keywords: farm viability, FADN, farm income, opportunity costs

‡ National University of Ireland, Galway, Galway, Ireland.
* Teagasc, Mellows Campus, Athenry, Co. Galway, H65 R718, Ireland. Corresponding author: mary.ryan@teagasc.ie
** Wageningen Economic Research, WUR, Den Haag, the Netherlands.

Introduction

Family farming is the dominant form of farming globally. FAO (2014) estimates that 500 million farms in the world can be classified as family farms, defining family farming based on ownership by an individual, small group or household. These family farms are highly important for a variety of reasons including food security: they supply 80 per cent of the world's food (FAO, 2014) and contribute to the sustainability of rural areas (Brouwer, 2004; Hennessy *et al.*, 2008). Supporting farm viability in 'ensuring a fair standard of living for the agricultural community' is one of the key objectives of the European Union's (EU) Common Agricultural Policy (CAP). Measurement of farm viability, in terms of the achievement of a specific income objective, would appear to be the simple option for determining the effectiveness of this objective. However, with the changing and restructured agricultural sector, the surge in pluriactivity and the growing contribution of other income sources in the EU (EC, 2008), the measurement of farm household income is complex and data demanding.

Family farm viability has been documented globally over several decades (e.g. Commins, 1985; Frawley and Commins, 1996; Argilés, 2001; Slavickienė and Savickienė, 2014). Aggelopoulos *et al.* (2007) modelled the financial viability of farms and discussed the difficulties in the Greek agricultural sector and the necessity to measure farm viability in order to avail of financial aid. Hennessy *et al.* (2008) looked at quantifying the viability of farming in Ireland in the context of the persistence of the small farm problem and the idea that the "most economically and physically disadvantaged farming regions tend to rely most on agriculture as a provider of employment" (p.30). Vrolijk *et al.* (2010) examined farm viability across Europe in the context of the impacts that changes in subsidy payments would have on viability rates. Barnes *et al.* (2014) discussed farm viability as a concept which attempts to understand the criteria for "failure at the farm level and to identify factors which determine a switch from viable to non-viable and the consequences of consistent under-performance in the sector" (p.4).

Viability measurement has received attention at different periods in different areas, often at periods of difficulty within the sector, for example in the recent Greek economic context (Aggelopoulos *et al.*, 2007), and in the Irish context in the 1990s when concern was raised about the impacts of free trade on the sector, to the present day where an economic recession and a consequent loss of off-farm employment has an impact on the viability of farm households.

A key finding of the European Court of Auditors' report on the measurement of farm incomes (ECA, 2003) was that "At the present time the community's statistical instruments do not provide sufficient information on the disposable income of agricultural households to allow an evaluation of the agricultural sectors standard of living" (p.18). Other research has stressed the importance of farm household income (Hill 1999a; OECD 1995, OECD 2003) and this has led to several initiatives to evaluate the feasibility of farm household income statistics. Owing to political resistance and fear of farmer refusal, no systematic collection of farm household income has been achieved, although at national level some countries have been able to monitor household incomes in a more systematic way.

This paper reviews the measurement of farm economic viability internationally and assesses critically the methodologies used. Within the context of the long-term sustainability of agricultural production which encompasses the three pillars of economic, environmental and social sustainability, it particularly addresses the economic sustainability of a sample of farms across the EU. It does this by contributing to the development of a methodology to gain a more detailed understanding of the economic viability of the farm enterprise, while acknowledging the restrictions of available data

[1] http://orcid.org/0000-0003-3713-5366
[2] http://orcid.org/0000-0002-2293-3288
[3] http://orcid.org/0000-0001-8395-6953
[4] http://orcid.org/0000-0002-6928-4772
[5] http://orcid.org/0000-0001-7767-5880

to assess farm household income. The impact of off-farm employment is of particular interest in the context of recent economic turbulence. Indeed, off-farm sources of income can reduce annual variations in farm household income (OECD, 2003). The lack of comparable data to assess the economic viability and sustainability of EU farms is addressed by the utilisation of an international pilot data collection conducted as part of the EU FP7 research project FLINT (Farm-Level Indicators on New Topics in policy evaluation).

Theoretical foundations of farm economic viability

Several different definitions of economic viability are used in the literature. In general, the importance of making a living is the key priority, while some studies also require that returns from on-farm investment should also be evident. Among the factors influencing the definition of farm viability, the key difference, apart from the differing elements included, is the varying emphasis on viability as an opportunity cost measure or as a household welfare measure (Table 1). Researchers in the USA and Canada define viability in terms of meeting the income needs of the farm family (Smale *et al.*, 1986; Scott, 2001; Adelaja, 2004) while European definitions focus on viability as an opportunity cost measure (Frawley and Commins, 1996; Argilés, 2001; Aggelopoulos *et al.* 2007; Hennessy *et al.*, 2008; Vrolijk *et al.*, 2010; Berkum *et al.*, 2016). It may be the case that the availability of household data has facilitated this, with data within Europe being much more widely available at the farm enterprise level as opposed to the household level.

Models that utilise different opportunity costs

As a welfare measure, viability measurement has a parallel in concepts used in the more general welfare, poverty and inequality literature. The welfare measurement literature primarily uses the household as the unit of analysis, defining welfare at this level, often assuming equal welfare for members of the household. Farm viability differs however in that it is primarily a farm income-related concept, rather than a household income concept. The concept of viability is related to the contribution of the farm to the achievement of a particular standard of living. Alternatively, the objective could be regarded in achieving a wider, more general objective such as remunerating farm labour and resources in terms of the minimum wage, an agricultural contracting wage or an average wage. The latter view is chosen by many of the researchers listed in Table 1.

Table 1: Definitions of farm economic viability from the literature.

Location	Reference	Definition of viability
USA	Smale *et al*. (1986) (p.14)	A level of annual cash income sufficient to cover farm operating costs, meet the households minimum consumption needs, replace capital items at a rate that ensures constant serviceability of the capital stock, and finance loan retirement as scheduled.
Ireland	Frawley and Commins (1996) (p.21)	A viable farm (is described) as one having (a) the capacity to remunerate family labour at the average agricultural wage, and (b) the capability to give an additional 5 per cent return on non-land assets.
Canada	Scott (2001) (p.17)	Broad goals are basic livelihood security for farmers, and a return on investment sufficient to encourage investments in quality food production and responsible land stewardship.
Spain	Argilés (2001) (p.96)	Farm viability defined as its ability to remunerate working time put in by family members over a long period at a comparable wage to that available from alternative work, and the contrary for non-viability.
USA	Adelaja *et al*. (2004)	A farm is defined as economically viable when it generates enough revenue from its operations to cover all variable and fixed costs of production, all appropriate family living expenses, and capital replacement costs.
Greece	Aggelopoulos *et al*. (2007) (p.896)	Viable farms are farms which render family farm income per used family human labour unit (HLU) higher than the reference income (the Ministry of Agriculture Development annually determines the reference income as equal to approximately 80 per cent of the comparable income) and use at least 1 HLU.
Ireland	Hennessy *et al*. (2008) (p.17)	An economically viable farm is defined as one having (a) the capacity to remunerate unpaid family labour at the average agricultural wage, and (b) the capacity to provide an additional 5 per cent return on non-land assets – these include the capital value of machinery, livestock and production quotas.
Europe	Vrolijk *et al*. (2010) (p.20)	Financial Viability Categories (in the context of reduced subsidy payments in Europe): Category 1: farming provides a positive income higher than opportunity costs. Category 2: farming provides a positive income, but the rewards for the farmers input of labour and capital is less than he/she could earn in other economic activities. Category 3: farming provides no positive income, but it still provides a positive cash flow. Category 4: farming provides no positive income and no positive cash flow. Category 5: farm income has been negative during the reference period before the reduction of payments.
Lithuania	Savickienė *et al*. (2015) (p.413)	Economic viability of a farm is its capability to survive, live and develop by using the available resources.
Scotland/ Sweden	Barnes *et al*. (2014)	Do not define farm economic viability, however, state: "Whilst Viability must include the ability of business entities to meet their operating expenses and financial obligations, there must be some accommodation for future growth. Ultimately, studies on agricultural viability attempted to understand the criteria for failure at the farm level and identify factors which determine a switch from viable to non-viable and the consequences of consistent under-performance in the sector" (p.4).

Source: own compilation

The most common viability assessment is the comparison of Family Farm Income (FFI) per Family Work Unit with a reference income. There can be large differences between the definition of FFI and the reference income and there is a lack of uniformity in the literature as to the objective of the studies (Table 1). Further examination of this in relation to the viability measurement literature shows the challenge in defining a relevant income threshold. Aggelopoulos *et al.* (2007) points out that the Greek Department of Agriculture sets a threshold every year which is 80 per cent of the comparable income. In Ireland, the Labour Court defined the minimum hourly agricultural wage at EUR 9.33[6].

In Ireland, two variants of the farm viability measure have been used. Frawley and Commins (1996) regard farm viability as a 'multidimensional concept', simplified to be the definition of "(i) economic/income factors and (ii) demographic factors, or more accurately, the age composition of the household" (p.21). This definition is then further distilled to an operational definition of "a viable farm (is described) as one having (a) the capacity to remunerate family labour at the average agricultural wage, and (b) the capability to give an additional 5 per cent return on non-land assets" (p.21). The idea of non-land based assets is quite context-specific in this case as land assets are reluctantly sold in Ireland (Hennessy and Rehman, 2008; Hennessy *et al.*, 2008): less than 0.1 per cent of land is sold on the open market each year. This condition on return on capital occurs in several papers (Frawley and Commins, 1996; Scott, 2001; Hennessy *et al.,* 2008; Vrolijk *et al.,* 2010; Berkum *et al*., 2016). Scott (2001) and Hennessy *et al.* (2008) claim that this condition ensures long-term viability. As long as the return on investment is greater than other investment opportunities (such as bank interest or mutual funds), farmers will continue to invest in farming operations.

Assessments of farm viability

The most common assessment of farm viability is a comparison between the income earned by the family farm and a reference income. Most studies use an income definition similar to the FFI of the Farm Accountancy Data Network (FADN), that is to say 'remuneration to fixed factors of production of the farm (work, land and capital) and remuneration to the entrepreneurs' risks (loss/profit) in the accounting year'. This income represents a return to family labour, management and investment in the farm business. However, some authors use a cash income which can be seen as the approximate cash element of FFI. This definition of income does not take into account depreciation and inventory changes. For example, Smale *et al.* (1986) use this definition "because the household's minimum financial obligations […] must be met with cash expenditures" (p.13). Argilés (2001), in the Spanish context, defines viability as the ability to provide family income and concludes that this should be the case over a long time period. It is argued that the lack of specified income levels throughout the literature is reflective of the necessity to allow for annual fluctuations in comparable income. The addition of a time period attempts to account for yearly fluctuations. Scott (2001) and Hennessy *et al.* (2008) add a condition on return on capital in order to ensure that investments will continue in the farming activity. Several researchers also use a three-year average for the farm income, reducing the income variability and thus assess long-term viability. Barnes *et al.* (2014) use two measures of income: cash income, to assess short-term viability, and net farm income to assess long-term viability. Some authors add conditions on other ratios, such as a dependency ratio (Scott, 2001; Aggelopoulos *et al.*, 2007) of the dependence of farms on subsidies. When analysing the impact of subsidy changes in the EU, Vrolijk *et al.* (2010) strongly link to the ideas of opportunity cost and in their category 1, or optimal level viability, the farm provides a positive income level above the defined opportunity cost.

The income earned by the family differs depending on whether depreciation, taxes and inventory changes are taken into account, and whether off-farm income is taken into account. A challenge in many studies of farm viability is to utilise a broader definition of income, as data with detailed information on farm incomes may not necessarily incorporate other sources of income (Hill, 1999b; ECA, 2003; Hill, 2008).

Some of the reviewed studies suggest that a benchmark of living expenses should be the defined viability threshold. This may be a minimum wage in the agricultural sector, an average of non-agricultural workers' wages, or the value of paid labour. Argiles (2001) uses the average of non-agricultural workers' wages as reference income so as to define a long-term viability threshold. In the Irish definition of farm economic viability (Frawley and Commins, 1996; Hennessy *et al.*, 2008) the average agricultural wage is discussed as part of the viability threshold.

Farm viability and off-farm employment

Off-farm employment is a very important income source for most farm households in the EU (Fuller, 1990; Moxnes Jervell, 1999; Hennessy and Rehman, 2008). Off-farm employment interacts with the notion of farm viability in two ways. The first interaction occurs when a resource unit definition of opportunity cost is utilised. In this case, off-farm employment may reduce on-farm hours and so may affect the denominator often used in the viability metric. The second interaction relates to the impact of non-viability (vulnerability). The presence of off-farm income or other non-farming income sources may provide a mitigating measure from a household welfare point of view. According to Hill (1999b), farm households typically have a range of sources of income, and hence farm income on its own is not an appropriate measure of farm household welfare. Farm households with access to off-farm employment may also have greater resilience against farm income fluctuations. However, while both the presence and level of off-farm income are important, data issues restrict their measurement. As reported by EC (2008) and Hill and Bradley (2015), owing to the sensitive nature of data on total household income, these data are not available at EU level despite several attempts to generate statistics concerning other sources of income in agricultural households. This sensitivity also applied to data collection within the FLINT project, thus we do not have data for total

[6] S.I. No. 164 of 2010, Employment Regulation Order (Agricultural Workers Joint Labour Committee) 2010. Dublin Stationery Office.

household income. Instead, we use a combination of farm income plus the presence of off-farm employment as a proxy for total household income.

Farm viability, sustainability and vulnerability classifications

In Ireland, Commins (1985) noted that by 1978, "approximately one quarter of landowners with holdings of over 5 acres had other jobs besides farming" (p.257), this figure has since increased: DAFM (2012) estimated up to 50 per cent of farms have off-farm income from the holder or spouse. Hennessy *et al.* (2008) noted that loss-making farms may be sustained by off-farm employment and thus classify farms where off-farm employment is present as 'sustainable'. Those that are neither economically viable nor sustainable are classified as economically 'vulnerable'. At EU level, EC (2008) noted that there was an increase in pluriactivity in farming in the past few years. More than one third of EU-27 family farmers were pluriactive farmers in 2008. Pluriactivity was already well developed at the end of the 20th century, as Bryden (1993) already revealed high levels of off-farm work.

While the overarching contextual framework of this analysis is the notion of farm viability, this paper focuses on comparative measures of the economic sustainability classification within the overall farm viability context. The analysis employs a novel approach to overcome the data difficulties associated with comparing farm economic sustainability across the EU by using the pilot FLINT variables which are integrated with the wider FADN dataset for the FLINT pilot farms. This approach provides additional information on the comparative sustainability of a sample of farms across the EU. To the best of our knowledge, the lack of appropriate data has to date precluded such a comparative pilot study.

Methodology

Assessment of farm income

In order to develop a common metric that is comparable across EU Member States, the FADN definition of FFI is utilised in this analysis, i.e. the "remuneration to fixed factors of production of the farm (work, land and capital) and remuneration to the entrepreneur's risks (loss/profit) in the accounting year" (EC, 2015, p.15) and is defined as:

$$FFI = Total\ output - Total\ intermediate\ consumption + Balance\ current\ subsidies\ \&\ taxes - Depreciation + Balance\ subsidies\ \&\ taxes\ on\ investment - Total\ external\ factors$$

Total intermediate consumption represents total specific costs (including inputs produced on the holding) and overheads arising from production in the accounting year. Total external factors cover remuneration of inputs (work, land and capital) which are not the property of the holder (wages, rent and interest paid). As discussed above, this income does not take into account off-farm income, as the relevant data are not collected in FADN.

Choice of farm viability threshold

As already discussed, the viability threshold is one of the key issues in viability analysis. Hennessy *et al.* (2008) used the minimum agricultural wage defined by the Irish Labour Court. However, this wage level is not defined for all EU Member States, therefore cannot be used in a comparative study. The same problem arises for a minimum wage in the wider economy (for example, Finland has no minimum industrial wage). On this basis we have utilised the average wage of full-time employees in the total economy based on OECD data in order to facilitate cross-country comparison of farm incomes to those in other sectors. However, these industrial wages are quite high: for example, the average annual wage in Ireland in 2015 was EUR 47,366, whereas the Irish minimum agricultural wage used by Hennessy and Moran (2015) was EUR 19,167. This is likely to have a big impact on viability results. In order to compare the farm income to an average agricultural income, we employ the wages paid by the farms in the sample. We approximate the annual FADN hourly wage by country as:

$$Annual\ hourly\ paid\ wage = \frac{Paid\ wage}{Paid\ labour\ unit\ (in\ h)}$$

These wages are close to the minimum wages defined nationally and are therefore considered plausible for this analysis.

Measures of farm viability

This section describes the range of viability measures used in this analysis. Hennessy *et al.* (2008) and Hanrahan *et al.* (2014) use three viability classifications: viable, sustainable and vulnerable farms. A farm is classified as viable if the FFI is higher than the average agricultural wage and provides a 5 per cent return on the capital invested in non-land assets, i.e. machinery and livestock. Farms are economically sustainable if they are not viable but either the farmer or the spouse has off-farm employment. Finally, vulnerable farms are neither viable nor sustainable. They do not produce enough profit to be viable and there is no other income.

The broad model of viability is:

$$\frac{Family\ farm\ income - Cost\ of\ own\ capital}{Hours\ worked\ on\ the\ farm} > Threshold\ wage$$

Although the condition on 5 per cent return on non-land assets is relevant in Ireland because of the specific land market, it is not relevant in all countries. Based on Vrolijk *et al.* (2010), we apply a condition on all own assets (total assets – total liabilities): the cost of own capital is defined as a fixed percentage of all own assets (based on long-term ECB interest rates[7]). It is noticeable that farms with a relatively modest income can be viable if they have a small labour input and a low capital investment. On the contrary, farms with a large income may be vulnerable if they have high labour inputs and a significant cost of own capital. Based on the different definitions of farm viability described in previous sections, we apply eight different models of viability (Table 2) which are distinguished on three criteria:

[7] http://sdw.ecb.europa.eu/browseTable.do?node=bbn4864

- *Opportunity cost or farm-level approach*. This approach enables us to see if the farmer would be better off financially to spend an hour working off the farm. The farm-level approach focuses on the farming activity as a whole. If the farm is not viable at the farm level, the farmer would better spend his or her time in another activity (not on their own farm) and invest their capital elsewhere.
- *Condition on cost of own capital (COC)*. The ability to cover the COC enables us to ensure that farmers will be in a position to continue to invest in farming operations. The absence of this condition can be interpreted as farming as a way of life rather than an activity which has to make money.
- *Viability threshold*: Two kinds of thresholds are used here: average wage in the economy or paid wages as observed in FADN. The differences between them are discussed below.

Taking off-farm employment into account in measuring farm economic sustainability

Using the FLINT indicators, it is possible to consider the presence of off-farm employment on the farm, i.e. whether the owner or spouse has an off-farm job. This enables us to distinguish between economically sustainable and vulnerable farms. Here, only data regarding the presence and not the level of contribution of off-farm employment are available.

Data

The FADN dataset is the 'gold standard' of micro-economic data in EU agriculture. However, it includes only information which is directly related to the farm business and this leads to some notable omissions from the farm household's perspective, including education, gender, marital status, household debt (FADN records farm business debts only), number of household members, number of children, whether the farmer has a successor and, critically, off-farm employment. In the context of evaluating CAP objectives (such as farm viability) across the EU, the FLINT project commissioned a pilot survey on a sample of 1,000 farms that are currently within the FADN sample. This survey contains supplementary qualitative and quantitative questions to provide new data for new policy topics (Vrolijk *et al*., 2016).

Some adjustments have been made to account for outliers in the data. We exclude the largest farms with asset values of over EUR 10 m and outliers with very negative asset to income ratios, focusing on farms with moderate loss to capital ratios. The Greek data do not include liability information, so cannot be used to assess the return to capital, which depends upon net asset information in the other countries. About 5 per cent of cases are dropped as a result of these exclusions.

Although the small sample size does not enable us to draw conclusions at a larger scale, the relative values of the components of economic sustainability of farms in eight EU Member States can be compared (Table 3). There are large variations in FFI between farms and also between the countries. The highest average income is achieved in the Netherlands. This is mainly due to high total output. That is also the case in Germany. Ireland shows the second highest average income, because of relatively low intermediate consumption, external factors and depreciation. Spain and Greece have the lowest average incomes. This is due to low output and, in Spain, also because of a high ratio of total intermediate consumption to output. There is a strong variation in COC

Table 2: Models of farm viability.

Model no.	Definition	Opportunity cost or farm level	Presence of cost of own capital	Threshold
1	$(FFI-COC)/Nbhours \geq Avg\ wage\ (h)$	Opportunity cost	COC	Average wage
2	$(FFI-COC)/FWU \geq Avg\ annual\ wage$	Farm level	COC	Average wage
3	$FFI/Nbhours \geq Avg\ wage\ (h)$	Opportunity cost	No COC	Average wage
4	$FFI/FWU \geq Avg\ wage$	Farm level	No COC	Average wage
5	$(FFI-COC)/Nbhours \geq Paid\ wages\ (h)$	Opportunity cost	COC	Paid wage
6	$(FFI-COC)/FWU \geq Paid\ wages$	Farm level	COC	Paid wage
7	$FFI/Nbhours \geq Paid\ wages\ (h)$	Opportunity cost	No COC	Paid wage
8	$FFI/FWU \geq Paid\ wages$	Farm level	No COC	Paid wage

COC: Cost of Own Capital; FFI: Family Farm Income; FWU: Family Work Unit; Nb hours: number of hours worked by unpaid labour units
Source: own compilation

Table 3: Average values of the components of economic sustainability of farms in eight EU Member States.

Component	Member State							
	DE	EL	ES	FI	HU	IE	NL	PL
Number of farms	51	123	127	49	92	59	153	144
FFI (EUR)	27,893	8,452	6,264	24,800	11,222	34,542	60,747	14,746
COC (EUR)	2,664	13,469	4,383	2,490	7,144	10,159	12,070	9,042
Unpaid labour input (h)	2,772	1,574	2,072	2,910	1,463	2,412	3,094	4,456
Unpaid labour input (FWU)	1.17	0.68	1.13	1.32	0.66	1.13	1.33	1.87
Paid labour input (h)	1,485	224	629	538	4,490	154	1,753	910
Paid labour input (AWU)	0.73	0.09	0.31	0.25	2.04	0.08	0.79	0.38
Off-farm employment rate (per cent)	0.63	0.34	0.44	0.43	0.61	0.47	0.58	0.26
Annual paid wage (EUR)	35,360	10,491	18,770	27,786	7,733	21,633	50,786	6,298
Hourly paid wage (EUR)	16.77	4.28	8.12	12.77	3.51	10.23	23.15	2.67
Annual average wage (EUR)	37,613	17,642	27,479	40,893	9,609	47,366	46,384	11,046
Hourly average wage (EUR)	23.69	8.09	14.86	22.85	5.36	22.73	22.20	5.40

Data sources: FADN, FLINT and OECD

between farms and also between countries. For example, the Netherlands has one of the highest COC, due to high investment in machinery assets on these farms.

Regarding the number of worked hours, strong variations are evident between farms and between countries. Polish farms have the highest average number of hours worked by family labour, whereas Hungarian farms have the highest number of hours worked by hired workers. Germany and Hungary have the highest incidence of off-farm and Polish farms have the lowest. Finally, in relation to wages, in most of the countries (except in the Netherlands) the paid wages are lower than the average industrial wages.

Results and discussion

Proportion of economically-viable farms across Member States

Each of the eight farm viability models listed in Table 2 was run on the combined FADN and FLINT dataset to identify the percentages of viable farms (Table 4), represented in Figure 1. It should be kept in mind that these results are only indicative due to the small sample size.

In general, Hungary has the highest farm viability rate, while Spain has one of the lowest viability rates. The former is partially due to the nature of the Hungarian sample, which contains a higher share of large cooperative farms. Greek data are only reported for models excluding the return on capital, due to the fact that liabilities are not reported in the data, so that return on capital reflects gross, not net, capital.

There are particularly strong variations in Greece, Ireland, Finland and Poland, meaning that, for many farms in the sample, the high average wage in the economy compared to paid wages prevents them from being viable. When paid wages are used instead of average wages, the increase in viability rate is higher between the opportunity cost models than between the farm-level models. That is the case in Germany and Spain. This can be explained by a higher difference between hourly and annual wages. Thus, from an opportunity cost perspective, for a farmer who earns more than the paid wages but less than the average, it is preferable to work off-farm and achieve the average wage per hour.

Across models, poorer countries such as Greece, Hungary and Poland have the highest farm viability rates, reflecting lower minimum wage rates. In Hungary, the low labour input and the low average wages in the economy explain the high viability rates. In Poland, they are mainly due to the low average wages in the economy. Western European countries such as Germany, Finland, the Netherlands and Spain have lower viability rates due to the higher benchmark thresholds as a result of higher minimum agricultural and average wages.

This point highlights one of the challenges in making cross-country farm viability comparisons as the paid wages threshold used to calculate viability differs across countries. This is to be expected as the latter are often lower than the average wages. The viability rate is lower in the Netherlands because of a higher threshold of paid wages. Thus, countries with higher farm viability rates are not necessarily those with higher farm incomes, but rather lower opportunity costs of labour.

The level and ranking of viability vary with the choice of definition. For example, Germany has one of the lowest viability levels if one looks at the opportunity cost or rate per hour, but has one of the highest when one looks at the farm level. Most of the time the farms are more viable at farm level than from the opportunity cost perspective. This means that this category of farms is only viable because of the number of hours worked. A high labour input enables them to achieve a high FFI, but they are not viable when examined on a per-hour basis. This is particularly true in Germany, meaning that hours worked is a key element in the viability of these farms.

The viability level is higher for models 5-8 than for 1-4. This is because the benchmark for viability, the average wage paid for agricultural labour, is lower than the average wage in the economy. There is some mobility, due to the relative differences in wage rate, found across countries. Ireland, for example, is ranked second and third lowest for models 2-4 for the average wage, but is ranked among the highest for models 5-7. The Netherlands moves in the opposite direction, as it is ranked higher for average wage and lower ranked for the agricultural wage.

There is less variability between models when the return on capital is considered. The proportion of viable farms is higher in models without a condition on COC. Clearly, it is easier for a farm to be viable if this condition is not taken into account. In Poland, the highest increase is often reached

Table 4: Percentage of viable farms in eight EU Member States according to eight models.

EU Member State	Model number							
	1	2	3	4	5	6	7	8
DE	0.09	0.28	0.10	0.31	0.23	0.31	0.29	0.37
EL			0.31	0.31			0.57	0.56
ES	0.11	0.11	0.18	0.18	0.19	0.18	0.25	0.19
FI	0.05	0.15	0.07	0.15	0.24	0.23	0.26	0.27
HU	0.28	0.45	0.47	0.52	0.50	0.50	0.52	0.52
IE	0.12	0.13	0.16	0.18	0.33	0.33	0.40	0.37
NL	0.19	0.21	0.25	0.25	0.19	0.17	0.24	0.25
PL	0.15	0.15	0.22	0.26	0.26	0.26	0.48	0.46

For details of models see Table 2
Source: own data

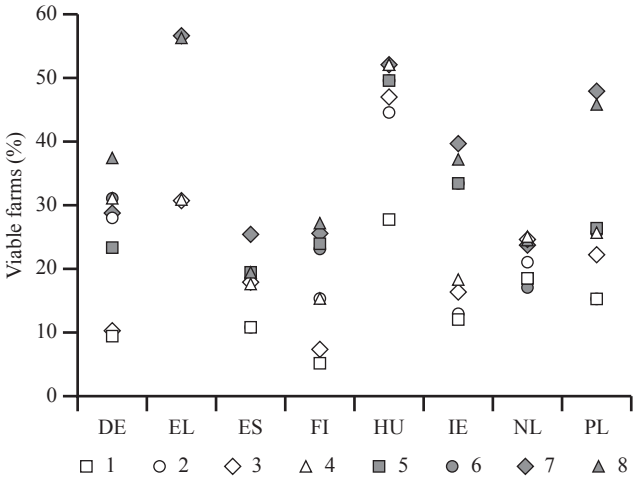

Figure 1: Percentage of viable farms in eight EU Member States according to eight models.

For details of models see Table 2
Source: own data

between models with paid wages, meaning that the condition on the COC plays an important role here. For example, in Poland the difference is about 20 per cent, which means that for 20 per cent of the farms the farmer would be better off to spend an hour working off the farm where his or her wages would not include a condition on COC.

Proportion of economically-sustainable farms across Member States

A similar procedure was undertaken to examine the economic sustainability of farms across the eight Member States (Table 5), represented in Figure 2. There is no strong variation in the rankings of the countries between the different models, so the rankings are firstly described in the context of country differences in the results for model 1, then compared across all models.

In model 1, the share of sustainable farms ranges from 26 (Poland) to 57 per cent (Germany). The countries with the lowest economic sustainability rates are Poland and Greece. This is because these countries have the lowest incidence of off-farm employment. As a corollary to this, Germany, the Netherlands and Hungary have the highest rates of sustainable farms and also have the highest incidence of off-farm employment, with the order changing relatively little if conditioned on being non-viable. Moreover, the difference between the incidence of off-farm employment and the proportion of sustainable farms is less than 13 per cent in these countries. Thus it is evident that many farms would be economically vulnerable without supplementary income from off-farm employment.

Compared to the significant change in the relative rankings in relation to farm viability, there is no strong variation in the proportion of sustainable farms and their ranks between the different models. This can be explained by the fact that off-farm employment is the main variable impacting economic sustainability. The only noticeable difference between models is in terms of thresholds. The proportion of sustainable farms is smaller in models using paid wages, particularly in Ireland. This means that the farms which are no longer viable if we apply paid wages, have an income between the average wage and the paid wage, but also have off-farm income. This may indicate that the paid wage is not sufficient to cover their needs.

Proportion of economically-vulnerable farms across Member States

The final component of the analysis examines those farms that are economically vulnerable as defined above. Again, there are substantial differences across countries and between models (Table 6), represented in Figure 3. The vulnerable

Table 5: Percentage of sustainable farms in eight EU Member States according to eight models.

EU Member State	Model number							
	1	2	3	4	5	6	7	8
DE	0.57	0.49	0.56	0.45	0.53	0.45	0.48	0.41
EL			0.29	0.29			0.23	0.24
ES	0.43	0.43	0.41	0.41	0.41	0.41	0.40	0.41
FI	0.41	0.39	0.41	0.39	0.32	0.32	0.32	0.30
HU	0.49	0.43	0.42	0.40	0.41	0.41	0.40	0.40
IE	0.40	0.39	0.38	0.37	0.27	0.27	0.23	0.26
NL	0.44	0.41	0.41	0.41	0.44	0.45	0.42	0.41
PL	0.26	0.26	0.24	0.22	0.22	0.22	0.17	0.17

For details of models see Table 2
Source: own data

Table 6: Percentage of vulnerable farms in eight EU Member States according to eight models.

EU Member State	Model number							
	1	2	3	4	5	6	7	8
DE	0.33	0.23	0.33	0.23	0.23	0.23	0.23	0.22
EL			0.40	0.40			0.20	0.20
ES	0.46	0.46	0.41	0.41	0.40	0.41	0.35	0.40
FI	0.54	0.46	0.52	0.46	0.44	0.44	0.43	0.43
HU	0.23	0.12	0.11	0.08	0.09	0.09	0.08	0.08
IE	0.48	0.48	0.46	0.45	0.40	0.40	0.37	0.37
NL	0.38	0.38	0.34	0.34	0.38	0.38	0.34	0.35
PL	0.59	0.59	0.54	0.52	0.51	0.52	0.35	0.37

For details of models see Table 2
Source: own data

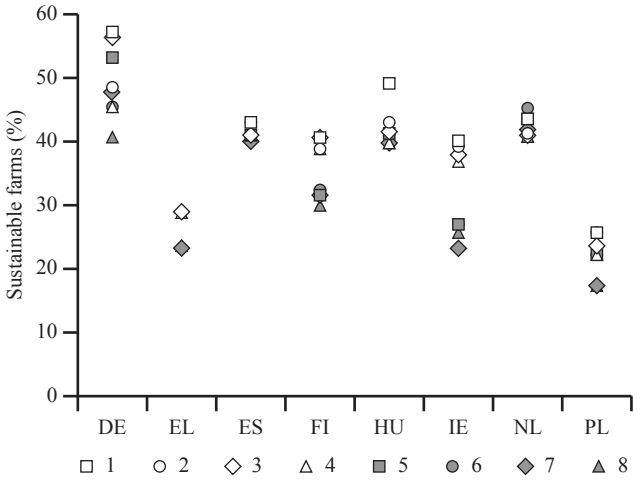

Figure 2: Percentage of sustainable farms in eight EU Member States according to eight models.

For details of models see Table 2
Source: own data

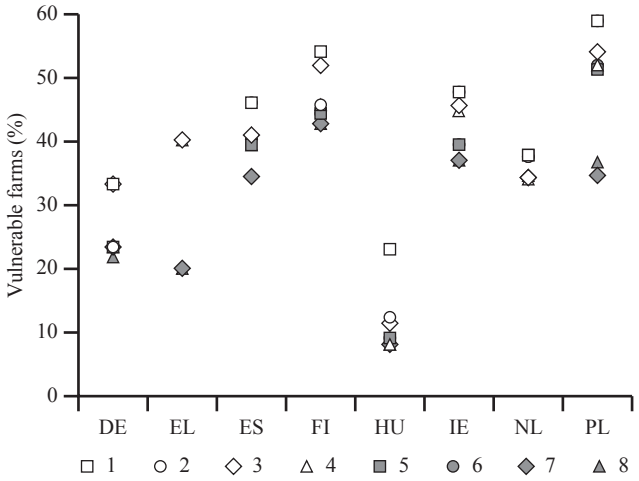

Figure 3: Percentage of vulnerable farms in eight EU Member States according to eight models.

For details of models see Table 2
Source: own data

cohort is the complementary proportion of the previous results. Poland has the highest proportion of vulnerable farms (59 per cent in model 1). Moreover, the low off-farm employment rate explains why most of the farms are not economically sustainable. At the opposite end of the scale, Germany and Hungary have the smallest proportions of vulnerable farms, due to the high proportions of farms classified as sustainable.

Unlike sustainability, vulnerability is affected by changes in the models. A comparison between thresholds shows that there are fewer vulnerable farms with paid wages. The difference in the vulnerability rates assessed with average wage and those assessed with paid wage represents the farms which become viable when the threshold is changed. These farms generate an income between the two wages, but do not have an off-farm job. It can be surmised that either such an income is sufficient for these farmers or they do not want to work off the farm.

In many cases, there is a higher proportion of vulnerable farms when using opportunity cost rather than the farm-level approach. This is the opposite for viability, and sustainability is not impacted. This corroborates our hypothesis that this may represent farms which have a large labour input, preventing the farmers from having an off-farm job. In these cases, the farms generate a sufficient annual income but not a sufficient hourly income.

Conclusions

The measurement of farm economic viability becomes relevant and receives academic interest at different time periods in different areas. During periods of failure or difficulty in the agricultural sector, attention turns toward the measurement of viability with a view to improving the situation given improved methods of measurement. In addition, there is an ongoing and growing need to evaluate CAP and EU Rural Development Programme objectives such as the improvement of farm viability. These needs present challenges to researchers and analysts to develop a farm household income measurement which provides details of the income levels of farm households which could then be analysed relative to other sectors within society. However, a lack of comparable data across EU Member States poses difficulties for meaningful evaluation.

While the comparative cross-country analysis undertaken in this paper is a pilot study, limited by the small sample size, it nonetheless presents a template for future work. The analysis highlights the following factors:

There are substantial differences in viability rates between countries. Some of these are related to national policies. There are a number of different definitional choices that can be used when viability is measured as discussed in this paper. These include the comparator wage which determines the threshold at which viability is determined. Similarly, we can choose whether to incorporate a return on capital, which also affects the viability rate. Lastly, we compare the choice of measuring viability in terms of the opportunity cost of farm resources or as an income measure, comparing farm incomes with an income from another source of employment. With respect to cross-country comparison, we note the importance of the change in both the levels and the rankings of viability between countries, depending upon the measurement choice. It is important therefore in comparing viability across countries to test the sensitivity of results to different measures.

Measuring viability using the current viability definition provides a head count analysis of viability in the country. While the head count measure of viability detailed in this paper is useful in many regards, it lacks detailed results of the issues affecting the non-viable group. More detailed analysis is required to identify different improvement instruments for farms which are in states of chronic vulnerability as opposed to farms which experience less severe vulnerability over a shorter time period.

The results demonstrate the sensitivity of the measures to the use of particular thresholds in the measurement of the viability head counts. In particular, the farm viability rate is sensitive to the threshold or benchmark wage employed. Further work is required at national level to define a comparable threshold metric across the EU. As in the poverty literature, there may be merit in developing measures that are based upon the gap or distance from the threshold as compared to a simple binary measure of being above or below the threshold.

The capacity to evaluate the economic sustainability of farms on the basis of off-farm income, conferred by the use of the FLINT data in this analysis, opens up an important new economic viability classification, by distinguishing between the three categories studied (i.e. economically viable, sustainable and vulnerable farms).

The extension of the FLINT data collection pilot to the wider FADN sample would enable more robust nationally-representative analyses to be undertaken. In addition, the development of additional statistics on other sources of income would present an opportunity to refine the three economic viability categories. Further information on household income would also enable analysis of the relative impact of farm total other incomes on the economic viability categories. Additionally, if data collection was to be undertaken at three- or five-year intervals, a time-series FADN dataset would allow for volatility assessment and the illustration of trends over time, as well as providing an early warning of potential future economic, social or environmental threats. Data collection at a larger scale would also enable the impact of agricultural structures and characteristics of the area on economic sustainability to be studied.

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