



The State of Family Farms in the World

BENJAMIN E. GRAEUB^a, M. JAHİ CHAPPELL^{b,c}, HANNAH WITTMAN^d,
SAMUEL LEDERMANN^e, RACHEL BEZNER KERR^f and BARBARA GEMMILL-HERREN^{a,*}

^a *Food and Agriculture Organization of the United Nations (FAO), Rome, Italy*

^b *Institute for Agriculture and Trade Policy (IATP), Minneapolis, USA*

^c *Washington State University, Vancouver, USA*

^d *The University of British Columbia (UBC), Vancouver, Canada*

^e *Biovision Foundation for Ecological Development, Zurich, Switzerland*

^f *Cornell University, Ithaca, USA*

Summary. — 2014 was the United Nations’ International Year of Family Farming, yet the importance of family farming for global food security is still surprisingly poorly documented. In a review of agricultural census data, we find that globally family farms constitute over 98% of all farms, and work on 53% of agricultural land. Across distinct contexts, family farming plays a critical role for global food production. We present two examples of policy approaches toward family farmers—Brazil and Malawi—to provide insight into some of the complexities and challenges behind the global numbers.

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Key words — family farming, smallholder agriculture, Brazil, Malawi, food and nutrition security, sustainable development

1. INTRODUCTION

The United Nations’ (UN) 2014 International Year of Family Farming provided an opportunity to reflect on the status of family-based agriculture throughout the world in relation to food security, socio-ecological sustainability, and equitable economic development. However, the diversity within this global sector in terms of farm characteristics and position within the global food system creates significant challenges for systematic policy design and development aimed at maximizing global food and nutrition security, secure livelihoods, environmental sustainability, and socioeconomic development (FAO, 2014a; Smith & Haddad, 2015). Recent policy debates at the international and regional levels have seen a shift in how smallholders and family farmers are viewed: from being a part of the hunger problem, to now being central to its solution (HLPE., 2013; McIntyre, Herren, Wakhungu, & Watson, 2009; Silva, 2014).

Within the global food system, the contribution of family farmers to food security and local and regional development is surprisingly poorly documented. FAO’s SOFA report (2014a) estimated, based on an analysis of just 30 countries using the 2000 round of agricultural census data, that there are approximately 500 million family farmers in the world who produce 80% of the world’s food, thus highlighting the need for more accurate accounting and relevant policy analyses. In this paper, we review the policy environment for enabling family farming contributions to food production, food security, and sustainable agricultural development. We then analyze a larger range of international agricultural census data for 105 countries and territories, including newer data from the 2010 round of agricultural census data that together encompass a majority (85%) of the world’s food production. We use regional and country-level contextual definitions for family farms to make the best available estimates to date of the percentage of family farms, percentage of land area under family farming per country as well as the calories produced by family farmers in the sampled countries. We find that family

farms constitute 98% of all farms and at least 53% of agricultural land, thus producing at least 53% of the world’s food. Our work identified 475 million family farms out of 483 million farms in our sample, supporting the SOFA estimate on the existence of at least 500 million family farms (out of a total of 570 million farms) in the world (FAO, 2014a). While we arrive at similar numbers regarding the proportion of farms in the world that are family farms, our larger and newer dataset and more conservative approach to the definition of family farms produces an estimate of 53% for the percentage of agricultural land held by family farmers, a considerable difference from SOFA’s 75%.

Our findings further demonstrate the tremendous diversity of family farms around the world, calling for context-specific policies to support family farmers. Thus, to illustrate the regional diversity and complex challenges facing the family farming sector, we profile the evolving policy environment in two countries that present both very different contexts for family farming, and who have taken distinctly different approaches to providing support for family farmers and smallholders: Brazil and Malawi. In keeping with the understanding that detailed knowledge of local context is necessary to reasonably design and assess policies affecting family farms, these two case studies deal with countries where several of the authors have extensive on the ground research experience. Regarding their contexts, Brazil is a relatively industrialized middle-income country that maintains a significant family farm sector oriented to the domestic market, while also

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playing a key role in the global agri-food sector as a dominant agricultural exporter. In contrast, Malawi is an example of a low-income country, with a majority rural agrarian population, the vast majority of whom are family farming households, experiencing high rates of poverty, chronic food insecurity, and child undernutrition. In composing these profiles, we use best practices for family farming policies derived from existing literature to evaluate the approaches taken in both countries, alongside our own extensive experience and research in each country. We suggest that a much improved measurement, and understanding, of the role of family farmers is needed to inform policies related to food security and sustainable development.

An initial challenge within any review of family farming is that the term itself is not a clearly defined statistical entity at the global or often even national level. The FAO, as part of its strategic planning for the International Year of Family Farming in 2014, defined family farming as:

“a means of organizing agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant on family labor, including both women’s and men’s. The family and the farm are linked, co-evolve and combine economic, environmental, social and cultural functions.”

[FAO, 2013a, p. 2]

A relatively small scale of agricultural operations has often been used as a proxy for family farm ownership. Many organizations, such as the World Bank in its Rural Development Strategy (World Bank, 2003), use landholding size to identify smallholder farmers—the most common being under 2 hectares (Conway, 2011; Salami, Kamara, & Brixiova, 2010; World Bank, 2003). Yet, the Committee on World Food Security’s (CFS) High Level Panel of Experts (HLPE) defines smallholder agriculture as

“practised by families (including one or more households) using only or mostly family labour and deriving from that work a large but variable share of their income, in kind or in cash. Agriculture includes crop raising, animal husbandry, forestry and artisanal fisheries. The holdings are run by family groups, a large proportion of which are headed by women, and women play important roles in production, processing and marketing activities.”

[HLPE, 2013, p. 10]

Both the FAO and the HLPE are clear that the family and smallholder sector cannot be defined solely based on the size of landholdings. The size of an economically viable family farm holding varies by region, production strategy, level of market integration, family structure, access to inputs, technology, and infrastructure, and off-farm labor opportunities. Yet, gaining a better understanding of the family farm sector—beyond the smallholder <2 ha class—is critically needed to better understand its role in global agricultural production for food security and rural development. Indeed, there is a large diversity within this sector, which is largely distinct from the needs of the global agri-business sector with its easier access to infrastructure, capital, and information. Echoing Berdegue and Fuentealba (2011) and subsequent research building on their analysis—e.g., Chappell *et al.*, 2013; Vorley, Cotula, & Chan, 2012—the broad term “family farming” can be divided into at least three groups with differing needs: those that are well-endowed and well-integrated into markets (“Group A”); those with significant assets and favorable conditions but lacking critical elements (like sufficient credit or effective collective action) and who may not qualify for social safety nets (“Group B”); and land-poor farmers, who are primarily characterized by family subsistence/non-market activities and who require significant investment in social safety nets (“Group

C”). Our understanding of family farming includes all three groups, as explained in our methodology section. Following Berdegue and Fuentealba (2011) we suggest that such multi-dimensional characterization of family farmers is useful and necessary, and aligns with the definitions used by the relevant international actors i.e., FAO, CFS HLPE, and represents a significant improvement on the <2 ha cut-off.

One of the main issues impeding efforts to strengthen family and smallholder farmers on the policy and field level, however, has been the effective lack of data on such basic issues as their number or their specific contribution to agricultural production. FAO (2014a) based its analysis on landholding status, counting as family farms those farms that are owned by an individual or a household. Based on Lowder, Skoet, and Singh (2014), FAO (2014a, 2014b) estimated the number of overall agricultural holdings in the world; this analysis of the data in 167 countries from agricultural censuses, estimates that there are 570 million farms. In a separate, smaller sample of 52 countries, Lowder *et al.* (2014), using the land holding status as criteria, found that in all but four countries, more than 90% of farm holdings are family farms. Based on this work, the SOFA Report (FAO, 2014a) thus assumes that at least 90% of the 570 million farms—approximately 500 million farms—are family farms. In a further step, based on the land holding status of farms from 30 countries’ censuses—all farms that are owned by individuals or families count as family farms—they estimate that family farms hold 75% of agricultural land and contribute at least 80% of the world’s food production, following an assumption that small-scale farms are more productive on a per-hectare basis than larger farms. The SOFA report builds on previous efforts in both academic and civil society literature to develop rough estimates—so-called ‘guestimates’. For example, one of the previously most commonly cited statistics is that globally smallholder or peasant farmers produce 50% of the human food supply, and an additional 20% are produced by hunters and gatherers, as well as smallholder fishers (ETC Group, 2009). Our review of the primary sources underlying these earlier guestimates that have been circulated widely in civil society and government reports found little empirical basis for most of the major claims for the role of the family farming sector in global food security and landscape management (e.g., Bailey, 2011; IFAD, 2010; ILO, 2008; Mazoyer, 2001; Naranjo, 2012; Vorley, 2002).

In response, we developed and report here on a new methodology to more accurately assess the global scale and scope of family farmer holdings and their use of land. Our approach to identify family farms in the world more explicitly takes into account regional and country-level differences, while widening the sample size and including newer data from the 2010 round of world agricultural censi. This paper thus identifies key metrics on family farms and their contribution to global agricultural production.

In this paper, we start by summarizing main challenges faced across a diversity of local and national contexts by family farmers, and presenting a range of ‘policy best practices’ aimed to address these challenges. We then report on our analysis of available agricultural census data from 105 units—98 countries and seven territories—to suggest that family farmers are the predominant actors in the global agricultural system, significantly contributing to the world’s agricultural production. Within our sample, they comprised 98% of all agricultural landholdings, manage 53% of total agricultural land, and provide at least 53% of global agricultural production. We conclude by illustrating the importance of effective and appropriately tailored policies and institutions in achieving

food and nutrition security with the critical involvement of a vibrant, family-based agricultural sector. In this context we support the argument that agricultural policy relating to family farmers “requires that each society find the right mix of market forces and government interventions to drive a process of economic growth that reaches the poor” (Timmer, 2014).

2. EVOLUTION AND CHALLENGES IN THE FAMILY FARMING SECTOR

Between the 1950s and 1970s, a global agricultural division of labor emerged as export-oriented development formed the backbone of national agricultural policies in the global South (McMichael, 2009). Subsequent economic crises and structural adjustment programs weakened investment in agricultural infrastructure including research and technical assistance in developing countries (Bello, 2009), resulting in global trends of land consolidation and urbanization (Araghi 1995). Yet, despite the significant transformation of global food supply chains, family farmers still make significant contributions to a global agricultural economy worth approximately US\$2.2 trillion¹ (World Bank, 2014). Considerable research in the past several decades has indicated that the small-scale and family farming sector plays a key role for environmental sustainability and farmer livelihoods (e.g., Chappell *et al.*, 2013), and given the non-market values generated by agriculture (Sandhu *et al.*, 2015), the true contribution to the global economy is likely much larger than the US\$2.2 trillion figure. There is also consistent evidence that small-scale farms can be more productive per unit area (Barrett, Bellemare, & Hou, 2010); may show enhanced stability and resilience (HLPE, 2013; Holt-Gimenez, 2002); generate more jobs and money within local economies (HLPE, 2013; Lyson, Torres, & Welsh, 2001); and harbor more agrobiodiversity and contribute to dietary diversity (HLPE, 2013; Jarvis *et al.*, 2008)—the latter being a key indicator of overall food security (Smith & Haddad, 2015). Thus, the FAO’s High Level Panel of Experts (2013) state

“the fact that smallholder agriculture is able in some cases to outperform large-scale agriculture in terms of yield should be reason enough to concentrate on the question of overcoming the problem of limited or restricted access to factors and inputs to production, rather than to focus on the change of model/scale.”

[p. 46]

However, sharp reductions in public support for agriculture, privatization of farming services, socio-political and economic inequality, and consolidation within the agribusiness sectors have presented escalating challenges for family farmers; ones which likely cannot be addressed without dealing with local histories and contexts, as well as inequalities at international levels (Chappell *et al.*, 2013; Constance *et al.*, 2014). Lack of access to appropriate markets, credit, education and locally appropriate agricultural research and extension can significantly impact family farmers (Berdegué & Fuentealba, 2011; HLPE, 2013).

In their attempts to address the viability of the family farming sector, governments have chosen a range of approaches, with some commonalities in “policy best practices” for supporting the family farm sector:

1. Improve communication and negotiation processes within and between farmer organizations, businesses, social movements, and family farmers to set agricultural priorities; partner in identifying and/or developing, adapting and scaling up innovations (FAO, 2014a; Pretty, 1995; Vorley, 2002).

2. Identify national priorities on the functions and objectives of smallholder and family-based farming, and create policies to foster these efforts (including, *inter alia*, good governance and sound economic policies, secure property rights, and a conducive regulatory framework) (FAO, 2014a; Vorley, 2002).

3. Focus on family farms in agricultural research and development; long-term public commitments to agricultural research that support family farms are essential, recognizing that such research results are important public goods, irreplaceable by private investment. Improved linkages between farmer groups and researchers can ensure a focus on the priorities of family farmers (FAO, 2014a; Sumberg, Thompson, & Woodhouse, 2012).

4. Promote inclusive rural advisory services; agricultural extension services are key to sharing knowledge on innovation and sustainable practices among family farmers (FAO, 2014a).

5. Build innovation capacity through education and training with a special focus on women and youth through education, farmer exchange, and training (FAO, 2014a; Pretty, 1995; Smith & Haddad, 2015).

6. Improve the workings of markets for output, input, and financial services to overcome market failures, including creating environments for fair trade between small farmers and agribusiness, and democratic control over markets (Hazell, Poulton, Wiggins, & Dorward, 2010; Vorley, 2002).

These key success factors range from pointing to especially important areas of intervention—such as research and extension—to more procedural necessities such as creating an overall enabling policy environment and assuring inclusiveness in any process. For national policy efforts to strengthen family farmers to be successful they must address both the right focus areas and use the right processes.

In the subsequent sections, we explain the basis for our analysis of global agricultural census data and then characterize regional diversity and income group comparisons in the number of family farmers and extent of landholdings, as well as relative contributions to global food production. We conclude with an illustrative example of how two distinct agricultural economies—Brazil and Malawi—address challenges faced by the family farming sector in their respective contexts.

3. METHODOLOGY

The FAO Program for the World Census of Agriculture (WCA) provides a methodology to frame and organize agricultural census initiatives in each country. The program started in 1950 and ever since has supported countries to carry out their national agricultural census. Organized in decadal rounds, e.g., 1996–2005, 2006–15, each country is encouraged to carry out at least one census within each round. FAO provides countries with guidelines for the design and scope of their census, but does not prescribe how censuses must be implemented (FAO, 2014b). As the HLPE (2013) has noted: “(i) not all the countries have the means, the interest and the capacities to carry out [an agricultural census using the WCA methodology]: the last completed WCA round [1996–2005] covered 114 countries; (ii) data are not always homogeneous and comparable; they can vary according to the specific focus of each country; and (iii) they are not linked to production statistics.” In many countries, agricultural census data are also not disaggregated by farm size.

Several analyses on smallholder farmers based on sub-sets of the 2000 round of the World Census of Agriculture (WCA) covering censi from 1996 to 2005 data have been published (Berdegué & Fuentealba, 2011; HLPE, 2013). For example, Berdegué and Fuentealba (2011) analyze the smallholder and family farming sector in Latin America based on data from the 2000 round of censi. The HLPE (2013) report on investment in smallholder agriculture provides data on smallholder holdings and the percentage of agricultural land area farmed in 81 countries and territories. For countries without farm size disaggregation, their analyses used the mean of the reported size groups and multiplied it with the number of farmers in each size group (HLPE, 2013). The HLPE report emphasizes the importance of a new deal for food security and nutrition through investments in smallholder agriculture, with the caveat that very limited data on smallholder farming are currently available.

This paper builds on the prior analysis by the HLPE (2013) and Berdegué and Fuentealba (2011), extending it beyond smallholders, and to a global scope, to prevailing concepts of family farmers—despite the challenge of the lack of a single agreed global definition of family farming. Only countries—Argentina, Brazil, Chile, Mexico, Uruguay, and USA—have developed formal definitions of the family farm sector (as discussed below). While these definitions are contextual and country-specific, they share several characteristics across global agricultural contexts, including a *reliance on family labor for farm management and operation* and having the *dominant source of family income derived from agricultural operations*. Farm size comprises a formal part of MERCOSUR family farming definition for Brazil, Uruguay, Chile, Paraguay and Argentina—with upper limits ranging from 50 hectares in Paraguay to, in some cases, up to 1,000 hectares in Uruguay. However, while census data are quite detailed in certain countries, they do not consistently provide information relevant to these metrics across a broad range of countries; in fact, at present, data on reliance on family labor (available in only 15 countries according to FAO, 2014a), income from farm holdings, and family management practices are available for relatively few countries.

In response to these practical constraints we developed the following approach to identify family farms around the world: we have chosen to capture the best available data, prioritizing first those countries that directly report on numbers of family farmers according to an internal definition; secondly from countries where research suggests a proxy criteria for family farmers; thirdly from countries that recognize a category of “smallholders”; and lastly using farm size alone as a criteria. The logic behind this stepwise approach is explained below:

1. Several countries have outlined national, multi-criterion definitions of family farms and have used those definitions in their national census or have used these definitions to analyze their census data. These comprise the countries that have been participating in the MERCOSUR REAF program (Special Committee on Family Agriculture): Argentina (2002), Brazil (2006), Chile (2007), Mexico (2007), Uruguay (2000) and the United States of America (2007).² (see Box 1 for the definitions employed in these countries).

Total: 6 countries

2. For European countries for which data were available within the Farm Structure Survey 2010,³ we used the approach proposed by Davidova and Thomson’s (2013) Background Report for FAO’s Regional Dialogues on

Box 1. *National definitions of family farmers.*

Argentina:

1. The producer works directly on the farm;
2. The producer does not employ non-family permanent labour;
3. The producer may hire temporary non-family labour.
4. Farm not registered as a joint stock company or other type of commercial company.
5. Upper limits of “capital level” that vary by region: farm size, cultivated size of the farm, and size of cattle herd, machinery assets, planted area with fruit trees and irrigated area. (Obschatko, Foti, & Román, 2007 cited in HLPE, 2013)

Brazil: 2006 Family Farming Law (Law 11,326)

1. Landholdings less than four fiscal modules¹;
2. Predominantly utilizes its own family labour;
3. Most household income originates in the family farm; and
4. The family manages the farm.

Chile:

Farmers who manage fewer than 12 hectares under basic irrigation, with a total farm value of less than 3,500 investment units (US\$158,000), with income primarily from farm activities and that work directly on the land.

Law N° 18.910—Modif. Law N° 19.213 (1993) cit. in FAO, 2013c)

Mexico

Family farming or smallholder agriculture is composed of “agriculture and livestock producers, foresters, and artisanal fishermen with limited resources, despite their heterogeneity, have the following main features:

- limited access to land and capital,
- predominant use of family labor, with the head of the family being directly involved in the production process; which means that, even though there may be some division of labor, head of the family does not exclusively assume managing functions, but rather is a further worker from the family.”¹ (FAO, 2013c)

United States of America: 2007 Census.

All farms except those that are “organized as non-family corporations, as well as farms operated by hired managers” (USDA, 2009, pp. B-8)

Uruguay:

1. Farms less than 500 hectares under any form of land tenure
2. Employs no more than 2 permanent full-time workers
3. Lives on or near the farm
4. Total gross income is not above a certain level.¹

(Ministerio de Ganadería, 2007)

Family Farming.⁴ This report used the sole holder criteria based on the legal status of the farm to identify family farmers. This essentially excludes partnerships—where several natural persons jointly own a farm—as well as farms owned by legal persons such as producer cooperatives or corporate farms (European Commission, 2012). While not a perfect measure for family farms—e.g., it excludes family farms that are jointly operated by several families in a partnership—the sole holder criteria identifies family farms more precisely than a pure holding size-based measure in a European context where many family-held farms are much larger than the often used cut-off rates of 2 ha or even 10 ha (see point 4 below) for smallholder farms.⁵ While a multi-criterion definition—such as the ones used within MERCOSUR countries (see Box 1)—would be even more precise, the European Union and its member states have so far not elaborated such a definition. In a similar manner, Canada was included in this group defining “family farmers” as “unincorporated farmers” (Canadian Census of Agriculture, 2011).

Total: 33 countries

3. Where no multi-criterion country-specific definition on family farms existed but national definitions and/or criteria for smallholders had been created, we used the category ‘smallholders’ as a proxy for family farmers in this context. In six cases—Azerbaijan (2005), Bangladesh (2008), Botswana (2007/2008), Malawi (2006/2007), Mozambique (2009/2010), and Tanzania (2007/2008)—related categories to smallholders were used. Botswana, for example, distinguishes between traditional farmers and commercial farmers. In this case traditional farmers were used as a proxy for family farmers (Republic of Botswana Central Statistics Office, 2007). In three Latin American countries—Nicaragua, Guatemala and Ecuador—the work by Berdegú and Fuentealba (2011) was used in order to identify more locally adequate definitions for family farms or smallholders—they use the terms interchangeably: up to 50 ha in Nicaragua, up to 45 ha in Guatemala, and a group with a mean size of 66 ha in Ecuador. Based on Berdegú and Fuentealba’s work in Chile and Ecuador, a similar classification was used in Peru, defining Family Farms as those with up to 50 ha of land.

Total: 10 countries

4. In the remaining 56 countries—mostly in sub-Saharan Africa, Asia, and Oceania—where size-disaggregated data on land holding were available in the census, smallholders and medium-sized farms with a general criteria of up to 10 ha of land were used as a proxy for family farms. The 2-ha cut-off often used for smallholder farmers was deemed too small. In the African context this would exclude many family farmers as average farm size in Africa is above 10 ha (FAO, 2010). In Asia, major agricultural producers like India define 10 ha as the threshold between medium-sized and large farms. Also FAO (ND) uses 10 ha as its cut-off for smallholder farmers. In three cases—Guam (USA, 2007 census), North Mariana Island (USA, 2007 census) and Vanuatu (2007 census)—our literature review indicated that a threshold lower than 10 ha would more accurately represent a family farm sector characterized by primary use of family agricultural labor and principal income from farm operations. In these cases lower thresholds of 4 ha (Guam, USA & North Mariana Island, USA) or 5 ha (Vanuatu) was employed. In seven cases—Samoa, American Samoa (USA), Virgin Islands (USA) Saint

Lucia, Puerto Rico (USA), Haiti, and Egypt—the 10 ha varied due to conversions from local measures to hectares and the existing size groups in the census. For example, in Haiti *carreaux* (~1.3 ha) are used as a measuring unit. We considered all farms below 6.5 ha as family farms, given that the next greater size class exceeded 10 ha (i.e., 6.5–13 ha).

Total: 56 countries

Total countries and territories included in this analysis: 105

While these inclusion criteria do not constitute a single, global definition, such as the land holding criteria used by FAO (2014a) in its sample of 30 countries, we believe that this approach more accurately recognizes the variety of family farms existing around the world, and helps to address current shortcomings and gaps in characterization of the sector. Where more accurate definitions than the land holding criteria exist—i.e. in countries with a formalized definitions, these are taken into account. In order to still arrive at a larger and more representative sample, proxy criteria of land sizes are used. This approach resulted in a sample size of 105 units, including 98 countries and 7 territories (e.g., Guam (USA) and La Réunion (France)). Table 1 gives an overview of the sample, distinguishing between the definitions applied and indicating the datasets from which the data were taken.

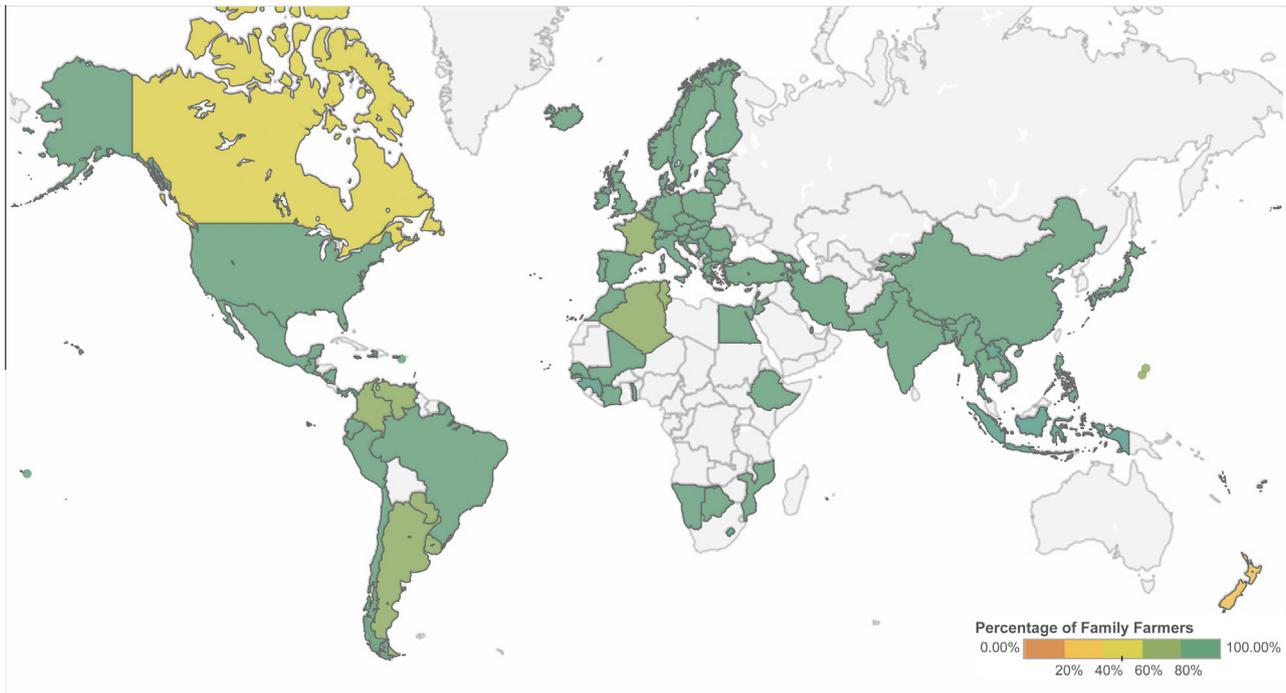
4. RESULTS—CHARACTERIZATION OF THE GLOBAL FAMILY FARM SECTOR

(a) Number of family farms and extent of landholdings

The 98 countries—including their seven territories—in the sample represent around 5.8 billion people—or slightly more than 80% of the world’s population (UN DESA, 2012)—85.8% of the world’s GDP (World Bank, 2012), and 85.4% of the gross value of the global agricultural production (FAO, 2012)—as opposed to FAO’s (2014a) sample, covering 35% of the global agricultural production.⁶ We first calculated the percentage of farms in our sample that qualified as family farms. From the overall sample, in 96 countries and seven territories the number of family farm holdings could be inferred, according to the criteria laid out above. From this sample, 98%⁷ or 475,067,424 holdings qualified as Family Farms (see Figure 1). This broadly confirms the findings of FAO

Table 1. *Data source and criterion designation*

Dataset	No. of units (countries and territories) from each dataset	No. of units using national multi-criterion definition of family farmers	No. of units using sole holder criteria	No. of units using national smallholder criteria	No. of units using the 10 ha criteria
Country level data from 1990 WCA round (data from 1986 to 1994)	1	0	0	1	0
Country level data from 2000 WCA round (data from 1996 to 2005)	45	2	0	4	39
Country level data from the 2010 WCA round (data from 2006 to 2015)	27	4	1	5	17
2010 European farm structure survey ¹	32	0	32	0	0
Total	105	6	33	10	56



Source: Own calculations.

Figure 1. World map with countries covered and the percent of family farms in each country.

(2014a) that at least 90% of farms in the world are family farms, but with our larger sample size and detailed stepwise classification approach, we in fact present strong evidence that the true proportion exceeds their estimate.

We then identified the percentage of agricultural land that family farmers currently manage. Where data were available on agricultural land holdings disaggregated by farm size, we used the original census data. Where agricultural land area was not disaggregated at the individual country level, we followed the methodology used by HLPE (2013): we multiplied the numbers of farms in each size-category by the arithmetic mean of the size group to arrive at the overall land held by this size group (e.g., if there were 100,000 farmers in the size group “one to three ha”, we multiplied 100,000 by two—the arithmetic mean of one and three—to produce an estimate of 200,000 ha held by farmers in this size-category).

This calculation resulted in an estimate of 53% of total agricultural land—1,009,507,053 ha out of 1,906,921,938 ha—as held by family farmers, considerably less than the 75% resulting from FAO’s (2014a) sample, using only the land holding criteria in 30 countries. This figure is based on a subset of 103 census units as data on land held by family farms from Canada and Japan were not available (see Figure 2). This percentage of land held by family farmers should be considered as a lower bound estimate: Lowder *et al.* (2014), for example, in analyzing census data for 31 countries, where data on land ownership as a criterion for family farming were available, found that family farms controlled on average about 70% of agricultural land. Overall, both the percentage of family farmers and the percentage of acreages held by family farmers show that statistically significant regional differences exist (see Figure 3) and while FAO (2014a) reports on the global level, we believe that regional level data are essential in order to better understand regional specificities and tailor relevant policies to them.

(b) Regional and Income Group Comparisons

Across the six regions, the mean of estimated percentage of area held by family farmers was highest in Asia (85%) and lowest in Oceania (2%).⁸ Undertaking an analysis of variance of aggregated country-level means, the average acreage held by family farmers in South America (18%) was significantly below the global average of 53%, while the percentage of area held in Africa (67%), Europe (69%) and North and Central America (68%) were above. With regard to the percentage of family farmers, the highest percentage was in Asia (99%) and the lowest—both statistically significant—were in Oceania (78%) and South America (82%). Compared to the global family farmers’ share of 98%, Europe (97%), and Africa (97%) were just below this average, with North and Central America (88%) resting in between. In summary, both South America and Oceania stand out by having statistically significant lower means for both percentage of family farmers and the percentage of acreages held by them.

Disaggregating the data by country income group in Figure 4 provides additional insights into existing differences across economic groupings. Not surprisingly, the percent of family farms are highest in the lower income countries, with low-income to upper-middle income ranging between 98% and 99%. High-income countries still hold on average 90% of family farmers. This pattern of lower percentages of family farmers’ contributions with increasing income according to the country income classifications does not similarly apply for the estimated percentage of area held by them: the upper middle-income countries stand out as holding a significant lower percentage of area held—33%—compared to the global average of 53% and the high-income countries average of 68%. This can be attributed to the fact that eight out of the 10 South American countries from Figure 3 are represented in this income group. In summary, both Figures 3 and 4 provide

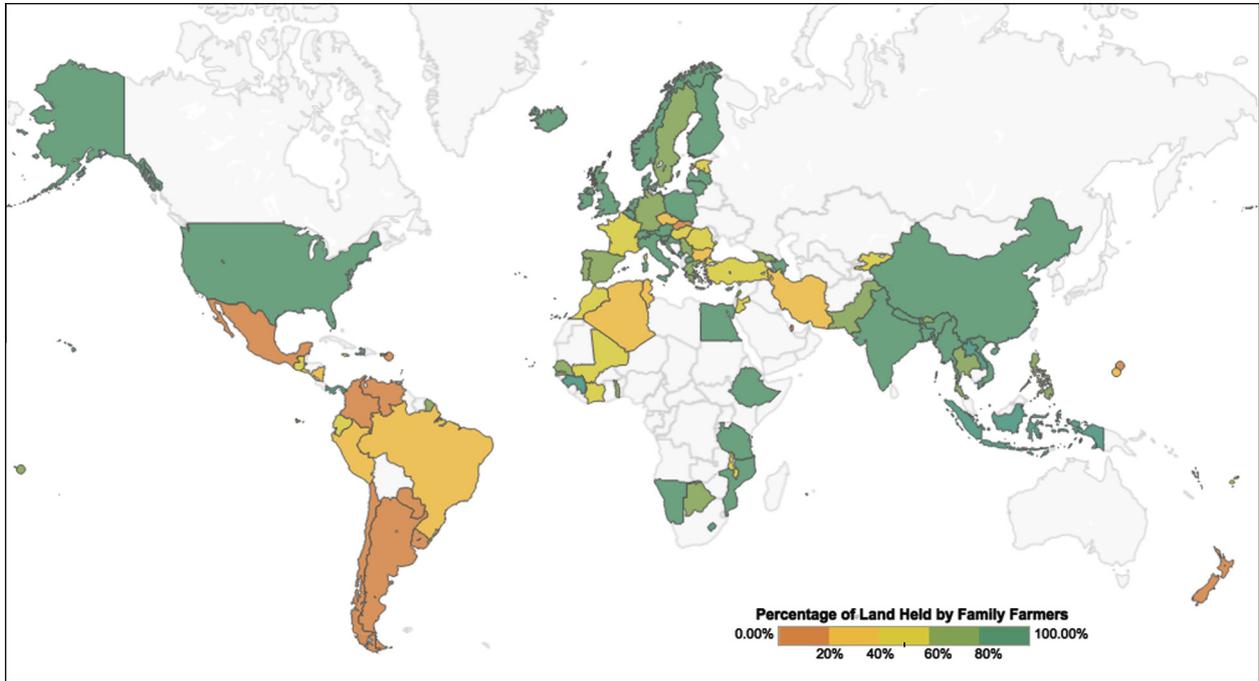


Figure 2. Global map of percentage of land held by family farmers.

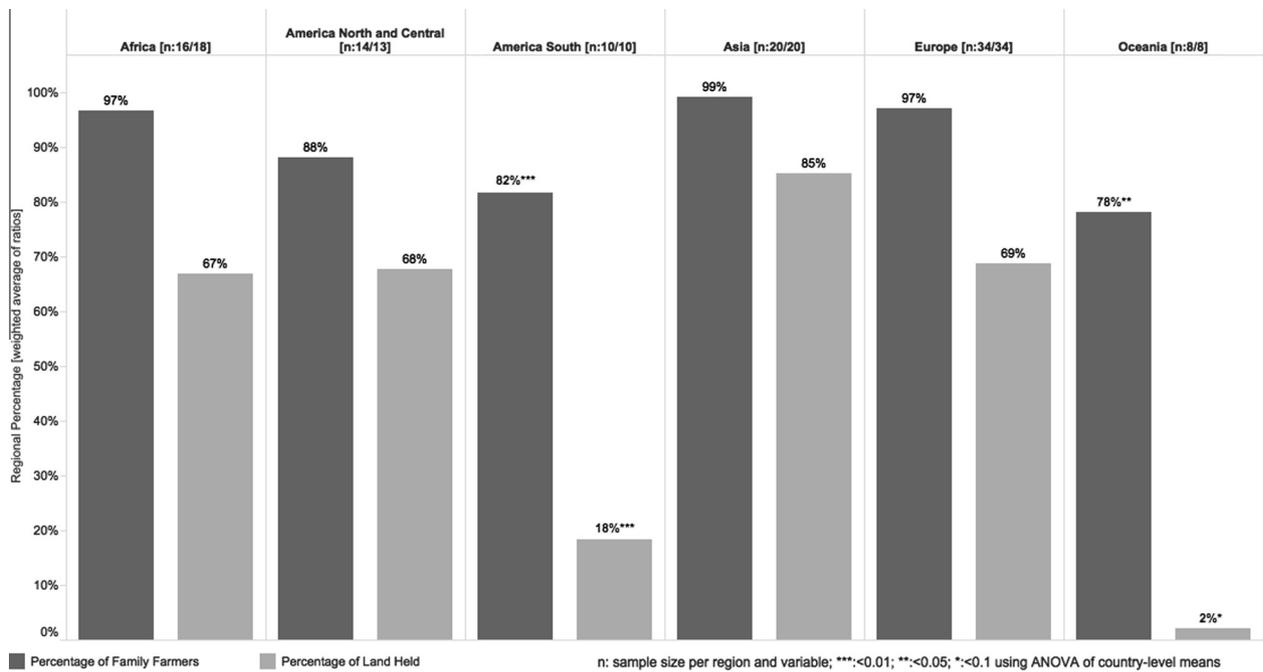


Figure 3. Share of family farmers by regional averages.

additional insights across regions and country income groups, with two distinct trends emerging: African and low-income countries on the one hand, and South American countries, represented in the upper middle country income group, on the other.

(c) Contributions of the family farm sector to food production

Assuming equal productivity per hectare by family farmers and non-family farmers, the previous analysis estimates that

family farmers provide 53% of the world’s agricultural production. While the dominant narrative about agricultural productivity assumes efficiency and productivity gains on larger farms, a large body of empirical studies has shown that smaller farms can also be more productive on a per hectare basis, in what is known as the inverse relationship (IR) between size and productivity.⁹ Barrett *et al.* (2010) emphasize that although some studies do show “large farms being more productive on average than small farms[...] such cases are the exception rather than the norm.”¹⁰ However, even in the

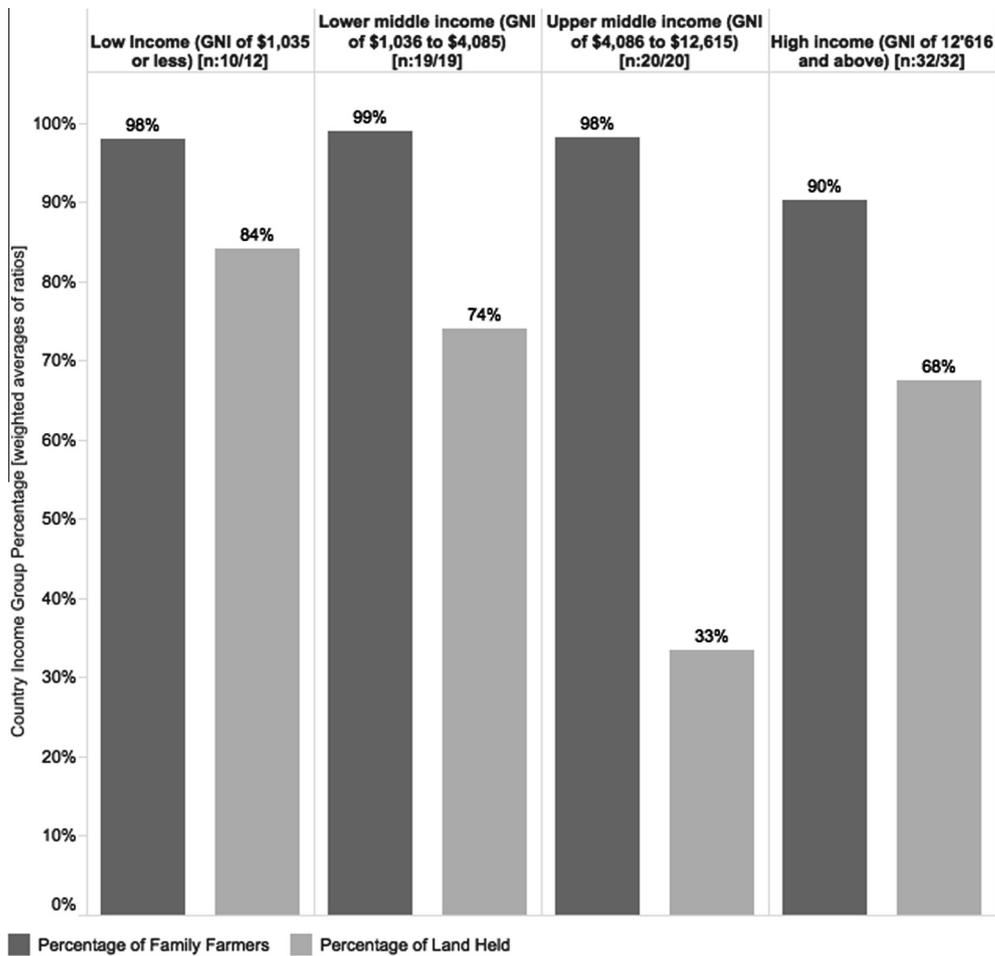


Figure 4. Share of family farmers by income group.

presence of this relationship, there are no clear indications on how strongly it would hold on the global level. We thus argue that the weight of the evidence indicates that assuming equal productivity between family farmers—comprising also a large number of smallholder farmers—and non-family farmers is a conservative approach. The 53% should thus be understood as a lower-bound estimate of agricultural production by family farmers and is an attempt to shed some data-based light into a debate that has so far been completely based on expert opinions, such as *ETC Group (2009)* or analyses of smaller sets of country-level data (*Lowder et al., 2014*).¹¹

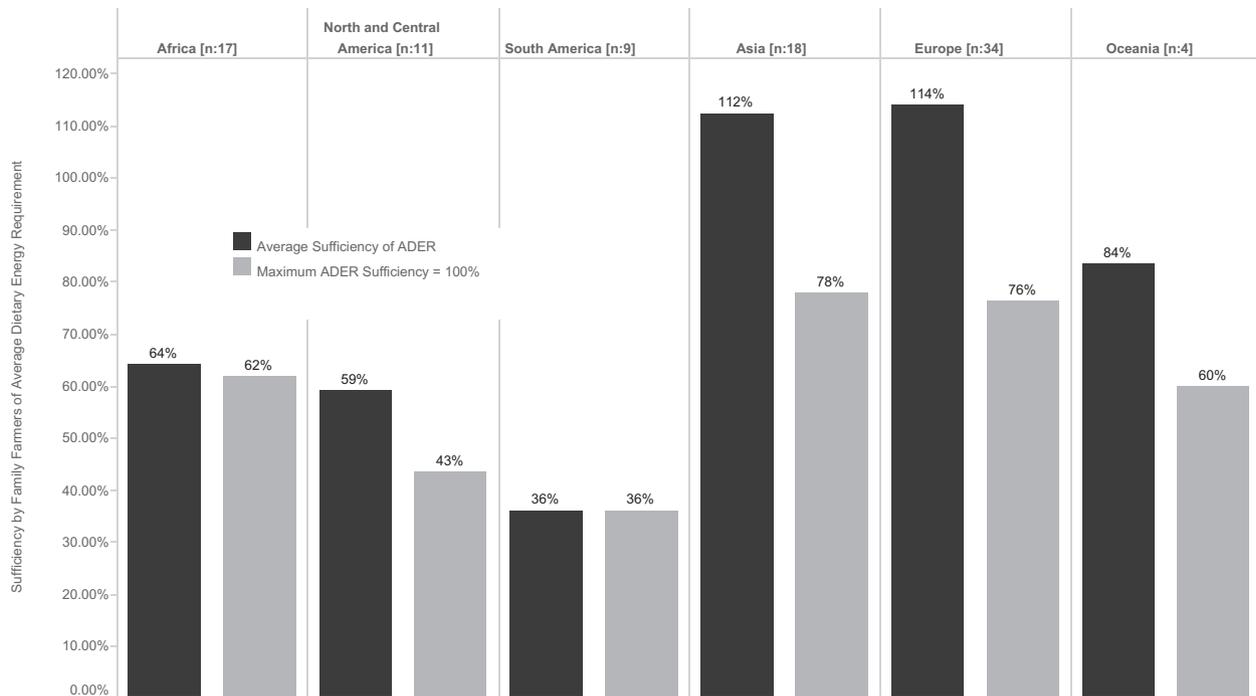
To further ground our empirically based estimates for the potential contributions of the family farm sector to food production, we calculated estimates of how many calories were produced by family farmers in the sampled countries. We then divided this by the Average Dietary Energy Requirements (ADER)¹² to provide a rough estimate for how much of the caloric requirements in each country is currently—with no changes in policies or technology—being met by family farmers within each country.

Methodologically, we started from the FAO's Food Balance Sheets (FBS), which record how much food is produced in each country across 21 categories. The FBS also provide data on how much of each category is used for Feed, Seed, Food Manufacturing, and goes to (pre-consumer) Waste. Given that Feed, Seed, and Manufacturing all go toward food that may show up in another category,¹³ we subtracted each of these from the (primary) Supply Produced—along with Waste,

which was not assumed to change in magnitude—in order to calculate the total Food produced domestically in each category.¹⁴ We then calculated, from this Food supply, the daily per capita caloric equivalent¹⁵—i.e., daily per capita calories produced domestically. Given this number, and our overall estimates of the percent of food produced by family farms in each country, we were able to give rough estimates of the portion of the ADER produced by family farmers. The high percentages of ADER sufficiency we found in each region (see *Figure 5*) indicates that this sector significantly contributes to the food production around the world.

Using country-level averages¹⁶ of sufficiency by family farmers, the European region scores the highest sufficiency levels (114%)—even when limiting maximum sufficiency levels to 100% of the country's ADER (lowering sufficiency based on family farmers to 76 in Europe). Besides Europe, both Asia (112%) and Oceania (84%) stand out with comparatively high levels of sufficiency. While countries in Africa (64%) and North and Central America (60%) are reaching on average at least 50% sufficiency levels with family farming, South America stands out once again with lowest shares of sufficiency achieved at 36%. It also is the only region where not a single country is achieving more than 100% sufficiency with family farmers, with the highest share reached by Uruguay at 71% sufficiency. The two countries covered in our case studies—Malawi and Brazil—reached 71% and 65% ADER sufficiency, respectively.

In summary, these numbers clearly illustrate the global importance of family farmers in terms of agricultural holdings



Note: Unweighted averages of country-level sufficiency shares used to calculate regional aggregate shares.

Figure 5. Share sufficiency by family farmers of average dietary energy requirement (ADER).

as well as in terms of agricultural production. The importance of family farming—as percentage of all farms and in terms of the percentage of land worked by family farmers—differs strongly in countries within similar income groups. The following case studies aim to highlight the effects of different policies on family farmers in distinct global contexts. In choosing our case studies, we sought to bring light to some of the complexities and challenges behind the global numbers we present here. We selected two contrasting cases with significant family farming sectors: one from a middle-income country in South America, and the other from a low-income country in Sub-Saharan Africa. In accordance with the importance of deep place-based knowledge and understanding of local context, we chose two countries from these categories where several of us have many years of on-the-ground experience and connections. Malawi and Brazil offer important glimpses at different approaches taken between two countries in the global South with high land and income inequality, but with signifi-

cant differences in per capita income, food insecurity, and human development (see Table 2 below).

5. WHAT POLICIES STRENGTHEN/INHIBIT FAMILY FARMS?

(a) Brazil: zero hunger in an agricultural powerhouse?

As a leading global producer of soy, beef, coffee, sugar, oranges, and poultry, whose exports increasingly drive the national economy, Brazil has invested heavily in the transformation of its agricultural landscape with about 40% of the national land area now under agricultural production (Fernandes, Welch, & Gonçalves, 2012). The family farm sector comprises 4.37 million farms (84% of all holdings) on 24.3% of total agricultural area, engaging 74% of agricultural labor and responsible for 38% (US\$27 billion) of gross annual

Table 2. Overview of the two case study countries

Indicators/country	Malawi (data from the 2006/2007 census if not otherwise indicated)	Brazil (data from the 2006 census if not otherwise indicated)
Number of Family Farms	2,665,565	4,367,902
Percentage of Family Farming holdings of all holdings	Data not available	84.4
Percentage of land farmed by family farmers/minimum contribution to production	44.14	24.32
% ADER Sufficiency (FAO, 2013b & own calculation)	71 (2006)	65 (2006)
% of under 5 stunted (FAO, 2013b)	47.8 (2010)	7.1 (2007)
Cereal Import Dependency Ratio (FAO, 2013b)	7.2 (2005–2007)	15.1 (2005–2007)
Domestic Food Price Volatility Index (FAO, 2013b)	47.4 (2006)	41.1 (2006)
Gross Domestic Product per Capita (Current USD, World Bank, 2012)	234 USD (2006)	5,788 USD (2006)
Human Development Index (UNDP, 2013)	0.373 (2006)	0.704 (2006)

value. The non-family farming sector is characterized by highly capitalized large-scale commodity and export-oriented production (807,587 farms on 75.7% of agricultural area), producing 62% (US\$44.5 billion) of total agricultural output, with the top 1.5% of rural land owners occupying 52.6% of all agricultural lands (de França, Del Grossi, & Marques, 2009; IBGE, 2009; Fernandes *et al.*, 2012; MDA, 2013). The family farm sector also makes a significant contribution to national food security, producing in 2006 an estimated 70% of total domestic food consumption (de França *et al.*, 2009; Fernandes, 2014).

The policy environment for agriculture in Brazil has two distinct (and competing) foci. The Brazilian Ministry of Agriculture aims to maximize the economic impact of agriculture within the global economy. For the 2013–14 growing season, the Ministry of Agriculture budgeted R\$ 136 billion (US\$62 billion) in low-interest loans, grants, and capital investment projects in support of the agribusiness sector (MAPA, 2013). The Ministry of Agrarian Development, tasked with supporting the family farm sector, allocated R\$ 39 billion for the 2013–14 season in their programs for operating loans, crop insurance, agricultural extension, home-grown school feeding, and other public nutrition programs (MDA, 2013). Despite significant increases in support to the family farm sector in the last decade (e.g., a 300% increase in loans to the family farming sector and expansion of other agrarian development initiatives), these uneven levels of public investment indicate a lack of agreement on the priorities for the sector. For example, despite a long history of agrarian reform mobilization and legislation (during 1973–2011, 931,730 families received parcels of land in 8,765 land reform settlements covering 87.5 million hectares across the country (MDA-INCRA, 2012) land made available for family farmers was often located in environmentally inappropriate areas at the agricultural frontier, without the basic infrastructure for local agricultural development (e.g., housing, electricity, education, health care, agricultural credit) (Fernandes, 2009). After 2003, land settlement numbers declined significantly, from a peak of over 100,000 families settled in 2005 to just 4842 families settled on redistributed land in 2012 (DATALUTA, 2013).¹⁷ In the last decade, government investment in the family farm sector has focused on improving rural living conditions and investing in regional value-added processing and marketing infrastructure for domestic consumption. Departing from previous land reform programs, the 2003 Plan for Agrarian Reform called for a “new model for rural development” that would contribute to food sovereignty, combat poverty, re-invigorate local and regional economies and support the family farm sector (PNRA II, 2003).

As part of this new model, Brazil’s landmark Fome Zero (Zero Hunger) program was launched in 2003, with a strategic alignment between public health programs for food and nutrition security and policies for rural and agrarian development. A 2010 Law on Food Security indicates support for increased agricultural research and extension, and as part of Fome Zero, the federal Ministry of Agrarian Development (MDA) and the Ministry of Social Development and Fight against Hunger (MDS) developed a series of food security programs that involve public procurement of agricultural production from family farms for distribution to schools, hospitals, and other national food security initiatives—a strategic initiative to adjust market conditions to favor the family farm sector. These programs specifically target women and youth for agricultural credit and extension. The Fome Zero Food Acquisition program (PAA) involves direct purchases of foodstocks (crops, meat, milk) by the federal government to build food

stocks and regulate prices, and for distribution to school food and other social welfare programs (Rocha, 2009). This program (2014 budget R\$ 1.2 billion) has involved an average of 84,000 family farmers per year during 2003–12, and distribution of food supplies to an average of 16 million beneficiaries/year during 2010–12 in over 3,500 municipalities. Since 2003, the program has purchased 2.6 million tons of food with the objective of “promoting food sovereignty and security through the acquisition of local agro-biodiversity” (MDS, 2010). While Brazil has operated a National School Meal Program since the 1950s, a 2006 policy change now requires that 30% of school food program budgets (i.e. R\$ 1.1 billion) be utilized in direct purchases from family agriculture.

Brazil has pioneered and modeled, in many ways, contemporary support programs for family farmers. At the same time, given the large number of family farmers, higher per-hectare job production, and greater share of responsibility for the production of domestically consumed staple foods, the amount of support provided to them is insufficient. The greater resources (and clout) of the agribusiness sector of course reflects, at least in part, the benefits the export sector brings to the country. But the empirical evidence at least opens the possibility that this lopsided focus does not reflect the most efficient path to supporting food security and productivity within Brazil.

(b) *Malawi: focus on smallholder agriculture mainly through agricultural inputs*

Malawi is a small landlocked country in southern Africa of 15 million people, most of whom rely on agriculture for their food and livelihood (World Bank, 2013). There is an estimated 5,580,000 ha of agricultural land in Malawi, 44% of which is considered to be farmed by family farms (under 2 ha). This figure is likely an underestimate, since there are no data on farms over 2 ha, and many family farms are greater than 2 ha (Fisher & Lewin, 2013). Family farmers primarily grow maize, legumes, tubers, and vegetables, contributing an estimated 31% of total food production nationally based on weight. Approximately half of all calories consumed by smallholder farmers come from their own food production (Dorward & Chirwa, 2011).

Under British colonialism, 3.7 million ha was taken from family farms to establish tobacco, cotton and tea estates (Ng’ong’ola, 1990). Most agricultural research and extension focused on estate cash crops, while African farmers were encouraged to grow maize for colonial institutions (Vaughan, 1987). The postcolonial dictator Kamuzu Banda (1966–94) implemented programs that benefitted family farms, including fertilizer subsidies, rural depots for input and market supply channels, and agricultural extension in rural areas. At the same time, land inequalities worsened, as thousands of hectares were seized for tobacco estate production. Subsequently, structural adjustment policies in the 1980s and 1990s included removal of fertilizer subsidies, agricultural credit and other public expenditures on agriculture (Ellis, Kutengule, & Nyasulu, 2003; Sahn & Arulpragasam, 1991). Poverty rates increased, with estimates that smallholder income levels declined by 25% while estate producers’ income rose by 44% (Dorward & Kydd, 2004; Ellis *et al.*, 2003; Sahn & Arulpragasam, 1991). Rising fertilizer prices, combined with several years of poor rainfall, and government mismanagement led to falling food production (Chirwa & Dorward, 2013; Ellis & Manda, 2012).

Since 2005, there has been increased political attention to smallholder agriculture through a national agricultural input subsidy program (AISP), which provides coupons to small-

holder farming households to purchase fertilizer and hybrid maize seed at reduced prices. This program has continued with varying numbers of recipients each year, but became highly politicized, used by the government to build political support, while suppressing dissent on agricultural policies (Chinsinga, 2011). Policy makers have argued that reduced fertilizer prices are crucial for Malawian smallholder farmers to increase productivity and incomes, through the increased sale of maize, while at the same time increasing the affordability of maize for net purchasers (Chirwa & Dorward, 2013). The government has also prioritized smallholder agriculture in the Agriculture Sector Wide Approach (Government of Malawi, Ministry of Agriculture and Food Security, 2010), the Malawi Growth and Development Strategy II (2011–16), and the draft National Agricultural Policy to be released in September 2015. All of these policies focused on smallholder agriculture as a critical aspect of development. Malawi was heralded as one of the few African countries which met the goal of dedicating 10% of its national budget to agriculture (United Nations, 2013).

The costs of AISP however are considerable: between 7% and 16% of the overall national budget annually, upward of \$US214 million dollars at the highest point. In later years, critics blamed inflation, foreign exchange shortages and fuel shortages on the AISP, with increased political unrest and donor unease (Bezner Kerr, 2012; Chinsinga, 2012). The national fiscal debt increased from 8.2 of GDP, in 2005 to 15.7 of GDP in 2010, almost doubling the debt load in less than a decade, in part due to the AISP (Chirwa & Dorward, 2013). Currency devaluation was carried out in 2013, and inflation has gone from below 10% to over 30% (NSO, 2014). The lingering impacts of the high cost of the AISP thus remain to be seen, and some argue that it is a short term solution that may worsen conditions for family farmers and the economy in the long term (Bezner Kerr, 2012; Mhango & Dick, 2011).

There has been limited agricultural research dedicated to family farms in Malawi, and extension services have also declined, in part due to the high proportion of the agricultural budget devoted to the AISP (United Nations, 2013). Agricultural credit, scaled back as part of structural adjustment, remains largely inaccessible to most family farmers. The extension service, which under Banda had a ratio of 1:750 farmers, has declined dramatically, with current estimates of 1 field extension worker responsible for between 2,500 and 3,900 farmers (CISANET, 2013). Increasingly over the past decade extension has been handed over to the private sector and non-profit organizations, with inconsistent coverage and support for family farms. A “lead farmer” model was also initiated in the last decade, but lead farmers often lack adequate training or support to meet the needs of family farmers in their communities (CISANET, 2013). Gender inequality is a challenge more broadly in Malawi for women farmers, who carry out more than half of all agricultural labor, and gender inequalities in access to extension services, first studied in the 1980s, continues to be a problem (Fisher & Kandiwa, 2014; United Nations, 2013). The government released a National Youth Policy (Government of Malawi, Ministry of Youth and Sports, 2013), but agriculture was not a focus of the policy.

Rising inequality in Malawi between the poor rural majority and the urban middle-class and elite raises concerns about inclusive agricultural policies (United Nations, 2013). The AISP, the government’s centrepiece agricultural policy has increased national maize production and food security, (Chirwa & Dorward, 2013; Fisher & Lewin, 2013), but the majority of producers remain net buyers of maize (Chirwa & Dorward, 2013). There is evidence that the AISP preferentially benefits better-off farming households, who received more coupons, applied more

fertilizer and had more significant changes in food security than poor households (Chibwana, Fisher, & Shively, 2012; Holden & Lunduka, 2012). A recent survey found that 42% of rural households still experience food insecurity (NSO, 2012).

Alternative policy approaches to supporting family farms in Malawi include crop diversification and integration of agroecological methods to improve food production, with evidence of positive impacts on livelihoods, nutrition, food security and ecosystem health (Chinsinga, Mangani, & Mvula, 2011; Mhango & Dick, 2011; Snapp *et al.*, 2013). Malawi has made steps toward addressing the needs of family farms, but greater attention to inclusiveness and equity issues, alongside a diversification of approaches, including more agricultural research, extension and access to credit, are necessary steps to ensure the long term viability of family farms.

(c) *Putting the cases together*

Brazil and Malawi provide two contrasting examples of countries in very different contexts that have deployed country-specific strategies targeted to the family farming sector, with policy approaches that aim to address the linked challenges of addressing poverty, food insecurity, and improving rural livelihoods. Examining these two case studies in detail brings perspective on the “big picture” view provided by our estimates of the number, land area, and production capacity of family farms around the world. Knowing how many family farmers there are, the amount of area they occupy, and their importance to food production is of limited use without an understanding of how different policies may support the livelihoods and broader benefits to society that they provide. Given the differences by region, country, and local context, we used two cases to assess what policies strengthen or inhibit family farms, in light of our clear evidence of their predominance around the world. Thus, together, our assessment of their number along with these two cases establishes both the importance of family farms and the requisite careful consideration and on-going policy development needed to adequately support their functioning, and perhaps even expand their contributions to a food-secure and prosperous future.

Brazil’s multi-faceted approach roughly aligns with the six policy recommendations reviewed above. However, imbalances in support for large-scale versus family farming, especially with regards to markets and financial services and research and development; the lack of reliable and easy access to high quality education in many rural areas; and the degree of emphasis on women and youth could be much improved. Further, despite Brazil’s innovative food policy councils (CONSEA), the evidence for significant investment and progress in the first policy priority area—improving communication and negotiation processes within and between farmer organizations, businesses, social movements, and family farmers to set agricultural priorities and scale-up innovations—is scant. And insofar as all six priorities include elements of direct communication with family farmers; building their democratic agency and power; and including their voices in policy and research priority-setting; this lacuna affects Brazil’s performance in all aspects of recommended approaches to supporting family farmers.

In stark comparison, the mainstream approaches to supporting family farmers in Malawi appear to address only part of two priority areas: identification and creation of national priorities and policies around smallholder and family-based farming, and efforts to improve the workings of the market for one class of inputs (fertilizers). Its commitment to spend

10% of its national budget on agricultural research would potentially address the third priority area, although how much of this budget is targeted toward family farmers, remains to be seen. Further, the “alternative approaches” that have gained some toehold in Malawi appear to be consistent with the known best practice areas, and should likely be expanded.

Despite the differences in Brazil’s bifurcated approach and Malawi’s high investment overwhelmingly focused on one major intervention, both countries reflect strategies that arguably under-invest in the family farm sector compared to the empirical evidence of its importance and potential. At the same time, the two cases also indicate the difference more carefully tailored programs can make—Brazil’s programs recognize the different needs of agri-business and family farmers, and their aggressive moves on improving certain social safety nets is the type of intervention likely to help “Group C” (land-poor) family farmers. Their suite of programs appears well suited to help raise all groups of family farmers—a diversity of interventions that should not be forgotten or lost if Brazil were to decide to shift its portfolio of agricultural support. And the benefits already reaped in Brazil—not to mention many other examples in the literature from other situations and countries, and the large-scale international consensus report on agricultural knowledge and development (McIntyre *et al.*, 2009)—hint at the potential gains to be had by a more diversified approach in Malawi.

6. CONCLUSION

Once seen by some actors as part of the poverty problem, family farmers, including smallholders, are increasingly seen as key components of campaigns to improve food and nutri-

tional security and to end global poverty. Based on a comprehensive analysis of global agricultural census data, family farming is by far the most predominant form of agriculture. At the same time, the fact that family farmers are not a defined group in most countries is a major challenge. Improvements are required both in agricultural census design and data collection and the development of specific, targeted and effective policies on family farming in most parts of the world. Further, although many benefits have been documented to accrue from small-scale and family farming, much research remains to be done to understand the precise mechanisms, limits, and contextual dependencies of these relationships.

Where they do exist, as the case studies from Brazil and Malawi show, policies for family farmers and smallholders are very diverse in their approaches. In Brazil, policies focused on domestic consumption, finding a niche for family farmers in a domestic food system dominated by export crops. In Malawi, on the other hand, measures were much more focused on increasing agricultural productivity in order to increase food security through resilience to global agricultural input volatility. Future policies on family farming will undoubtedly aim at different goals, with respect to diverse societal priorities and challenges. We believe that such policies can be enriched by an explicit discussion and more accurate assessment of the contribution of family farmers to food security. Future research is thus needed to focus on the different approaches used in designing and implementing policies on family farming, and identifying successful principles that could be shared in policies across different countries. With the momentum of the International Year of Family Farming, we are hopeful that our methodology and findings on family farming provide a stable platform upon which to build both future policies and research.

NOTES

1. Calculated based on [World Bank \(2014\)](#) estimates for “Agriculture, Value Added (% of GDP)” for 2012 (Table 4.2). The number reported corresponds to the 3% reported contribution to a ~US\$72 trillion world GDP.

2. Note that we used the definition for Family Farming used in the 2007 Agriculture Census. The United States of America have since changed their Family Farming definition. For further information see: [Hopper and Banker \(2012\)](#)

3. The part of the European Farm Structure Survey relevant for this paper is based on EU member states’ agricultural census. The data are compiled by Eurostat, the statistical office of the European Union ([Eurostat., 2014](#)).

4. In line with [Davidova and Thomson \(2013\)](#)—and due to limited data availability on other potential factors such as ownership of productive resources and farm operation and management—we use the legal status of sole-holders as the defining criteria for Family Farmers in the EU.

5. One case in point for this is the Republic of Ireland. Using a 10-ha cut-off for family farmers would lead to the classification of only 18.2% of holdings, working only 3.9% of the country’s agricultural land as family farmers. Using instead the sole holder criteria over 99% of the holdings working 96.1% of the country’s land are classified as family farmers ([Government of Ireland, 2010](#)).

6. Based on data available in FAOSTAT’s “Value of Agricultural Production”, in current US\$ from 2011.

7. This global percentage is calculated by aggregating the number of family farms from all countries and dividing that number by the total number of all holdings in our sample (483’589’857). Aggregating unweighted averages of country-level ratios, the share of family farms from all individual countries is 91.4%, managing 64.2% of the land.

8. Analysis of variance comparing aggregated country-level means reveals that Oceania was weakly significantly lower in both area held and share of family farmers, as New Zealand, with its comparatively large land mass, has an estimated share of land held by family farmers of less than 1%.

9. See for example [Barrett *et al.* \(2010\)](#), [Carletto, Savastano, and Zezza \(2013\)](#), [Berry and Cline \(1979\)](#) for Brazil, Colombia, Philippines, Pakistan, India, and Malaysia; [Cornia \(1985\)](#) for 15 different countries; [Heltberg \(1998\)](#) for Pakistan, [Khusro \(1973\)](#), [Rudra and Bandopadhyaya \(1973\)](#), [Bhalla \(1979\)](#), [Bharadwaj \(1974\)](#), and [Sen \(1964\)](#), [Sen \(1981\)](#) for India; [Carter \(1984\)](#) for Haryana in North India; [Kutcher and Scandizzo \(1981\)](#) for North East Brazil; [Benjamin \(1995\)](#) for Java; [Masterson \(2005\)](#) for Paraguay; [Gül Ünal \(2008\)](#) for Turkey; [Larson, Otsuka, Matsumoto, and Kilic \(2012\)](#) for Sub-Saharan Africa; and [Holden and Fisher \(2013\)](#) for Malawi.

10. Although the mechanisms and direction of the IR are contested, [Barrett *et al.* \(2010\)](#) conclude that “only a small portion of the [IR] is explained by market imperfections and none of it seems attributable to the omission of soil quality measurements” (two of the most common candidates for explaining IR). This conclusion was reinforced by [Carletto *et al.*’s \(2013\)](#) study in Uganda, which found that careful and precise measurements reinforced the strength and existence of the IR.

11. One additional limitation of this approach is related to countries in which the majority of the production is not linked to land. In the case of Iceland for example, where the majority of agricultural production is fished the percentage of land worked on by family farmers will only be a very weak indicator for the percentage of agricultural production they supply.
12. “The average of the individual’s dietary energy requirement,[...] is a proper normative reference for adequate nutrition in the population. [...]its value could be used to calculate[...] the amount of dietary energy that would be needed to ensure that, if properly distributed, hunger would be eliminated.” (FAO, 2013b).
13. For instance, most or all of “Sugar Crops” are usually fed into Food Manufacturing, and thus do not show up as Food consumed within that category, but rather appear as Food consumed in “Sugar and Sweeteners”
14. Stock variation, Exports, Imports, and Other Uses were ignored for our purposes.
15. Calculated by taking the ratio of our new Food Supply number to the FBS’s original Food Supply number, and multiplying the FBS’s originally reported number for KCal/person/day by this ratio.
16. As opposed to Figures 3 and 4, which were calculated using weighted averages of the ratios, in this case country-level averages were aggregated due to the facts that sufficiency is measured and politically supported within sovereign boundaries and ADER are determined on a country basis.
17. This number comprises new land reform settlements, not including title regularization for traditional populations.

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APPENDIX A. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.worlddev.2015.05.012>.

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