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Capital Structures for Large Scale Australian Agriculture: Issues and Lessons

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Abstract

Macro institutional factors, such as the level of public subsidies and Australia's natural resource endowment, explain much of the comparatively large size of its farms. Allen and Lueck's transaction cost framework is used to examine patterns of family farm and corporate ownership in Australian large-scale farming. Ceteris paribus, it should be expected that in areas of greater climatic variability, family farm structures will tend to dominate corporate forms. Factors that lessen the impact of climatic variability, such as irrigation, protected environments and, possibly, big data, encourage corporate ownership. At issue is the degree to which big data can permit production processes to be meaningfully separated in highly seasonal production and thus provide scope for greater ownership flexibility. Capital is required to lift productivity within Australian agriculture so agriculture can yield competitive rates of return over suitably long time horizons. Large family farms generate comparatively high rates of return whilst corporate returns have been mixed, although corporate interest in agriculture is building. Corporates could supply more capital and lift operator productivity if new structures could free up farmer capital for investment into operations. Factors such as hurdle rates and time horizons influence the means by which corporate ownership will flow into agriculture. Several structural examples are discussed.

Key words: Scale economies, corporate farms, family farms, productivity, transaction costs, climate (seasonal) variability.

Introduction

Allen and Lueck (2004) use a transaction costs framework to examine the incentive effects of seasonality and timeliness costs on farm ownership and farm organisation, as these affect the gains from specialisation and the costs of contracting. Seasonality is modelled as the number of cycles, stages, tasks and length of tasks in a production system and the system's propensity to be impacted by the weather.

Their insights can be presented schematically as follows:

Family Farm: best suited to	**Corporate Farm: best suited to**
Single cycle of production	Many cycles of production
Few stages of production	Many stages of production
Few tasks	Many tasks
Short task lengths	Long task lengths
e.g. rain fed grain production: weather dependent, single cycle, few stages of production, few tasks of short duration. A great need for 'on the spot decisions', less gain from specialisation (all round farmer), less capital intense.	e.g. broiler production: climate-controlled sheds with technologies that increase the number of cycles, tasks and length of tasks. Need for 'on the spot decisions' lessened, increased gains from specialisation, increased capital intensity. Some contracting out of growing to semi-residual claimants.

Farm production results from cumulative actions where decisions at one stage of production impact on the next stage. These actions are affected by or are conditional on, the amount of effort applied, capital input and random stage specific natural events. The most important decisions on a rain fed grain farm remain the timeliness of management decisions on seeding, spraying, fertiliser applications and harvest and these are often specific to prevailing conditions. Single owner organisational forms align residual claimants to net returns, so that owner operators bear the full wealth effect of their management decisions. In comparison, labour used in corporate organisations is provided by specialised wage employees. These employees experience far less volatility in their earnings compared to owner-operators, and do not usually share in any wealth appreciation of the farm business, as they are not residual claimants. Consequently, they bear no loss of accumulated wealth from poor decisions or shirking. These work requirements in highly seasonally impacted farm production systems, such as rain fed grain production, better suit owner operators (e.g. the traditional family farm) than corporate structures with paid employees.

Allen and Lueck (2004) argue that 'only when farmers can control the effects of nature by mitigating the effects of seasonality and random shocks to output does farm organisation gravitate toward factory processes, developing into the large-scale corporate forms found elsewhere in the economy' (p.196). The value of a corporate farm, therefore, will be highest when capital is relatively important, when seasonal parameters allow gains from specialisation to be high and when labour monitoring is relatively inexpensive.

Hence it is unsurprising that broiler production is dominated globally by corporate type structures, whereas rain fed grain farming is undertaken predominately by family structures. However, corporate interest in all forms of agriculture is growing strongly as demand for food grows. New technologies and machinery that support labour substitution are resulting in a reskilling of labour operations. For example, the size of modern crop machinery and its embedded technology allows crop operations to be undertaken by fewer workers who often require a minimum of computer skills and an ability to operate several machines. Farm managers must increasingly become highly computer literate. This technology is available to those who can afford it – larger, more profitable family farmers and corporates.

Allen and Lueck's (2004) framework outlines the influences that lead to family or corporate ownership being the preferred ownership structure. For example, irrigation and associated technologies that help to insulate production from the vagaries of climate make those farming

enterprises more attractive to corporate investors and operators. Increases in climatic variability will have the opposite effect. The degree to which the collection and analysis of production data can facilitate the management of production and environmental complexity will shift the preferred ownership structure towards corporate structures. This technology is very established in protected environment (e.g. greenhouse) production as *stable* climatic conditions make the interpretation of production data much easier and so automated management regimes can be applied to great effect. These technologies are also used extensively in irrigated field situations, such as cotton and horticulture. However, a greater level of management skill is required in their application because of the greater impact of climatic variability. In rain-fed field cropping the (much less widespread) collection and analysis of soil assay data overlaid with yield map data also helps to inform management decisions; however, greater climatic variability implies that the skilled application of localised knowledge is likely to be a more important determinant of production performance. As discussed earlier, the family farm structure provides the sharpest incentives for the application of localised knowledge. Thus, ceteris paribus, it should be expected that in areas of greater climatic variability, family farm structures will tend to dominate corporate forms.

Several factors will affect the means by which corporate capital flows into agriculture. The factors include investors' patience; their target rate of return; threshold sizes of transactions; their tolerance of volatility in returns; and other objectives such as the bundling of capital with other services; or, in the case of some foreign government investments, satisfying a food security goal. Further, as outlined by Harris et al. (2012), a world awash with capital has a number of effects and two are particularly pertinent to this discussion. The first is that hurdle rates on returns need to be adjusted downwards. The second is that an over-abundance of capital implies that the greatest returns will flow to the execution of good ideas over longer time horizons. Agriculture is a long-term investment and it could be reconfigured away from value created by land ownership to new models, for example, that involve splitting operations and land ownership. Moreover, investment capital can be linked to value chain creation with target markets and to the use of specific inputs. Allen and Lueck's insight into the family farm's dominance when seasonality is high still pertains to operational control, but this may not always necessitate land ownership where land ownership need not be central to operational control.

Farming in Australia: Two Important Themes

Scale

By global standards, Australian farms are comparatively large as indicated in Table 1.

This largeness partly reflects the enormous size of Australian cattle stations in the northern part of the country. Cattle stations are low input, low output systems that reflect Australia's lack of natural agricultural endowment, in so far as its soils are generally aged and poor, its climate is on average dry and highly variable and inland population density is low. Corporate ownership in the Northern Territory tends to be concentrated in its more climatically stable north ('from Tennant Creek to Darwin', Curtain and Brown, 2013) and family ownership tends to predominate in central Australia.

Foreign ownership is more pronounced in some Australian regions and agricultural industries. For example, foreign ownership accounts for 18 per cent of the Northern Territory, predominately in the cattle industry. Indeed, 'the proportion of the value of agricultural production under foreign ownership was much smaller than the proportion of land owned by foreigners, suggesting that foreign ownership was concentrated in the less-intensive forms of agricultural production' (Moir, 2011, p.20).

Table 1. Number of farms and area for selected countries and years

Country	Census year	Farm Number	Area of farms (acres)	Average farm size (acres)	Total land area ('000 acres)	Area of farms as a percentage of total land area (%)
Canada	2001	246,923	166,802,197	676	2,278,502	7.3
Canada	2006	229,373	167,010,491	728	2,278,502	7.3
Argentina	2002	295,485	425,273,427	1,439	676,236	62.9
Australia	2001	140,516	1,126,091,533	**8,014**	1,898,296	59.3
Brazil	1996	4,859,865	873,773,389	180	2,089,604	41.8
China	1997	193,445,894	321,326,863	2	2,304,806	13.9
France	2000	663,810	73,877,143	111	135,930	54.3
United Kingdom	2000	233,250	40,839,774	175	59,521	68.6
United States	2002	2,128,982	938,268,725	441	2,263,179	41.5

Source: Statistics Canada (2006)

For instance Anna Downs, Australia's largest cattle station, is 24,000 sq. km and only stocks around 10,000 head on average. It is part of the (diffuse) Kidman family set of properties, which cover 100,000 sq. km. Much of the Kidman empire was built by buying distressed drought-affected assets, including some from overseas corporate owners. Large northern cattle holdings, such as Kidman and the listed AACo, are generally vertically integrated into feedlots and abattoirs, and they are mostly corporate-owned. Spatially spreading production assures a constant flow of stock for feedlots and abattoirs, and properties display some specialisation such as calf production or backgrounding of older cattle (Cottle and Kahn, 2014, p.165-6). AACo is the largest cattle aggregation (7M ha, 0.5M head, $800M capital value) and Australia's oldest agricultural company, being founded in 1824. It is partly foreign-owned and nearly 80 per cent of its revenue is from boxed beef, reflecting its integrated production model. It has spent some of its history as a private (unlisted) and as a public (listed) company.

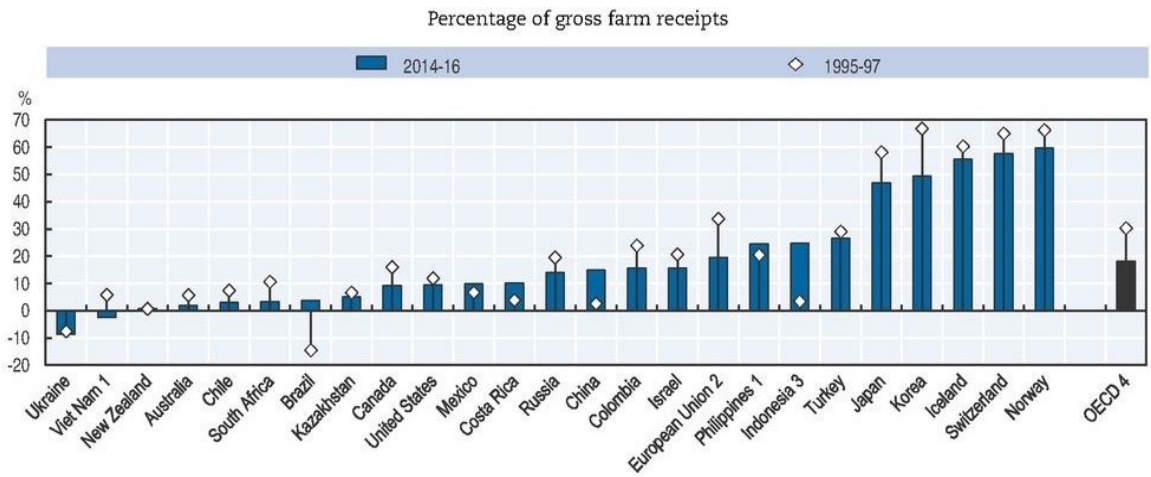
Cattle stations aside, where scale and vertical integration provide strong incentives for corporate ownership, generally Australian farms tend to be larger than their comparable overseas peers. The larger scale of most Australian farms is due to several factors.

First, land settlement for farming, especially in Western Australia, mostly occurred in the 20th century. The small population of Australia, combined with the vastness of its land mass, facilitated the granting of larger land blocks for settlers. Blocks were provided to potential farmers on terms known as conditional purchase whereby the farmer was able to acquire large tracts of land at a low price, conditional on the farmer clearing much of the natural vegetation on the property. In addition, due to poor soils and low amounts of growing season rainfall (gsr), crop and pasture yields were low. Hence, farmers needed more land to provide sufficient income to support their families. The Western Australian (WA) wheatbelt was developed much later than the grain belt in eastern Australia. Moreover, the science necessary to develop its very poor soils was not available until the 1950s and 1960s. Consequently, its average farm size is two to four times the size of farms in other

cropping regions of Australia. Economies of size advantages allow these farms to generate higher rates of return.

The aforementioned resource endowment effect can be further illustrated by comparing New Zealand's and Australia's dairy sectors. Both are predominately pasture-based systems and therefore are more extensive than northern hemisphere grain-based systems. New Zealand has a similarly low level of public subsidy (1 per cent) of farming. However, New Zealand's more temperate, even climate and rich volcanic soils result in its average dairy farm consisting of 410 cows on 144 hectares (LIC/Dairy NZ, 2014, p.14). By contrast, the average dairy farm in Australia consists of 220 cows on 205 hectares (Murray Dairy, 2015).

Figure 1. Producer Support Estimates by country, 1995-97 and 2014-15 (percent of farm receipts)



Source: OECD (2017, p.42)

Second, Australian farms receive very low levels of public subsidies (Figure 1) serves to drive their low cost structures. The OECD (2017) estimates public subsidies at 3 per cent for Australia compared to an average of 17 per cent across 47 other countries which collectively represent 80 per cent of global agricultural production. The low level of support received by Australian farms makes them very self-reliant and causes farmland prices to often reflect their agricultural profitability. The exceptions occur in areas close to population centres and the sea. The low productivity of this land, combined with the absence of government support and the absence of competing land uses in much of regional Australia makes its farmland relatively cheap, thereby allowing larger sizes of farms.

Furthermore, most agricultural industries are subject to either export or domestic competitive pressure. Small, fractured industries persist only in pockets shielded from competitive pressure, such as much of the Western Australia's horticulture industry, due to transport costs and bio-security barriers. Consequently, Australia has the largest average farm business (by value of sales) in the world (AFI, 2013, see also Figure 2). Fractured industries also exist where the opportunity for labour-saving intensification has not yet developed and dispersed holdings are not widely used to mitigate seasonality, such as the sheep meat industry which occurs in the south of Australia.

Third, industries that have been able to lift returns by substituting capital for labour have gained scale. For instance, around 6,000 hectares of crop is required to fully utilise a standard machinery set for grain production in Australia. Farm machinery that offers faster work rates can lift returns. Moreover, the use of GPS technology has reduced the costs of monitoring labour which was traditionally a major factor limiting the size of agricultural ventures (Allen and Lueck, 2004; Taylor, 1994, p.27). The process of mechanisation embeds new productivity-enhancing technology into

farming operations, particularly with respect to minimum tillage and chemical weed control. In this way larger farms not only tend to have lower unit costs, but the new equipment also allows for better management options.

Like most developed agricultural economies, the bulk of farm production in Australia is concentrated in a small number of larger producers. Each year Planfarm/BankWest produce an annual farm business analysis of 566 farm business clients of selected consultants and Bankwest. The clients are grouped into the top 25%, average and bottom 25% ranked by operating surplus per mm of effective growing season rainfall within the same rainfall zone. The 2014-15 Benchmarks noted that 'different from our earlier analysis that showed that farm size was very similar between the top 25% and the average, the current data set is showing that the larger farms are now managing to produce an advantage with economies of scale' (p.34). The six year multiple year analysis found that the 'top 25% of businesses generated double the profit of the average' (p.6). The 2017 Benchmarks found that 'compared to the industry average, over the last 10 years the top 25% of broadacre businesses generated nearly double the return, enjoyed 20% higher operating profit … and realized on 0.4% higher costs' (p.14).

Fourth, larger farm size in Australia is supported by an active land-leasing market. Leasing implies land can be operated by the best farmers without a change of ownership. Hence, farm businesses can expand the size of their operations and achieve economies of size advantages in their use of farm machinery, yet need not acquire farmland. For example, as shown in Australian farm surveys (e.g. Kingwell et al., 2013) most successful farm businesses operate more land than they own. Hence, these businesses have some separation of their land operation from land ownership, yet their usual goal is to own *and* operate more farmland. Land ownership can provide the additional benefit of greater wealth through land value appreciation.

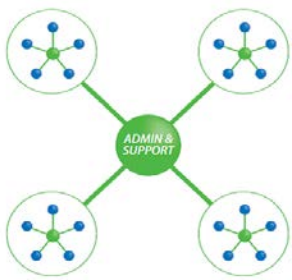
Although the land lease market is growing in Australia, it is less developed compared to the United States (US). This probably reflects institutional factors in the US that encourage land holders to retain land, such as production subsidies, subsidised crop insurance and tax arrangements. As much as 40 per cent of agricultural land has been leased in the US since 1997 and in many cropping areas, this rises to over 50 per cent (Nickerson et al., 2012). Burns et al. (2018) report a strong inverse relationship between share of operated land that is owned and value of production. Furthermore, younger farmers are far likelier to rent most of the land they operate (Burns et al., 2018). Nickerson et al. (2012) also reported that non-operators owned 29 per cent of all land and 77 per cent of the land that is rented. Leasing in the US is an important means of overcoming the barrier to structural adjustment caused by high land values that are not supported by production returns, usually because of public subsidies, proximity to urban areas or issues related to farm succession. By contrast, in Australia, a combination of an absence of public subsidies, fewer alternative uses for land in much of regional Australia and its set of institutions favour land transfer via ownership over leasing.

Although a large farm holding does offer scale advantages, it is not without risk. For example, two of Australia's largest grain producers (around 100,000 hectares), both family structures, augment their holdings with leased land and off-farm investments. However, both, in recent years, placed all, or a large part, of their assets on the market (Locke, 2014; Sprague, 2015). One is in a low rainfall region of the WA grainbelt that has been affected by a drying climate (see below) and he sold his 68,000 hectares with a 10 year lease-back from Hong Kong purchasers (Neale, 2016 and Gill, 2016). The other, in north eastern NSW, is in an area in which corporates have invested, suggesting that land prices may be reducing the opportunity for further growth; and better returns may now lie elsewhere. From 2016, parts of this enterprise were sold to a North American passive land investor, Westchester.

Scale is particularly important for corporates as they have additional governance and reporting overheads that do not pertain to a family structure. A large-scale corporate business can spread these costs over more hectares or more value of produce thereby lowering the unit costs of their overheads. These corporate structures include management entities operating for domestic pension funds (e.g. Warakirri/DIRT, during 1996 to 2006, operated 35,000 ha of cropping), sovereign wealth funds (e.g. Hassad Australia owns and operates around 150,000 hectares of grain and livestock enterprises (2018)[1]), direct ownership (e.g. Wellard's ownership and operation of 30,000[2] hectares of grain production in 2014; by January 2018 the last of these properties had been sold (Hale, 2018)) and funds and operations management for overseas pension and institutional funds (e.g. Macquarie Bank's Lawson Grains that operates around 90,000 hectares[3] of grain and livestock production; in 2018, it is one of Australia's largest grain producers (~ 200,000 tonnes of grain (Anthony, 2017)). Size of investment also matters for investors, with $20M a typical minimum investment threshold for institutional investors. The fact that foreign businesses own only 1 per cent of farm businesses but 13.6 per cent of Australia's farmland (CPA Australia, 2018) illustrates the corporate preference for scale.

Indeed, specialist land aggregator companies have developed to parcel and prepare smaller properties into deals of sufficient size to be of interest to large institutional investors[4]. These holdings are held for as long as it takes to aggregate them to an acceptable size and/or to develop them to a suitable level of productivity. A shorter turnaround time implies a preference by aggregators for a higher rate of return compared to a foreign pension fund or sovereign wealth fund.

Warakirri/DIRT, Hassad Australia, Wellard and Macquarie are corporate examples that operate or have operated 'hub' aggregations of either grain and/or livestock operations, with each hub around, at least, the scale required to fully utilise a set of machinery, either owned or contracted-in. Further scale economies are gained from spreading other management costs across the entire structure. Hubs can permit spatial hedging against adverse weather events such as drought. Hub development (Figures 2 and 3), based around irrigated cotton, was a core strategy of the formerly listed $350M company Prime Agriculture (PAG). Tension between its need to fund ongoing development of its hubs whilst providing an immediate return to shareholders was one of the reasons for PAG's eventual delisting and the sale of its assets (Plunkett, 2015a).

Figure 2: *Within* hub structure and economies of scale	**Figure 3: *Across* hub structure and further economies of scale**
	

Source: PAG Prospectus (2007)

[1] https://hassad.com.au/
[2] http://www.wellard.com.au/home/rural-production/wellard-agri-farms.html
[3] http://www.lawsongrains.com.au/about-lawson/
[4] http://gofarmaustralia.com.au/about

Exploratory discussions conducted with several large farmers in WA indicate a trend of dispersing production at minimum efficient scale for the reasons given above. Careful attention is paid to the crafting of incentives for managers of these properties. Indeed, careful attention to these incentives is a common theme across growing enterprises (for example, see Plunkett, 2015b, p. 11-12) as labour-to-capital ratios fall and labour skills become increasingly important. Central to performance management appears to be the setting of general strategy and the advantage a knowledgeable farmer has in monitoring a manager's performance.

To date, there has been far less adoption in Australia of multi-farmer equity models such as those widely existing in the New Zealand dairy industry. In these models, several farmers co-contribute equity to finance a new farm. Historically, these models were used to convert a South Island extensive sheep property to an irrigated intensive dairy farm. Note that the use of irrigation implies less climatic variability and consequently, more even production results and lower monitoring costs. A managing partner is also granted equity to tightly align the interests of the manager to the enterprise. Monitoring costs are reduced when a group of knowledgeable farmers constitute the oversight board. Unlike Australia, capital gains tax is not levied on land transfers in New Zealand, which encourages liquidity with the use of these structures (Tomlinson, 2014). A very close alignment of business objectives between the investing partners is of paramount importance to the successful formation of these partnerships (Reekers et al., 2014), signaling high levels of collective entrepreneurial intent. The use of selective incentives to align business goals may also be thought of as a form of collective entrepreneurship (Cook and Plunkett, 2006).

External capital can also be included as an equity partner. For instance, in 2014 the Australian dairy co-operative, Murray Goulburn (MG), facilitated the injection of $20M of equity from Swedish pension funds into selected member farms for the expansion of those businesses (Lynch, 2014). Murray Goulburn's screening of applicants and establishing of suitable investment protocols, suggested it could reduce the costs of aligning the partners' interests. By aggregating the farmers' requirements for capital, MG delivered the scale of investment required to attract external capital, thereby facilitating the investment transaction. The incentive for MG's entrepreneurial behavior was to attract additional milk supply to improve returns to its manufacturing assets.

Certainly, the lease market around sharemilking in New Zealand is highly developed. It helps to create a career path and asset formation as participants graduate along a continuum of farm worker, farm manager, lower-order sharemilker, full sharemilker, owner operator and farm lessor. Tomlinson (2014) suggests that this model has not developed in Australia to the same extent as in New Zealand because Australia's greater seasonality implies that the relative performance of the herd-owning sharemilker and the lessee land owner in maintaining pasture is harder to determine. This provides further insight into MG's strategy of equity partnership facilitation.

Harvest Capital Partnerships channel investment to larger, well established farmers seeking growth equity; in 2010 it raised $400M from just five clients. Its Executive Director indicated that the 'main impediment to corporate investment was lack of investment grade opportunities that offer the management capability, size and scale required by larger investors' (Eyres, 2010). Equity partnerships are generally not for small farmers as most large investors are not interested in small deals. That large deals are not common in broadacre agriculture suggests, again, that Australia's greater seasonal variability is an important factor in shaping how capital flows to this agricultural sector.

As large family farms grow in size to better utilise economies of scale and to spatially spread production risk they are adopting more corporate-like structures. This is to take advantage of specialised skill sets required by their increasingly sophisticated operations and to take advantage of

the data their high tech operations generate. For instance, management board-type structures that incorporate finance, human resource management, legal skills, marketing and agronomic skills are becoming more prevalent (AFI, 2015). Marketing has taken on greater importance in Australia since the de-regulation of statutory marketing in the 1990s and 2000s. For instance, farmers are now responsible for the marketing of their entire product whereas, previously, statutory bodies undertook grain marketing on behalf of all farmers.

Climate variability

A feature of agricultural production in Australia is its pronounced variability in climate (Kingwell, 2012; Kingwell et al., 2013). An important impact of climatic variability, when combined with the low levels of government support to the farm sector, is that multi-peril insurance schemes 'have struggled in Australia because of actuarial perception of high risk in production volatility and farmer perception of high premiums' (Williams et al., 2014, p.5). This has further impacted the sector's willingness to adopt price risk management strategies aggressively, compared to the US that has farm revenue subsidies and yield protections.

Hubs are also a strategy to help large farm holdings manage Australia's particularly acute climate variability, as farms can be dispersed across uncorrelated climatic areas. For instance, Prime Agriculture employed its hub strategy with a large portion of its investment being irrigated capacity in an attempt to mitigate the effects of climatic swings. However, it suffered major production setbacks due to widespread periodic flood damage.

Table 2 outlines the importance of irrigation to Australian agriculture. Although irrigated land forms a tiny proportion of the land area of Australia, it generates the bulk of Australia's farm profits and much of the value of farm production. Irrigation accounts for 100 per cent of rice, 96 per cent of grapes and 92 per cent of cotton produced in Australia. Note the fall in irrigated water use due to drought in eastern Australia and the maintenance of irrigated farm gate revenue. This reflects the operation of water markets which were reflected in a doubling of the average price of water in Australia (Australian Bureau of Statistics (ABS), 2010).

Table 2. Irrigation across Australia, 2004-05 / 2008-09

Total irrigated area	2.5M ha
Proportion of Australian area	<0.5 per cent
Water diverted for irrigation	12,200GL / 7.600GL
Proportion of water used	65 per cent / 54 per cent
Irrigated farm gate revenue	$9.6B / $9.7B
Proportion of total agricultural production	28 per cent / 29 per cent
Proportion of total agricultural profit	51 per cent / NA

Source: ABS (2010)

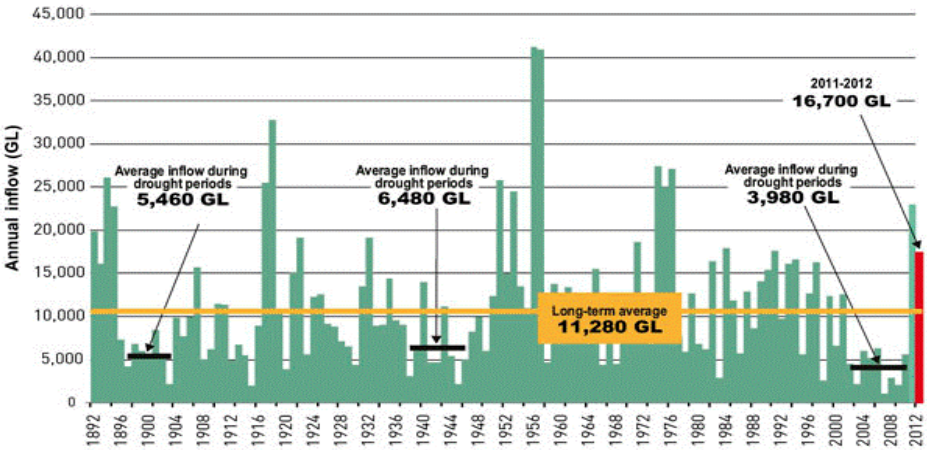
Climate variability is more pronounced on Australia's east coast in large part because of the combination of the Southern Oscillation (El Nino/La Nina cycle) and the rain-shadowing effect of the Great Dividing Range. Figure 4 illustrates the agriculturally highly significant Murray Darling Basin (MDB) in eastern Australia. The MDB drains much of the agricultural regions of Queensland, NSW and Victoria. It produces a third of the country's food and fibre (and nearly all of its rice and cotton and a majority of its hay, grapes, fruit and sheep) from irrigated and dryland production. The basin contains 40 per cent of Australia's farms and 70 per cent of its irrigation area (Murray Darling Basin Authority, 2014).

Figure 4. Location of the Murray Darling Basin system

Source:[5] Google Images

Figure 5 illustrates the pattern of extended droughts and floods across the last century in the MDB. The black bars indicate years of extended drought that typify the nature of climate variability in eastern Australia.

Figure 5. Historical Murray River system annual inflows from 1891 - 2012



Source: Murray Darling Basin Authority (MDBA, 2012)

This climatic variation is further illustrated in Table 3 which compares the historical peak to trough rations of selected world river systems. The last four entries, the Namoi, the Gwydir, the Condamine and the Macintyre systems, are all part of the MDB.

The Cubbie aggregation, located on the MDB in Queensland, is an example of a corporate business based at a single location operating a very large-scale irrigation entity. Its recent fortunes illustrate the business risks created by climate variation.

[5] https://www.google.com.au/search?q=murray+darling+basin+map&biw=979&bih=413&tbm=isch&imgil=16vb2x9wtUenRM per cent253A per cent253BpAjdcVXMVil7nM per cent253Bhttp per cent25253A per cent25252F per cent25252Fwww.abc.net.au per cent25252Fnews per cent25252Frural per cent25252Fspecials per cent25252Fmurray-darling-basin-plan per cent25252F&source=iu&pf=m&fir=16vb2x9wtUenRM per cent253A per cent252CpAjdcVXMVil7nM per cent252C_&dpr=1&usg=__udMF2l6NrlaWX0-4VbOWj_RoHnI per cent3D&ved=0CCgQyjdqFQoTCLb7jdzY68YCFUR9pgodfr8FTw&ei=rvOtVbbsBsT6mQX-_pb4BA#imgrc=16vb2x9wtUenRM per cent3A&usg=__udMF2l6NrlaWX0-4VbOWj_RoHnI per cent3D

Table 3. Historical peak-to-trough ratios of selected world river systems

Country	River	Ratio between the maximum and minimum annual flows
Brazil	Amazon	1.3^
Switzerland	Rhine	1.9^
China	Yangtze	2.0^
USA	Potomac	3.9^
South Africa	Orange	16.9^
Australia	Murray	15.5^
Australia	Hunter	54.3^
Australia	Darling	4705.2^
Australia	Namoi (EOS*)	139.2[a]
Australia	Gwydir (EOS*)	46.15[b]
Australia	Condamine (at Warwick)	104.8[c]
Australia	Macintyre (at Goondiwindi)	28.23[d]

Sources: Kirk (2008^), Murray Darling Basin Authority (MDBA, 2010[a-d])

It consists of 93,000 hectares of cotton production of which 23,000 hectares is irrigated. This may be compared to a typical 500 – 2,000 ha combined irrigated and dryland operation in Australia. It has Australia's largest irrigation water entitlement. While irrigation tempered some of the climatic risk of its operation, Cubbie nonetheless became a distressed asset due to prolonged drought. It was sold to Chinese interests in 2012 for around $250M. Its bale crop in 2010/11 was worth $150M and its EBITDA was $80M (De Garis, 2013), implying a rapid return to profitability when seasonal conditions improved.

The Western Australian agricultural region does not have extensive river systems for irrigation, but it does have a more stable Mediterranean climate. However, the region has been subject to climate change impacts. It has lost an average of 25 per cent of its annual rainfall over the last four decades and Figures 6 and 7 indicate that the eastern edge of the grainbelt has shifted westwards.

Figure 6: Annual Rainfall Zones 2000-13 compared with historical data

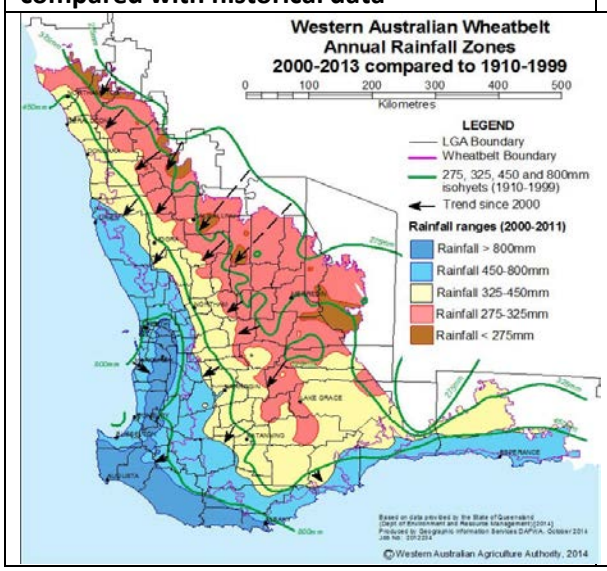
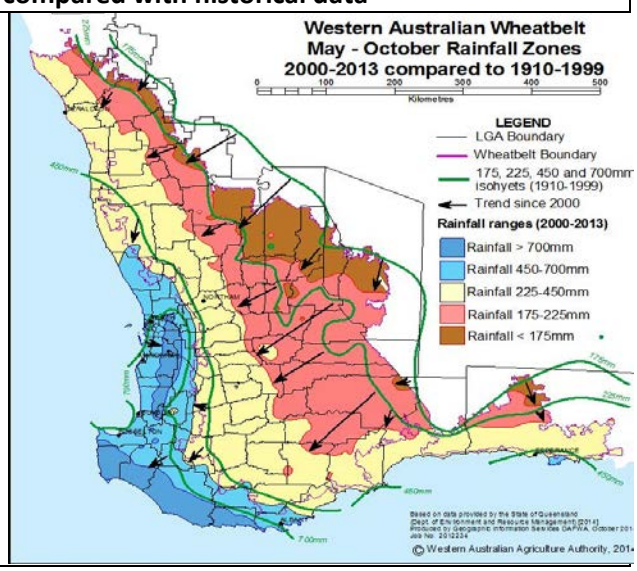


Figure 7: Growing season rainfall 2000-13 compared with historical data



An increasing prevalence of crop damaging events across wider areas such as hot days during crop flowering have been observed (Plunkett, 2015b). Frosts are also more prevalent. Despite the loss of rainfall, the average total annual output of grain has remained constant. In part, this is because previously wet areas are now more suitable for grain production which has led to increased plantings. Adoption of modern technologies has also greatly enhanced yields. Note, in areas experiencing more weather volatility, changing business and agronomic practices have been observed, including reduced fertiliser use (Plunkett, 2015b). Feldman et al. (2015) modelled the expected returns from adopting a very low fertiliser strategy in a region where drying trends are evident. They found that a low input strategy is effective in reducing downside business risk.

The Farming Sector's Need for Capital and the Attractiveness of Agriculture's Returns to Investors

Farmer demand for external capital

Traditionally, banks have debt-financed farm investment. However, as farmers' terms of trade have deteriorated faster than farm productivity growth, banks have become progressively more selective in their support of rural enterprises and seek to target their lending to more profitable farmers. Many smaller, less profitable enterprises have increasingly found access to bank finance either difficult to secure, or may pay more for funds than better-performing farms.

Productivity in Australian agriculture is around 70 per cent of that of the US (Rural Industries Research and Development Corporation (RIRDC), 2013). Productivity growth in Australian broadacre agriculture has averaged 1.6 per cent per annum over the past three decades compared to 1.8 per cent and 1.2 per cent for the US and Canada, respectively. RIRDC reports that climate change impacts are predicted to detract 17 per cent from Australian agricultural productivity by 2050. This can be compared to 4 per cent and 1 per cent for the US and Canada, respectively. The majority of Australian agricultural productivity losses are largely expected to emanate from losses of water quantity and quality.

Further, the Australian Farm Institute (Tomlinson, 2014a) reports that 'the average farm sizes of global competitors such as New Zealand, Argentina, Canada and the US are growing at a much faster rate than Australian farms, suggesting that the funding arrangements for Australian farm businesses may be the factor limiting farm size growth.' To this could be added many depleted farm balance sheets caused by several years of drought during the 2000s, particularly in eastern Australia. As a result of the growth in farm indebtedness, fewer farms were keen to pursue expansion opportunities and banks were less amenable to funding farm expansions. In 2016, farm debt had grown to $60B and, according to Marshall (2016) 'would need to blow out $300B in the next 35 years to finance agriculture's hefty productivity growth expectations' in the absence of other capital sources.

The resulting slower rate of farm consolidation has also been affected by a growing productivity divide between larger farmers and small farmers, the former having greater access to new technology and the benefits of size economies. ABARES (2013) points out that the top 25 per cent of farmers generated 53 per cent of the gross value of broadacre farm production over the three years ending 2011-12' (p. 35) and generated 65 per cent of new investment compared to the bottom 25 per cent of farms (which) accounted for just 8%. Coupled with a rapidly aging farmer population, a dilemma is arising in Australian agriculture. Dodson (2004) comments that there is a growing number of aged farmers seeking retirement; at the same time they face uncertain remuneration and are dealing with farm succession difficulties. Yet, simultaneously there has been historically a

shortage of more profitable farmers with the financial resources to take over the assets of those wishing to exit farming.

Note, however, in recent times this constraint has been somewhat eased. In early 2016, Neales (2016) reported that large Australian farming families were buying up major agricultural assets as they accessed a record $5.1B of savings in Farm Management Deposit (FDMs), created as a result of good returns from a series of record sheep and cattle prices and cropping seasons. FDMs allow farmers to pay no tax on income deposited from good seasons, earn interest on the deposited money and draw these during poor seasons. From 2017, FMDS could be offset against farm debt, which will presumably further increase the attractiveness of existing farmer takeover of land if the flows of heathy returns continue.

Notwithstanding the recent uptick in family farming investment, the state of financial viability in Australian agriculture suggests a growing need for new forms of capital, aside from traditional bank debt, to lift productivity growth. Land is the traditional asset class for agricultural investment yet other investment forms could include separating land ownership from farm operations (to various extents) and having capital linked to productivity innovations, particularly around identified market opportunities. This would require new ways of thinking and new investor models.

Investor interest in Australian agriculture

As of 2010, 97 per cent of Australian farms were family-owned, either through sole proprietorships, partnerships or private companies. The rest are either vertically integrated with supply chain operations or else owned by non-farm equity investors (Malcolm, 2011). Foreigners owned 13.6 per cent of agricultural land in Australia in 2017 (FIRB, 2017), which mainly reflects the large scale of foreign holdings in northern cattle properties.

Table 4. Average investment yields and risk: T bills, farmland and stock markets* (1990 – 2005)

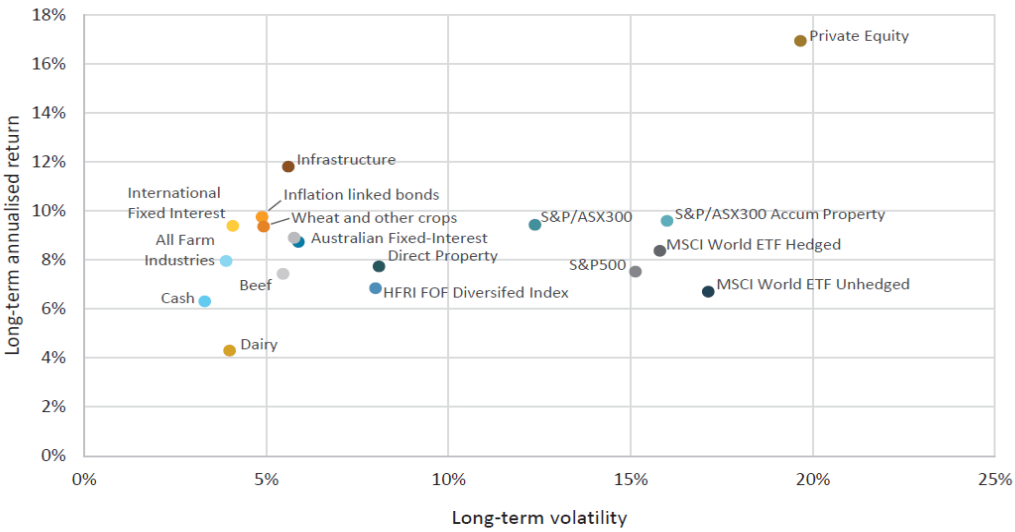
	Average Yield (%)	Standard Deviation (%)	Coefficient of Variation
Risk-Free Rate (T Bills)	5.6	0.0	-
Australian Farmland	9.8	5.4	0.55
Canadian Farmland	5.9	3.3	0.56
NZ Farmland	14.4	16.3	1.13
US Farmland	8.5	4.4	0.52
Australia*	8.5	18.3	2.15
Canada*	9.3	22.6	2.43
New Zealand*	6.4	26.8	4.19
France*	8.5	19.2	2.26
Germany*	6.6	24.4	3.70
Italy*	6.1	22.8	3.74
Hong Kong*	9.1	39.2	4.31
Japan*	1.0	26.6	26.60
UK*	5.9	15.8	2.68
US*	9.4	18.7	1.99
MSCI World Portfolio*	6.9	16.4	2.38

Source: Eves and Painter (2008)

Eves and Painter (2008) indicate that returns that are superior, and uncorrelated, to equities markets, with less risk, are possible from agriculture over a 15 year period (Table 4). They compared Australian, Canadian, New Zealand and US farmland yields (income and capital gain returns) between 1990 and 2005 with Treasury Bills and stock market returns. New Zealand farmland returns were better than its stock market; Australia and the US had similar returns to their stock markets. While Canadian farmland yielded less than its stock market, it was close to the MSCI World Portfolio. Further, the study found that the risk associated with farmland investment is generally lower than stock market investment, even when compared to the US stock market, which has the lowest stock market coefficient of variation. A generally negative correlation between stock market and farmland returns (McKinna, 2012) increases the attractiveness of this investment class within a portfolio of assets. Farmland is also a very good hedge against inflation; for instance, US farmland has a .65 correlation with inflation over the period 1970 - 2014 (see Anthony, 2017).

Note that the 15 year study period shown in Table 4 smooths out the variability in returns. Note also that Figure 8 suggests that these returns are likely to have increased since 2005, so that an increasing interest in agriculture by external capital is unsurprising. Similarly, Anthony (2017) presents data from 1990 – 2016 comparing the risk reward performance of Australian farm sectors to global and local equity and property indexes (Figure 8). The data indicate that, with the exception of dairy, Australian agriculture performed comparatively well with much less volatilty.

Figure 8. A comparision of investment risk-returns across investment classes 1990 – 2016



Source: ABARES / Frontier Capital data in Anthony (2017)

Eves (2012) notes that, despite impressive productivity growth in Australian agriculture over the 30 years to 2004 (bettered only by telecommunications and IT sectors) and the size of the agribusiness sector (12.1 per cent of GDP in 2009), the property and investment sectors had not focused on agriculture as much as other sectors, especially from the 1980s until 2006[6].

The 2007 soft commodity boom changed this dynamic (Figure 9). The interest of domestic and international pension and investment funds and Sovereign Wealth Funds (SWF) in Australian farmland has steadily gathered momentum since. Foreign investment in agriculture rose from

[6] Agricultural Managed Investment Schemes (MIS), driven by tax concessions, are ignored, particularly as the Australian Tax Office has disallowed their use in recent years. For interesting discussion on the economic and legal aspects of MIS see Mackarness and Malcolm (2005) and Jahn (2007).

AUD8M in 2005/06, and AUD100M in 2006/07 (Williams et al, 2014) such that, by 2008-09, foreigners had secured over $3B of land (Eves, 2012). This was further accentuated by the 2011 boom and historically continuing high prices.

Figure 9. Commodity price indices, 1998 – 2018

Source: Index Mundi (2018)

By 2011, Hassad Foods Australia (a Qatar government-owned company) had secured 140,000 hectares of Australian farmland for $100M for food security purposes. This is twice the amount of farmland available in Qatar (Houston and Millar, 2011) and by 2014 it had expanded to 250,000 hectares (Williams et al., 2014). IFFCO, a United Arab Emirates (UAE) company purchased 20 per cent of AACo over 2010-12. Terra Firma (a European investment firm) purchased $425 million of beef cattle properties in the same period. The Australian Financial Review (AFR, Cranston, 2011b) reported in 2011 that "at least $4B is being raised to buy rural property around Australia" as illustrated in Table 5. (Note the preponderance of overseas money is highlighted in **bold** font.)

In 2015, the head of Macquarie Bank reported that a 'wall of money' was seeking to enter Australian agriculture as land prices had not appreciated as anywhere near the levels observed in other agricultural exporting nations such as Canada and the US due to various trade and climatic conditions (Schlesinger, 2015). Also the devaluation of the Australian currency since early 2014 increased the attraction of Australian farmland. Schlesinger (2015) added that 'Australia is seen as a stable, more reliable and more predictable jurisdiction to establish and do business in and with a government and banking sector that operates in a very transparent way. It's also a very predictable jurisdiction to do an exit from too.'

Allen and Linklater, an international law firm that regularly advises domestic and international investors, conducted a 2014 survey of international and domestic investors on *their perceptions* of investing in Australian agriculture. It found the main reasons for investor interest in Australia was its proximity to markets (76 per cent), its quality of infrastructure (67 per cent), its surplus production for export (61 per cent) and its Free Trade Agreements with other countries (53 per cent). However, Williams, et al. (2014, p.2) report that 'there are perceptions that transacting business in Australia is not perceived to be easy relative to other countries, with Australia currently ranked 15th in terms of the ease in doing business (Doing Business, 2012), behind Singapore (1st), New Zealand (2nd), US, (4th), and Canada (12th).'

Table 5. Investment in Australian rural land

Fund	Investors	Commodity	Funding goal ($M)
Agri Fund	Prime Ag Ltd (listed), Australia's Future Fund, and **US hedge fund**	Crops	600
JPT Capital Agrifund	**Mauritius, Western Europe**	Wheat	80
Westchester	**Swedish SWF and US pension funds**	Crops	500
Macquarie	**European and US**	Crops, dairy and pastoral	1700
Warakirri Asset Management	Superannuation funds and charities in Australia	Dairy and crops	160
Sustainable Agriculture Fund	Domestic superannuation funds	Crops, dairy and pastoral	350
Laguna Bay Pastoral Company	Open to domestic and **offshore**	Crops	800
RM Williams Agricultural	**Jersey (Channel Islands), US, PNG** and domestic	Poultry, pastoral, carbon	140
Hassad	**Qatar SWF**	Sheep, crops	100
TFS Corporation	**Middle Eastern SWF**	Timber plantations	300

Source: Cranston (2011b)

Further, Allen and Linklater's (2014) survey of investors found that, besides climate variability (72 per cent), the main disincentives to investing in Australian agriculture were input costs (61 per cent), tax (44 per cent), government decision-making (31 per cent), regulatory burden (28 per cent), the value of the Australian dollar (8 per cent) and the lack of investment opportunities (7 per cent).

Investor expectations meet agricultural assets

Climate variability was identified in Allen and Linklater's survey as the largest factor discouraging investment, apparently because of its impact on the variability in returns. Two published comments in response to the survey are particularly pertinent: 'The problem with Australia is climate-related volatility. You have volatile prices that you multiply with volatile yields due to the climate. So the volatility of returns in Australia is larger than anywhere else' … and… 'variable climate has already started to affect the agriculture business in some parts of Australia and is emerging as the biggest threat for the sector. If unchecked soon, Australia will be vulnerable to natural calamities and (it) could lose its reputation as a favourable destination for investment in agriculture' (Allens Linklater, 2014, p.7).

Yet, Heath (in Marshall, 2016) reported at AFI's 2016 roundtable conference that surveyed investment managers rated 'agriculture's volatile market and seasonal trends' as of mid-level concern, but as noted earlier in this paper, wanted greater liquidity options. He suggested that 'an industry dominated by family farms and related agribusiness' … 'by necessity adopted conservative management tactics which were generally not conducive to attracting new capital partners, or hastily dissolving partnerships amicably.' This conservativeness is presumably, in part, driven by Australia's comparative seasonal volatility. The greater risk associated with these production systems implies higher comparative returns, all other things being equal.

Similarly, Eslake (in Rollins, 2017) argues that illiquidity rather than volatility of returns is the principal reason for institutional reluctance to invest in agriculture, noting that while farmers 'are prepared to borrow, often heavily, they are far more reluctant to share the equity and ownership rights that accepting investment from an institutional investment would typically involve' (Eslake in Rollins, 2017). 'I ask them' said Eslake (in Rollins, 2017), "Are you prepared to sell 40 per cent interest in your farm and give someone else a say in how you run it?" Few do when it is put to them like that.'

Land is a highly 'lumpy' investment and land markets are relatively illiquid, implying that they take time to clear; this underpins the importance of an active leasing market to reallocate land resources (Bullock, 2000). Edwards (in Marshall, 2016) stressed the 'importance of pre-planning an exit strategy (as) one of the many investment rules the farm sector had to better understand' when agreeing with Heath's observation that investors 'wanted the option of a more nimble investment environment where they could cash out relatively swiftly in an emergency'. Illiquidity is noted as a 'key reason Australian superannuation funds allocate only 0.3 per cent of their $1.2 trillion war chest' to agriculture (Marshall, 2016). However, Van Beers et al. (2013, p.12) argue that land's 'illiquidity is one factor behind (agriculture's) apparently attractive risk-return profile.'

If the proposition put forward above is valid, then a fundamental issue around increasing external capital flows into agriculture is the creation of ownership structures and rights that both encourage flow but preserve the responsive management systems associated with family structures. In turn, this would imply a further pertinent question is whether the application of information technology can render farms transparent enough so that external capital can understand the relevant performance of operators. In this way, capital could flow to most skilled operators employing the most responsive management structures.

Indeed, Anthony (2017) argues that the sectorial data available from ABARES is of limited usefulness. This is because voluntary collection implies only a partial representation of performance across industries and a lack of repeat sampling to measure performance over time. Further, a lack of oversight of data means it cannot be audited. The lack of an independent official data series 'establishing the risk and return profiles across commodity producers in the entire agricultural sector on a comparable basis' (p.30) makes it difficult for superannuation funds to 'establish a reliable benchmark for normal operating conditions through time', … and … 'identify the top tier of performers … through time'. Consequently, fund trustees 'find it difficult to justify investing member savings in agriculture, especially when it is so much easier to benchmark more conventional investment options in terms of their risk/return characteristics' (p.30). Thus, Australian superannuation institutions allocated only around 0.3 per cent of their funds to production agriculture in 2015.

Given investor concerns about revenue variability, performance measurement and liquidity, it is unsurprising that foreigners are heavily invested in post-farmgate agribusiness (Table 6). McKinna (2012) argues that, without foreign capital, Australia's post-farmgate agribusiness sector would be a fraction of its size. Many of these types of investment are by late-stage investors into stable businesses with proven (mainly domestic) revenue capacity. Often, these businesses require asset refurbishment. In 2016, 60 per cent of the top 25 Australian agribusiness food companies by sales turnover were foreign-owned (Anthony, 2017).

Concern with variable returns has led to the development of new financial products to give investors exposure to agriculture without direct exposure to production variability. For instance, around $2B of water rights are traded in Australia's well-developed southern MDB water markets.

Table 6. Foreign ownership of Australian agribusiness in 2010

Sector	Degree of Foreign Ownership (%)
Grain trading and storage	40-55
Dairy processing	50
Sugar processing	60
Red meat processing	40
Pork processing	25
Grain / oilseed processing	65-90
Poultry processing	0 (>60 as of 2013*)
Vegetable and cotton processing and beef feedlots	Predominately foreign

Source: ABS in Keogh (2012), *Jasper (2015)

These rights are perpetual and fungible and leases are often traded to uses with the highest economic value and investor interest is growing[7].

There are several types of investor models that account for the nature of assets being purchased and the different motivations for investment. Again, if our proposition is valid, then it would be consistent with investor structures that concentrate on comparatively stable rainfall areas, climatically uncorrelated diffuse holdings and/or irrigation[8] as these are more likely to match an apparent preference for revenue stability. It would also be consistent with passive ownership structures that are not involved with operational control, such as leasing, and with owner-operator models that have highly responsive (family farm like) management structures.

Westchester, an application of a well-established US lease model, is an example of *passive* investment in agricultural land. In Australia, it has reportedly amassed around $1B in assets that include dryland regions with reliable rainfall and irrigation enterprises (Wagstaff, 2016). It purchases land in areas traditionally thought of as being stable and then leases that land to farmers who wish to invest in operational efficiencies. Westchester is owned by the Teachers Insurance and Annuity Association of America, a pension fund, so it is suited to a modest, long term flow of returns. Its approach to financing retains the lessee operator as the main residual claimant and can align the interests of the two parties, as Westchester seeks a flat pension type of lease return. However, it implies that significant productivity gains must accrue to the farmer from expansion, as the farmer must forgo any capital appreciation as well as paying for the lease. There may be other sound business reasons, such as asset diversification away from farming, to enter into a leasing arrangement.

Sale and lease back is another variant of passive investment. Recent deals have included poultry production (Inghams/TPG Capital, $650M), irrigated almonds (Adveq Almond Trust/Olam Australia, $200M), and irrigated vineyards (Qualco West Vineyard/Belvino) (Jasper, 2015). Like the Westchester model, land investors gain access to knowledgeable management. Murray Goulburn dairy co-operative, as previously mentioned, sourced Swedish superannuation funds to provide $20M to purchase dairy farms in 2014. These were leased via the co-operative to member family farms, securing the milk for the co-operative (Lynch, 2014).

[7] For example see https://blueskyfunds.com.au/?s=water+entitlements

[8] In Western Australia, the exception to this pattern was the investment by Chinese Beidahuang Group with its purchase of 30,000 ha and lease of around 50,000 ha in 2013. Many of these properties were in the drier eastern area of the WA grainbelt. This year the company announced it was scaling back to 35,000 ha of cropping.

Indeed, such was the interest in sale and lease back by 2017 that Caw (2017) asked if 'is sale and leaseback the new black in Australian agribusiness?'. Anthony (2017) indicated that institutional investors should expect to earn 6 to 9 per cent from long term buy-lease arrangements. Caw listed a number of attributes that investors were seeking in addition to capital growth: risk adjusted returns (lower returns from leasing land), scale, 'skin in the game' (co- equity investment of some sort), skilled operators (lessees), and known investment parameters (lease term and rent levels, including buyback provisions (see Masters and Erikson, 2017)). The last two in particular suggest increasing returns from digitisation of farming operations that lend transparency to the managerial efficiency and financial status of the farming operator.

Of the investment models that involve ownership *and* management of assets, the stock-exchange-listed model in Australia has generally had difficulty in being a good fit for agricultural assets (see Manning (2012) for an insightful discussion). This is because many have not met investor expectations for smoothness of returns and they have frequently traded at less than net asset valuation (NAV) resulting in delisting (Brown, 2013). Shares in Australia's largest agricultural company, AACo only began to trade above NAV in 2014 as the boom in cattle prices continued. AACo was relisted in 2001, and in October 2014 the financial media was speculating whether the company should consider delisting (Binstead, 2014).

The fortunes of the 2015 delisted Prime Agriculture Ltd is another example of the stock exchange model not being a good fit with agricultural investment in Australia. It achieved its production targets in normal years after it had finished implementing its three-year capital expenditure program. However, repeated adverse weather events (floods), and a high land market visibility made it difficult to execute its consolidation strategy (lack of scale economies), resulting in poor stock valuations such that it never traded above its NAV. Eventually, the company was taken into private hands by Australian Food and Fibre, a company that itself had previously delisted. Interestingly, the Australian media has recently reported that AFF leases $120M of land from Westchester which has freed AFF to concentrate its capital on operations. PAG's history also illustrates that a changing composition of a listed company's shareholding can also misalign the nature of agricultural returns and shareholder expectations, resulting in demands for asset divestment. Dominant, patient shareholders on the company register may be necessary to counter the intense focus on short term returns from other shareholders, especially non-agricultural specialist investment funds (for a full discussion of PAG's history see Plunkett, 2015a). The constant returns of a factory like output from protected systems such as broilers and glasshouse horticulture may be better suited to listed entities (Lynch, 2015*)*.

Australia has the fourth largest global pension system that could presumably provide capital for Australian agriculture. In 2014 the compulsory-defined contribution[9] scheme held a combined value of $1.6 trillion in assets, which is roughly equivalent to Australia's GDP. However, only 0.3 per cent of those assets are invested in Australian agriculture (Cranston, 2015). In addition to the volatility, illiquidity and performance measurement mentioned earlier, the rate of return demanded by Australian investors appears to be higher than those by foreigners. For instance, in 2011 the Agri Fund, a fund backed by the Australian sovereign wealth fund (the 'Future Fund') and PAG, indicated that it would seek a 13 per cent return. Around the same time, the Swedish pension fund AP2, teamed with the US pension fund TIAA-CREF to purchase properties, stating it was targeting a 7 per cent return (Cranston, 2012a). This implies that, like for like, foreigner investors will pay more for assets than Australian investors. It should be noted that Australia has a history of high current account deficits and a consequent history of comparatively high interest rates. In turn, this implies

[9] 9.5 per cent of all wage and salary earning must be contributed to pension funds of their earner's choosing. These funds are market-linked.

demands for higher returns from domestic investors compared to investors from jurisdictions with much lower interest rates.

Warakirri/DIRT fund (1996-2006) is another example of a specialist fund established over the past 20 years to manage agricultural assets on behalf Australian pension funds, including the Australian Retirement fund and the Retail Employees Superannuation Trust. It managed between $50-60M of assets. Delahunty (2014) indicated that the Warakirri/DIRT fund's spatially diverse, 35,000 hectares of dryland cropping operations made returns in line with the top 25 per cent of producers of around 10 per cent over the last five years of its operation. The fund operated for 10 years, so presumably the first five years did not perform at this level as it was not reported. If so, then this underscores the amount of time required to implement new technology and lift productivity (e.g. weed control, nutrition, physical infrastructure, etc.). Similarly, PAG was able to achieve its production targets, in normal production years, after three years of operation, which was required to embed its investment in machinery, systems and personnel (Plunkett, 2015a, p. 28-29). Anthony (2017) reports that while the original DIRT management team left in 2007, Warakirri Cropping continues to manage operations and it has achieved an average 8 per cent return per annum over the past three years.

In spite of the volume of superannuation funds accruing in Australia, Australian pension funds are 'very well aware of the difficult history of some agricultural (investment) vehicles' (Cranston, 2015a). One reason for Australian pension funds not investing in Australian agriculture has been the absence of reputable indices of the growth in value of agricultural assets, which made it very difficult for pension funds to compare results between entities set up to invest in agriculture on their behalf, according Arthur Apted (Cranston, 2015a), the former CEO of Sustainable Agriculture Fund (SAF). SAF is a specialist fund established to manage agricultural assets on behalf of Australian pension funds[10]. By contrast the US maintains transparent indices of US farmland values, such those provided by the US National Council of Real Estate Investment Fiduciaries (NCREIF). To remedy this lack in Australia an Australian Farmland Index was launched in 2016 (Hemphill, 2017). It is modelled on the US NCREIF which has seven large investors, who fund the index, providing data on over 700 farms, valued at over AUD10B. Access to other farms' data is provided on condition of submission of one's own data. Seven large investors contribute to the Australian Farm Index with 57 properties across grains, horticulture and livestock and the Australian index is compiled by NCREIF. Contributors can compare their operations not only with each other, but also to US contributors and other real estate sectors such as commercial and industrial properties. The index indicated that corporate farming represented by the index performed well in the year to March 2017, with combined operational and capital returns nearing 17 per cent. This reflected Australian agriculture's recent buoyant fortunes evidenced by the earlier noted extent of well-established farming families buying assets across the country. Anthony (2017) indicated that institutional investors with quality assets should expect to earn 8 to 12 per cent over the long term.

SAF sold the first tranche of its assets in 2017 to a North American pension fund after one of the Australian superannuation trust partners wished to exit the fund. Constructed in 2009 the portfolio is under sale contract (as of September 2017) to a range of institutional and family enterprises (Schlesinger and Bleby, 2017). The CEO of SAF commented that the fund 'in recent years delivered our investors steady income returns, capital appreciation and annual distributions' (Newnham, in Cranston, 2017). This comment underscores the observation that highly volatile returns are not favoured by this class of investor. Indeed, the fund's management company chair indicated that 'super fund (managers) fail to understand agriculture as an asset class … as they fail to understand

investment in agriculture requires a long-term vision and a long-term commitment' (Harlock in Cranston, 2017).

Despite some notable exceptions, corporate farms often have struggled to outcompete well-run family structures. Tomlinson (2014) reports that corporate farms achieved an average return of around 4 per cent from 2000-13. The Western Australian Planfarm consultancy annual survey of 550 family broadacre businesses indicated that the top 25 per cent of these businesses generated average rates of return to capital of around 8 per cent in 2005-13 (Planfarm/Bankwest, 2014 in Tomlinson, 2014)[11]. The managers of these farm businesses are highly skilled at managing climate variability (Kirk, 2014; Kingwell et al., 2013; Varischetti, 2015) which enables these businesses to remain as family-owned and operated businesses.

Hassad Australia's patient investment horizon is reflective of its food security objective. Food security implies a long investment horizon, with a comparatively lower rate of return on capital employed and a consequent willingness to pay more for assets. From its establishment in 2008, the company acquired around 40 farms. Recently, it has divested some of these as it focuses on creating value chains by expanding 'into value adding and food processing, rather than just farming' (McCarthy and Fowler, 2017).

The considerable increase in Chinese investment in recent years may also be thought of, in part, as a food security objective (Hunting, 2015) but may also be thought of as a profit maximisation objective, as Chinese companies have access to 'the world's largest and fastest growing consumer class'. Indeed, a value chain development objective is a common thread to many Chinese agricultural investments. Chinese investments should also be thought of in a wider context of large capital outflows that impact real estate and resource markets across the globe. Tighter capital account controls have lessened this flow, but Weiping (2017) argues these will redirect investment towards technology, energy and resources, including agriculture. She also notes that some of the investments are 'trophy investments' for prestige and the return metrics on these will bear little resemblance to those traditionally used to gauge performance.

Usually private equity investment in agriculture is at the late stage, investing in businesses that have demonstrated steady returns over several business cycles. It is the least tolerant of variable returns. Private equity firm, KKR (Kohlberg Kravis Roberts) Australia, recently invested $100M to expand Sundrop Farm's high value horticulture venture in South Australia. It is noteworthy that KKR is not typically an early stage investor or an agricultural investor. However, the consistency of Sundrop's cashflow, its expansion potential and its obvious status as a 'global solutions investment' (to food security and climate change challenges) made Sundrop an attractive proposition to KKR. The investment lifted Sundrop's scale by 100 times from 0.2 hectares to 20 hectares. Sundrop is a fusion of several technologies: solar thermal (for desalination, heating and electricity) water efficiency, and big data to control production within a protected environment. The massive productivity increase and low-cost constant production of perfectly uniform output resulted in Sundrop securing a 10 year contract with a major Australian retailer. A contract of this length had never before been secured with a major retailer for this type of product. From Sundrop's perspective, a long-term contract provides commercial security and gives a basis for further expansion, if warranted. The technology is replicable in hot dry climates elsewhere and provides an opportunity for further scaling as it is situated on land with little other use. This enterprise provides scope for the level and variability of rates of return that is attractive to this form of equity (See Wagstaff, 2017; Evans, 2014).

[11] Use of farm consultancies is highly likely to be correlated with farm business success. Therefore this should be a better performing segment of the broader West Australian broadacre farming community, which consists of around 3,000 businesses.

Discussion, Conclusions and Further Research

An owner operator's capacity for nimble management is the primary reason for the dominance of family structures of ownership in those sections of agriculture most impacted by seasonality, most notably in broadacre cropping. This is because of the skill required to operate a complex biological system with many unknowns.

This suggests that a pertinent research question is quantifying the location of corporate versus family farming operations to reveal the spatial importance of climatic factors, such as rainfall variability and weather risks, in affecting forms of ownership.

A second pertinent research question would be quantifying the correlations of multi holding businesses with respect to climatic factors, particularly rainfall (Kingwell et al., 2018). Corporates' ability to fund large purchases enables them to acquire spatially diversified portfolios of farmland. By quantifying climate or enterprise return correlations, corporates can compile a portfolio of locational assets whose returns are weakly or negatively correlated, thereby lessening the overall variability of investment returns.

Technology that renders more of these climate or locational unknowns transparent, such as climate forecasts, soil assays and yield maps, help favour corporate ownership of farm assets and operations to the extent that production can be standardised with fewer critical decisions. If greater climate variability implies a greater number of unknowns, all other things being equal, then greater climate variability causes a family-based owner operator structure to be preferred where local knowledge, local adaptation and labour flexibility become crucial components for business success.

That this technology is increasingly out of reach for smaller, lower-performing farmers implies their assets will flow, over time, to either larger, better performing family farmers or to corporates. Corporates' relative intolerance of variable returns suggests that their assets may pass to family structures in areas of greater climatic variability. Greater variability in climate implies greater risk and, therefore, that greater returns are required to compensate investors, implying land prices will have to adjust to reflect relative risk and returns.

Quantifying the value of accurately measuring the management performance of operators for the finance community is an interesting research topic. The establishment of the Australian Farmland Index indicates that this information is of value to investors wishing to understand their performance and to benchmark this performance against other asset classes. At issue is the extent to which corporate funds can flow to high-performing owner operators that face capital constraints to expanding their businesses, and these may be typically younger, smaller producers. For instance, a survey of banks, pension funds and other potential passive investors could establish the key metrics required for them to confidently invest with owner-operator partners. It may also identify mismatches between the needs of owner-operators and financiers. This information could be used to inform institutional development required to overcome these mismatches.

For instance, the Clean Energy Finance Corporation has apparently bridged the risk divide between many previously unfamiliar renewable energy proposals and institutional financing (debt and equity) since its inception. Established in 2012, the CEFC is modelled on the successful British Green Investment Bank and is mirrored in similar structures 'in over 10 US states' (Eggleston, 2015). It is a Statutory Corporation, independently governed, with access to $10B to finance energy efficiency,

low emissions and renewable energy projects[12]. While it acts like a traditional bank financier, it tailors finance to meet the needs of specific companies and projects that are smaller, more complex or new to the Australian market. It does this by partnering with established financial institutions to co-finance projects. In this way these institutions lessen the risk of dealing with new technologies as they develop new assessment skills and spread their risks, with the CEFC taking the lead role in assessment and financing. That is, the CEFC brings in co-financers and project partners ' … with the objective of devising new financing techniques, mixed with demonstrated success stories and the take up of technologies… to move down the cost curve' as it is 'not just another bank' but seeks to 'mobilise private money for a public policy outcome' (Eggleston, 2015). By 2015, it had committed $1.4B to $3.5B worth of projects. It pays a dividend to the Federal government and 'expected to achieve an average financial return of about 7 percent' (CEFC, 2014).

The Sundrop buildout discussed earlier was originally to be financed by a consortium of Australian financiers led by the CEFC. The domestic institutional interest it created was the validation needed to spark interest by major capital providers (CEFC, 2014). In early 2015, Sundrop Farms announced it had received USD100M in investment from the major New York private equity firm KKR. Private equity firms like KKR seek high return investment and are typically a late stage investor. It is rare for KKR to invest at a very early stage of development or into agriculture. The presence of the CEFC catalytic investment vehicle played a critical role in 'market making' communications between potential investors and Sundrop. Its CEO Phillipp Saumweber stated that 'without the CEFC we would not have been in a position to negotiate funding with KKR' (CEFC, 2014).

Greenop (2014) reports that the CEFC has also invested in other agriculture-related energy efficiency projects, such as bioenergy for waste management, apple processing refrigeration and a meat processor gas tri-generation.

These examples raise a public policy issue as to whether government should examine the efficacy of such an institution dedicated to catalysing early start development equity in high productivity Australian agriculture beyond energy efficiency.

If data generation and analysis can permit production processes to be sufficiently meaningfully separated then it could provide scope for greater management and ownership flexibility, such as the development of share leasing and equity partnerships as in New Zealand.

Equity partnerships are also a possibility for owner-operators to incorporate passive capital into their balance sheets and free up their capital to invest in technology and systems. New Zealand examples indicate that strong alignment of interests can be created when the operator is an equity partner in the business. However, successful partnerships require very clear agreement between the partners as to the business goals and directions of the partnership. This thinking may be extended to whole-of-value-chain approaches, in that capital for expansion and productivity growth could come from value chain partners with a direct stake in farmers' productivity. For instance, seed and machinery suppliers, in partnership with dedicated end users, could supply passive equity capital, technology training and specific seed types to target specific markets and secure the production management skills required from the owner operator.

Equity partnerships in New Zealand provide a means to train a new generation of farm managers. An apparent dearth of appropriately trained personnel in Australia (see Farm Policy Journal, Winter issue, 2015) suggests that the model may have some applicability in Australia.

[12] Its mission is to 'Accelerate Australia's transformation towards a more competitive economy in a carbon constrained world, by acting as a catalyst to increase investment in emissions reduction'. (Greenop, 2014, p.2)

In safer production areas, such as those with good rainfall, and/or irrigation, competition for land from corporates could place sufficient pressure on land prices such they will pass to the bidder with either the lowest target rate of return, or with the greatest capacity to inject value from some sort of entrepreneurial activity such as described earlier. The lowest target rate models may be the passive forms of investment, such as lease models. They may also be the food security investors. Lease models, although well developed in other countries, do not enjoy the institutional support provided by farm programs in these countries and these are highly unlikely to pertain to Australia. The further development of lease models imply the skills of the owner operator can be retained and/or capital can be freed up for investment in technology, or entrepreneurial, value chain formation; indeed, their recent 'new black' status implies that this process is underway.

The evolution of performance indices may see an acceleration of corporate investment in those sectors with low enough variability in returns to take advantage of standardised management systems. The Warakirri/DIRT example indicates that corporate operators can achieve sound rates of return, but that models may have to be simple to account for the complexity of biological systems in natural environments and have the necessary time to be implemented. Furthermore, corporate models will always need to have scale to compensate for their larger overheads; this suggests the further need for simplicity to counter the potential for management complexity. However, larger corporate structures tend to have higher reporting requirements and more complex governance structures. These may be ill-suited to the nimble management required in biological production systems characterised by high levels of seasonality.

In Australia's dry, variable climate, the adoption of further irrigation implies intensified production with more stable returns and these encourage corporate ownership[13]. Success in the development of irrigated feeding systems on northern Western Australian cattle stations will likely attract corporate interest. Indeed, mining magnates (with pastoral family backgrounds) have invested in cattle stations and aquifer recharge technology (Schwartz, 2015). Falling solar PV power (Parker and Chang, 2014), storage and desalination costs also imply an increased likelihood of intensification of previously extensive livestock industries, as well as already intensifying horticultural industries. Australia has abundant sunshine and considerable brackish water, and unlimited seawater, to desalinate.

It could also be envisaged that in broadacre industries, fund business model attributes could be adapted to enhance the value generated by in situ farmer expertise, with capital and non-production expertise. This would be along the lines that operating fund managers are placed by venture capital firms into target businesses to lift operating performance. Indeed, perhaps this type of partnership structure could be developed across multiple enterprises so they are able to better access world class funding, technology and advice in return for access to world class in situ production decision making that cannot be routinised and standardised.

The Sundrop case is an example of how innovation, sophisticated value-added management, high constant returns and scalability can make some investments highly attractive to corporate businesses. More industries may follow similar routes of intensification as energy and associated irrigation costs fall, particularly if they are developed around dedicated value chains.

Lastly, Chaddad (2016) examines the sources of the 2.79 per cent total factor productivity growth in Brazilian agribusiness over the period 1970 – 2010 (accelerating to 4.1 per cent over 2000 - 10). He noted not only the necessary condition of enabling policy liberalisation, but also the sufficient

[13] KIA's investment to develop the Ord River irrigation precinct is predicated on the release of enough land to justify production at scale of a major commodity.

conditions of institutional change that drove value chain formation and access to capital. The country transformed from a recipient of food aid in the 1970s to become the world's largest net exporter of agricultural products. Although beyond the scope of this paper, these issues of industrial and institutional structure bear examination within an Australian context of total factor productivity and international competitiveness growth.

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