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ASSESSING THE FINANCIAL PERFORMANCE OF KOREAN AGRICULTURAL CO-OPERATIVES AN APPLICATION OF THE DUPONT EXPANSION PATH

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Assessing The Financial Performance of Korean Agricultural Co-operatives

An Application of the Du Pont Expansion Path

Abstract

This study aims at evaluating the financial performance and its drivers for Korean primary agricultural co-operatives within the National Agricultural Cooperatives Federation between 2012 and 2016. With the help of the DuPont expansion method we estimate the effect of livestock farmers' terms of trade, changes in meat consumption and imports as well as the co-operative specific size, DEA efficiency score and geographical location on 82 livestock co-operatives' net profit margins, total asset turnovers and equity multipliers. The empirical results show that co-operatives' financial performance is hurt by increases in consumer prices and meat imports, and improved as meat consumption increases. We find that smaller livestock co-operatives are more profitable and the less efficient, while co-operatives located in rural areas are more profitable and less leveraged than their peers.

This study provides valuable lessons for countries seeking to enhance the financial strength of their co-operatives based on individual characteristics as size, efficiency and geographical location vis-à-vis increased competition and opening markets.

Keywords: Korea, financial performance, agricultural co-operatives, livestock, *DuPont analysis*, DEA

JEL Codes: Q13, Q14, Q17

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1. Introduction

Amidst Korea's spectacular GDP growth rates of almost 7% between 1970 and 2010, the primary sector's average growth rate does not surpass 2% annually. Moreover, since 1970 both the share of agriculture in the GDP and the share of agriculture in total employment have decreased from 27.4% to 2% and from 50.4% to 5.2%, respectively. While such a transformative process is attributable to significant economic growth periods in industrialising countries, in Korea, it has taken place two to five times faster than in Japan, Germany or the United Kingdom (KREI, 2015).

Compared to Korea's industrial sector, its agricultural sector has faced various constraints inhibiting high factor productivity growth levels. Notably, farmland conversion has reduced Korea's arable land - about a fifth of the national surface - by more than 35% since 1970 (KREI, 2015). While some of the reduction is offset by increases in productivity and average farmland size; today only 15.3% of farmers have more than 2 hectares of farmland at their disposal (Statistics Korea, 2018). Hence, favourable gains from economies of scale, ordinary across European agricultural sectors, are considerably restrained (Calus & Van Huylenbroeck, 2010).

Beyond the geographical restrictions, throughout the on-going transformation process, the average age of farmers has increased remarkably. While in 1990 only 31.3% of farmers were of age 60 plus, this number increased to 60.9% in 2010. Considering the ratio of farm owners below 35 to those over 55 years of age, Korea shows the lowest average worldwide (KREI, 2015).

The aforementioned strategic weaknesses within the agricultural sector add upon problems related to the dominance of rice cultivation, depopulating rural areas and high production costs. Notably, Korean dairy products are produced at a price that is 60% higher than the world milk price (Corazzin, Schermer, & Park, 2017). Hence, Korea's vulnerability vis-à-vis recent international agreements, such as the EU-South Korea or the US-Korea free trade agreement, exposing Korea's agriculture to foreign competitors, is exacerbated (Moon, Han, & Shin, 2016).

Ever since the early days of the Korean development, agricultural co-operatives have played a critical role in supporting and advising farmers (Boyer & An, 1991). Particularly, the supply of fertiliser and agricultural inputs as well as marketing services and - through their role as a bank - financial services such as credit, insurance and

managerial advice have been essential for the rural sector. While the supply of inputs has decreased in importance to Korean farmers over time, support in marketing and financing has remained vital to rural Korea (KREI, 2015). Established in 1961, the National Agricultural Cooperative Federation¹ (NACF), today, is a two-tier umbrella organisation with co-operatives on the local and a federation on the national level. Contrary to what is common in the Western co-operative establishment, the state implemented the Korean co-operative system to foster rural development and improve the productivity of Korean farmers (J.-H. Choi, 2006).

Since its establishment, changes in management, purpose and organisational structure of the NACF have mirrored much of Korea's economic and political development towards a more pluralistic and economically developed society. Primary co-operatives have transformed from being instruments of policy implementation in the early decade of the bureaucratic-authoritarian industrialisation period to democratic entities with institutionalised participation and election procedures. Likewise, agricultural policy objectives have developed from self-sufficiency driven political targets to resilience vis-à-vis opening markets and increased foreign competition more recently (Burmeister, 2006).

Beyond Korea, where over 90% of Korea's 2.6 million farmers member in one of the NACF's 1,134 primary co-operatives, the federation is renown internationally due to its size. The International Co-operative Alliance (ICA) ranks the NACF as the third most significant co-operative in the agriculture and food industries sector and the fourteenth largest co-operative in the world based on its USD turnover in 2015 (33.94 billion USD) (ICA & Euricse, 2017).

Thus, due to the high enrolment rates and the importance of the NACF in rural Korean areas, analysing critical financial performance data in the fields of profitability, efficiency and solvency for Korean co-operatives might serve as a reference of how the Korean agricultural sector's performance has evolved. Inter alia, co-operative efficiency is considered an indicator of healthy economic performance both vis-à-vis policy changes and national competitors such as investor-oriented firms (IOF) and is usually either measured as economic efficiency or via financial ratios (S. D. Hardesty & Salgia, 2004; Sexton & Iskow, 1993). Moreover, particularly in the field of agriculture, besides efficiency and beyond the comparison with investor-oriented firms, profitability and

¹ 농협 (Nonghyup) in Korean.

solvency are of interest (Mishra et al., 2013). Given the heterogeneity of Korean co-operatives, an assessment of economic performance has to account for differences in specialities and regions. To do so, we will derive the speciality specific drivers of profitability, efficiency and solvency relying on a DuPont financial ratio analysis that has been used in the US American farming sector for a similar purpose (Mishra et al., 2013).

Applying Mishra et al.'s model to livestock co-operatives in the Korean agricultural sector, we will be able to provide insights on the effects of nationwide trends and co-operative specific characteristics on the financial performance. To fill a gap in the co-operative literature and enrich the discussion concerning non-parametrically measured efficiency and ratio efficiency, we will use the results of a data envelopment analysis as an explanatory variable in the DuPont model.

In summation, this thesis compares the cross-province and cross-speciality performance of 1,060 co-operatives between 2012 and 2016. Furthermore, with the help of the DuPont expansion method, this paper examines the drivers of financial performance of 82 Korean livestock co-operatives within the Korean National Agricultural Cooperatives Federation. For this aim, a Seemingly Unrelated Regression (SUR) analysis is conducted with panel data between 2012 and 2016. Subsequently, the effect of general livestock farmers' terms of trade, meat consumption and meat imports and the co-operative specific size, DEA efficiency score and geographical location on co-operatives' net profit margins, total asset turnovers and equity multipliers are estimated.

From our results, we hope to find critical factors that define profitable, efficient and solvent co-operatives amid exposure to changes in sales prices, consumption patterns and imports. Thus, our results may serve policymakers and NACF personnel alike as a tool to create policies that acknowledge differences in size, location and efficiency of co-operatives as well as national trends to mitigate the competition's most adverse effects in fostering co-operatives' efficiency and profitability. Finally, this paper is divided into four sections. First, the history of Korean co-operatives is studied. Second, Korean co-operatives' financial performance is analysed across provinces and specialities with the help of key financial figures. Third, the DuPont expansion path, the Data Envelopment Analysis and the SUR Model are introduced. Lastly, the results are examined, and several conclusions are drawn.

2. Agricultural Co-operatives in Korea

2.1 The Nature of Co-operatives

Co-operatives or co-operative organisational structures represent an alternative to corporate or investor-owned firms but also to independent private firms that have been shaped by pioneers of the co-operative movement as Raiffeisen, Schultze-Delisch, Rochdale or Muhammad Yumus (Fairbairn, 2004). The core principles of a co-operative, despite changes in form rather than substance, may be formalised by the combination of the following two definitions. First, "a co-operative is an *autonomous* association of persons united *voluntarily* to meet their *common* economic, social, and cultural *needs* and aspirations through a *jointly-owned* and *democratically controlled* enterprise" (ICA, 1995). Second, "a co-operative is a *user-owned* and *user-controlled* business that distributes benefits *on the basis of use*" (USDA, 2011). Throughout this thesis, we use a combination of both definitions as the distribution of benefits by use is of particular importance in the agricultural sector.

The agricultural co-operative in particular is an organisation of farmers, owned by farmers, established for the collective purchase of inputs and marketing of agricultural commodities. It follows the one-member-one-vote governance structure and concept of patronage divides its surplus.

A *multipurpose co-operative* within the agricultural sectors provides credit and financial services; input supplies and marketing services as well as extension services, while *specialty co-operatives* serve a particular homogenous group within the farming sector (Münkner, 2012). While in Europe specialised credit or banking co-operatives act independently from specialised co-operatives that dominate, say, the dairy sectors, in a country as Korea, analysed in depth throughout this work, the multi-purpose co-operative model is the prevalent model.

Finally, the term *dual nature* of co-operatives refers to the discussion whether; a co-operative is an imitation of or an opposition to the capitalistic guiding principles and, thus, whether social or economic goals will dominate co-operative management (Chomel & Vienney, 1996; Vienney, 1960). *Dual nature* further describes the notion that co-operatives are too economically oriented to be included in the not-for-profit sector and too community- or member oriented to be considered a pure economic for-profit organisation (Levi & Davis, 2008). Moreover, the term displays the symbiosis between

union and business, where either of which is essential to let a co-operative thrive as an organism (Fairbairn, 1994).

2.2 Agricultural Co-operatives and Economic Development

2.2.1 Agrarian transformation

Lewis argues that Korea's critical growth period has led to a *new orthodoxy* interpretation of its underlying reasons naming market discipline, private sector initiatives and export promotion as prominent explicators for the imminent success of the Korean economy (J. Lewis, 1986). The so derived idealised East Asian model based on two main aspects. First, efficient resource allocation through the neoclassical notion of *getting the prices right*, and, second, a strong focus on a stable balance-of-payments (Bradford, C., 1986). However, instead, a myriad of factors may be attributed to the rapid change of the Korean political economy, which is characterised by a relationship between state and society that is independent of institutional assumptions inherent in neoclassical economics (Burmeister, 1990).

In describing Korea's path from a primarily agrarian to an industrial nation since the end of the 19th-century researchers have argued fiercely as to how the relationship between colonialism and development can be best interpreted. This dispute has led to two opposing theories that Shin, lately, has unified in a synthesis (G. Shin, 2006). Korean nationalist scholars, defenders of the so-called *sprout theory*, claim that Japanese colonial rule has somewhat distorted the Korean capitalist development path emphasising that *sprouts* of Korean capitalism were eminent in pre-colonial times (G. Shin, 2006). Most importantly, Kim Yongsop's extensive land and tax register analysis argues that the first signs of Korean commercial capitalism are observable before the annexation by Japan. Notably, as early as during the eighteenth-century entrepreneurial farmers increased both profits and productivity in agricultural practices adopting improved techniques and technological innovations as double cropping and transplanting (Y. Kim, 1960a, 1960b, 1970). Moreover, agricultural exports to Japan at the end of the 19th century further illustrate early Korean capitalistic commercialisation tendencies (G. Shin, 2006). The second line of argumentation supports the *offspring* of the empire theory, identifying the timely origins of capitalism in Korea during the Japanese colonisation and has been defended by scholars from the United States and Japan. Notably, Eckert emphasises how colonialism has fostered

industrial development on the Korean peninsula to the extent that by the end of the colonial period Korea formed an integral part of the Japanese imperial commercial network (Eckert, 1991). Also, he highlights the vital economic activity of the state, the concentration of private economic power within a limited elite of business groups, and the priority given to exports (Eckert, 1991). In line with Eckert, later research numerates both material and immaterial legacies ranging from infrastructure to human-cultural aspects from the Japanese dominated period (G. Shin, 1998, 2006).

Shin criticises both the sprout and the offspring currents arguing that the former school exaggerates the capitalist development potential of the commercialisation of the agricultural sector. Often entrepreneurial farmers, he argues, became landlords rather than agricultural capitalists tempted by promising returns on land and usury. Also, even though the colonisation period has shifted Korea's economic trajectory, a regressive agrarian class structure in the late Choson dynasty has hindered capitalist development in the agricultural sector (G. Shin, 2006).

The *offspring* school, however, fails to explain endogenous forces of industrialisation and, most important, the participation of Korean entrepreneurs and business partners throughout the process. As Korean citizens owned about 40 per cent of firms and co-owned around 30 per cent with Japanese partners, Korean participation was substantial and contributed significantly to post-colonial industrialisation (G. Shin, 2006). Haggard et al.'s argument that much of the legacy of colonial industrialisation has been erased by historical events between the liberalisation from the Japanese and the development as the Korean War supports this theory (Haggard, Kang, & Moon, 1997).

Moreover, Shin, in using an agrarian conflict theory focusing on agrarian class structure, relations, struggles and conflict resolution, following writers as Barrington Moore, Jr. or Robert Brenner, he explains the rise of capitalist production relations (Brenner, 1982; B. J. Moore, 1966). For the agrarian class to rise, the breakdown of the regressive agrarian class structure through class struggle and following conflict resolution weakening the landed class' power, was vital (G. Shin, 2006).

Shin adds to the discussion in highlighting the importance of the conditions in rural Korea and the relationship between the rural population and urban workers. Moreover, he claims that, ultimately, the power of the landed class was one of the reasons why increased commercialisation did not lead to capitalisation in the late

Choson dynasty. During the colonial period, however, agrarian class struggles and subsequent conflict resolutions facilitated capital flows from the agrarian to the industrial sectors and hence paved the way for colonial capitalisation. Lastly, again agrarian conflict was one of the reasons leading to the implementation of land reform in postcolonial Korea (G. Shin, 2006).

The importance of agriculture throughout the colonial times becomes evident, as 1940 less than 6 per cent of Korean workers were employed in the manufacturing sector. More significantly, in real terms, average farm incomes reported only marginal changes between 1915 and 1937. Indeed, real wages from labour within the agricultural sector, as well as the caloric intake from primary staple foods, fell during this period (Haggard et al., 1997; Kwon, 1977).

Immediately following the liberalisation of the Korea peninsula from its colonial power, both the communist government in the north and the Provisional Government in the South, propagating an anti- Japanese and anti-colonial narrative, instrumented land reform as a remedy to circumvent past land-related conflicts described above (Burmeister, 2006). Land reforms in the south, finally completed in the 1950s, provided ownership for former tenants and implemented a three-hectare ceiling on holdings of land. Gaining the position of owner-operators empowered former tenants and, at the same time, weakened the somewhat conservative landlords' political and economic influence in the countryside (Wade, 1992). However, the collective economic power of farmers remained limited. Primarily, this was due to tight authority controls over the agricultural economy and rural politics (M. Moore, 1984; Wade, 1988, 1992).

Burmeister describes the land reform as the replacement of the historical landlords by the state agro-bureaucracy which he defines as a supra-landlord (Burmeister, 1990).

Notably, the 1950 Grain Management Law, issued during Rhee's presidency, centred budgetary authority to purchase, transport, store, allocate and establish prices for agricultural commodities (Burmeister, 2006). The law, which is understood as a response to post-war economic stabilisation problems during the U.S. military government interregnum (1945-1948), eased food system controls. The relaxation henceforth allowed likewise for private trading and government purchase and distribution, making the government responsible for securing and organising the supply of staple food (Francks, Boestel, & Kim, 1999).

Having studied at a North American university facilitated the co-operation between the West, particularly the United States, and South Korea's first president after the U.S. military government and throughout the Korean War, Rhee Syng-man (1948-1952; 1952-1956; 1956-1960) (Burmeister, 2012).

During his presidency, the Agricultural Bank specialising in agricultural banking credit services was established as a joint-stock company in 1956. Subsequently, in 1957, the Agricultural Law was passed, and the Agricultural Co-operative founded in the following year. Independent as institutions, the Agricultural Co-operative lacked funding to operate effectively in the input supply business and the Agricultural Bank, remaining conservative and risk-averse, focused excessively on its profitability impeding a general flow of funds (J.-H. Choi, 2006).

2.2.2 The Establishment of the NACF

The 1960 military coup gave the way to the ascent of General Park Chung-hee. As he both needed to gain influence in the rural areas and himself had a rural background, his actions aimed at strengthening the food production and revitalising the rural sector (Whang, 1987). Still, the agriculture was the predominant sector of the Korean economy, although agricultural productivity had stagnated through the end of the Rhee regime (Michell, 1990).

The agro-bureaucratic structure of the Rhee era was somewhat fragmented and, thus, suboptimal for implementing the military government's economic mobilisation and political control objectives. Here, the National Agricultural Cooperative Federation became the cornerstone of the bureaucratic reorganisation, which was established in 1961 through a merger between the Korea Agricultural Bank and the far less potent village agricultural co-operatives (Y.-C. Kim, 2003).

Simultaneously with the establishment of the agricultural co-operative, local governments throughout Korea were restricted in their autonomy, facilitating the implementation and control of government policies on the local level (Burmeister, 2006).

Thus, the establishment of the co-operative federation was not a result of farmer-members trying to pool resources or increasing bargaining power. Instead, it provided the government with a tool to implement policies from the central

government agencies in general and the Ministry of Agriculture and Fishery in particular.

The three-tier structure foresaw that under the managerial authority of the central bureau ("중앙회"; *Chunganghoe*), city-and country level co-operatives formed the second, and the third tier level, while primary co-operatives represented the basis. Nevertheless, the lower-level co-operatives did not participate in the establishment of the umbrella organisation. Hence, farmer-members could neither influence the establishment of funds for the local-co-operatives, vote for the local representatives nor did they have an institutionalised representation (Burmeister, 2006).

Critical aspects of the co-operative organisational structure are the standardisation of the primary co-operative as the local organisational unit regarding service areas and its multipurpose orientation (J.-H. Choi, 2006).

Seven years after its establishment the NACF counted about 16,000 village-co-operatives with an average of 139 farmers per co-operative (J.-H. Choi, 2006). The lack of funding, high transaction costs and insufficient economic performances led to mandated consolidation inducing the merger of co-operatives into multi-village co-ops congruent with the smallest Korean government unit ("면"; Myeon). The merger, taking place over a period of five years (1969-1973), led to a final number 1,500 co-operatives with about 1,400 members each (J.-H. Choi, 2006). Although the reform showed positive effects on the economic efficiency compared to the initial organisational structure during the early Rhee era, researchers mark several aspects critically. First, linking the primary co-operatives with the lowest government level facilitated the influence of the central government on the local decision-making processes. Second, the restructuring hampered primary co-operatives from emphasising collective action through joint interests as the new organisational structure diverged from traditional forms of organisation at the village level. Third, it also dampened the rural sector's pluralist social and political development (Burmeister, 2006).

Moreover, the state's influence materialised through the introduction of rural guidance departments in the primary co-operatives' organisational structure (Steinberg, 1984). Guidance personnel formally held extension service positions; however, often they functioned as political operatives, which increased the monitoring capacity of the state to secure the implementation of development campaigns (Burmeister, 2006).

The urge to increase the productive capacity through physical infrastructure development dominated the 1960s agricultural policy agenda. As Krueger et al. show, U.S. foreign aid had been the primary source of financing for fertiliser imports, which Korea has been reliant on since the end of the war (Krueger, Michalopoulos, & Ruttan, 1989). Given the fertilisers' strategic importance, the government soon prioritised self-sufficiency for agricultural inputs. Subsequently, during the 1960s by founding the Korean Government Chemical Company, five fertiliser plants were erected (Cole & Lyman, 1971). Here, too, major co-operation with the United States of America was key, as the economic endeavour was facilitated through loans of USAID and joint investments from companies as Gulf Oil, Skelly, and Dow Chemical (Jones, 1975; Krueger et al., 1989). As the 1970s had started, Korea had already become a net exporter of nitrogen fertiliser and, more importantly, through the startup of the fertiliser production industry laid the groundwork for the petrochemical sector yet to develop (Enos & Pak, 1988)

The government, through the NACF's country-wide network of branches, purchased and sold Korea's entire national fertiliser production at pre-set prices that secured the contractually guaranteed profits to the joint investment partners (Kang, 1986). Within this praxis also lays an explanation for the high membership rates throughout the history of the NACF. Co-operative membership was compulsory to acquire fertiliser at the below-market co-operative price. Hence, the NACF not only possessed and managed one of the most critical and often scarce resources during the 1960s but it also secured high membership affiliation through its provision (Burmeister, 2006). Qua exerting the role as the single national supplier the NACF became dependent upon state resources and accustomed to the influence of the state in its business.

2.2.3 Self-sufficiency and growth

Significant changes characterised the Korean agricultural development policies and affected the NACF organisational structure throughout the 1970s. Most importantly, the green revolution led the way towards self-sufficiency in rice, and the ("새마을"; Saemaul) or new village movement centred upon physical infrastructure improvements. Both developments achieved increasingly stable incomes from on- and off-farm economic activities in rural Korea (H.-A. Kim & Sorensen, 2011; Turner, Hesli, Bark, & Yu, 1993).

The new development policies, requiring supervision and implementation at a larger scale than before, multiplied the number of co-operative employees during the first half of the 1970s by two. These increases, however, differed widely across the organisation. Primary co-operatives, reflecting the increased need for human resources, saw their personnel even increase fourfold. Much of the new personnel, closely working with the local administrative entities, oversaw the strict development goals as new rice variety adoption targets or the Saemaul project goals that were set by the government (Boyer & An, 1991). Throughout the green revolution campaign, which required the distribution and adoption of new technology on a large scale, farms witnessed gains in productivity and, subsequently, income. Also, to encourage the technological adoption, the government increased agricultural products' prices. This stepwise development enhanced the participation of farm households in the cash economy significantly and, thus, increased the demand for banking services. Hence, increased marketisation induced the government to foster the expansion of the co-operatives' banking business. Since 1972, the establishment of mutual savings banks at the primary co-operative level was legally encouraged and has since then risen both concerning employees but also income share (Burmeister, 1990).

Furthermore, the nationwide network of co-operative stores increased the awareness towards the NACF among the urban population and somewhat deepened the linkages between the urban and rural population. Overall, different agricultural policies have led to relatively increasing household incomes that fortified the demand for domestically manufactured products. In combination with the far-reaching network of co-operative stores in the most rural Korean areas, consumer products became a part of the everyday life (E. Lee, 1979).

To sum it up, throughout the 1960s and 1970s the NACF acted as an efficient and effective body implementing economic policies and programmes. Being omnipresent in rural Korea and vast in its scope and hierarchy it reached the most secluded areas. However, the uniform development policies at the national level were somewhat reoriented at the primary co-operative level as the local members adapted the strategies making use of their knowledge. Hence, to the extent possible within the authoritarian-bureaucratic system, this inherent flexibility allowed the rural societies to benefit extensively. As Evans has described it, the NACF is an example of how para-

statal organisation can be the social linchpins of development-enhancing synergies between the society and the government (Evans, 1996).

2.2.4 Trade liberalisation and the Korean agriculture

The beginning of the 1980s marked a new era in the history of the NACF. First, Korea gradually increased its interaction with other economic powers in the world. Notably, the acceptance of the GATT framework and increasing pressure from the United States as the bilateral trade balance favoured South Korea, put pressure on the agricultural sector. Second, replacing food self-sufficiency as Korea's primary concern, agricultural adjustment problems vis-à-vis global competition grew imminent. Income differentials between urban and agricultural workers had widened and reproached levels of the 1960s. Hence, the fear of economic and sociocultural marginalisation appeared as a prominent concern within the sector (Burmeister, 1992).

Significant investments were needed to support and enhance the resilience of the Korean agriculture. First, further mechanisation and specialisation increasing value added were seen as necessary to secure higher income levels. Second, the strongly fragmented Korean agricultural economy failed in creating economies of scale needed to compete on the global market. Third, as education was seen as the means to upward social mobility, the farming sector sensed it was lacking significant infrastructure and, thus, losing competitiveness compared to the urban areas and its employees in the industrial sector with access to the most prestigious and specialised educational institutions (Burmeister, 2006).

The shares of income attributed to the marketing and supply and the banking sector explicate the shift in needs and the corresponding changes in the primary co-operatives. In the middle of the 1970s, the sales of inputs generated about 75% of the primary co-operatives' income. Only a decade later, the share had been reduced to one third while financial services generated two-thirds of the primary co-operatives' income. Also, during the same time, the number of employees within the co-operative banking sector increased significantly (Burmeister, 2012).

Policy loans at interest rates below the market rate could be offered to member farmers as the primary co-operatives increased its funds with money received from the government. Park finds that the government carefully ensured an egalitarian distribution of loan to deposit ratios across the primary co-operatives by providing

deposit-poor primary co-operatives with more state funding than deposit-rich co-operatives (S. J. Park, 1993).

Notably, the number of members per household per village were decisive in allocating loan funds. Subsequently, so-called village councils used farm size criteria to distribute the funds received equally. As mentioned earlier, both farm size and typology were somewhat homogenous at least until the early 1990s and, hence, led to equal access of farmer-members in villages (S. Park, Park, & Shin, 2012).

Throughout the 1980s and 1990s, as the NACF increasingly faced trade liberalisation and subsequent economic adjustment issues, the subsidised loans remained the most prominent and continuous state policy. Loan funds not only helped farmers to persevere vis-à-vis opening agricultural markets, decreases in price support or the lack of off-farm employment opportunities in rural areas, but served as an incentive to stay within the agricultural co-operative (Burmeister, 2006).

For the Korean economy as a whole, the share of agriculture over the GDP decreased significantly during the 1980s and early 1990s, falling from 15.9% in 1980 to 8.4% in 1990 (KOSIS, 2018a). Thus, the agro-industrial linkages due to expanded co-operative banking had become less apparent. Nevertheless, as Koo points out, often co-operative financial service and banking institutions financed human capital formation at the farm household level, which, in the form of highly educated graduates from the countryside, have transferred to the urban-industrial sector (Koo, 1990).

Here again, and in line with what has been mentioned in earlier parts, it becomes apparent how intertwined rural and industrial sectors of the Korean economy evolved and, thus, how essential the understanding of both is, to give a comprehensive picture of the early stages of Korean economic development.

2.2.5 Regime change in Korea

With the introduction of free and direct elections in 1987 and the shift from military to civilian rule, economy-wide transformations began. Two main reasons for dismantling the old relationship between the state and the economy became more evident with the beginning democratisation and accelerating globalisation process. First, political legitimacy concerns arose as the people demanded transparent and participatory decision-making processes in a more democratic and pluralist society. Second, both political corruption scandals and economic inefficiencies incited the

Korean people to demand changes. Notably, the democratisation processes created a momentum that allowed criticism towards the influence of the state on the NACF (Han, 1989; S.-H. Lee, 1993; Lie, 1998).

Interestingly, both politically significant government agencies as the Economic Planning Board but also local co-operative officials were unsatisfied with the current situation (Burmeister, 2006). While the former saw the relationship as an outmoded organisational relic of the authoritarian times, the latter felt that crucial co-operative business and policy decisions were taken without their consent or participation, as they had never enjoyed institutionalised participation in political or economic affairs on the primary co-operative level. While, as mentioned earlier, the local-staffing allowed for some organisational and decision making flexibility within local co-operatives, tight oversight by the state administrative hierarchy on different governmental levels limited the range of actions (Sorensen, 2013).

The Catholic Farmers' Organisation served as an essential advocate of more freedom of action for primary co-operatives, arguing that the past exploitation of farmer-members threatened the legitimacy of the continued existence of the co-operative without substantial reforms (CRRS, 1989).

Ultimately, the articulation of farmers' new ideas and visions for a restructuring of the NACF organisation, following public hearings, led to a revised co-operative law in 1988. Most significantly, farmer-members elected the primary co-operatives' presidents which, as of 1988, were entitled to vote for the national federation's president (J.-H. Choi, 2006). Also, local co-operative officials were granted more influence on the operational decisions, and the restrictive system of governmental oversight was replaced by a post-facto reporting system (Burmeister, 2006). These significant changes finally institutionalised channels of participation for Korean co-operative farmer-members and, substantially, shifted the power balance between the NACF and the state paving the way for active involvement in future decisions and the decision-making process regarding agricultural and rural policies.

2.2.6 Independence and reforms

The newly installed election process ensured that the federation's president represented the primary co-operatives genuine opinions in fields as rice pricing or market liberalisation. However, given the fact that Korean co-operatives still depended upon government issued loan funds among others, the transition towards a more independent organisation was difficult from the beginning (Burmeister, 2006). Nevertheless, the NACF's first elected president, Han Ho-sun (1988-1994), heavily opposed the Kim Young-sam (1993-1998) administration's New Agricultural Policy in fields as rice price levels or the government's negotiating strategies throughout the WTO talks. Following corruption allegations, Han Ho-sun served a single term as a president in office. In response to the scandal, the government proposed amendments to the basic co-operative law pursuing limits to the power of elected NACF presidents through the separation of the marketing and supply business and the banking business as well as the replacement of elected primary co-operative officials with professional managers (Dongailbo, 1993). Due to the opposition, mainly on the primary-cooperative level and, subsequently, political resistance in the rural areas, however, the top-down reform was halted (Burmeister, 2006).

With the election of the next Korean president, Kim Dae-jung (1998-2003), and the appointment of the new Minister of Agriculture, Kim Sung-hoon, a renowned critique of the agricultural co-operative system became part of the government. Most importantly, Kim Sung-hoon criticised high co-operative marketing margins hampering producers from achieving more profitable prices. Also, he argued the NACF's quasi-monopoly in the rural banking sector decreases the incentive to achieve gains in economic efficiency (Burmeister, 2006).

Following Han's presidency, Won Churl-hee (1994-1999) was elected the new president of the NACF. In a far-reaching corruption scandal involving local co-operative officers accepting payments for loan approvals, Mr Won had to step down, and a government-induced merger between the National Ginseng Cooperative Federation, the National Livestock Cooperative Federation and the NACF was decided (NACF, 2016). The two key pillars of the new reform were the rationalisation of the administration and gains through increased economies of scale. Requiring farms to submit formal business plans within the loan fund application process is one example of the efforts to rationalise and professionalise the every-day business practices (Yonhab, 1994).

Particularly on the level of the primary co-operatives, resistance both to business rationalisation and depoliticisation measures has remained strong. Further merger into larger co-operatives is equally rejected. Furthermore, farmers fear that formal division of the banking and the marketing and supply business would hamper the central positive aspect of multipurpose co-operatives, which in Korea is the subsidisation of other business practices through profits obtained in the banking sector (Burmeister, 2006).

Thus, continuous protests have led president Chong Dae-kun (1999-2007) to halt both co-operative consolidation and the further separation between the marketing and the banking business (Dailian, 2007).

Moreover, the NACF has exercised its freedom to represent its interests in several moments. Notably, the NACF has participated in the anti-WTO activities in Seattle as an advocate of multifunctionality in opposition to WTO agricultural practices. Also, it has joined forces with grass-roots farmers' organisations to raise objections towards both the free trade agreement with Chile and the then-starting Doha Round WTO negotiations. Burmeister describes these involvements, which are in line with Korean public opinion and Korean farmer interests, as the wish to become an actor-for-itself within a more pluralistic and open civil society and South Korean polity (Burmeister, 2006).

Choi, Won-byeong (2007-2016), followed as the new NACF president, emphasising different types of reforms as a response to the financial crisis. The revision of the Agricultural Cooperative Act of 2009 focused on systematic improvements related to the governance structure and the revitalisation of economic services. Notably, the introduction of an indirect election system limiting the president's power to a single-term presidency was proposed. Also, the authority of the board of directors was increased to control the business performance under the general managing director. Lastly, a non-permanent director system was implemented to increase the performance of specialty co-operatives. Regarding the reforms' efforts to revitalise the economic service sector competition between co-operatives was encouraged with a right-to-choose between types of co-operatives. Also, a cross-compliance framework of rules was introduced to promote fewer specialities (H. Choi, 2018; J. Lee, 2018).

The most recent times were marked by the NACF's on-going reform that started under Mr Choi's presidency and now continues under the governance of chairman Kim

Byeong-won's presidency (as of 2016). Since 2012 the NACF has reorganised its business structure dividing its economic and credit service into a holding company system, which will be described in more detail in the following section. Particularly in 2016, the NACF has focused on education and capacity development with opening the Academy of Cooperatives, the Creative Agriculture Support Center and the Urban-Rural Cooperation Training Center (NACF, 2016). Also, the commercial service sector has been revitalised regarding supply chain efficiency, which has led to lower costs in the marketing business with the introduction of large-scale distribution and production centres (H. Choi, 2018; J. Lee, 2018).

2.3 The current structure of the NACF

Traditionally, the scope of the NACF multipurpose agricultural co-operative business encompasses three different areas in Korea.

First, the area of education and support organises consulting and training for agricultural production and management abilities, support for medical aid and welfare of farmers but also joint-shipment and sales support (J. Lee, 2018).

Second, the field of economic services contains the manufacturing, processing, sales and the export of members' agriculture-livestock goods. Here also, marketing control and the stocking-up of members' agriculture-livestock goods as well as the commodity purchase can be listed.

Third, within the area of credit services members' deposits and savings are managed, loan funds and other banking or financial services are offered (H. Choi, 2018).

Since its restructuring process and the establishment of the economic and the financial holding company following the revised National Agricultural Cooperative Federation Act and a resolution by the Board of Directors in March 2012, the first and the second area have been divided, and the third area has been split up. As it can be seen from figure 2-1, the education and support services remain at the federation's level. Also, co-operative banking services limited to members' deposit and savings management, loans as well as domestic and foreign exchange services, remain as mutual credit services within the NACF management (J. Lee, 2018).

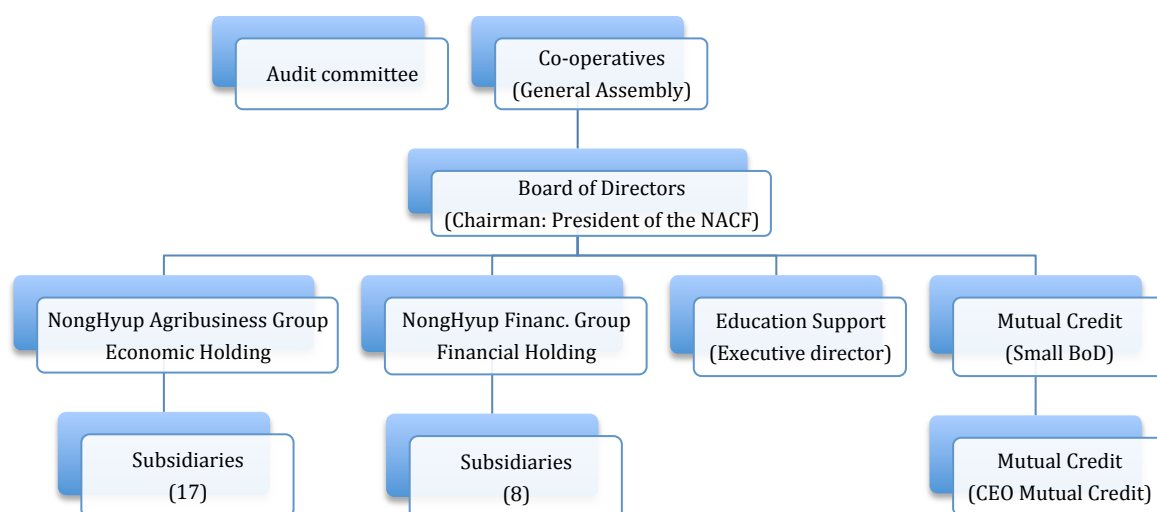
Banking and banking operations related to corporations, financial operations and the insurance business, among others, are situated within the financial holding company (NongHyup Financial Group Inc.). Analogously, all economic services are now

organised within the economic holding company of the NACF (NongHyup Agribusiness Group Inc.). The former holding company now consists of 17 and the latter of 7 subsidiaries (see table 2-1) (NACF, 2016). When it comes to the income and expense structure, both holding companies are charged 2.5% of the average sales profit for the use of the NH NongHyup name. This, so-called agricultural support expense, formally known as the brand fee, is paid jointly with the dividends to the NACF. Each of the agribusiness and financial subsidiaries (see table 2-1 for an extensive list and the owner share of the NACF) pay their dividends directly to the holding companies (J. Lee, 2018).

Currently, 1,134 member co-operatives representing 2.25 million farmers are the owner of the National Federation of Agricultural Cooperatives in Korea (H. Choi, 2018).

For the future, the NACF has to fulfil its task in addressing both member-farmers and the NACF's ambitious goal to be an internationally acting and relevant bank. Also, while the multipurpose structure of Korean co-operatives has been of uttermost help to Korean farmers in the early period of Korea's development, its future role will have to be discussed. As the Korean economy in general and the agricultural sector, in particular, is increasingly involved in international trade, further specialisation and thus separation of business practices might be helpful for particular specialities as the livestock sector.

Figure 2 - 1 Operational structure of the National Agricultural Cooperative Federation including holding companies



Source: Author's own drawing from (H. Choi, 2018; J. Lee, 2018).

Table 2 - 1 Subsidiaries of the NACF

NongHyup Agribusiness Group Inc.	NongHyup Financial Group Inc.
NH Hanaro Mart Inc. (100%)	NH Bank (100%)
Agric. Corp. NG Food Grain Inc. (98.6%)	NH Life Insurance Co., Ltd. (100%)
Nogwoo Bio Co., Ltd. (52.8%)	NH Property & Casualty Ins. Co., Ltd. (100%)
NH Feed Co., Ltd. (100%)	NH-Amundi Asset Mngmnt Co., Ltd. (70%)
NH TMR Co., Ltd. (60.4%)	NH Investment & Securities Co., Ltd. (46.2%)
Namhae Chemical Corp. (58%)	NH Futures Co., Ltd. (100%)
NH Chemical Co., Ltd. (100%)	NH Capital Co., Ltd. (100%)
NH Red Ginseng Co., Ltd. (100%)	NH Savings Bank (100%)
NG Logistics Service Inc. (100%)	
NH Trading Co., Ltd. (100%)	
Agric. Coop. Busan Gyeongnam Mrktng Inc. (100%)	
Agric. Coop. Chungbuk Mrktng Co., Ltd. (70.9%)	
Daejeon Agric. Products Mrktng Co., Ltd. (93.9%)	
NH Agro Inc. (94.8%)	
NH Heuksarang Co., Ltd. (63.9%)	
Korea Agric. Coop. Mrktng (100%)	
NH Moguchon Inc. (100%)	

Source: (NACF, 2016)

3. Financial Performance Analysis and DuPont Analysis

3.1 Data

The data we are going to use throughout the financial analysis stems from the Korean Financial Statistics Information System (FISIS) and comprises a set of 1,060 agricultural co-operatives organised within the National Agricultural Cooperative Federation (NACF). Of these co-operatives 89 are specialised in livestock, 33 in horticulture 11 in ginseng, 11 in fruit and vegetables, 9 in meat, 11 in dairy and milk production, 3 in flowers, 1 in raw sugar and 1 in honey. In total, 169 speciality co-operatives oppose 891 general co-operatives. The period analysed is 2012 to 2016. For the DuPont analysis, we consider panel data for 82 livestock co-operatives from the same data set. For the price indices we use data from the Korean Statistical Service, and for the consumption and import variables, we use data from the OECD (FISIS, 2018; KOSIS, 2018c, 2018b; OECD, 2016). Table 3-3, 3-5 and 3-6 in the analysis section provide an overview of the variables we have used throughout the assessment.

3.2 Literature Review

Due to co-operatives' hybrid business model inherent in the dual nature, their economic performance over time and across other companies and industrial sectors has been of great interest to researchers. Indeed, many studies assess co-operatives vis-à-vis Investor-oriented firms or their interdependencies (Shermain D. Hardesty, Salgia, Hardesty, & Salgia, 2004; Müller, Hanisch, Malvido, Rommel, & Sagebiel, 2018; Porter & Scully, 1987; Sexton, Wilson, & Wann, 1989). Notably, Porter and Scully examine dairy co-operatives and find, utilising a production function approach, that investor-owned firms (*IOF*) outperform their co-operatively organised counterparts. They even argue that co-operatives display an inefficient form of organisation and, thus that supportive governments promote and subsidise inefficient entities (Porter & Scully, 1987).

Sexton, Wilson and Wann, on the other hand, found that cotton ginning co-operatives match *IOF*'s allocative efficiency (Sexton et al., 1989). More recently, Hardesty and Salgia, using traditional financial ratio analysis, find that while the financial performance of agricultural co-operatives and their *IOF* counterparts were comparable, co-operatives show lower asset turn over rates and hence efficiency. They also see co-operatives in the dairy, farm supply, fruit and vegetable, and grain sectors to be less leveraged (S. D. Hardesty & Salgia, 2004).

Co-operative efficiency is considered an indicator of healthy economic performance both vis-à-vis trade liberalisation and national competitors and is usually either measured as economic efficiency or via financial ratios (Sexton & Iskow, 1993).

Regarding the differences in using the two approaches, it may be helpful to compare the Data Envelopment Analysis, which is a commonly used method for efficiency assessment, and the traditional ratio analysis (Thanassoulis, Boussofiane, & Dyson, 1996).

The DEA not only leads to a measure of relative efficiency but also provides information about optimal (i.e. efficient) input and output levels given its production technology approach. Ratio analysis, unlike DEA, considers the relationship between one resource and one output at a time, which may lead to substantially differing results between the two methods described above (Thanassoulis et al., 1996). As banks engage in a myriad of businesses with income flows and expenses, simple return on assets and return on equity measures, based on a single measure, may serve as snapshots of financial performance but hardly illustrate year-to-year dynamics in the management of an economic business (J. Y. Lee & Kim, 2013).

Today, however, ratio analysis is the method of choice in the field of finance, rendering companies highly comparable and thus assessable across a wide range of sectors and sizes, importantly vis-à-vis creditors, also in agriculture (Barry & Ellinger, 2012).

DEA, however, remains of overarching importance in research. Notably, as the DEA may take account simultaneously of several, hardly unified, outputs and resources its non-parametric origin has made it highly accessible for assessing the efficiency of schools and hospitals (Friedman & Sinuany-Stern, 1998; Wei, Chen, Li, Tsai, & Huang, 2012).

In the Korean agriculture, Park has analysed banking production efficiency of primary agricultural co-operatives within the National Agricultural Cooperative Federation (S. J. Park, 1993). He emphasises that primary co-operative banks situated in rural areas make use of scale economies in a more proficient manner than urban Banks. Also, he argues that the number of policy loans, as explained in the first section of this work, masks cost saving opportunities through the expansion of the banking business (S. J. Park, 1993).

Interestingly, Kim, Ahn and Kang find that both efficiency and productivity of

newly merged co-operatives was inferior to the co-operatives that remained independent. They argue that both a lack of post-merger policies and the fact that mostly inefficient co-operatives were due to merge may explain their findings (D. H. Kim, Ahn, & Kang, 2011).

Youn and Choi, employing the DEA analysis, conclude that inefficiencies across regional co-operatives within the NACF stem from technical rather than scale inefficiencies. Moreover, they find that co-operatives located in rural areas and engaged in the livestock business are more efficient than their urban counterparts (Youn & Choi, 2005).

Besides efficiency and beyond the comparison with investor-oriented firms or its peers, profitability in the agricultural sector has become a field of interest as the sector shows two particular characteristics: First, chronic low returns to factors of production and boom/bust cycles (Cochrane, 1993). In the United States and particularly during the 1980s, the agricultural sector endured financial stress, whereas the mid-nineties were financially more confident (Mishra et al., 2013). Second, the fact that investments in agriculture must offer returns that are both competitive vis-à-vis alternative investments and cover the financial obligations of a farm business has sparked heightened interest in finding out the drivers of farm profitability and hence an explanation for the structure of the agricultural sector (Mishra et al., 2013).

Based on the DuPont Analysis and its expansion method, Mishra et al. utilise a financial ratio analysis to examine the drivers of profitability, efficiency and solvency of the US American farming sector (Mishra, Harris, Erickson, Hallahan, & Detre, 2013; Mishra, Moss, & Erickson, 2009). They find that factors, as farm typology, crop specialisation, and the level of government payments received are critical drivers of the net profit margin. The asset-turnover (i.e. efficiency of farms), however, is mainly affected by factors as farm specialisation, vertical coordination and government payments. The results for vertical coordination are consistent with transaction cost theory (Williamson, 1979).

Finally Mishra et al. find that farm size, farm typology, contracting, and specialisation affect the asset-to-equity ratio component (i.e. the equity multiplier or solvency component) of the DuPont model (Mishra et al., 2013). In their study, they also confirm Moss and Schmitz' notion that the agricultural sector is subject to significant boom and bust cycles as several temporal variables show significant effects on

performance (Mishra et al., 2013; Moss & Schmitz, 2006). Hence, in booming periods, farm households somewhat expand their economic activity inducing sectorial overcapacities, as the augmented wealth lowers the relative interest rate paid. In bust times, however, the access to reasonable credit markets may be reduced, or the relative interest rate increased due to lower levels of solvency (Mishra et al., 2013).

Applying Mishra et al.'s model to livestock co-operatives in the Korean agricultural sector, we will be able to provide insights on the drivers of profitability, efficiency and solvency. Livestock co-operatives, as described in the data section and shown throughout the financial analysis section, are the single largest and most homogenous group of specialty co-operatives. Also, the livestock sector is of particular interest to policymakers and interest groups vis-à-vis on-going discussions about the opening of markets. One of the reasons is Korea's particular cost structure within the livestock sector. Notably, Korean dairy farms produce dairy products at a cost that is 63.9% higher than the world market milk price. Moreover, producer support to Korean dairy farmers by the government is 2.5 times higher than the average of countries within the OECD (Corazzin et al., 2017).

Incorporating the results from a data envelopment analysis as an independent variable within the DuPont model may allow us to study the effects of the production technology approach on the ratio analysis. In doing so we close a gap in the literature as this analysis will not only emphasize co-operative efficiency with two significant tools, but it expands the analysis to measure the effects of the DEA efficiency score on the profitability and solvency of Korean livestock co-operatives.

The following sections assess the financial performance of Korean agricultural primary co-operatives in two different ways. First, it compares the cross-province and cross-specialty financial performance of 1,060 co-operatives between 2012 and 2016 illustrating the differences between livestock and general co-operatives. Second, with the help of the DuPont expansion method, this paper examines the drivers of profitability, efficiency and solvency of Korean livestock co-operatives within the Korean National Agricultural Cooperatives Federation. For this aim, we conduct a Seemingly Unrelated Regression (SUR) analysis with panel data for a five year period (2012 to 2016). We estimate the general effects of meat imports, per capita meat consumption and livestock farmers' terms of trade, as well as the co-operative specific size, input efficiency as measured by the DEA and geographical location on co-

operatives' net profit margins, total asset turnovers and equity multipliers. With the help of this method, we want to test the following research hypotheses.

3.3 Research Hypotheses

3.3.1 Efficiency

As described throughout this literature and shown in the section concerning the DEA, co-operatives with an efficiency score closer to 1 use their inputs most efficiently compared to their peers and, thus, may perform better in profitability too. Hence, we expect that the efficiency score created from the data envelopment analysis may have a significant effect on the profitability, efficiency and solvency of Korean co-operatives.

3.3.2 Geographical Location

We believe the location of Korean co-operatives has a significant effect on the profitability, efficiency and solvency of Korean livestock co-operatives. We may find results that are in line with the research of Youn and Choi, indicating that co-operatives in rural areas are more efficient than urban co-operatives (Youn & Choi, 2005). However, as their analysis solemnly focuses on the efficiency of co-operatives that are not considered as speciality co-operatives and uses a DEA approach we are cautious. Nevertheless, we expect to find rural co-operatives to be less leveraged than their peers as they have a limited client base and thus lower asset level than co-operatives located in metropolitan regions.

3.3.3 Size

The effect of co-operative size is a recurrent topic in the literature regarding the ability to utilise economies of scale. Indeed, Park finds rural co-operative banks to be more effective in utilising scale efficiency than their urban peers (S. J. Park, 1993). However, we doubt that this result may be repeated with a ratio analysis approach, which, instead, measures efficiency as the operating revenue to assets relationship. Moreover, we expect the competitive advantage of smaller co-operatives to lay in higher levels of profitability, as they tend to be more cost-efficient, which the results of earlier studies reflect (S. J. Park, 1993; Youn & Choi, 2005).

3.4 Financial Analysis

As it can be seen from the graphs below, the overall financial performance of Korean agricultural co-operatives in general and livestock co-operatives, in particular, has been subject to ambiguous changes throughout the analysed period. Admit declining operating revenues; net income has been somewhat constant as figure 3-1 shows. For both variables, livestock co-operatives have outperformed general co-operatives showing significantly higher levels of operating revenue and somewhat higher values for the net income (compare LS OR and LS NI). Moreover, while total assets and total liabilities have increased symmetrically, co-operative equity has remained stable over the entire period and increased slightly in 2016. Livestock co-operatives show higher values for both assets and liabilities while the equity level is only somewhat higher than for average co-operatives (compare figure 3-2).

The solvency ratio, as measured by the equity multiplier in figure 3-3, has decreased from 14.41 to 12.85 for the average co-operative, indicating that total assets have decreased relative to the equity level. For livestock co-operatives, the value has decreased from 16.46 to 13.97 in the same period. High solvency ratios may have two different explanations. First, being multipurpose co-operatives, Korean co-operatives engage in banking services, where high debt-to-asset ratios are common. Well-known banks in Korea, such as Kookminbank or Shinhan Bank displayed an equity multiplier of 13.01 and 11.03, respectively for the years 2012 and 2013 (FISIS, 2018). In addition, NACF co-operative banks show lower levels of equity even compared to other banks (J. Y. Lee & Kim, 2013). The fact that livestock, i.e. specialised co-operatives are more leveraged than general primary co-operatives is in line with what Mishra et al. find for the U.S. farming sector (Mishra et al., 2013).

Admit the rise in solvency Korean co-operatives have lost in efficiency, as the total asset turnover shows a negative trend. A drop in operating revenues and the significant increase in assets explains the substantial decline in total asset turnover. Livestock co-operatives have faced a similar trend while the livestock specific total asset ratio is lower than for the average co-operative. However, this gap has been narrowing over the analysed period as figure 3-3 shows.

Financial Indicators of Korean Agricultural Co-operatives, 2012-2016

Figure 3 - 1 Average operating revenue and net income for general primary and livestock speciality co-operatives in million KRW (2012-2016)

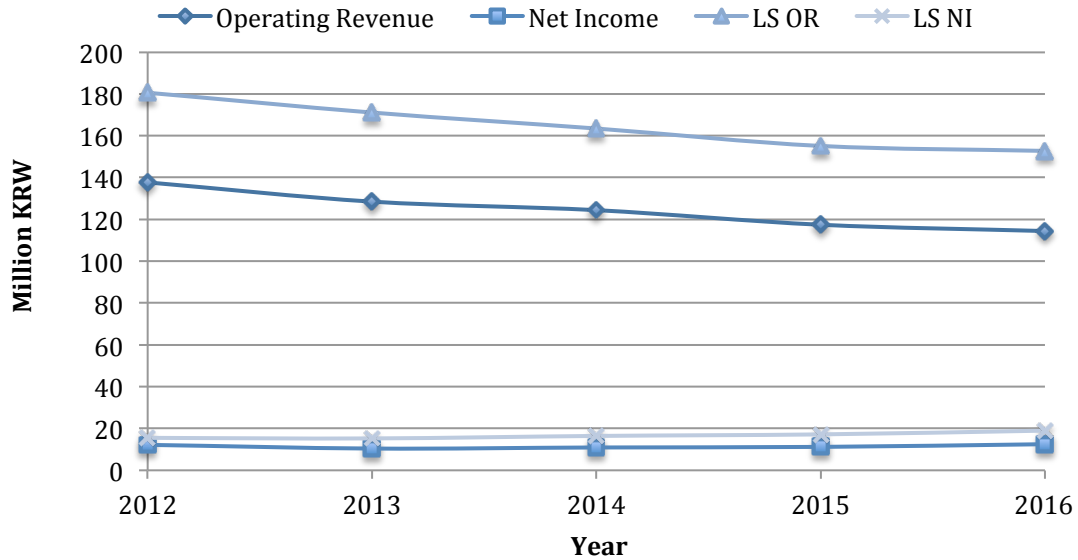


Figure 3 - 2 Average equity, total assets and total liabilities for general primary and livestock speciality co-operatives in million KRW (2012-2016)

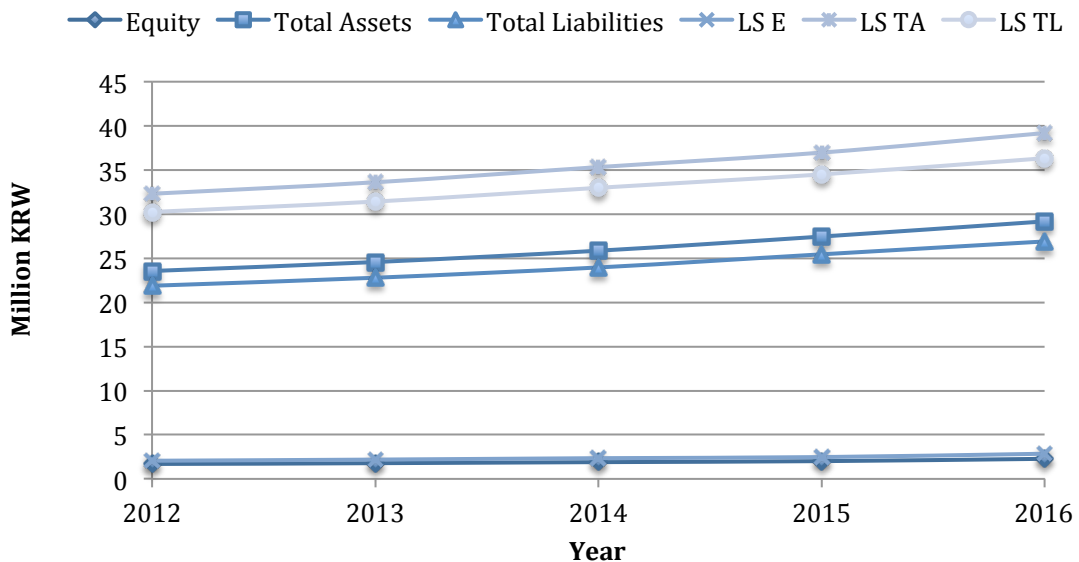


Figure 3 - 3 Average total asset turnover and equity multiplier for general primary and livestock speciality co-operatives, ratio (2012-2016)

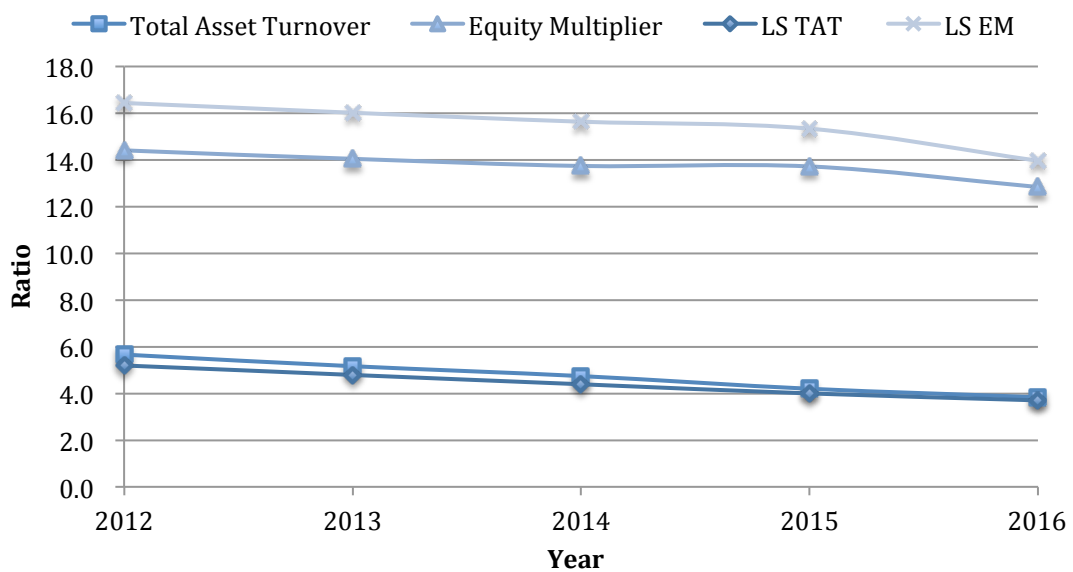


Figure 3 - 4 Average net profit margin and return on assets for general primary and livestock speciality co-operatives, ratio (2012-2016)

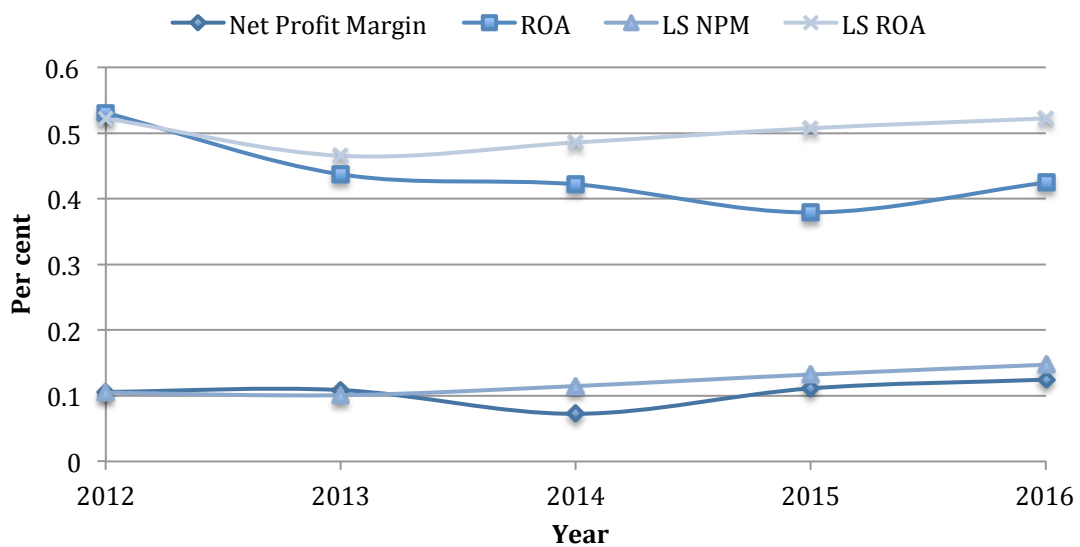
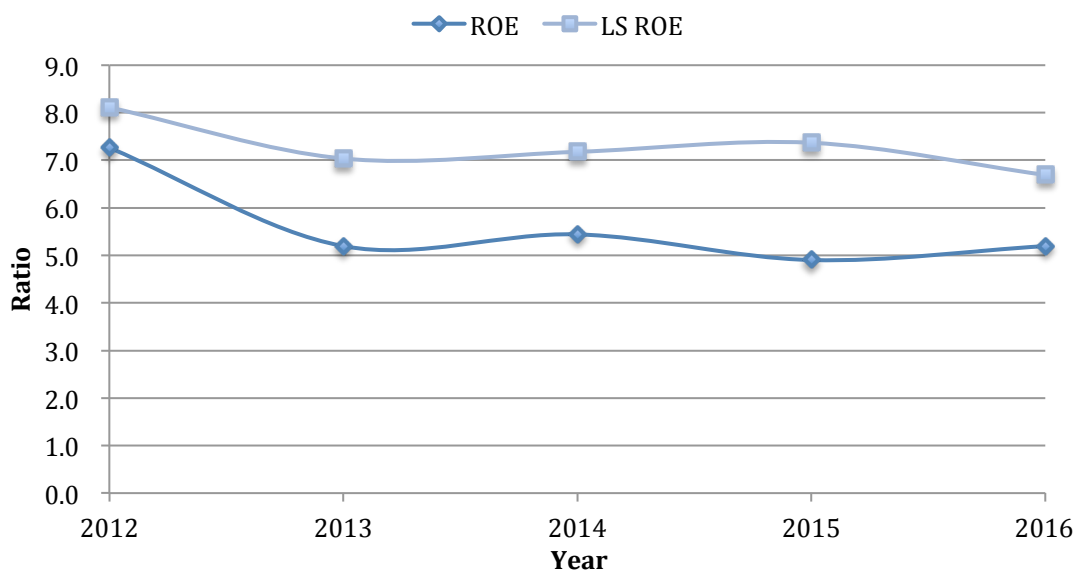


Figure 3 - 5 Average return on equity for general primary and livestock speciality co-operatives, ratio (2012-2016)



Source: Author's calculation with data from the *FISIS*.

Analysing the Korean agricultural co-operatives' profitability (figures 3-4 and 3-5), we can observe how the return on assets' downward trend from 2012 has reverted mildly in 2016 and 2013 for the livestock co-operatives. In general, the Korean co-operative sector shows healthy profitability numbers as its *ROA* oscillates around 40% and its net profit margin around 10% throughout our analysed period. Starting off from similar levels for the *ROA* and the *NPM* livestock co-operatives have increased both values compared to co-operatives in general. Also, co-operatives' low equity leads to a high *ROE* oscillating around 500% and 700% for livestock co-operatives over the last four years. During the period analysed the *ROA* dropped from 53% to 42% for general and remained above 50% for livestock co-operatives. In summation, Korean co-operatives show remarkably strong returns on asset and equity levels, with strong values for efficiency admit high leverage measured as total asset turnover and equity multiplier respectively. Livestock co-operatives outperform average co-operatives on all but the total asset turnover ratio and the solvency measure.

3.4.1 Financial Analysis by Province and Specialty

As we analyse profitability, efficiency and solvency separately for the Korean provinces, three patterns dissolve from figures 3-6 to 3-8. First, figure 3-6 displays - admit outlying Gyeongsangnam and Jeollanam province - the proximity of net profit margins across regions. However, absolute mean deviations increase from 11.4 to 13.8 percentage points between 2012 and 2016.

Second, analysing mean deviations regarding cross-provincial efficiency, we can see how the spread in deviations has decreased, as the *TAT* has converged (see figure 3-7). While in 2012 the efficiency ratios between Gyeonggi and Jeollabuk province differed 120.1 percentage points, the mean deviation has been halved in 2016 (62.9 percentage points difference between Gyeonggi and Jeollabuk province). Remarkably, Gyeonggi province has remained the highest positive while Jeollabuk province displays the highest negative mean deviation throughout the period.

Third, regarding solvency average mean deviation has decreased at a somewhat slower pace between 2012 and 2016 (280 to 210p%). Also, our analysis shows that while Gyeonggi and Chungcheongnam province have remained more solvent than the mean throughout the period analysed, Jeollabuk, Chungcheongbuk, Gyeongsangbuk and Gyeongsangnam province have emerged as comparatively leveraged (see figure 3-8).

When we analyse the mean deviations of the return on asset and the return on equity (figures 3-9 and 3-10), volatility is more apparent than in the other graphs. However, here too we can see that particular provinces remain clearly above or below the mean. Both regarding *ROA* and *ROE*, Jeju province has been above the average in four out of five years while the most significant negative deviation from the mean cannot be stated unequivocally. Regarding the absolute mean deviation, it has decreased from 20.5 to 13.6 percentage points in the case of the *ROA* and 2.3 to 1.9 percentage points in the case of the *ROE*.

Financial Indicators of Korean Agricultural Co-operatives by Province, 2012-2016

Figure 3 - 6 Deviations from the mean net profit margin by province in percentage points (2012-2016)

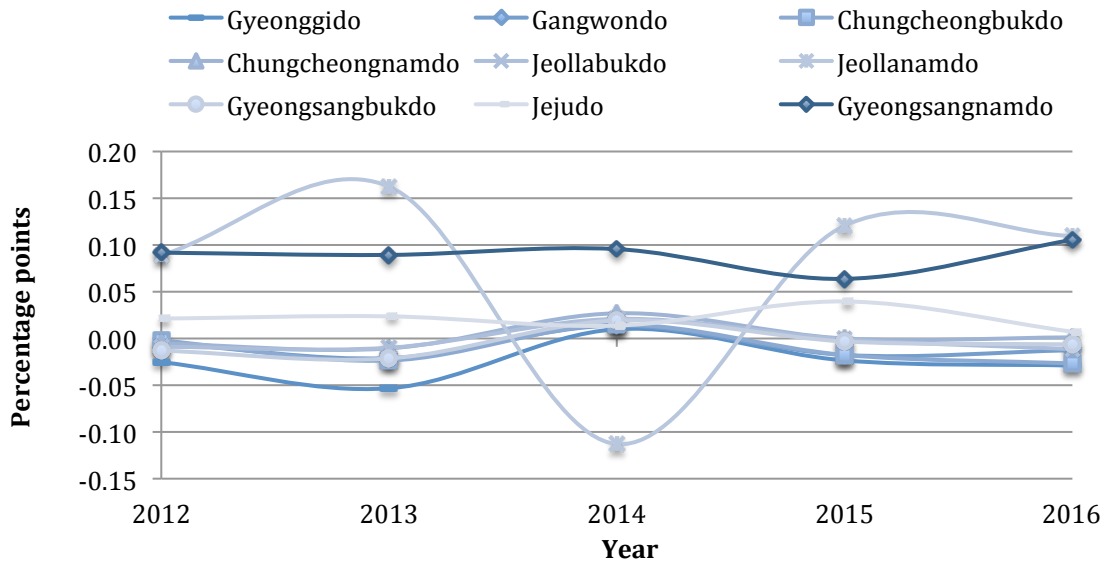


Figure 3 - 7 Deviations from the mean total asset turnover by province in percentage points (2012-2016)

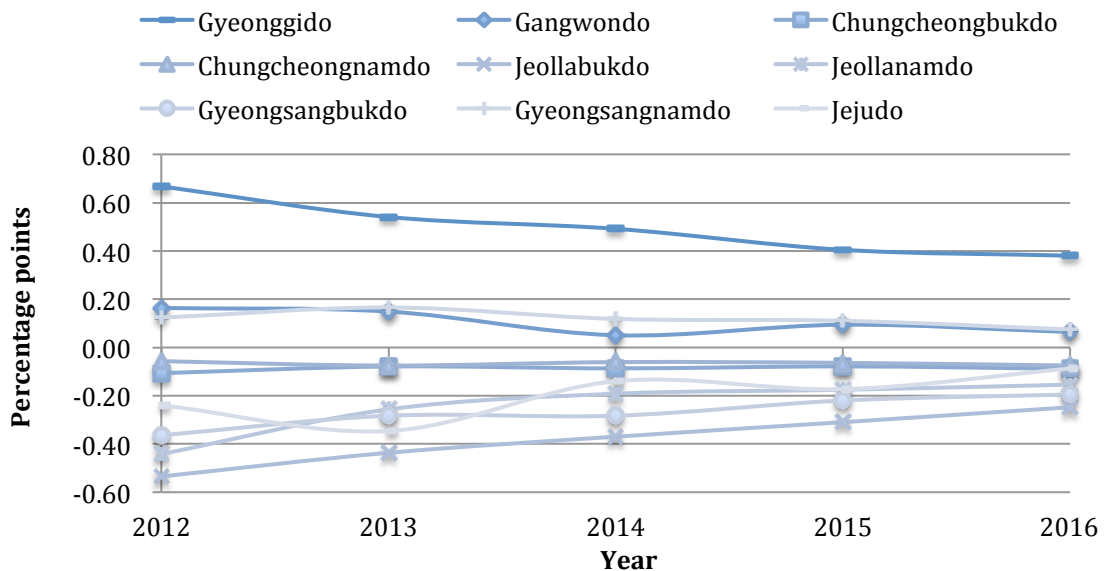


Figure 3 - 8 Deviations from the mean equity multiplier by province in percentage points (2012-2016)

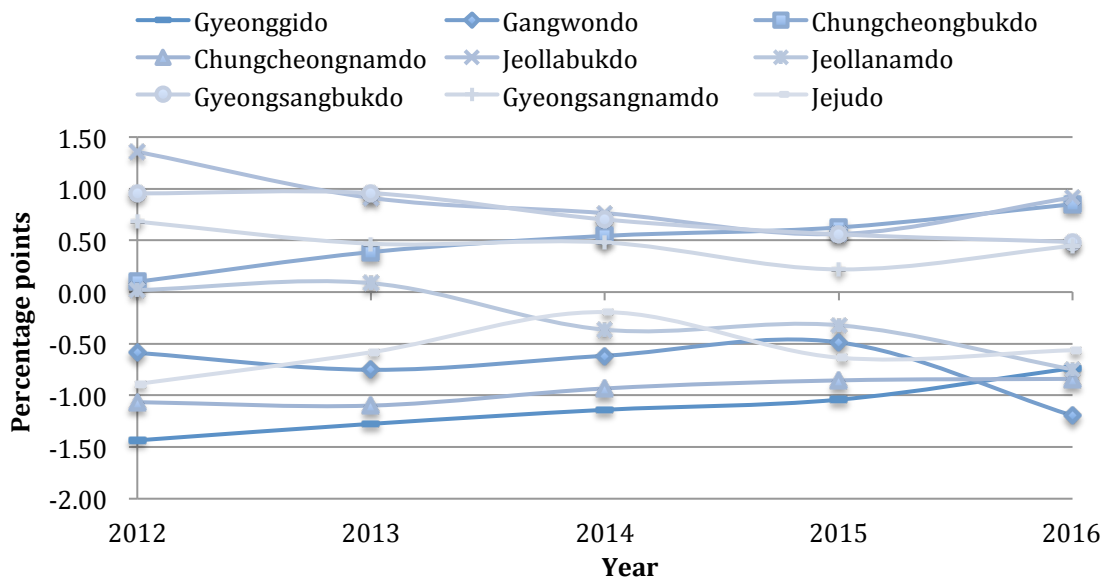


Figure 3 - 9 Deviations from the mean return on assets by province in percentage points (2012-2016)

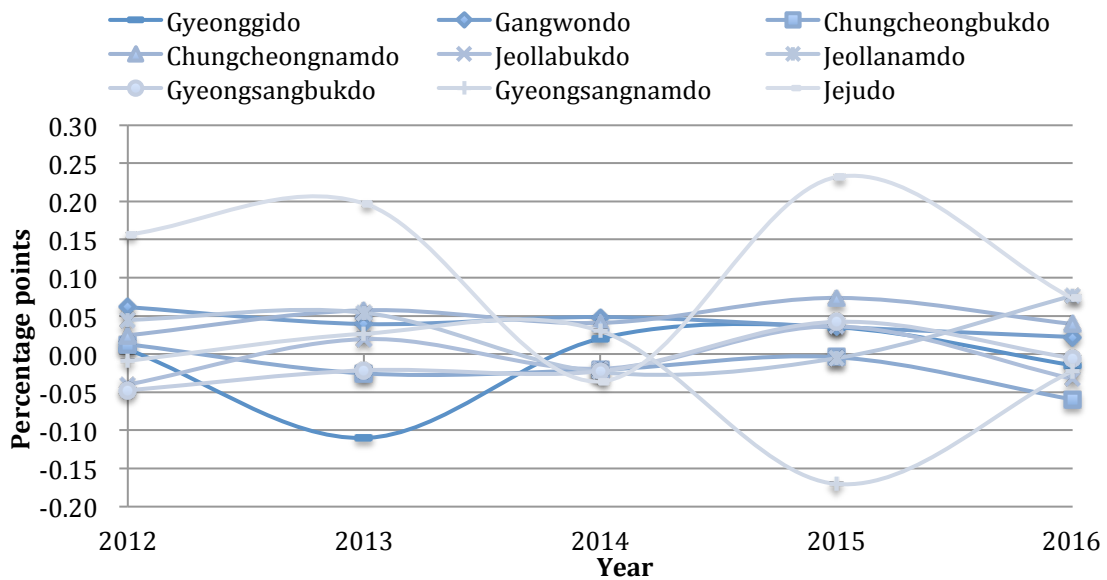
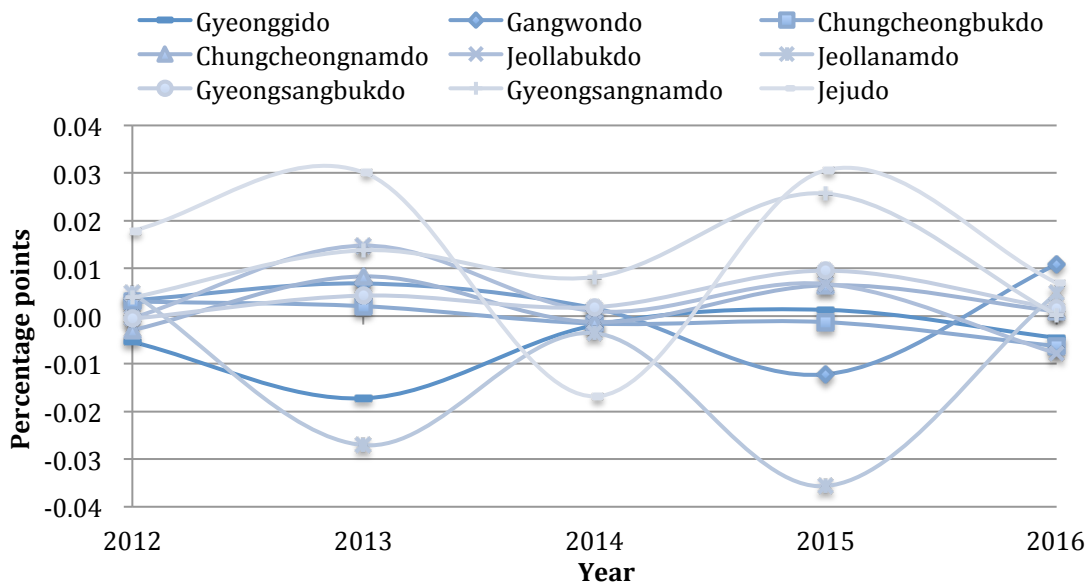


Figure 3 - 10 Deviations from the mean return on equity by province in percentage points (2012-2016)



Source: Author's calculation with data from the *FISIS*.

When analysing the financial indicators regarding co-operatives' specialities several findings emerge. First, analogously to the cross-province comparison, the absolute mean deviation changes regarding profitability, efficiency and solvency. Admit the highly volatile fruit and vegetable co-operatives' profitability (excluded in the graph), the *NPM*, in general, is similar across specialities (figure 3-11). Excluding the statistics for the fruit and vegetable co-operatives, absolute mean deviations have decreased from 11.9 percentage points to 6.9 percentage points between 2012 and 2016.

Second, regarding efficiency, absolute mean deviations have decreased significantly between 2012 (291.9 percentage points between other specialities and Ginseng co-operatives) and 2016 (130.9 percentage points between the same two speciality groups). Also, horticulture and other speciality co-operatives (consisting of one raw sugar, one honey and three flower co-operatives) have been most efficient throughout the five-year-period while fruit and vegetable, as well as ginseng co-operatives, have underperformed mean efficiency continuously (figure 3-12).

Third, solvency related mean deviations have absolutely decreased from 620.6 percentage points in 2012 to 455.5 percentage points in 2016 between meat and fruit and vegetable co-operatives. While other speciality and meat co-operatives have

remained at higher leverage levels, fruit and vegetable co-operatives, being more solvent, have underperformed the Korean mean. Livestock, ginseng, dairy and horticulture co-operatives' solvency ratios have converged over the period, while the last three showed closer proximity (see figure 3-13).

Comparing returns on assets and returns on equity across specialities (figures 3-14 and 3-15), the similar pattern between fruit and vegetable and ginseng co-operatives becomes apparent. Moreover, as the meat, livestock and horticulture co-operatives' ROAs evolve parallel, and their ROE's only do so recently, the meat co-operatives equity level has converged compared to the mean. Regarding both variables, ginseng co-operatives perform well below the mean, as indicated by their strong negative deviations. Absolute mean deviations have decreased from 44.3 to 26.2 percentage points (ROA) and from 7 to 3.6 percentage points (ROE) between 2012 and 2016.

Financial Indicators of Korean Agricultural Co-operatives by speciality, 2012-2016

Figure 3 - 11 Deviation from the mean net profit margin by speciality in percentage points (excl. fruit and vegetable) (2012-2016)

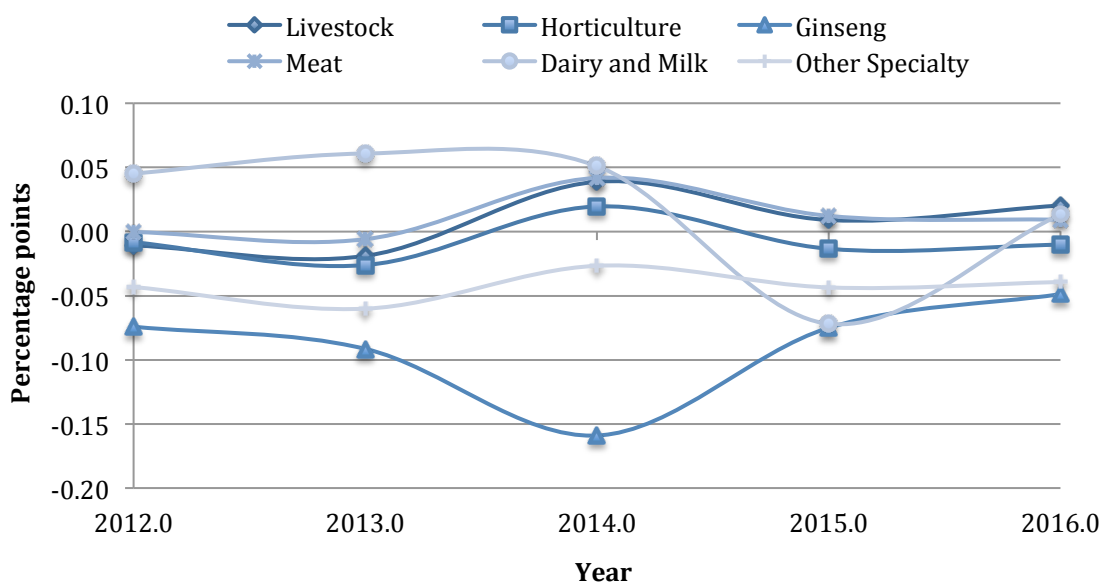


Figure 3 - 12 Deviations from the mean total asset turnover by speciality in percentage points (2012-2016)

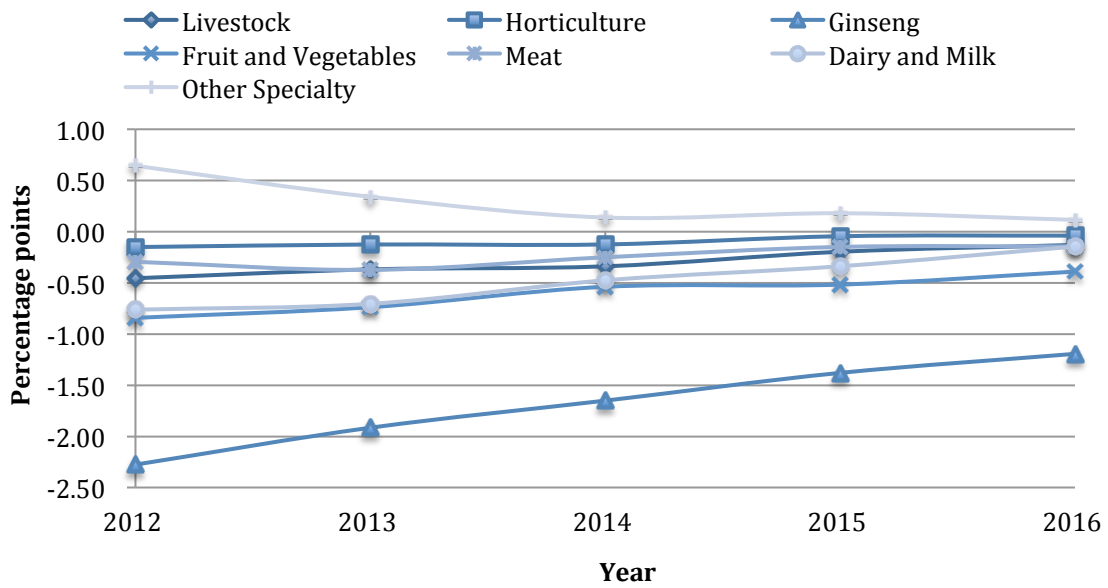


Figure 3 - 13 Deviations from the mean equity multiplier by speciality in percentage points (2012-2016)

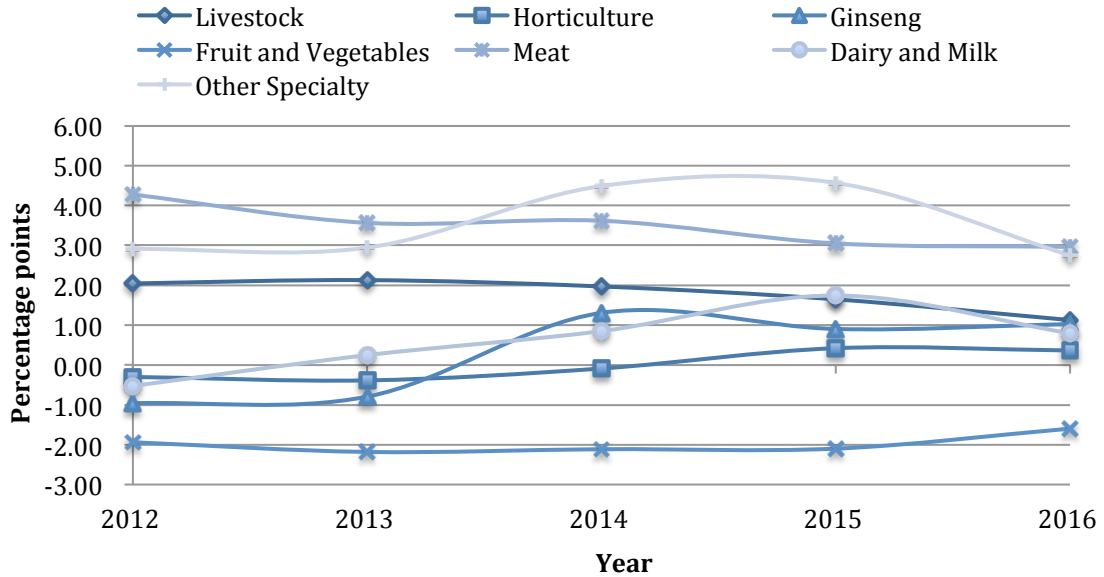


Figure 3 - 14 Deviations from the mean return on assets by speciality in percentage points (2012-2016)

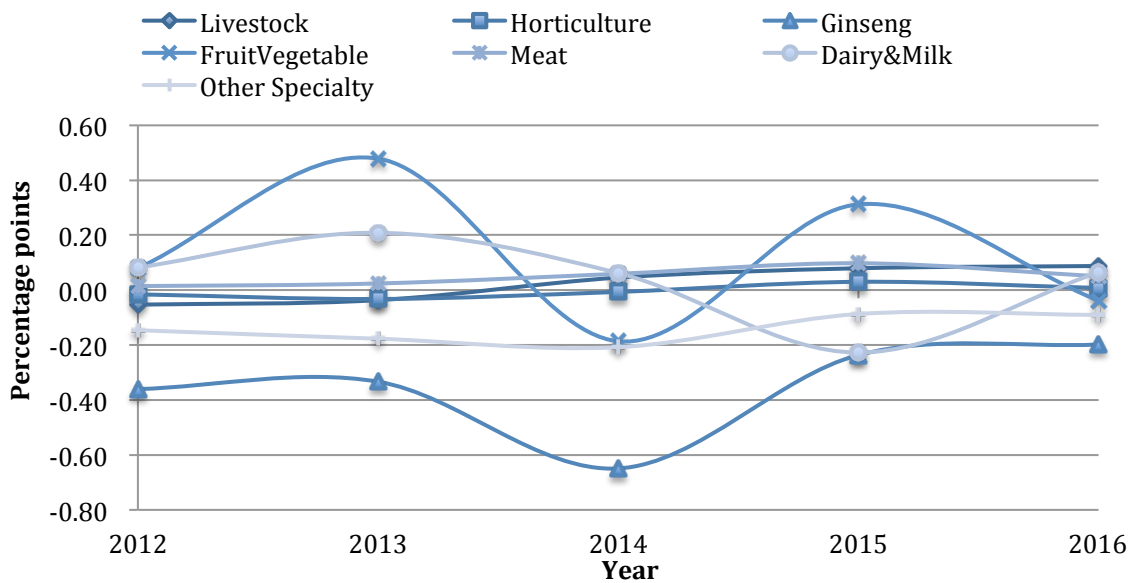
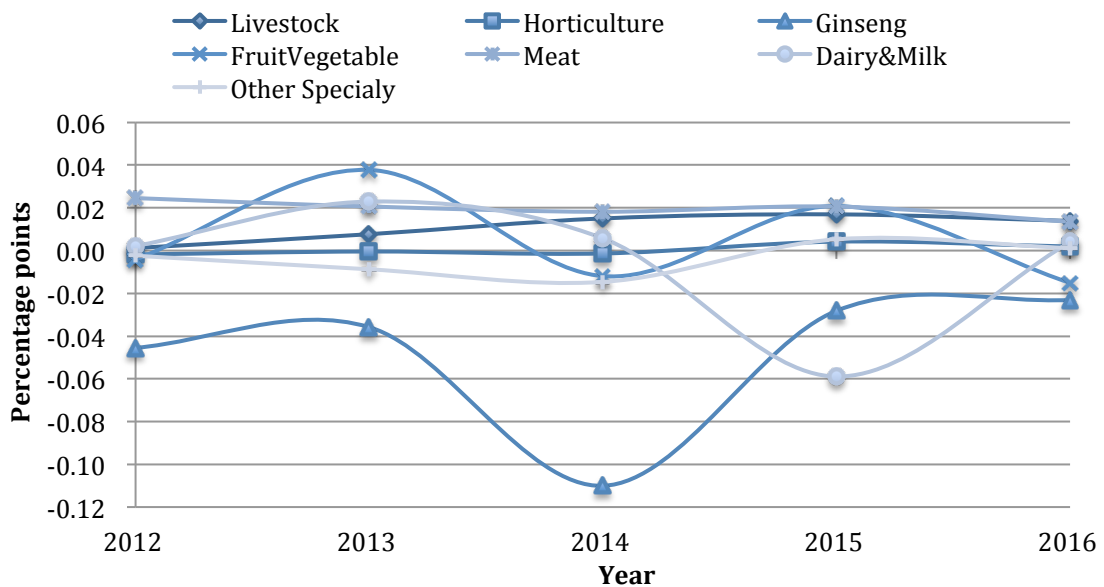


Figure 3 - 15 Deviations from the mean return on equity by speciality in percentage points (2012-2016)



Source: Author's calculation with data from the *FISIS*.

3.5 Data Envelopment Analysis

As mentioned throughout the literature review, the data envelopment analysis allows the comparison of a decision-making unit (DMU) with its peers. The idea of an efficient frontier was first invented by Farrell and later developed towards the DEA as it is known today by Charnes et al. (Charnes, Cooper, & Rhodes, 1978; Farrell, 1957). This type of efficiency calculation bases on a vector y of outputs with s elements (y_1, y_2, \dots, y_s) and a vector x of inputs containing m elements (x_1, x_2, \dots, x_m). Together the two vectors solve the following optimisation problem

$$\max_{u,v,\theta} \theta = \frac{\sum_{r=1}^s u_r y_{rn}}{\sum_{i=1}^m v_i x_{in}} \quad \text{Subject to} \quad \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1; \quad \begin{matrix} \forall j = 1, \dots, n; \\ u_1, \dots, u_s \geq 0; \\ v_1, \dots, v_m \geq 0 \end{matrix} \quad (1)$$

where u and v represent the implicit weights calculated through an iterative process. The first condition sets the initial weights so that an efficiency of 1 is yielded for a DMU. Subsequently, this set of weights is applied to all other DMUs of the calculation group. As the efficiency, in general, is limited to 1, a result above 1 for any combination of weights would be rejected. Thus, the programme selects a new pair of weights and restarts the process until finding the most efficient DMU and assigns a unique efficiency score vis-à-vis the most efficient DMU (Charnes, Cooper, & Rhodes, 1978). Assuming constant returns to scale within the livestock sector due to relatively small production units, we have used the CCR DEA method.

Table 3 - 1 Variables used within the DEA

Variable	Mean	Std. Dev.	Min	Max
Operating Revenue*	1646.60	20151.65	15.02	1552.90
Current Assets*	2739.55	348590.6	257.88	24148.75
Total Employees**	124.683	89.263	31	586

Legend: *in Million KRW; **number of persons; all data from (FISIS, 2018)

Considering the data from the table (3-1) a DEA input analysis has been done taking into account current assets and total employees as inputs and operating revenue as output. Hence, the DEA measures which co-operative is the most effective in managing both its current assets and total employees to achieve its operating revenue.

Table 3 - 2 Results DEA analysis

Variable	Mean	Std. Dev.	Min	Max
Livestock CRS_eff	0.839	0.085	0.632	1

Based on the results from the DEA (see table 3-2) we then created a dummy variable that we are going to use in the DuPont model explained throughout the next section. For the division into four different groups, we have used the 25%, 50%, 75% and the above 75% percentiles.

Table 3 - 3 DEA efficiency score dummies

Percentiles	Rank	CRS_eff	Frequ.	Percent	Cum.
25%	1	0.7808	102	24.88	24.88
50%	2	0.8294	103	25.12	50.00
75%	3	0.9024	102	24.88	74.88
>75%	4	>0.9024	103	25.12	100.00

Table 3 - 4 DEA efficiency rank across geographical specifications

Variable	Mean rank	Std. Dev.	Frequ.	Percent	Cum.
Special City	3.0333	1.02	60	14.66	14.66
Rural area	2.3829	1.10	175	42.67	57.33
Other	2.44	1.22	175	42.67	100.00

3.6 DuPont Analysis

The DuPont Model measures and indicates through the *ROE* how efficiently a firm is managed, taking profitability, efficiency and solvency into account. In the case of an agricultural farm, it calculates the rate of return that a farm earns on farm business equity (Sheela & Karthikeyan, 2012).

$$ROE = \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} = \frac{\text{Net income}}{\text{Equity}} \quad (2)$$

To simplify the above equation:

$$\frac{R}{E} = \left[\frac{S-C}{S} \right] * \left[\frac{S}{A} \right] * \left[\frac{A}{E} \right] \quad (3)$$

Where R is the profit defined as gross receipts minus the cost of production, E is the KRW value of equity; A is the total KRW value of assets, S is the level of sales and C is the cost of production. As Mishra et al. show, the DuPont model is linear in logs (Mishra et al., 2013):

$$\ln(ROE) = \ln\left(\frac{\text{Net income}}{\text{Sales}}\right) + \ln\left(\frac{\text{Sales}}{\text{Assets}}\right) + \ln\left(\frac{\text{Assets}}{\text{Equity}}\right) \quad (4)$$

where $\ln(x)$ is the natural log operator. Since equation (4) also is a strict identity, we can decompose the *ROE* into each component.

3.7 Empirical Model

As our model consists of several equations across which we can not rule out a correlation between the error terms (i.e. non-zero covariance), we utilise a generalisation of the linear regression model, the Seemingly Unrelated Regression (SUR) model (Greene, 2003). The result of the Breusch-Pagan test of independence confirms that we cannot rule out a correlation between the residuals ($\text{Chi}^2 = 133.00$, $\text{Pr} = 0.00$); hence, the utilisation of the SUR model is supported.

Model Set Up

1. $LN(NPM) = \alpha_{10} + \alpha_{11}LNTotFarm + \alpha_{12}LNMeatCons + \alpha_{13}SIZE + \alpha_{14}DEARank + \alpha_{15}SpecCity + \alpha_{16}Rural + \varepsilon_1$
2. $LN(TAT) = \alpha_{20} + \alpha_{21}LNTotFarm + \alpha_{22}LNMeatImp + \alpha_{23}SIZE + \alpha_{24}DEARank + \alpha_{25}SpecCity + \alpha_{26}Rural + \varepsilon_2$
3. $LN(EM) = \alpha_{30} + \alpha_{31}LNTotFarm + \alpha_{32}LNMeatImp + \alpha_{33}SIZE + \alpha_{34}DEARank + \alpha_{35}SpecCity + \alpha_{36}Rural + \varepsilon_3$

Table 3 - 5 Variable description SUR model

Variables Description	
NPM*	Net profit margin**
TAT*	Total asset turnover**
EM*	Equity multiplier**
ToTFarm	Livestock producer sales to purchase price index ratio*****
MeatCons*	Annual per capita meat consumption (weighted average)***
MeatImp*	Annual meat imports in thousand USD***
Size	Quantile division of co-operatives based on the operating revenue**
DEARank	Quantile division of co-operatives based on the DEA efficiency score**
SpecCity	Dummy for co-operatives found in Special Cities*****
Rural	Dummy for livestock co-operatives found in rural areas (myeon)****

Legend: *variable in logarithmic form; **data from Korean Financial Statistics Information System (2017); ***data from OECD (2016); ****data from co-operatives' individual websites; *****data from KOSIS (2018b, 2018c)

As the average meat consumption and the meat imports to Korea show a strong positive correlation (88.62%) we have restrained from using both variables in the same equation. Other correlation values between independent variables remain below 0.6 (LNMeatImp and LNToTFarm), below 0.35 (LNmeatcons and LNToTFarm) and below 0.23 in all other cases.

Special Cities in Korea include Busan, Daegu, Daejeon, Gwangju, Incheon, Sejong, Seoul and Ulsan. In our dataset, 12 out of 82 (14.63%) of co-operatives are located in Special Cities. Livestock co-operatives are considered rural if the headquarter is located in a rural, i.e. "myeon" district. This applies to 35 (42.67%) co-operatives in our sample. The remaining 35 (42.67%) co-operatives are located outside Special Cities and within the urban areas of the remaining eight Korean provinces (compare table 3-4).

Table 3 - 6 Summary statistics DuPont model

Variable	Mean	Std. Dev.	Min	Max
Operating Revenue*	128.91	14836.10	9.17	1552.90
Net Income*	12.47	1628.53	0.08	323.70
Equity*	2.00	228.16	0.18	29.77
Total Assets*	26.94	3018.72	2.96	279.18
Net Profit Margin**	0.11	0.06	0.001	0.82
Total Asset Turnover**	4.74	0.89	1.89	8.24
Equity Multiplier**	13.61	2.90	5.06	25.65
Return on Equity**	6.29	2.55	0.11	28.86

Legend: *in Million KRW; **ratio; all data from (FISIS, 2018)

3.8 Empirical Results

We have performed a Seemingly Unrelated Regression analysing 82 Korean livestock co-operatives using the statistical programme Stata.

First, considering the net profit margin (NPM), we find several statistically significant results as displayed in table 3-7. A rise in terms of trade of Korean livestock farms, defined as the ratio of the sales price index over the producer price index, hurts the NPM significantly (-1.91; Std. Err.: 1.13). We assume that consumers are susceptible to price changes and, hence, vis-à-vis a rise in sales prices, reduce their purchase of meat products. Also, higher sells prices may stimulate the supply by rivalling livestock companies resulting in lower profitability for the NACF livestock co-operatives.

If the per capita meat consumption increases, net profitability of Korean livestock co-operatives increases significantly (1.04; 0.39). We believe that a strong demand increases the quantity sold and thus the operating revenue, which translates into a higher net profit margin.

Concerning the size of livestock co-operatives, we find that, as the operating revenue increases, the net profitability decreases significantly. Comparing to the smallest percentile, net profitability decreases by (-0.26; 0.09), (-0.42; 0.11) and (-0.43; 0.12) respectively for each percentile increase in revenue. Hence, we can conclude that smaller co-operatives perform at least as or even more profitable than larger ones. Thus, somewhat larger livestock co-operatives are not capable of making use of their increased scale. Also, as the co-operatives include the banking business' operating revenues, size is not a priority in determining profitability. Lastly, larger co-operatives have a tendency to be located in cities, which, as we find later too, exposes them to a more complex cost structure.

Compared to the least efficient 25% as measured by our data envelopment analysis only the most efficient group has a significant effect on the net profitability (-0.14; 0.08). Hence, livestock co-operatives that most efficiently use current assets and the number of employees vis-à-vis their peers are somewhat less profitable. Here, we believe that higher profitability might reduce a co-operative's incentive to use resources efficiently, which may explain that the most efficient co-operatives are somewhat less profitable.

Regarding the geographical location of livestock co-operatives, we also find significant results. First, co-operatives located in Special Cities are somewhat less

profitable than their peers in other provinces (-0.17; 0.08). Co-operatives found in Special Cities usually face higher costs both concerning wages and fixed costs, which may be an explanation for profitability decreases. Second, rural livestock co-operatives are somewhat more profitable than their peers located outside Special Cities (0.17; 0.09). Rural co-operatives face lower wages, fixed costs and less competition than their peers in the metropolitan regions, which may serve as an explicator for the higher net profit margin.

Second, analysing the total asset turnover, that is the efficiency component, we observe an adverse effect induced by a rise in terms of trade of livestock farmers (-1.79; 0.25). Here, we believe that an overall increase in the sales price index or decrease in the purchase price index may induce the co-operatives to invest in their machinery and infrastructure which increases their asset values and subsequently decreases the efficiency ratio measured as sales to asset ratio.

Increasing meat imports, too, have a deteriorating effect on the efficiency of co-operatives (-0.94; 0.04). Two separate effects may explain this observation. First, in the short run, higher imports increase competition and thus reduce sales revenues. Second, in the more extended run, livestock co-operatives aim at increasing competitiveness through investments, which augment the asset value and, thus, reduce the efficiency.

Co-operative size has a significant and critical positive effect on the total asset turnover (0.13; 0.02), (0.15; 0.02) and (0.2; 0.02) respectively for each 25% percentile increase compared to the smallest livestock co-operatives. Hence, co-operatives that are larger regarding their operating revenue see their sales level increase at a higher rate than their asset level.

Next, the efficiency of livestock co-operatives as measured by our DEA analysis has a significant, positive and increasing effect on the efficiency of co-operatives compared to the least efficient peers (0.06; 0.02) and (0.1; 0.02) for the percentile over 50% and over 75%, respectively. Thus, the more efficient co-operatives utilise current assets and the number of employees, the higher ranks their efficiency as measured by the total asset turnover ratio.

Lastly, while livestock co-operatives located in Special Cities are significantly more efficient than their peers (0.03; 0.02), rurally located co-operatives do not show any statistically significant differences vis-à-vis their peers. There is a reason to believe that livestock co-operatives located in Special Cities facing more prominent costs are

incentivised to use their resources efficiently. A comparison with table 3-4 in the DEA section supports this notion, as, on average, Special Cities show the highest DEA scores followed by the urban livestock co-operatives and, at last, rural livestock co-operatives.

Third, analysing the drivers of the solvency ratio for Korean co-operatives, we observe that - in line with the results for the total asset turnover - an increase in livestock farms' terms of trade has a detrimental effect (-1.31; 0.45). Here, too, we believe that a substantial increase in the sales price index or reduction in the production cost index induces co-operatives to increase critical investments to maintain competitiveness. Also, increases from higher sales may translate into higher equity values for future use.

Similar to the effect on the efficiency of co-operatives, rising meat imports decrease the leverage of Korean livestock co-operatives (-0.44; 0.08). Stricter competition may induce co-operatives to enhance competitiveness through an incrementation of necessary appliances and facilities.

Regarding the size of co-operatives, an increase has only a statistically significant effect when the largest and smallest percentiles are compared (-0.08; 0.04). Relatively higher equity levels for larger co-operatives may explain the fact that they are somewhat more solvent than their smallest peers. Also, as mentioned throughout the first part of this work, policy loans are distributed somewhat equally across co-operatives cushioning the effect of more substantial differences in the levels of solvency levels across percentiles.

The DEA efficiency rank has a significant and positive effect that increases - compared to the least efficient peers - with each percentile by (0.06; 0.03), (0.11; 0.03) and (0.13; 0.03), respectively. Thus, livestock co-operatives are more leveraged the more efficiently they manage both the level of current assets and the number of employees vis-à-vis their peers.

Finally, livestock co-operatives located in Korean Special Cities are not different regarding their solvency ratio compared to their peers on a statistically significant level. However, being located in a rural area hurts the solvency ratio significantly (-0.14; 0.3). Rural livestock co-operatives may be less leveraged and thus more solvent than their urban counterparts.

In summation, farms' terms of trade, meat consumption and meat imports have a statistically significant effect on the financial performance of Korean livestock co-

operatives in general. The analysed period from 2012 to 2016 has seen critical changes in all three variables. First, the ratio of the livestock sales price to the livestock production price index has increased by 63.4% while the meat consumption per capita has increased by 28% and meat imports have increased by 20% (OECD, 2016; FSIS, 2017). The changes mentioned above show the relevance of variables analysed within the model.

Concerning our research hypotheses, we have found the following results. First, regarding efficiency as measured by the DEA, the more efficient a livestock co-operative is vis-à-vis its peers, the more efficient and leveraged, yet less profitable it is as measured by the ratio analysis. Thus, as we find a statistically significant effect of DEA efficiency on ratio efficiency on all equations analysed, we can confirm our first research hypothesis.

Second, the geographical location of Korean livestock co-operatives affects the financial performance significantly as we find rural co-operatives to be more profitable and more solvent, while livestock co-operatives in Special Cities are less profitable and more efficient than their peers. Thus, we can support our hypothesis that the geographical location has a statistically significant influence on the financial performance of livestock co-operatives. While we also proved our assumption that rural co-operatives are less leveraged than their peer, our results contradict Youn and Choi's results. We believe that the results differ as we consider ratio analysis while Youn and Choi follow a DEA efficiency approach, which utilises Selling, General & Administrative expenses as well as the value of the real estate as inputs. Also, using co-operatives performing within the livestock business without being a speciality co-operative may be a reason for differing results compared to this study (Youn & Choi, 2005).

Third, concerning size, the smaller a livestock co-operative is regarding its operating revenue, the more profitable and less efficient it is. Moreover, the largest co-operatives are somewhat more solvent than their smallest peers. Our results support our hypothesis of finding that smaller co-operatives seem to have a competitive advantage, as they seem to be more cost-efficient and thus profitable.

Finally, as the global variables considered throughout this study (consumption, imports, etc.) may vary from region to region the explanatory power of the results is limited. Nevertheless, we believe that several conclusions may be drawn, which we display in the next section.

Table 3 - 7 Results SUR estimation

Variable Name	Net Profit Margin (NPM)			Total Asset Turnover (TAT)			Equity Multiplier (EM)		
LNTot Farm	-1.91*			-1.79***			-1.31***		
	(1.13)			(0.25)			(0.45)		
LNMeat Cons	1.04***								
	(0.39)								
LNMeat Imp				-0.94***			-0.44***		
				(0.04)			(0.08)		
Size ^o	-0.26***	-0.42***	-0.43***	0.13***	0.15***	0.20***	0.04	0.01	-0.08**
	(0.09)	(0.11)	(0.12)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)
DEA Rank ^o	-0.07	-0.1	-0.14*	0.02	0.06***	0.1***	0.06**	0.11***	0.13***
	(0.08)	(0.08)	(0.08)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
SpecCity	-0.17**			0.03**			0.03		
	(0.08)			(0.02)			(0.03)		
Rural	0.17**			0.01			-0.14***		
	(0.09)			(0.02)			(0.03)		
Constant	-5.84***			15.69***			9.49***		
	(1.62)			(0.70)			(1.25)		
R ²	Chi ²	0.245	128.6	0.683	870.22	0.224	110.14		

***: 1% significance level, **: 5% significance level, *: 10% significance level

^o: each column measures the changes towards the first (omitted) percentile (0-25%)

4. Conclusion

The history of Korea since the Korean War is well mirrored in the development path of the National Agricultural Cooperative Federation. Granting funds, fertilisers and inputs on the condition of co-operative membership in combination with a top-down organisational structure helped to foster the rapid development of rural Korea. As a multipurpose co-operative, the profitable banking sector supported less rentable marketing and input business departments and the equal distribution of loan funds across the by and large homogenous farmer-members helped to overcome rural poverty and close the gap between urban and rural wage increases. However, rapid development through hierarchies and rigid controls was achieved at the expense of democratic values as free elections and farmer-member representation, which are essential co-operative characteristics.

Eventually, the democratic transition repercussion granted farmer-members the right to elect local officials and, indirectly, the federation's president. Nevertheless, these changes towards a more democratic and pluralistic NACF that is in line with ICA rules have to be lived up to by the organisation and its members in total. Subsequent corruption scandals have deteriorated trust in the NACF in general while the question will recur if the once useful model of multipurpose co-operatives is efficient enough to withstand international competition following a more open Korean agricultural economy.

Financially, across provinces and specialities, we see an ever-closing gap between the most positive and negative mean deviations for the financial indicators of efficiency, return on assets and return on equity. The effects of profitability, however, are ambiguous. While the profitability spread for provinces has widened, absolute mean deviations have decreased for speciality co-operatives. We believe it is critical for the National Agricultural Cooperative Federation and policymakers to carefully follow these developments. More profitable co-operatives in provinces like Jeollanamdo or Chungcheongnamdo could serve as examples to adapt, while those found in Chungcheongbukdo and alike may not fall behind further. In all cases, the mean convergence effect across specialities was stronger than across provinces.

Analysing the drivers of profitability, efficiency and solvency of Korean livestock co-operatives, we can emphasise the importance of the general levels of sales and

production prices, meat consumption and import levels as well as the individual co-operative size, efficiency and geographical location.

Generally, co-operatives financial performance is hurt by price increases and increased meat imports, while increased consumption helps co-operatives to become more profitable. Regarding the individual size, efficiency and the geographical location of Korean livestock co-operatives, we can derive four main conclusions. First, the smaller a co-operative is regarding its operating revenue, the more profitable and the less efficient is it compared to its peers. Second, the more efficient a co-operative is as measured with our DEA analysis, the more efficient and leveraged it is as measured with the DuPont model. Third, livestock co-operatives located in Special Cities are less profitable but more efficient than their peers and, fourth; co-operatives located in rural areas are more profitable and less leveraged than their peers.

These results may serve as a reminder to carefully follow price changes vis-à-vis opening agricultural markets, increased imports and the supply elasticity of the Korean livestock sector. If detrimental effects on solvency and efficiency are a result of increased investments to gain competitiveness, decreases may be acceptable as livestock co-operatives depart from significantly high levels.

For policymakers, it is important to retain that measures and policies have to be differentiated. First, policies aiming at the terms of trade of Korean livestock farmers, meat consumption and meat imports can be addressed on a national basis. However, based on size, efficiency and location, Korean livestock co-operatives have different needs. Hence, efficient policies would enhance rural co-operatives' solvency ratio and the profitability of livestock co-operatives that are larger and found in the Special Cities. Notably, in the rural areas, the access to credit has to remain constant and at a level high enough to sustain the rural communities. Rural co-operatives could be helped to become more efficient in using their employees and current assets, as emphasised by our DEA analysis, while larger co-operatives and Special City co-operatives may focus on a larger market share to increase consumption and, subsequently, profitability.

Future research has to elaborate on the careful distinction between smaller, larger, efficient, urban and rural co-operatives. Within each of these fields research may distinguish and decompose the drivers of financial performance to help Korean co-operatives in general and livestock co-operatives in particular to enhance their financial strength vis-à-vis opening markets and investor-owned competitors.

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