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Explaining Recent Firm Growth in Dutch Horticulture

Expliquer la croissance récente des entreprises horticoles néerlandaises

Gründe für das aktuelle Betriebswachstum im niederländischen Gartenbau

Evert Los, Cornelis Gardebroek and Ruud Huirne

Dutch horticultural firms have expanded rapidly in recent decades, both in terms of production area as well as in number of employees. Recently, however, a number of very large horticultural firms emerged with often more than one hundred employees and tens of hectares of greenhouses. These firms also differ from traditional family farms in their management and organizational structures (Verdouw *et al.*, 2014).

“ L’effet positif de la taille de l’entreprise sur chiffre d’affaire stimule la croissance de l’entreprise. ”

A standard explanation for firm growth is that firms want to benefit from economies of scale. A larger scale of production lowers average (fixed) production costs (Kimura and Le Thi, 2013). However, research shows that the cost reductions due to scale economies often decline when firms grow even further. The largest average cost reductions are often found between small and medium-sized firms rather than between medium- and large-sized firms (Van der Meulen *et al.*, 2011).

Recently, other explanations for production expansion have been given. Large production quantities can

also lead to a better bargaining position towards input suppliers, processors and retail partners (Sexton, 2013). For example, most retail partners want a fresh and consistent supply of fruits and vegetables throughout the year. Therefore, they prefer buying from a limited number of very large suppliers instead of multiple small producers. Dealing with fewer suppliers also reduces transaction costs (Sauer *et al.*, 2012).

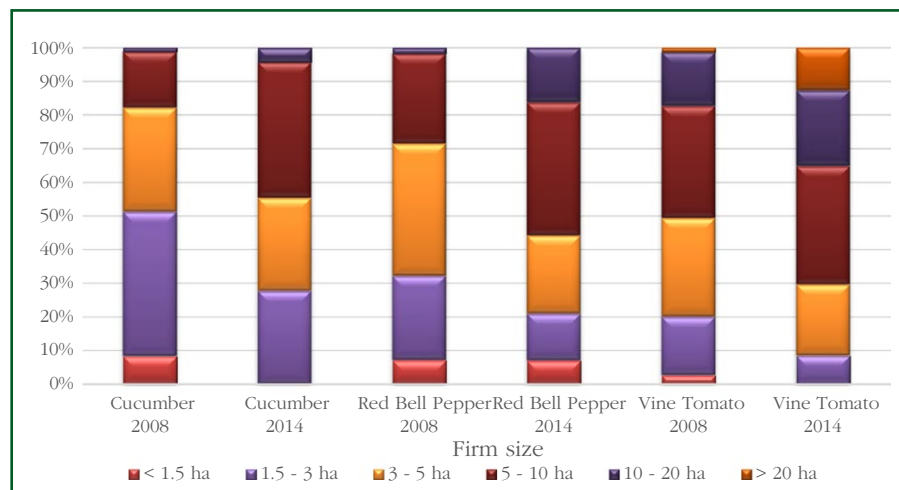
This article examines recent scale increases in Dutch horticulture. We focus on the scale economies argument as well as the bargaining position of firms. For the latter we look at the relationship between firm size and output prices. To analyse these developments, we use unique firm-level data from Rabobank. This dataset contains observations for firms specialised in growing cucumbers,

bell peppers and vine tomatoes, which are considered the main greenhouse vegetables in the Netherlands. All these firms are connected to Rabobank, which is the biggest credit supplier in Dutch horticulture with a market share of about 80 per cent. For the analysis, data of more than 250 horticultural firms in the period 2008 to 2015 are used, providing more than 1,000 observations. Data are available on all operational costs, individual firm output prices, production numbers as well as various firm characteristics and indicators of (financial) firm performance.

Firm size growth in Dutch horticulture

Figure 1 shows that the average size (measured in hectares of greenhouses) of Dutch horticultural firms is steadily increasing. For all three products,

Figure 1: Development of firm size in vine tomato, bell pepper and cucumber production between 2008 and 2014



almost half of the firms had at least five hectares of greenhouses in 2014. In addition, we see the development towards very large firms, with more than ten hectares of greenhouses, particularly for vine tomatoes. Although such acreages may not sound large compared to arable or dairy farms for example, it should be noted that the value of output per hectare in greenhouse horticulture is much larger. On average the production value of 1 hectare of fresh vegetables is €400,000, which compares to the production value of, for example, a dairy farm of roughly 100 dairy cows (Eurostat, 2017).



Due to their lower expenses on capital and labour, smaller firms are on average able to produce more cost efficiently.

The effect of firm size on cost structure

In order to see whether larger firms can reduce average costs due to scale economies, Table 1 shows the average production costs per unit production for small, medium and large cucumber growing firms. The results show that both capital costs and labour costs increase with firm size, implying that larger firms on average face higher costs in order to meet their labour and capital requirements. In contrast, energy costs per cucumber are highest for the smallest firms and decrease for medium and larger firms. So, large firms benefit from scale effects in energy.

The observed differences could also be due to differences in technology between small and large producers. For example, large cucumber firms

often use high wire cultivation. This is a form of cultivation where the plants grow towards a 4 m high wire. Once the top of the plant reaches the wire, it is dropped down for about 50 cm. This enables a more efficient growth of the cucumbers, yet also creates additional labour requirements. In this light, it is relevant to note that it is often difficult to disentangle the effects of firm size and the use of advanced technologies on firm performance, as they are often related (Sheng *et al.*, 2015). Moreover, quality differences might arise due to such underlying differences in the production process.

The main conclusion from Table 1, however, is that average production costs are in fact lowest for the smallest companies. This is mainly caused by their lower average expenditure on capital and labour. Especially in the production of crops that are sensitive to variations in the amount of daylight

and sunshine, sudden changes lead to a highly irregular demand for labour. Large-scale production in such a case involves high transaction costs for organising this temporary labour, whereas smaller-scale producers are able to manage such changes more smoothly. A similar pattern is observed for vine tomato firms, where the input costs per square metre for firms of different sizes are shown in Figure 2. These findings therefore contradict the idea that larger firms in this industry are able to produce more cost efficiently.

The effect of firm size on output prices

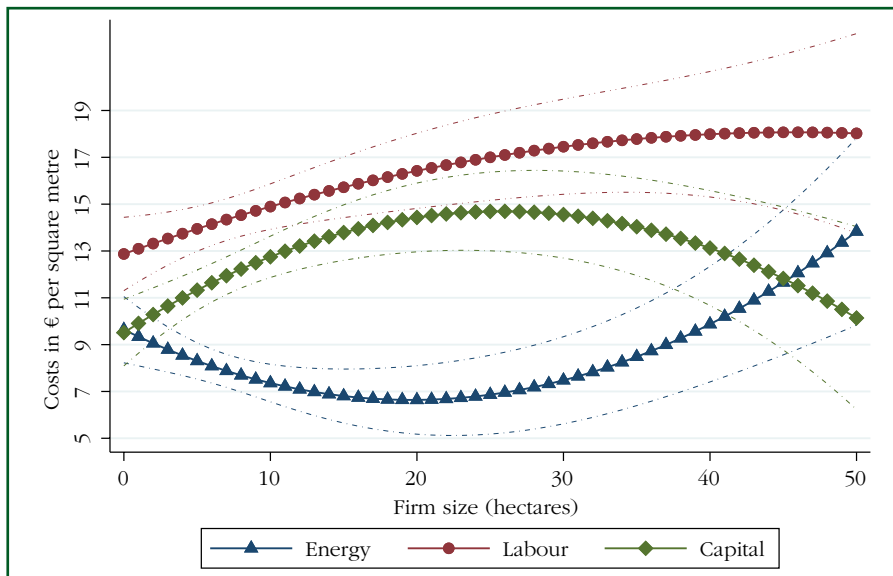
Next, we turn to the effect of firm size on bargaining power. The market for fresh fruit and vegetables is increasingly dominated by large retail partners, who demand a large and consistent supply of products

Table 1: Differences in cost structures for cucumber firms based on firm size

	< 2.1 ha	>2.1 & <5.2 ha	> 5.2 ha
Energy costs per unit production (€)	0.060 (0.03)	0.052 (0.02)*	0.046 (0.02)***
Labour costs per unit production (€)	0.054 (0.02)	0.068 (0.02)***	0.072 (0.01)***
Plant and seed costs per unit production (€)	0.045 (0.02)	0.050 (0.01)*	0.050 (0.01)*
Capital costs per unit production (€)	0.034 (0.02)	0.059 (0.02)***	0.063 (0.03)***
Marketing costs per unit production (€)	0.032 (0.01)	0.027 (0.02)	0.023 (0.01)**
Average size (ha)	1.686	3.515	7.104
N	131	273	135

Notes: Average values for the smallest 25 per cent (<2.1 ha) of the firms, the largest 25 per cent of the firms (>5.2 ha) and all medium-sized firms. Standard deviations in parentheses. *, ** and *** represent statistical significance at the 10, 5 and 1%-level, respectively, based on t-tests between the medium-sized and large firms compared to the smallest firms in the sample, which are used as the reference category.

Figure 2: Costs of main inputs per square metre for vine tomato firms based on firm size



(Camanzi *et al.*, 2011). In Dutch horticulture, with a high degree of seasonality in production, the ability to supply fresh products year-round is therefore becoming more important. To meet such demands, primary producers can choose to bundle their outputs via producer organisations. However, at individual firm level they can also opt for a more year-round production through investments in such things as artificial growing light or through producing at different locations (Van der Meulen *et al.*, 2011). Such invest-

ments, however, require a considerable scale of production. In combination with the increased emphasis on shorter supply chains (where primary producers tend to have more direct contact with retail partners), these developments might render large horticultural firms a better bargaining position. This should be reflected in a positive relationship between firm size and the marketed value of the firm output.

In order to study this relationship, we performed two regression

analyses. In the first analysis, firm size (measured in hectares) is regressed on the firm-specific output prices. In order to correct for specific product characteristics, we also include a few control variables. Production per square metre is considered in our model in order to correct for various product-specific characteristics. Beyond this, since markets and production technologies differ for the three vegetables, indicator variables for red bell peppers and vine tomatoes are included to distinguish firms producing these crops from cucumber growing firms. The results show that firm size is significantly and positively related to the obtained output prices. The positive coefficient of 0.009 implies that, if we control for other product characteristics, an increase in firm size of 1 hectare is associated with a 0.9 eurocent higher output price per kilogram produced. We also tested whether this effect differs per crop, but did not find any significant differences. This implies that the positive relationship between firm size and output prices is consistent for the whole set of cucumber, tomato and bell pepper firms.

“ Die positiven Effekte der Betriebsgröße auf die Erlöse sind Haupttreiber des Wachstums. ”



Not only in the production of fruit and vegetables, but also in the production of potted plants, the average size of Dutch horticultural firms is increasing. © commons.wikimedia.org

In the second regression analysis, firm size is regressed on the stability of these output prices, as measured by the coefficient of variation (CV). The lower the CV, the more stable the prices are for a given firm over the years. The results here show a negative and significant effect of firm size on the coefficient of variation. This means larger firms have more stable output prices over time. An increase in firm size of 1 hectare is found to lower price

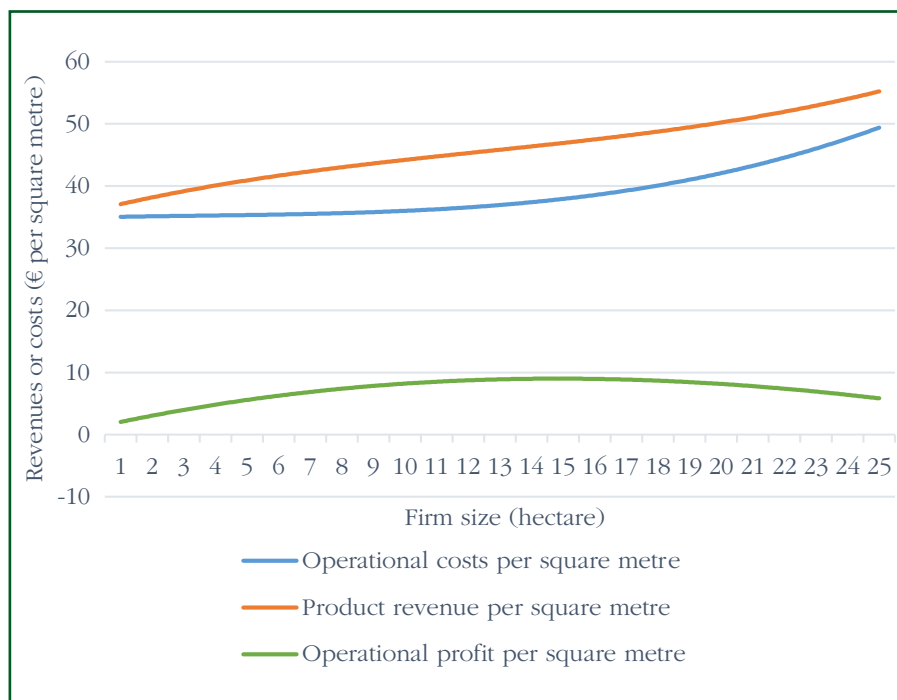
variability over time by 0.2 per cent. Although this seems a small effect, one should not forget that most price variation is due to yearly conditions.

Overall, the regression results confirm the idea that larger firms have an advantage when it comes to their market positioning. This can be attributed either to their better bargaining position, or to the fact that for handling and trading larger volumes lower transaction costs are incurred. These lower transaction costs may be partially passed on by retailers to the primary producer in the form of a higher output price (Sauer *et al.*, 2012). Furthermore, the modernity of the firm might also play a role here (Sheng *et al.*, 2015), as the use of advanced technologies is often associated with firm size and can arguably lead to better quality products.

A synthesis: Operational costs, product revenue and firm size

Figure 3 shows the relationship between costs, revenues, profits and firm size of vine tomato producing firms (in total 627 observations). The blue line indicates the average operational costs (the sum of all expenses on energy, labour and plant materials) per square metre. The orange line represents the average product revenue per square metre (measured by the output price times the production per square metre). The cost line shows that the smallest firms face the lowest operational costs (on average below €35 per square metre), whereas costs go up to around €50 per square metre for the largest firms. With respect to revenues, we observe steady increase in revenues per square metre as size increases, with the highest values obtained by the largest firms. The difference between these two lines is represented by the green line that indicates the operational profit per square metre.

Figure 3: Operational costs and product revenue for specialized vine tomato firms by firm size



Thus, the main driver of firm growth in the Dutch horticultural sector would seem to be the positive relationship between firm size and firm revenues, rather than the potential of scale increases to reduce production costs. This is in line with the positive relationship between firm size and firm-specific output

prices that was found in the regression analysis.

Revenues drive firm growth

Dutch horticulture is increasingly composed of large firms that stray away from the traditional family-farm model. When taking a closer look at



In intensive production systems, firms are able to harvest more than 60 kg of tomatoes per square metre. © commons.wikimedia.org

these developments, we observe that firm size growth is not primarily driven by cost reductions due to economies of scale. Our findings show that increases in firm size have a mixed effect on cost structures: some costs per unit do decrease when firms grow, i.e. energy costs; whereas other costs (e.g. labour costs per unit of product) rise as firm size increases. On average, however, lower production costs are found in the smaller firms.

“ The positive effect of firm size on revenues drives firm growth. ”



High-wire cultivation is increasingly becoming the norm in the production of cucumbers and tomatoes.

Therefore, the logic behind firm growth does not seem to lie in the alleged relationship between firm size and lower production costs. Rather, the positive effect of firm size on the revenue side seems to drive firm growth. This is supported by the finding that larger firms are able to obtain higher and less volatile output prices as well as higher product revenue per square metre.

With respect to the potential to generalise these findings towards other agricultural sectors, one important aspect of horticultural production should be kept in mind. Within horticulture, primary producers are mostly growers of an end product that can be directly transported to retail partners. It is therefore unclear how our results compare to farm sectors where products, such as milk, require

further processing. Moreover, the central role of producer organisations in linking individual producers and retail is not considered in our analysis. Nevertheless, the results show that differences in product revenue and individual firm output prices are of considerable importance and deserve more attention when studying growth in farm size in modern agricultural markets.


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Summary


Explaining Recent Firm Growth in Dutch Horticulture

 Dutch horticultural firms have expanded rapidly in recent decades, both in terms of their production area as well as in number of employees. In particular in the production of fresh fruits and vegetables, a number of very large horticultural firms emerged with often more than 100 employees, operating on tens of hectares of greenhouses. A standard explanation for firm growth is that firms want to benefit from economies of scale, where the increased scale of production would ensure lower average (fixed) production costs. This article however shows that cost reduction due to economies of scale is not the main driver behind the growth in horticultural firm size. In fact, our empirical evaluation shows that larger horticultural firms face higher average production costs compared to smaller firms. However, these higher production costs are compensated by the on average higher and more stable output prices obtained by larger firms. This positive effect of firm size on firm revenues therefore provides a different rationale for the recent growth in average size of Dutch horticultural firms. As a result, our findings demonstrate that revenue-related aspects are becoming more important in understanding firm growth of primary producers in the horticultural sector.

Expliquer la croissance récente des entreprises horticoles néerlandaises

 Les entreprises horticoles néerlandaises ont connu une expansion rapide au cours des dernières décennies, à la fois en termes de superficie de production et de nombre d'employés. En particulier, un certain nombre de très grandes entreprises horticoles de production de fruits et légumes frais ont vu le jour, comptant souvent plus de 100 employés et des dizaines d'hectares de serres. Une explication standard de la croissance des entreprises est que celles-ci veulent profiter d'économies d'échelle, car une échelle de production accrue permettrait de réduire les coûts de production (fixes) moyens. Cet article montre toutefois que la réduction des coûts due aux économies d'échelle n'est pas le principal moteur de la croissance de la taille des entreprises horticoles. En fait, notre évaluation empirique montre que les grandes entreprises horticoles font face à des coûts de production moyens plus élevés que les petites entreprises. Toutefois, les grandes entreprises compensent ces coûts de production plus élevés par les prix de production en moyenne plus élevés et plus stables qu'elles obtiennent. Cet effet positif de la taille de l'entreprise sur le chiffre d'affaire de l'entreprise fournit donc une raison différente pour la croissance récente de la taille moyenne des entreprises horticoles néerlandaises. En conséquence, nos résultats démontrent que les questions de chiffre d'affaire deviennent de plus en plus importantes pour comprendre la croissance des entreprises des producteurs primaires du secteur horticole.

Gründe für das aktuelle Betriebswachstum im niederländischen Gartenbau

 In den letzten Jahren sind die Gartenbaubetriebe in den Niederlanden sowohl im Hinblick auf ihre Anbaufläche als auch in Bezug auf die Anzahl der Arbeitskräfte rasant gewachsen. Insbesondere Betriebe, die Frischobst und Gemüse anbauen, haben teilweise inzwischen mehr als 100 Angestellte und eine Gewächshausfläche von deutlich über 10 Hektar. Eine häufige Erklärung für das Wachstum der Betriebe sind Skaleneffekte, wonach eine Produktionsausweitung zu geringeren (fixen) Durchschnittskosten führt. Der vorliegende Artikel macht jedoch deutlich, dass Kosteneinsparungen durch Skaleneffekte nicht der Haupttreiber für das Wachstum der Gartenbaubetriebe ist. Tatsächlich zeigt unsere Untersuchung, dass größere Gartenbaubetriebe sogar höhere durchschnittliche Produktionskosten haben als kleinere. Die höheren Produktionskosten werden allerdings durch höhere und stabilere Erzeugerpreise bei den größeren Betrieben kompensiert. Dieser positive Effekt auf die Erlöse weist somit auf einen anderen Bestimmungsgrund für die zu beobachtende Entwicklung hin. Nach unseren Ergebnissen werden erlösbezogene Aspekte immer bedeutender, um das Wachstum der Gartenbaubetriebe zu erklären.

summary