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THE ABOLITION OF THE EU MILK QUOTA SYSTEM

ECONOMIC EFFECTS OF THE ABOLISHMENT IN THE DUTCH AGRICULTURAL SECTOR

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Abstract

In 2015, the agricultural sector in the Netherlands had to deal with a drastic policy change: the abolition of the EU quota system. This research creates insights in the structural changes and analyses the influence of this policy change in the agricultural sector. The main question of this thesis is: to what extent does the abolishment of milk quota of 2015 explain different economic effects in the Dutch agricultural sector? This research contributes to the understanding of the impact of government intervention on agricultural markets, especially the impact of quotas. Quantitative research methods are used to gain an extensive understanding of the central research question in this single case study. The main economic effects that have a central position in this research are: structural change in agriculture, welfare of producers, welfare of consumers, trade and the uptake of new technologies. The relevance of the impact of the abolition of the EU milk quota system on especially structural change, welfare of producers and trade in the Dutch agriculture is supported by this study.

7. Reflection

1
Introduction

Until 2015, the European government was regulating the agricultural sector by milk quotas. The milk quota was introduced in 1984, when the EU production of milk was much more than the demand of milk. The reason for introduction of this regime was to overcome structural surpluses in the agricultural sector. It was a tool to solve the 'overproduction' problem in the European Union (European Commission, 2017). The milk quota was introduced in 1984 and has come to an end on 31 March 2015 (European Commission, 2017). By the introduction of the milk quota, they set a limit on production. This regime has had consequences for the agricultural sector, also within the Netherlands. The quota system might, for example, have had impact on the production levels, the welfare of producers, export and the uptake of new technologies (OECD, 2006). Nowadays, the European Commission argued that the abolishment of the dairy quotas will create the possibility for EU dairy farmers to expand production and therefore meet the growing demand (European Commission, 2017). Therefore, the European Commission suggest that a production quota is no longer needed. This research is based on literature about the economic effects of quota systems. The focus of this research will be the relation between the abolishment of milk quota and different economic effects in the agricultural sector. This research is based on an explanatory empirical research design. The research question is:

To what extent does the abolishment of milk quota of 2015 explain different economic effects in the Dutch agricultural sector?

The independent variable in this research is the milk quota policy change 'the abolishment of the milk quota'. The dependent variables exist of different economic effects in the agricultural sector.

1.1 Goal of the research

The research purpose of this paper is to examine the milk quota policy change and the impact of this change on the agricultural sector in the Netherlands. This research creates insights in the structural and economic effects of the abolition of the EU milk quota system. The mechanisms behind this policy change and their influence will be uncovered. The 'big picture' of this research

is based on theory of policy changes, government intervention and more specifically quota systems. The theory will be tested by focusing on a single case study: the abolishment of the milk quota in 2015 in the Netherlands. What are the pros and cons of the abolition? In what way did it affect business activities? To what extent does the abolishment of the milk quota in 2015 explain the economic effects in the agricultural sector? This retrospective research design will look for causes of effects for an event that happened in the past. The milk quota is abolished in April 2015. The method of research is based on quantitative analyses of mainly yearly and monthly data. The OECD presented in their rapport an analysis of trade and economic effects of milk quotas systems (2006). The main economic effects that have a central position in this research are: structural change in agriculture, welfare of producers, welfare of consumers, trade and the uptake of new technologies.

1.2 Added value of this research

First, it is relevant to realize that the abolishment of the milk quota has happened only three years ago. It is interesting to test this recent policy change by the existing scholarship about economic effects of policy changes by government. A recent study is the research project about the effect of the abolishment on shifts and stability in the intensity of farms (Groeneveld, Peerlings, Bakker, & Heijman, 2016). Results of this research refer to a strong increase in intensity of the largest farm type. The largest farm type will rise and this rise is limited for the smaller farm types (Groeneveld et al., 2016). Those outcomes are relevant, because of the impact for farmers and more general, the Dutch economy. This research will be more focused on the overall impact of the abolishment for relevant actors. Another example of recent research is a report by the OECD (2006). The OECD analyzed the trade and economic effects of the main policy measures applied to the dairy sector and the effects of milk price support measures and milk quota systems. Those reports are both based on economic effects of the abolished milk quota, before the abolishment in 2015 happened.

This thesis tries to provide new insights on how the abolishment of milk quota explain different economic effects. This thesis is scientifically relevant and contributes to Public Administration as

an area of knowledge by testing theory of policy changes, government intervention and more specifically the role of quotas and their economic effects. A large and growing body of literature has investigated with many issues related to quota (OECD, 2006). This research will be in line with the existing scholarships, but will test this theory by a relatively new, recent case. This thesis is also relevant for societal reasons because of the societal effects of the abolishment of milk quota. The dairy sector is important to the Dutch agriculture. It ranks as the second most important sector, after vegetables and horticulture. The sector currently comprises about 18,600 dairy farmers, which together manage 1.6m dairy cows (ZuivelNL, 2015). The share of the total value of agricultural production was in 2015 8,1% of the Dutch economy. The Dutch dairy production is related to a positive trade balance. While about 35% of Dutch dairy production is domestically consumed, 65% is exported, with the EU being the most important export market (ZuivelNL, 2015). ZuivelNL is the chain organization of the Dutch dairy sector. This organization figures as point of contact for the government and dairy sector. Policy changes in the Dutch agricultural sector might have economic consequences on large, national scale.

1.3 Readers guide

This thesis is composed of seven chapters. After the introduction, chapter two explicates broadly the history of the Dutch dairy sector. How does the milk quota system works? How does the dairy sector market look nowadays? To more broadly explicate the theory behind the mechanism studied in this thesis, different theories about government intervention and economic effects of production quotas are displayed in chapter three. Theoretical evidence results in six different hypotheses. After the conceptualization and operationalization of concepts and variables in chapter four, the focus shifts to empirical research. Chapter four is concerned with the data and methodology used for this thesis. This chapter discusses the case selection, data selection and method of analysis. On the basis of quantitative research, the results of the data analysis and regressions are discussed in chapter five. Chapter six will provides a summary of the findings and gives advice for policymakers. The thesis will conclude with a critical reflection and suggestions for future research in chapter seven.

2
History of the Dutch dairy sector

2.1 The introduction of milk quota system

Before the introduction of EU milk quota system, there was a system of guaranteed prices. The level of guaranteed prices was above the world market prices. Therefore, there was a growing structural milk surplus. This created a situation where the European Commission bought a large volume of 'butter mountains' (European Commission, 2017). To make an end of this structural surplus, the European Commission introduced the milk quota system in March 1984. The European Commission used the quota as a temporary measure against overproduction and at the same time, exploding budgetary expenditures in the agricultural sector. They aimed at minimizing damage to farmer incomes (Burrell, 1989).

In 1884, the milk quota system was introduced. The permitted milk quantity in the European Union was based on the production level in 1981 + 1%. In the first years of the milk quota system, the permitted milk quantity was sporadically lower. This because of the European Union has to reduce their intervention stocks (LEI, 2016). The quota quantities are divided among producers, farmers, in each Member State. When a firm exceeds the quota limit, penalties might be the result. Because of the high amount of penalties, farmers and their milk production hardly exceeds the quota quantity (LEI, 2016). In case of too much milk production, the dairy farmer will not receive a price on balance, unless there is underperformance in the whole country (LEI, 2016).

In period after the introduction of the milk quota system, the guaranteed price policy was further reduced. The European Commission enlarged the supply quota by steps (Groeneveld et al., 2016). Several policy reforms stimulated the further enhancing of the European agriculture market orientation (European Commission, 2017). For the dairy sector, following the reduction in the guaranteed price from 2003, producer prices have developed positively, with fluctuations (European Commission, 2017).

Since 1982, there have been four important instruments of the current EU dairy policy. The first instrument is based on export subsidies. The second instrument is in line with the export subsidies, namely import tariffs. Thirdly, intervention was generated for butter and skimmed milk powder. The fourth instrument is the supply quota for raw milk (Helming and Peerlings, 2002).

In 2008, the Common Agricultural Policy (CAP) announced for the first time the abolishment of milk quota at the end of March 2015. To prevent the agricultural sector for shock effects, they introduced a system with an increasing size of the production quota in the upcoming five years (European Commission, 2017). In the years after 2008, the European Commission aimed increasing market transparency (European Commission, 2017). The world market prices for dairy products increased in those years. This development has led to a decreasing gap between EU prices and world market prices. This is one of the reasons why the European Union decided to abolish the milk quota system (Groeneveld et al. 2016). According to Hogan, the European Commissioner for Agriculture, farmers would be better poised to benefit from international demand of milk, for example in Asia (Euractive, 2015). By the abolishment of the quota in 2015, farmers were no longer tied to a production limitation. They were able to grow and compete with dairy farmers outside Europe.

2.2 The dairy sector market nowadays

Over the recent years in the twentieth century, the demand of EU milk did not increase (ZuivelNL, 2015). The not-growing demand of EU milk is, among other things, affected by the economic slowdown and the reduced willingness to buy from countries outside of Europe (ZuivelNL, 2015). In August 2014, Russia started the Russian import ban because of political tensions. This ban related to fruit, vegetables, meat, fish, milk and dairy imports from the US, Europe, Australia, Canada and Norway (Erokhin, Heijman, & Ivolga, 2014). This ban played a role in the lagging demand. Therefore, those factors have put the dairy sector in the Netherlands and especially the milk prices under pressure (ZuivelNL, 2015). The average price level was lower in 2015 compared to the price level of 2014. Especially, the average price levels of milk powder, butter and the indicative value of Gouda cheese took a considerable step back (ZuivelNL, 2015).

Besides the continuously updates in EU dairy policy in the twentieth century, there have been policy changes at national level. An important change is the introduction of a phosphate right system. The quota abolition stimulates the growth of milk production, because farmers are no longer limited by the quota system. At the same time, this might increase the level of Phosphate and Nitrogen. Those minerals are related to the number of cows (Helming and Peerlings, 2002). The system has to prevent the milk production for producing more than the national phosphate ceiling. The European Commission has agreed on this measure on national level in the Netherlands (European Commission, 2017). This regulation might affect the Dutch agricultural sector.

In contrast to the original policy goal, make an end of a structural surplus, the abolishment of milk quota is linked to further enhancing of the European agriculture market orientation. What stands out is the policy goal of the European Commission to stimulate the further enhancing of the European agriculture market orientation and market transparency. Is the European Commission right and creates the abolishment of milk quota market transparency, a better international position for farmers, and nevertheless; no overproduction?

Theoretical Framework

A large and growing body of literature has investigated with many issues related to quotas (OECD, 2006). In this research, the quota system figures as policy tool. Based on a description and analysis of the impact of the abolition of the milk quota, the purpose of this paper is to contribute to the understanding of the impact of government intervention on markets and more specifically, the impact of quotas on markets.

3.1 Reasons for government intervention

Government intervention can have a significant impact on economies. Interesting parts of this theory are the supply side of the market, the demand side of the market and the resource allocation. Overall, the main reasons for policy intervention are efficiency and redistribution (Jelic, Durovic, Radojcic, & Anicic, 2014). Government intervention will correct for market failures, achieve equitable distribution of income and wealth and contribute to the overall performance of the economy. Reasons for government intervention, especially in the agrarian sector, relates to different policy fields (Jelic et al., 2014):

1) Increase of efficiency in production: improve market infrastructure, improve information, improve institutional infrastructure (Jelic et al., 2014).

2) Protection of income: price stability (Jelic et al., 2014). Especially protection of income has played an important role in the instruments of EU diary policy. Income protection instruments by the EU dairy policy have been for example import tariffs, export subsidies and a supply quota for raw milk (Helming and Peerlings, 2002).

3) National food safety and security (Jelic et al., 2014). National food safety has also played an important role in the instruments of EU dairy policy. After World War II, high priority in government policy have been agricultural production and food, especially in the Netherlands. There has been a shift from a one-dimensional focus of agriculture policy on productivity and production towards a domain with priority to research on environmental, food safety, animal welfare and land use issues (Spiertz and Kropff, 2011).

4) External effects and public good (Jelic et al., 2014).

3.2 Production quota

A production quota is a limit based on the quantity produced. They can have a minimum required production character or a production restricting character. In the European Union, the milk quota system had a production restricting character (OECD, 2006).

The system included two quotas. One for deliveries to dairies. This part exists of 97.7% of the EU total. The other quota consisted of direct sales at farms. This part exists of 2.3% of the EU total. The quota quantities were divided among producers, the farmers. There are differences and variations in dairy quota systems among OECD countries. For example, the quota systems are often governed and implemented differently in European member states. Those differences can affect milk production and trade in different ways (OECD, 2006). The milk production quotas as government intervention tool is used to control the growth of the production surplus and budgetary expenditures. In the context of the improvement of political sustainability, this way of government intervention is used (OECD, 2006). In line with reasons for government intervention, as discussed above, milk quotas have been used to stabilize prices and income. Especially the income of farmers (OECD, 2006).

As mentioned before, the quota quantities have been divided among producers, farmers, in each Member State. When a firm exceeds the quota limit, penalties might be the result (OECD, 2006). Those penalties mainly consist of a surplus levy of 27.83 euros per 100kg. This amount has been divided among producers within the country in proportion to their contribution (European Commission, 2013). In the 2014/2015 quota year, twelve Member States of the European Union exceeded their national milk quotas. In addition, the Netherlands received a penalty for exceeding their national milk quotas for deliveries. Those penalties ran into millions (European Commission, 2013).

Considering this production quota theory, it seems that the abolishment of production restricting quota might have an effect on the total quantity produced, control of the growth of production surpluses, budgetary expenditures and the stability of prices and income.

3.3 Economic effects of milk quota systems

In the next paragraph, the economic effects of milk quotas will be further discussed. What are expected effects of the quota abolition and why? According to the OECD, a limit on milk supply influences all facets associated with milk production (2006). Effects of the quota abolition are expected to see in price instability, increase of investment (supply and demand of animals) and production in the agricultural sector (Helming & Peerlings, 2002).
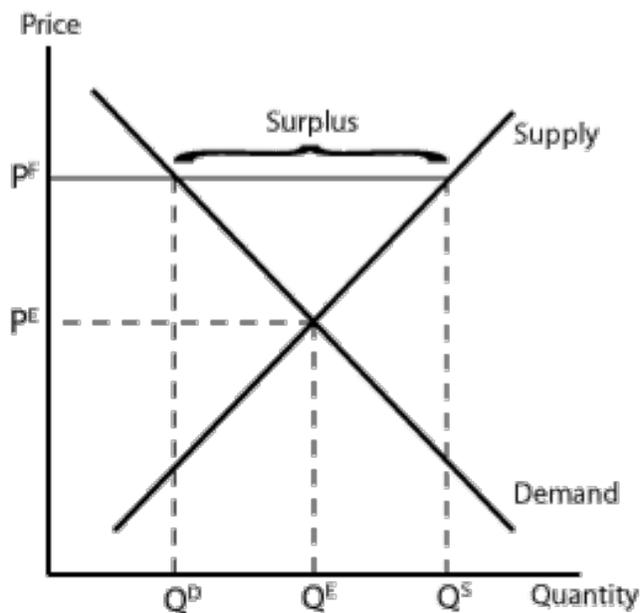

Figure 3

Figure 3 shows a market situation with a quantity surplus. Because of the high price level (Pf), the supply (Qs) is much more than demand (Qd). As discussed in chapter two, before the introduction of milk quotas, the European Union system consisted of guaranteed prices above the world market prices. A simplified representation in figure 3 shows the guaranteed price as Pf. Because of the high prices, the amount of milk offered (Qs) is much more than would be desirable in a market situation (Qe). To make an end of this structural surplus, the European Commission introduced the milk quota system in March 1984. This quota system included a limit based on the total milk quantity produced. The European Commission used the quota as a temporary measure against overproduction and at the same time, exploding budgetary expenditures in the agricultural sector (European Commission, 2017).

A large and growing body of literature has investigated the inefficient effect of quotas (Vavra, 2006). Compared to the free market situation, the welfare effects of quotas are inefficient (OECD, 2006). For example, because of losses in (allocative) efficiency and unnecessary transfer effects (Veeman, 1982). The imposition of a quota has in different ways negative effects on welfare. The causal mechanism behind this hypothesis are the emergence of distortions in the market and misallocation of resources. The implementation of a quota is inefficient and may result in distortions and misallocation of resources. A free market situation is more efficient. Because of the production limitation character, low-cost efficient milk production is no longer a stimulating aspect of production for producers. On the contrary, the expense of high-cost inefficient production is encouraged. A side note of this assumption is that quotas are in this situation related to production levels. If the quotas are related to efficiency criteria, efficient production might be the result. Assuming that quotas are related to production levels, all farmers have to deal with the same percentage cut in their production (OECD, 2006).

On the other hand, there is theory about the welfare improving aspect of quotas (Harvey, 1984). According to Harvey, adoption of quotas could improve welfare in a political economy (1984). According to research, a positive aspect of the quota is that farmers are risk-averse (Just, 2003). The introduction of a quota creates supply management. Therefore, the quota system creates more price stability for farmers (OECD, 2006).

What stands out are the different pro-arguments and counter-arguments related to the effects of a production quota. The successive paragraphs will discuss the effects in more detail.

P

S'$_{j,r}$

PS$_{j,r}$

RENT$_{j,r}$

S$_{j,r}$

PQ$_{j,r}$

D$_{j,r}$

Q

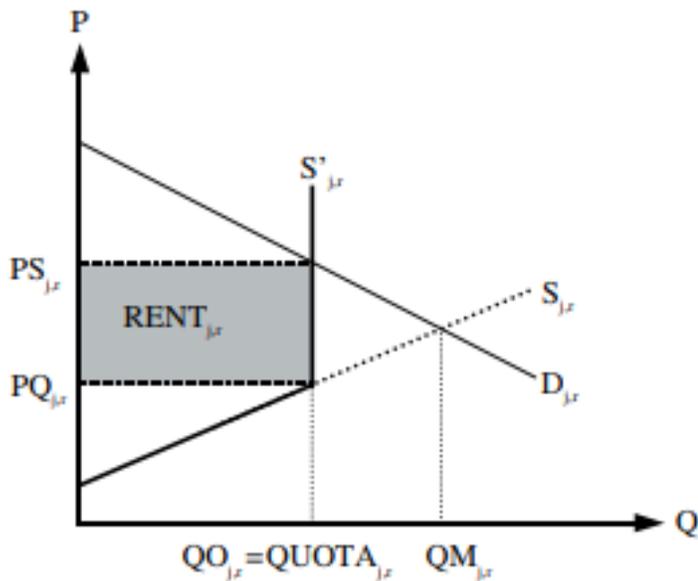QO$_{j,r}$=QUOTA$_{j,r}$ QM$_{j,r}$

Figure 4 (OECD, 2006)

Figure 4 illustrates a market situation with a production quota. Without that quota, the market equilibrium of the sector would be quantity QM. When the quota is implemented in the market, the supplied quantity of milk will change from QM to QO. There is a production limitation: the quota. The producers' farm price is in this market situation PS. In Figure 4, milk production in the general equilibrium model is approached as one sector with a sector-wide quota. The underlying assumption is that quotas are fairly distributed among milk producers (Lips and Rieder, 2004). When the production quota is abolished, there will happen two things. The supply curve will shift back to its original position, from S' to S. As illustrated in figure 4, the market will return to its original equilibrium, QM. At this point, the price is lower than before. The quantity is at this point higher than in a situation with production quota, from QO to QM (Réquillart, 2008).

It is important to realize that it depends on the market situation how the market will return to its original equilibrium. If the demand side is higher, compared to the supply side, the abolishment of milk quota will stimulate more production and therefore lower milk prices. If the demand side cannot meet the quantity offered, the abolishment will also stimulate more

production and therefore lower milk prices. In the second situation, there will be too much milk and the competition between farmers will lead to a new equilibrium.

In line with the expectation that milk production in the EU will grow or grow to a limited extent, their might be a shift from areas with relative high production costs to more efficient producing areas (LEI, 2016). The Netherlands belong to the last category. The expectations for the development of demand for dairy products are favorable. According to research, there are positive expectations to sell the extra-expected production of milk in the Netherlands (LEI, 2016). Especially if milk production in other regions of the EU decreases. In addition, investments in product innovations and marketing make the production growth possible (LEI, 2016).

Besides the economic effects in general, the abolishment causes some indirect effects. Owners of farms resources and suppliers of inputs might also be affected by the abolition of the milk quota in the agricultural sector. The producer's surplus is distributed across farmers and other input suppliers (OECD, 2006). Another important point about the effect of quota's, especially in the case of abolition of the production quota, is that quota carries a value. This value is not necessary a price value or tradable value, but an implicit value (OECD, 2006). The producer, the farmer ties to the milk quota. In most cases, it is not profitable to produce more milk than is permitted by the quota system. Therefore, the quota relates to income and has value for the person who has to deal with the quota. The quota affects decision-making. For example, when farm properties are transferred or sold (OECD, 2006). As illustrated in figure 2, by the abolishment of the quota the market will return to its original equilibrium. Thereby, there is no longer any difference between the market price and the price farmers are willing to 'work' for. The quota-rent will be lost.

Based on this theoretical framework, three important effects relate to the abolishment of milk quota (European Court of Auditors, 2009).

1) The total quantity of milk production will be higher. The increasing milk production will lower the market price. Therefore, the diary prices will become lower and more instable.

2) The most competitive countries will start to increase their production as compared to the non-competitive countries. Production of milk moves to those countries that have a comparative advantage in producing the good. Those competitive countries are because of the abolition no longer limited in their production level. Overall, it stimulates the EU's export. It may affect the world milk prices and non-European producers. It is a step towards worldwide market liberalization.

3) Transfer of welfare from producers to consumers.

By introducing a milk quota, policy makers bring the supply side of the market under direct control. The abolishment of milk quota will make it less easy for policy makers to control for the growth of production surpluses.

Literature review in previous paragraphs highlighted economic effects that relate to the abolishment of milk quota. According to the OECD, milk quotas could influence the agriculture sector and other involved actors in different ways (2006). Combining those studies, five different sub-groups of economic effects are created. Those economic effects will be further outlined in this paragraph. Together, these studies indicate six hypotheses.

1. Structural change in agriculture
2. Welfare of producers
3. Welfare of consumers
4. Trade
5. The uptake of new technologies

Structural change in agriculture

The milk quota abolishment will influence the industry's structure. Previous research findings indicate that after the abolition, there will be a shift from areas with relative high production costs to more efficient producing areas (LEI, 2016). This because the abolishment of the milk quota stimulates low-cost efficient milk production. Because of the end of production limitation, the expense of low-cost efficient milk production is the result. Compared to small farms, larger and more intensive farms will survive. According to Groeneveld et all., the abolition of a milk quota creates also a shift towards larger and more intensive farms in the Netherlands (2016). Their results indicate a strong increase in intensity for the largest farm type when milk quotas are abolished (Groeneveld et all., 2016). They also conclude that this increase in intensity is limited for the smaller farms. Groeneveld et all. indicate in their research that after the abolishment of the milk quota, some farms types keep the number of cows and the number of hectares on the farm constant (2016). An increase in production is not possible, because of the costs that are associated with the extending of production. On the other hand, most farms will extent the number of cows and grow, because of the abolishment of the milk quota (Groeneveld et all., 2016). Bailey (2004) argues that structural changes in the EU have been slow down under the quota system compared to what would have been the case in a free market situation (OECD, 2006). Therefore, there might be a relation between the abolishment of milk quota and the structural change in agriculture.

H1: The abolishment of milk quota creates a shift from areas with relative high production costs to more efficient producing areas.

Welfare of producers

One of the reasons for the introduction of the milk quota was to stabilize milk prices and income of milk producers. The abolishment of the milk quota will affect the welfare of producers, especially because the milk producers' prices become unstable. The income of milk producers might be effected.

How do quotas affect the producers' surplus? Because the supplied quantity is no longer restricted by a quota level, the abolishment of the dairy quotas will create the possibility for EU farmers to expand production (OECD, 2006). The supply curve will shift back to its original position. Therefore, the market will turn back to the original equilibrium. The increasing milk production will lower the (world) market price. The price is lower than before and the quantity is higher. If the demand side cannot meet the quantity offered, the abolishment will also stimulate more production and therefore lower milk prices. There will be too much milk and the competition between farmers will lead to a new equilibrium. If the demand side is higher, compared to the supply side, the abolishment of milk quota will stimulate more production. At the same time, the production risks will increase. Besides this, also the quota rent, unit value of quota, disappears (Vavra, 2006). This might be for some producers a positive effect, but also for some small producers a negative effect.

According to the OECD, this assumption might be more complex. In this 'simple analytical framework', the producer surplus and therefore revenues are related to the producer. The producer is in this case the farmer. This because he is the owner of the assets, for example land. In reality, the producer's surplus is distributed across farmers and other input suppliers (OECD, 2006).

H2: The abolishment of milk quota positively affects the total quantity of milk production in the Netherlands.

H3: The abolishment of milk quota negatively affects producers' welfare.

Welfare of consumers

The welfare of consumer refers to the consumer surplus that exist of demand and supply curves of milk and the market price. Consumers are not affected directly by the abolition of the milk quota system. On the other hand, the milk quota system facilitates high price support (OECD, 2006). When the total amount of milk production increases, the consumers price of milk might decrease, as showed by figure 2. Because of the decreasing consumer milk price, the consumer surplus will grow. According to a report by European Commission's Joint Research Centre on the

economic impact of the abolition of milk quota regimes, the overall welfare effects are slightly positive for the European member states (JRC-IPTS, 2009). Nevertheless, the prices of dairy products are expected to decline less than producer's prices of raw milk. For example, the input costs of manufactures decline more than consumers' prices of dairy products. This will rise the revenues of manufactures. Therefore, the positive effect of the abolition on consumer surplus is expected to be different in comparison with the negative effect of the abolition on producer surplus. Overall, the abolishment of the milk quota might influence to some extent welfare of consumers.

H4: The abolishment of milk quota positively affects consumers' welfare.

Trade

The abolishment of milk quota unites the European market with the world market. As mentioned before, the most competitive nations in the world will start to increase their production as compared to the non-competitive nations. The abolishment of milk quota stimulates producers to increase their production (OECD, 2006). Besides this, the European Commission noticed a growing demand of milk in the world. The abolishment of the quota would meet this growing demand. According to the Milk market observatory of the European Commission, the Netherlands is one of the biggest export countries in the agricultural sector (Milk market observatory of the European Commission, 2018). Overall, the abolition of the milk quota stimulates the European milk production and therefore the EU's export.

H5: The abolishment of milk quota will stimulate the milk export in the Netherlands, as competitive country.

The uptake of new technologies

Based on the theoretical framework, there might be a positive relationship between the abolishment of the milk quota and the investment effect. Referring towards economic effects, the investment effect plays an important role in this field. There is a relation between quota

systems and their impact on structural change or new technologies (Oskam and Speijers; Hennessy, 1995). Early examples of research into the investment effect of quota systems show that structural changes in the EU have been slow down (Bailey, 2004).

On the other hand, restructuring of the dairy sector has continues all the same (OECD, 2005). Research about the difference between advantaged areas, with quota, and disadvantaged areas, without quota, showed some relevant outcomes. According to the OECD, the average number of farms in the EU has continued to fall and the standard yields improved over time (2006). Those numbers are more stable in disadvantaged areas than in advantaged areas (OECD, 2006). Investments in product innovations and marketing make the production growth possible (LEI, 2016). Therefore, there might be a positive relationship between the abolishment of quotas and the investment effect.

H6: The abolishment of milk quota will stimulate investments in product innovations.

3.6 Hypotheses

There is a large volume of published studies describing reasons for government intervention. Different theories exist in the literature regarding production quotas and economic effects of milk quota systems. According to the theory, there are formulated six hypotheses regarding economic effects of milk quota systems. Those hypotheses reviewed here seems to suggest an important role for the following chapters.

H1: The abolishment of milk quota creates a shift from areas with relative high production costs to more efficient producing areas.

H2: The abolishment of milk quota positively affects the total quantity of milk production in the Netherlands.

H3: The abolishment of milk quota negatively affects producers' welfare.

H4: The abolishment of milk quota positively affects consumers' welfare.

H5: The abolishment of milk quota will stimulate milk export in the Netherlands, as competitive country.

H6: The abolishment of milk quota will stimulate investments in product innovations.

4
Research Design

In this thesis, quantitative research methods are used to gain an extensive understanding of the central research question. The research goal is explanatory, with focus on identifying a general causal effect. In chapter 4, the research design is justified. First, relevant variables are conceptualized and operationalized. Section 4.2 elaborates the case selection. Section 4.3 elaborates the data collection. An overview of the variables, operationalization and data collection is provided in table 1. Section 4.4 provides a discussion of the research approach and design.

4.1 Key concepts, their operationalization into variables and data

The theory mainly bases on the gains or losses induced from government interventions. Those gains or losses refer to the different economic effects. In this case, the concept 'policy change' is the abolishment of a quota. The key concepts based on the theory of economic effects and hypotheses shape the different variables. The independent variable is the policy change 'the abolishment of the milk quota'. The dependent variables exist of different economic effects of the abolishment of the milk quota, as discussed in chapter three. This paragraph will illustrate the conceptualization and operationalization of the dependent variables. This operationalization makes empirical research possible in the next chapter.

Based on the theoretical framework, there are three important effects. The dairy prices will be lower, the total quantity of milk production will be higher and the most (competitive) countries will start to increase their production as compared to the non-competitive countries. According to the OECD, milk quotas could influence the agriculture sector and all involved actors in different ways (2006). Seen from a more specific view, those effects are divided among the following economic effects (figure 5).

Figure 5. Relationship between concepts
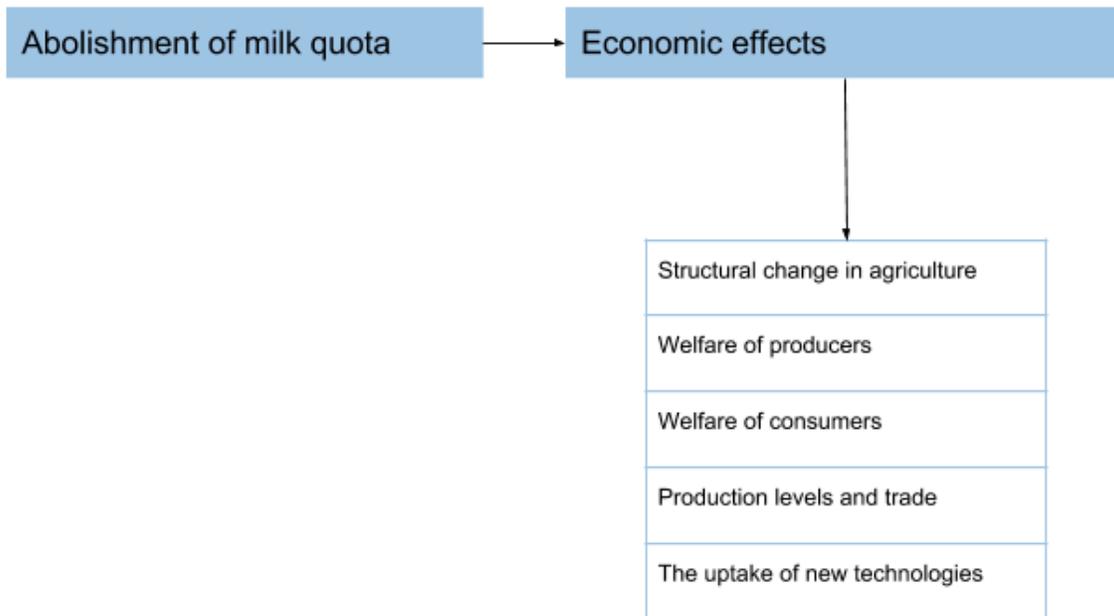
The outcome of the analyses will create insights in the structural changes and the overall economic effects of the abolishment of the EU milk quota system. The next section operationalizes the different economic effects.

- Structural change in the agriculture
- Welfare of producers
- Welfare of consumers
- Trade
- The uptake of new technologies

4.1.1 Structural change in the agriculture

The conceptualization of the first dependent variable, structural change in the agriculture, relates to the sectors structure. According to theory, the abolishment could result in a shift from small farms towards larger and more intensive farms (Groeneveld, 2016). The total share of small and more intensive farms in the Netherlands operationalizes structural changes in the agriculture sector.

The variable is made measurable by data on the number of farms, the number of cows and the size of farms during years. Analyzing the development of number of farms, the number of cows and the size of farms (during years before and years after the milk quota abolishment) will give insights in the relation between the abolishment of milk quota and structural change in the agricultural. The data sets of CBS Statline are representative for the number of farms, the number of cows and the size of farms in the Netherlands.

4.1.2 Welfare of producers

The conceptualization of the second variable welfare of producers is the perspective of how the abolishment affects producers' surplus. The producers' surplus is determined by the supply curve of milk and the consumers' price of milk. When the milk production quota is abolished, the market will turn back to the original equilibrium. The producer's price will become lower and more instable and the quantity of milk higher. This, because the supplied quantity is no longer restricted by a quota level (OECD, 2006). The income of farmers might be effected.

Welfare of producers is operationalized by milk prices, the total amount of milk production and the total amount of revenues of farmers in the agricultural sector. The milk prices are based on producer prices. It concerns the price that the producer, the farmer, receives for the milk. This price is not the same as the consumer's price. Analyzing the development of milk prices, the total amount of milk production and revenues of farmers (during years before and years after the milk quota abolishment) will give insights in the relation between the abolishment of milk quota and welfare of producers. The data set of Wageningen Economic Research is representative for the milk prices. The data sets of CBS Statline are representative for the total amount of milk production and the total amount of revenues of farmers in the agricultural sector.

4.1.3 Welfare of consumers

The conceptualization of the third dependent variable is based on the size of consumer's surplus. The consumer surplus consists of consumer's milk demand curve of milk and the consumers market price of milk. Although consumers are typically not affected directly by a quota system, the presence of quota may facilitate high price support (OECD, 2006). As discussed before, the

prices of dairy products are expected to decline less than the prices of raw milk. The input costs for, for example, manufactures decline more than prices of dairy products. This will rise the revenues of manufactures.

Welfare of producers is operationalized by the Consumer Price Index (CPI) of semi-skimmed and skimmed milk. Analyzing the development of consumer's prices will creates insights in the relation between the abolishment of milk quota and consumer's welfare. How do the results from before the quota abolition relate to the period after the abolition? The data set of CBS Statline is representative for the CPI of semi-skimmed and skimmed milk. The control variable is the CPI for all spending categories. This because the national development of the CPI might be correlated with the CPI for semi-skimmed and skimmed milk. If they are moderately of more correlated, interpreting the results might give difficulties.

4.1.4 Trade

The abolishment of milk quota unites the European market with the world market. As mentioned before, the most competitive nations in the world will start to increase their production as compared to the non-competitive nations (Milk market observatory of the European Commission, 2018). Besides this, the European Commission noticed a growing demand of milk in the world. The abolishment of the quota would meet this growing demand. According to the Milk market observatory of the European Commission, the Netherlands is one of the biggest export countries in the agricultural sector (Milk market observatory of the European Commission, 2018).

This variable is conceptualized by import and export levels in the Netherlands. Trade is operationalized by export, import and trade balance levels of the Netherlands according to the Standard International Trade Classification (SITC). The data sets of CBS Statline are representative for the Dutch input value, output value and trade balance of dairy products and eggs. The trade balance consists of the balance of the export value of dairy products and eggs minus the import value of dairy products and eggs. The segmented trend analysis does not account for the specific effects of eggs on the Dutch import and export value. Therefore, the results might be over-ambitious in its claims.

4.1.5 The uptake of new technologies

The conceptualization of the dependent variable uptake of new technologies is the perspective of how the milk quota creates an investment effect. Based on the theoretical framework, there might be a positive relationship between the abolishment of the milk quota and the investment effect. There is a relation between quota systems and their impact on structural change of new technologies (Oskam and Speijers; Hennessy, 1995). Early examples of research into the investment effect of quota systems show that structural changes in the EU have been slow down under quota systems (Bailey, 2004).

This dependent variable is operationalized by the average gross investments for dairy farms in The Netherlands, the level labor intensity in the Netherlands and the Dutch dairy cows per annual work unit (AWU). The average gross investments by dairy farms reflects the development and changes of the investments rates in the dairy sector. Analyzing the development of investments by dairy farms will give insights in the relation between the abolishment of milk quota and the uptake of new technologies. The level of labor intensity on dairy farms is a reverse variable. When the labor intensity decreases, this will mean an increasing intensity of technology. The annual work unit (AWU) represents the national average annual working time of adult full-time farm workers employed throughout a calendar year. The data sets of CBS Statline and Wageningen Economic Research are representative for the average gross investments for dairy farms in the Netherlands, the workforce on dairy farms in the Netherlands and the average Dutch dairy cows per AWU.

4.2 Case selection

The type of research that will be used is a quantitative single case study. Instead of measuring few variables for many cases, this research will be focused on observations related to a single case. Thereby, there is not only focus on one independent variable and one dependent variable, but focus on more dependent variables. According to Siggelkow, an advantage of single case studies is the possibility to describe a phenomenon in detail (2007). It creates high-quality theory, because of testing theory and probably produce extra and 'better' theory. The abolishment of the milk quota is decided by the European Commission and therefore, more European countries has

to deal with this policy change. Nevertheless, this research is focusing on only one country, The Netherlands. In the Netherlands, the dairy sector is the second most important economic sector (ZuivelNL, 2015). Policy changes in the Dutch agricultural sector might have economic consequences on large, national scale. Therefore, it is interesting to zoom in on the economic effects related to the abolishment of milk quota in the Netherlands. There is abundant room for further progress in determining the economic effects of the abolishment of the milk quota in 2015. For example, by including or comparing other European or non-European countries. The single-case study design is based on theory-testing to examine whether the effects are realized according to the hypothesized causal mechanism. How are the variables connected? More outcomes and probably alternative predictions and mechanisms, related to the single case, will be part of this research. The research method is based on segmented trend analyses.

As mentioned before, this milk quota is part of more general set of policies. The European Commission has abolished the milk quota for all European countries (European Commission, 2017). Therefore, the population exist of all the European countries who had to deal with that abolishment's in 2015. The result of this case, the abolished milk quota in the Netherlands, has the goal of learning something about the broader population. After the United States, the Netherlands has been the largest agricultural exporter in the world (CBS, 2016). This makes these case outcomes relevant for the agricultural sector and especially the European Union.

4.3 Method of data collection

The data is collected on country level between the years 1950 and 2018. The data is based on yearly and monthly measurement moments. This is slightly different for each variable. The collection of data consists of secondary data. An overview of the variables, operationalization and data collection is provided in table 1.

Table 1: Summary dependent variables

Dependent variables	Operationalization	Source
Structural change in the agriculture	Number of firms. Yearly data on agricultural farms from 1950 till 2017, number of farms with cows in the Netherlands.	CBS Statline, 2018-a
	Number of cows. Yearly data on the total amount of milk and calf cows from 1980 till 2017 in the Netherlands	CBS Statline, 2009. CBS Statline, 2018-b
	Size of farms. Yearly data on 2014, 2015, 2016. Development of amount of large dairy farms vs. small dairy farms.	CBS Statline, 2018-c
Welfare of producers	Producers price of milk. Monthly data on the price of the product milk with 3.7% fat.	Wageningen University & Research, 2018-a
	The total amount of milk production. Monthly data on amounts of milk supply and dairy production by dairies.	CBS Statline-d
	Dairy sector turnover. Quarterly data on revenues of farmers, according to the Agricultural Census, in the agricultural sector. From 1st quarter 2014 till 3rd quarter 2017. These are agricultural companies with an economic size of at least 3000 euros' standard revenues.	CBS Statline, 2017
Welfare of consumers	Consumer Price Index (CPI) of milk. Monthly data on fresh semi-skimmed and skimmed milk.	CBS Statline, 2018-e
	CPI of all spending categories *(control variable).*	CBS Statline, 2018-e
Trade	Monthly data on the Dutch input value of dairy products and eggs. Data on the Dutch output value of dairy products and eggs. Data on the Dutch trade balance of dairy products and eggs.	CBS Statline, 2018-f

The uptake of new technologies	Development of workforce. Yearly data on the total number of workers in agriculture who regularly work.	CBS Statline, 2018-g
	Yearly data on the Dutch number of dairy cows per AWU. Annual work unit (AWU) represent the national average annual working time of adult full-time farm workers employed throughout a calendar year. From 2003 till 2017.	Wageningen University & Research, 2018-b
	Average gross investments for dairy farms. Yearly data from 2001 till 2016.	Wageningen University & Research, 2018-c

4.4 Method of analysis

The first part of the research will consist of descriptive statistics. This provides insight into the dataset. Among other things, attention will be paid to the average, the highest and the lowest scores of the variables.

The second part of research will consist of analyzing the different dependent variables separately from each other. A time series analysis is performed. The variables are observed over a number of consecutive time units. When the same phenomenon is observed several times in time, there is a time series analysis (Eisinga & Lammers, 2006: 319). The purpose of this time series analysis is to describe the behavior of a changing phenomenon. For example, the price of milk, on the basis of a series of figures over time. The method of analysis that will be used is segmented trend analyses. This method will make it possible to interpreted trends before and after the point of interest, the abolishment of milk quota April 2015. The effects of a change in policy will become clear. The relationships and interactions between variables before and after the abolishment of the milk quota will be the main focus of analyses.

The first part of the segmented trend analyses will be a scatterplot. The second part will be a regression analysis with two different time periods (T1 + T2). The first period, T1, consists of the years before the abolishment of the milk quota. The second period, T2, consists of the years after the abolishment of the milk quota. This period contains the monthly data from 2015 and beyond.

The main weakness with this research method is the problem of the 'recent' case study. The milk quota abolishment took place in April 2015. This is only three years ago. Therefore, it is necessary to use monthly or quarterly data. This is possible most of the variables, but a problem when analyzing 'structural change in the agriculture' and 'uptake of new technologies'. The small number of measurements might give statistical problems. Notwithstanding the relatively limited data, analyzing the yearly data and comparing findings could give some valuable insights.

It is possible that depended variables are connected by causal mechanism. This research will test for correlations and reverse causality between those variables by the use of Pearson' s correlation coefficient. Thereby, it is important to realize that the abolishment of the milk quota probably interacts with effects of other policy tools in the agricultural sector. For example, the introduction of the phosphate rights in Dutch dairy farming.

5
Results and analyses

The results of the data have been analyzed in two different ways. In the first section of chapter 6, some descriptive statistics are presented and discussed to show what the dataset looks like. This provides insights into the data sets that has been used for this research. In the second part of this chapter, the different dependent variables will be observed separately from each other. To test whether the hypotheses hold, segmented trend analysis are used to test the hypotheses. Based on the different segmented trend analysis, the hypotheses are accepted or rejected and conclusions are drawn.

The statistics are conducted with a 95% confidence interval for the coefficients (p-value <0.05) in order to estimate whether an independent variable holds significant effects. For all regressions, the coefficient, p-value and R-squared are interpreted. The coefficient indicates the correlation between two variables, the p-value the statistical significance level and the R-squared the percentage of variance explained by the statistical analysis.

5.1 Descriptive statistics

Descriptive statistics quantitatively summarize characteristics of variables and analyses these statistics. Information about the variables is valuable in analyzing whether a relation exist. Table 2 presents the summary statistics and demonstrates the features of the different variables.

Table 2 shows an overview of the variables and their main characteristics. The average represents the average over the time period of the measurements. This time period is different for the different variables. Besides this, the number of measurement moments - observations - differs for the variables. This difference is not only based on the number of observations, but also on differences in monthly data, quarterly data and yearly data. These descriptive statistics are pure facts, but do not sufficient indicate the development of the variables over time. Section two of this chapter will elaborates on the outcomes by using segmented trend analyses.

Table 2. Descriptive statistics

Variable	Mean	St. dev.	Min	Max	Observations
Number of cows	1771704,68	350688,74	1413166	2549031	38
Number of firms	98,76	64,011	26	217	66
Dairy production	951146,86	104650,50	775809	1263110	276
Price of milk	30,78	4,67	19,45	44,85	277
Revenues of farmers	1419,40	196,66	1147	1822	15
CPI milk, skimmed milk	82,55	17,40	58,98	123,36	270
CPI all spending categories	86,87	10,48	68,03	103,42	270
Export SITC	481255,48	130212,13	293019	823911	264
Import SITC	236305,50	50896,97	151256	399780	264
Trade balance SITC	244949,98	244949,98	109656	399780	264
Average gross investments	83693,75	23507,572	53000	128300	16
Workforce dairy farms	219615	31968,69	170413	280584	18

Number of cows = absolute value of number of cows in the Netherlands.
Number of firms = absolute value of number of cows in the Netherlands.
*Dairy production = *1000 kg*
Price of milk = euro/100kg
*Revenues of farmers = *million euros*
CPI = index, 2005 is 100
Average gross investments = average gross investments of (single) dairy farms, all amounts are a mix of inclusive and excluding VAT.
Workforce = worked regularly, total amount in the Netherlands.

5.2 Structural change in the agriculture

By the abolition of the EU quota system, the industry structure would probably be influenced. Bailey (2004) argues that structural changes in the EU have been slow down under the quota system compared to what would have been the case in a free market situation (OECD, 2006). Therefore, there might be a positive relation between the abolishment of milk quota and the structural change in the agriculture. The effects of the abolishment of milk quota on structural changes in agriculture are displayed in the following figures and table. As mentioned before, the effects on structural changes are displayed by focusing on number of cows, number of dairy farms and size of dairy farms. The hypothesis that is being tested is: the abolishment of milk quota

creates a shift from areas with relative high production costs to more efficient producing areas (H1).

Number of cows

Van Berkum and Helming showed in their research that milk quota abolition might be beneficial for larger farms. The abolition makes it possible for farms to expand and to introduce structural changes (2006). According to Groeneveld et all., the abolition will lead to a shift towards larger and more intensive farms in the Netherlands (2016). Their research showed by the abolishment of the milk quota some farms types keep the number of cows and the number of hectares on the farm constant. An increase in production is not possible, because of the costs that are associated with the extending of production. On the other hand, most farms will extent the number of cows and grow, because of the abolishment of the milk quota (Groeneveld et all., 2016).

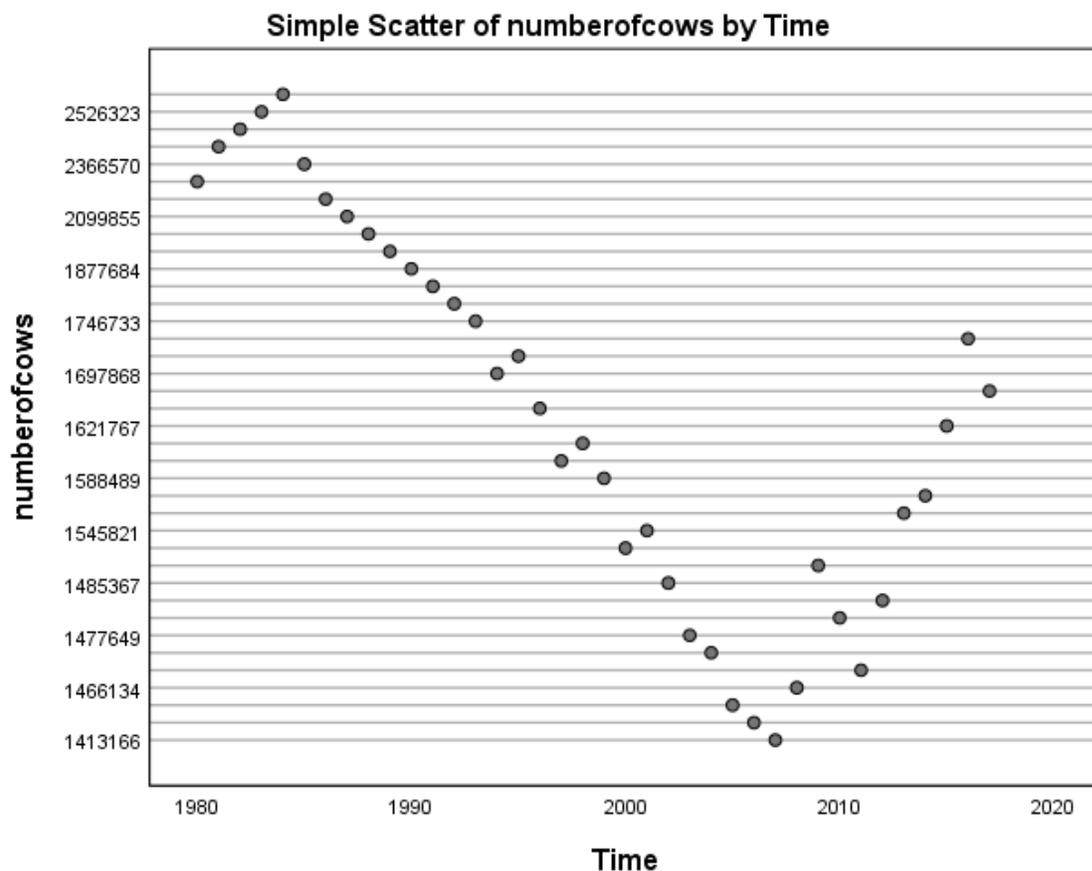Figure 6. Simple scatter of number of cows by time.

Figure 6 shows a trend break of the number of cows in the years 1984 and 2007. After 2007, a positive development of the number of cows is visible. Because there is no trend break visible between time period one before 2015 and time period two after 2015, a segmented trend analysis is not valuable. Based on this figure, we can not conclude that there is the abolishment of the milk quota system has influenced the number of cows in the time period before the abolishment and the time period afther the abolishment. This result does not relate directly to the size of farms. To analyse the size of farms, a comparison between the postive development of the number of cows in the Netherlands with the development of the number of farms in the Netherlands is needed.

What stands out in figure 6 is the trend break of the number of cows in 1984. The European Commission introduced the milk quota system in March 1984. Compared to the expectations of the abolition of the quota in 2015, the introduction of the milk quota in 1984 shows an inverse effect. After the introduction, the number of cows has decreased considerably. This result might indicate a correlation between the milk quota and the number of cows in the Netherlands. The more suprising result is the trendbreak after 2007. A possible explanation for this might be that the CAP have announced the abolishment of milk quota in 2008. As mentioned in chapter two, the CAP introduced a system with an increasing size of the production quota in the upcoming 5 years, to prevent the agricultural sector for shock effects (European Commission, 2017). Farmers could have responded to this. Besides this explanation, it does not seem like there has been any policy change in agriculture in 2007 or 2008. Futher research might figure out if there has anything relevant happened in 2007.

Number of farms
As mentioned before, their might be a shift from areas with relative high production costs to more efficient producing areas (LEI, 2016). Compared to small farms, larger and more intensive farms will survive.

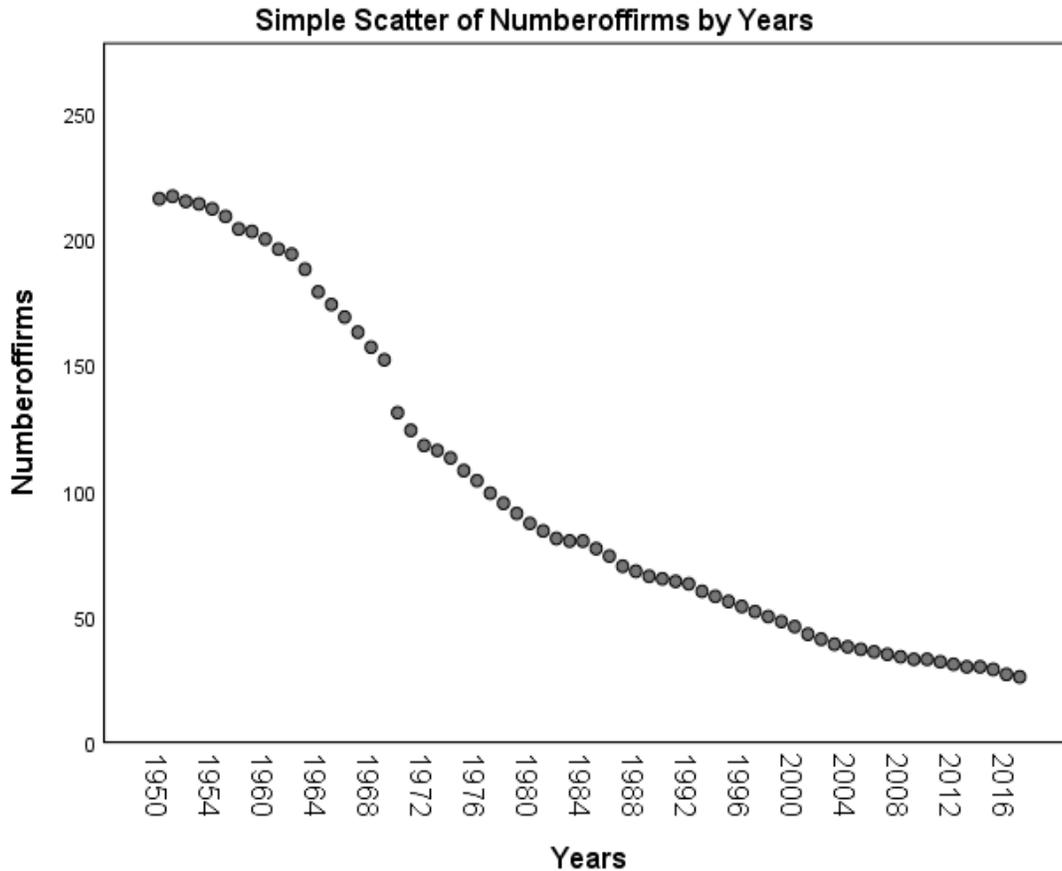Figure 7. Simple Scatter of number of firms by time

Figure 7 indicates a negative development of the number of firms in the Netherlands. Interestingly, this figure shows a general trend of a decreasing number of firms. Comparison of the findings with the positive development of cows in the Netherlands since 2007, there might a shift from small farms to relative larger farms during entire period after 2007. As mentioned before, the abolishment of the milk quota probably makes it possible for farms to expand and to introduce (structural) changes. In contrast to earlier findings, these results provide no insights into a trend break because of the abolishment of milk quota in 2015.

Size of farms

Both tables are based on dairy farms in the Netherlands.

Table 3. Standard yield category vs. number of farms

	2011	2012	2013	2014	2015	2016	2017
Standard yield	number	number	number	number	number	number	number
Total	17235	16900	17000	16810	16700	16505	16330
3 000 till 25 000 euro	100	95	155	155	140	50	90
25 000 till 100 000 euro	1190	1115	740	690	630	395	485
100 000 till 250 000 euro	8225	7805	5280	5045	4740	3225	3285
250 000 till 500 000 euro	6750	6795	8595	8575	8565	8345	8250
500 000 till 1 000 000 euro	905	1010	2060	2145	2375	3930	3695
1 000 000 till 1 500 000 euro	50	60	135	160	195	455	430
1 500 000 till 3 000 000 euro	15	15	35	35	50	95	95
Upward of 3 000 000 euro	0	0	0	0	5	10	10

Source: CBS, 2018-c

Table 4. Standard yield category vs. economic size

	2011	2012	2013	2014	2015	2016	2017
Standard yield	Euro*	Euro*	Euro*	Euro*	Euro*	Euro*	Euro*
Total	4503979	4550163	5598071	5650687	5833151	6998376	6794169
3 000 till 25 000 euro	1374	1262	2169	2173	1936	732	1431
25 000 till 100 000 euro	85992	81336	51382	48736	44772	28088	33092
100 000 till 250 000 euro	1513077	1444779	997125	956599	898507	613298	622813
250 000 till 500 000 euro	2249246	2280138	3003632	3008820	3024697	3048004	3010525
500 000 till 1 000 000 euro	568555	636793	1311192	1372505	1522829	2554595	2407654
1 000 000 till 1 500 000 euro	56651	71629	159848	188970	226935	536089	506261
1 500 000 till 3 000 000 euro	25384	30086	64513	69209	99673	178331	179545
Upward of 3 000 000 euro	3700	4139	8210	3676	13801	39239	32848

*Source: CBS, 2018-c, *1000 euro*

Table 3 shows, as showed before in figure 7, a decline of the number of farms in the entire period. Top of table 3 shows a decline of farmers with a standard yield of 3000 till 25000 euros and 25000 till 100000 euros. On the other hand, the number of farms with a standard yield of 100000 and more increased in the recent years. Especially the number of farms with the highest standard yields, the bottom of the table, increased. Table 4 shows for the most part an increasing total of the economic size of farms in the Netherlands. This result in combination with the results of a

declining number of farms in this period, indicates a shift towards larger and more intensive farms in the Netherlands.

According to Groeneveld et all. the abolition creates a shift towards larger and more intensive farms in the Netherlands (2016). The number of farms and the economic size of farms with the highest standard yields increased explosive in the years 2015 and 2016. The economic size decreased in 2017. This might indicate a shift towards larger and more intensive farms in the Netherlands because of the abolishment of milk quota. However, this is just a little indication. The study should be repeated using more or monthly data. Hypotheses 1 cannot be accepted.

5.3 Welfare of producers

Literature on producers' surplus has showed a negative effect of the abolishment of the milk quota on producer surplus. As previously showed, the abolishment of the milk production quota will shift back the supply curve of milk back to the original position (OECD, 2006). The producers price of milk will be lower and the total quantity of milk higher. Overall, the economic and welfare effects of producers are compared with the free market situation. The effects of the abolishment of milk quota on welfare of producers are displayed in the following figures and tables. As mentioned before, the effects on producers' welfare are displayed by focusing on the total amount of milk production, price of milk and revenues of dairy farmers.

The total amount of milk production

The abolishment of the dairy quotas will create the possibility for EU farmers to expand production. To test the second hypothesis, a segmented trend analysis of the total production of milk in the Netherlands is used.

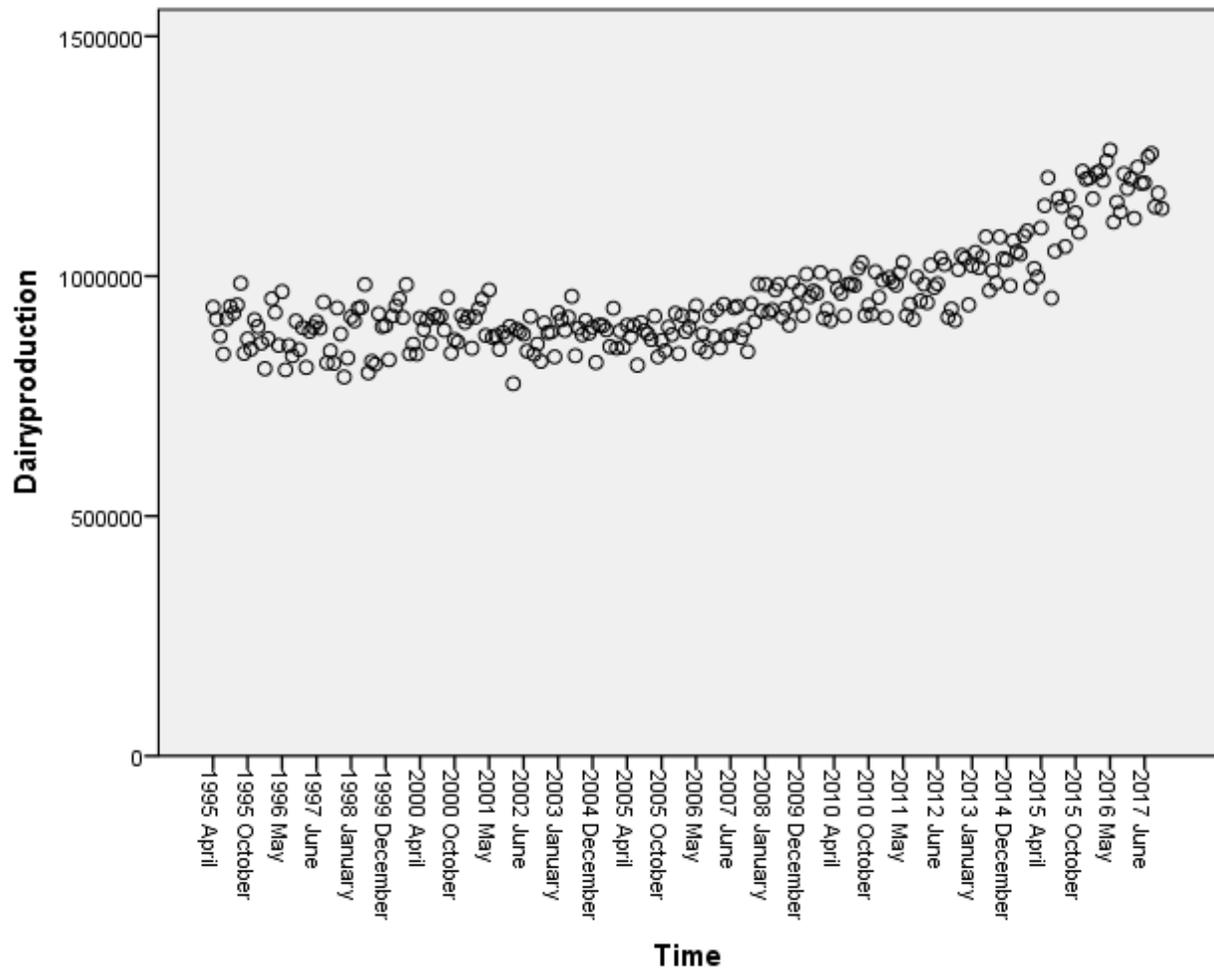Figure 8. Simple scatter of dairy production by time

Figure 8 shows an increasing line of the total amount of dairy production in the Netherlands. It seems like this effect intensifies in the months after April 2015. To zoom in on this trend break, a segmented trend analysis is used.

Table 5. Time vs. dairy production

	Dairy production
	Coeff.
T1	711,870***
	(48,46)
T2	7809,887***
	(576,93)

Notes. N=276. Time period 1 covers January 1995 till April 2015. Time period 2 cover April 2015 till June 2017. Asterisks denote: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Adjusted R2=0,724.

Table 5 shows a different relationship between the two time variables. When running the analysis, the results for T1 and T2 are statistical significant. The positive sign of time variable one, T1, indicates a positive development of the total amount of dairy production. In the period after the abolishment of milk quota, T2, there is also a positive correlation coefficient visible. In the period after the abolishment, T2, the relationship changed towards a higher correlation. Based on this table, we can conclude the abolishment of the milk quota system has influenced the total amount of dairy production. This observation supports hypothesis 2: the abolishment of milk quota positively affects the total quantity of milk production in the Netherlands. Note that the R-squared is high with .0724. This means that 72,4 per cent of the variance is explained by these statistical analyses.

Milk prices

One of the reasons for the introduction of the milk quota was to stabilize milk prices and agricultural income of milk producers. The abolishment of the milk quota will have effect on the welfare of producers, milk prices become probably unstable. The income of milk producers might be effected. To test the third hypothesis, a segmented trend analysis of the milk prices in the Netherlands is used.

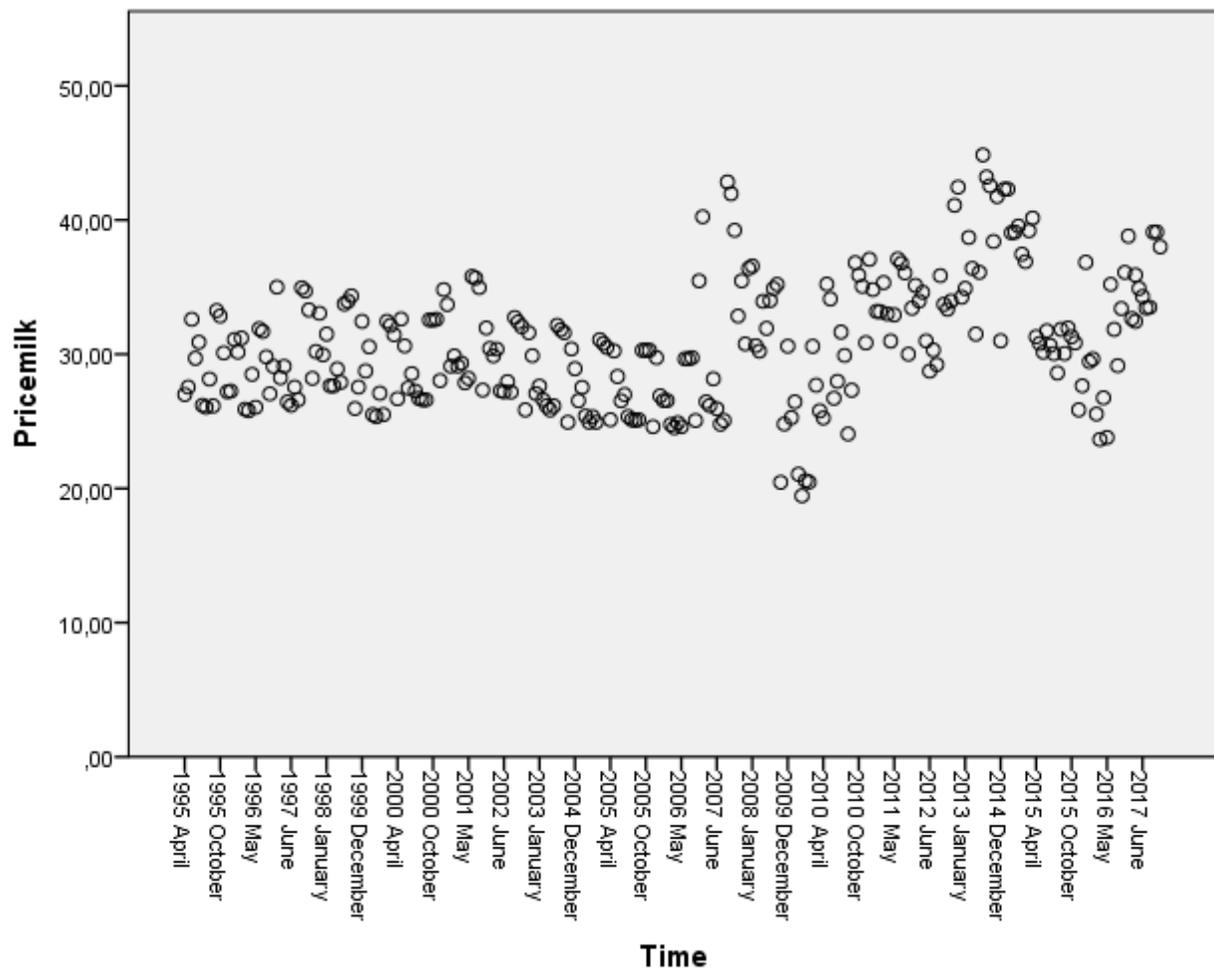Figure 9. Simple scatter of milk price by time

Figure 9 shows that it has been unable to demonstrate the abolishment negatively affects the milk prices. This finding is contraty to the expectations mentioned in the theoretical framework. Nevertheless, figure 9 shows unstable milk prices. Directly after the abolishment of the quota in 2015, the milk prices went down for a short period.

Interestingly, figure 9 indicates 2007 also as important year of change. The beginning of unstable milk prices started after 2007. As mentioned before, a possible explanation for this might be that the CAP have announced the abolishment of milk quota in 2008. The CAP introduced a system with an increasing size of the production quota in the upcoming 5 years, to prevent the

agricultural sector for shock effects (European Commission, 2017). This could result in unstable prices because of the increasing size of the production quota. An alternative explanation might be the development of the world market. The worldwide trend market liberalization might have influenced the milk prices. This study should be repeated using control variables. Future research about this trend break would be relevant.

To zoom in on the relation between the abolishment of milk quota and milk prices, a segmented trend analysis is used.

Table 6. Time vs. milk price (3,7% fat)

	Milk price (3,7% fat)
	Coeff.
T1	0,023***
	(0,004)
T2	0,010
	(0,044)

Notes. N=277. Time period 1 covers January 1995 till April 2015. Time period 2 cover April 2015 till January 2018. Asterisks denote: ***p < 0.01, **p < 0.05, *p < 0.1. Adjusted R2=0,141.

Table 6 shows a statistical significant coefficient for time period one. What stands out in the table is a non significant result for time periode two. No significant results are found in the development of milk prices in the period before the abolishment of the milk quota and after the abolishment of the milk quota. The positive share of T1 indicates a small positive development of the milk price in the first-time period. In the period after the abolishment, T2, the relationship changed towards a smaller effect. Hypothesis 2 is rejected, but the coefficients are not significant. Note that in the R-squared is low with .141. This means that only 14,1 per cent of the variance is explained by these statistical analyses.

To creates more insights into the relationship between the abolishment of milk quota and the welfare of producers, the revenues of farmers in the agricultural sector are analysed.

Table 7. Revenues of farmers in the agricultural sector

Period	Turn over
	mln euros
2014 1e quarter	1.525
2014 2e quarter	1.729
2014 3e quarter	1.401
2014 4e quarter	1.357
2015 1e quarter	1.172
2015 2e quarter	1.476
2015 3e quarter	1.268
2015 4e quarter	1.258
2016 1e quarter	1.259
2016 2e quarter	1.418
2016 3e quarter	1.147
2016 4e quarter	1.325
2017 1e quarter	1.533
2017 2e quarter	1.822
2017 3e quarter	1.601

Source: CBS

The increasing milk supply can be trace back to the abolition of the milk quota system. It depends on the increasing demand for milk products, to what extend the producer benefits. Table 7 shows an instable trend on revenues of farmers. This finding is in line with the unstable milk prices as showed in figure 9. Based on this findings hypothesis 3 is not accepted. The producers' surplus is determined by the supply curve of milk and the consumers' price of milk. Results indicates an increasing level of milk production after the abolishment of milk quota. At the same time, the milk prices became more unstable. This makes it not possible to indicates how the abolishment affected the producer's welfare surplus. Nevertheless, the income of farmers might be effected.

5.4 Welfare of consumers

The welfare of consumer refers to the consumer surplus that exist of demand curves of milk and the consumers price of milk. According to previous research, consumers are not directly affected by the abolition of the milk quota system. On the other hand, the milk quota system facilitates

high price support (OECD, 2006). The abolishment of the milk quota might influence the consumers price of milk. When the total amount of milk production increases, the consumers price of milk might decrease, as showed by figure 2. The consumer surplus might increase. As discussed before, the prices of dairy products are expected to decline less than the prices of raw milk. The input costs for, for example, manufactures decline more than prices of dairy products. This will rise the revenues of manufactures.

Figure 10. Simple Scatter of CPI skimmed milk
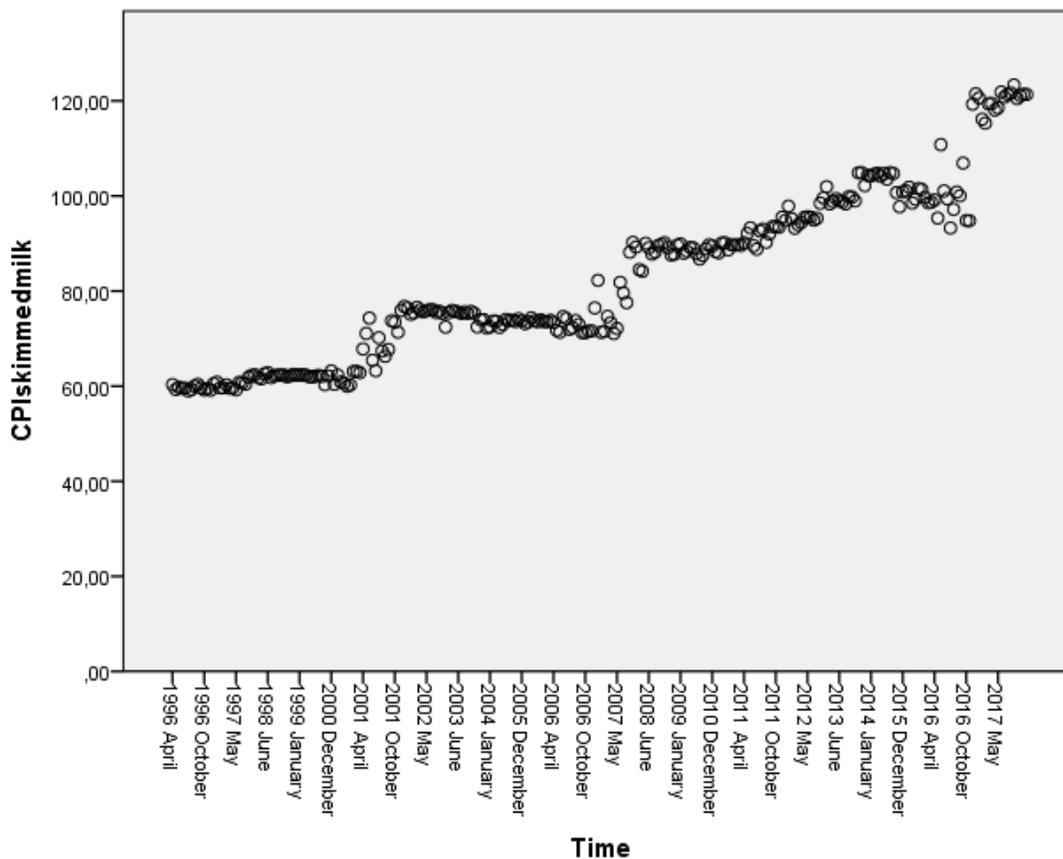
Figure 10 shows an overall positive development of the CPI semi-skimmed and skimmed milk. It seems like there has been a small trend break in the months around April 2015. After 2015, the table shows a short period of months with a declining CPI. On the other hand, there are more points of change visible over the years. For example, after 2001 and after 2007. To find out if there is any effect of the abolishment of milk quota and the consumers price of milk, a segmented trend analysis is used.

Table 8. Time vs. CPI skimmed milk

	CPI skimmed milk
	Coeff.
T1	0,194***
	(0,004)
T2	0,533***
	(0,037)

Notes. N=270. Time period 1 covers January 1996 till April 2015. Time period 2 cover April 2015 till June 2018. Asterisks denote: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Adjusted R2=0,937

Table 8 shows a small difference between the two time variables. When running the analysis, the results for T1, before 2015, and T2, after 2015, are statistical significant. The positive share of T1 indicates a positive development of the CPI of skimmed milk by time. T2 shows also a positive share. The strength of the positive development has increased. This finding is in line with the results of figure 10. The consumer price has not fallen down since the abolition of the milk quota system. Based on those finding, it does not seems like the abolishment of milk quota does directly positively affect consumers' welfare. Hypothesis 4 is rejected.

Note that in the R-squared is high with .937. This means that 93,7 per cent of the variance is explained by these statistical analyses.

General trends as economic situation and globalization might have affected the results of relation between the abolishment of the EU milk quota system and the CPI of skimmed milk. A way to improve this research is to control for those variables. The consumer price index (CPI) for all spending categories is used as control variable. This because the national development of the CPI might be correlated with the CPI for skimmed milk. If they are moderately of more correlated, interpreting the results might give difficulties.

Table 9.

	CPI skimmed milk	CPI all spending categories
	Pearsons Correlation	*Pearsons Correlation*
CPI skimmed milk	1	0,951***
CPI all spending categories	0,951***	1

Notes. N=270. Time period 1 covers January 1996 till April 2015. Time period 2 cover April 2015 till June 2018. Asterisks denote:
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Adjusted R2=0,937

What stands out in table 9, is the high correlation between the variables 'CPI skimmed milk' and 'CPI all spending categories'. Pearson Correlation is 0,951. This is a strong correlation. The results of figure 10 and table 8 do not explain the occurrence of these adverse events. Based on this result, there is no valid result that indicates the relation between the abolishment of the milk quota system and the development of the CPI of semi-skimmed and skimmed milk.

5.5 Trade

The most competitive countries will start to increase their production as compared to the non-competitive countries. According to the Milk Market Observatory of the European Commission, the Netherlands is one of the biggest export countries in the agricultural sector (Milk market observatory of the European Commission, 2018). Overall, the abolition of the milk quota stimulates the EU's export. The effects of the abolishment of milk quota on trade are displayed in the following tables and figures.

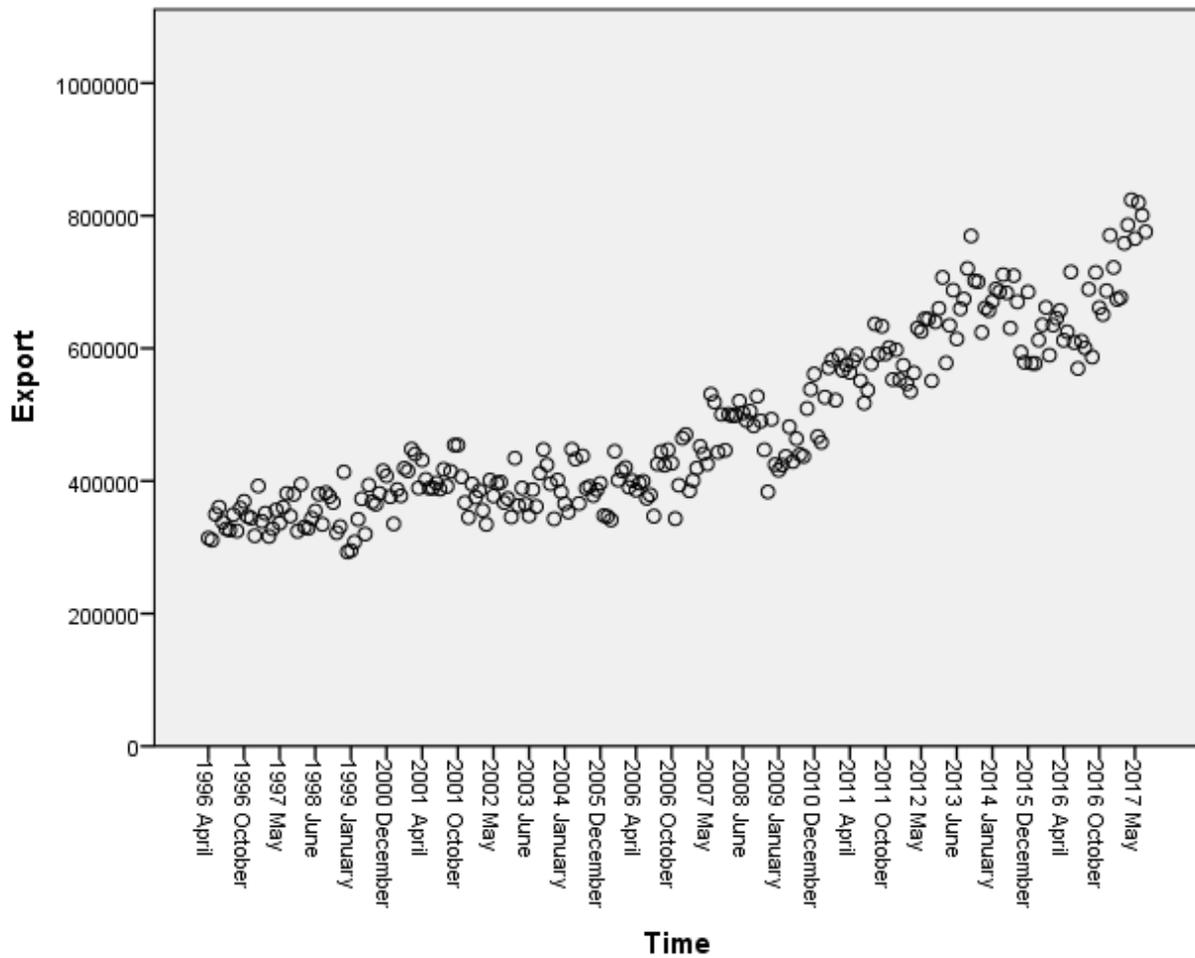Figure 11. Simple scatter of export by time

Figure 11 shows an increasing line of the total amount of milk export in the Netherlands. It seems like this effect slowed down in the period before the abolishment in 2015. After the abolishment in 2015, the export level of milk in the Netherlands increased.

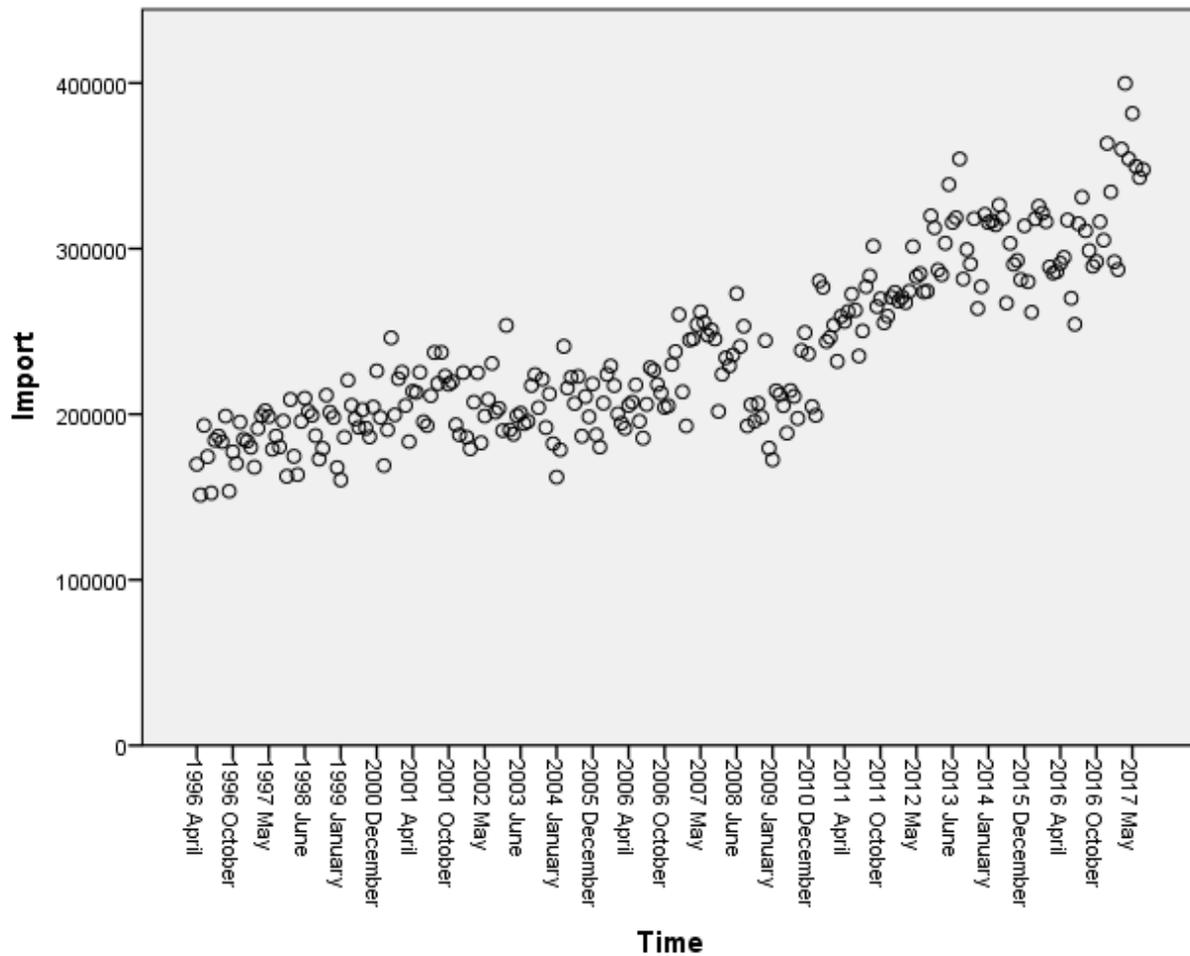Figure 12. Simple scatter of import by time

Figure 12 shows an increasing line of the total amount of milk import in the Netherlands. What is interesting about those figures is that both, export and import, show an increasing line. Closer inspection of those numbers is needed to determine the effect of the abolition of the EU quota system has positively stimulated trade in the Netherlands.

Figure 13. Simple scatter of trade balance
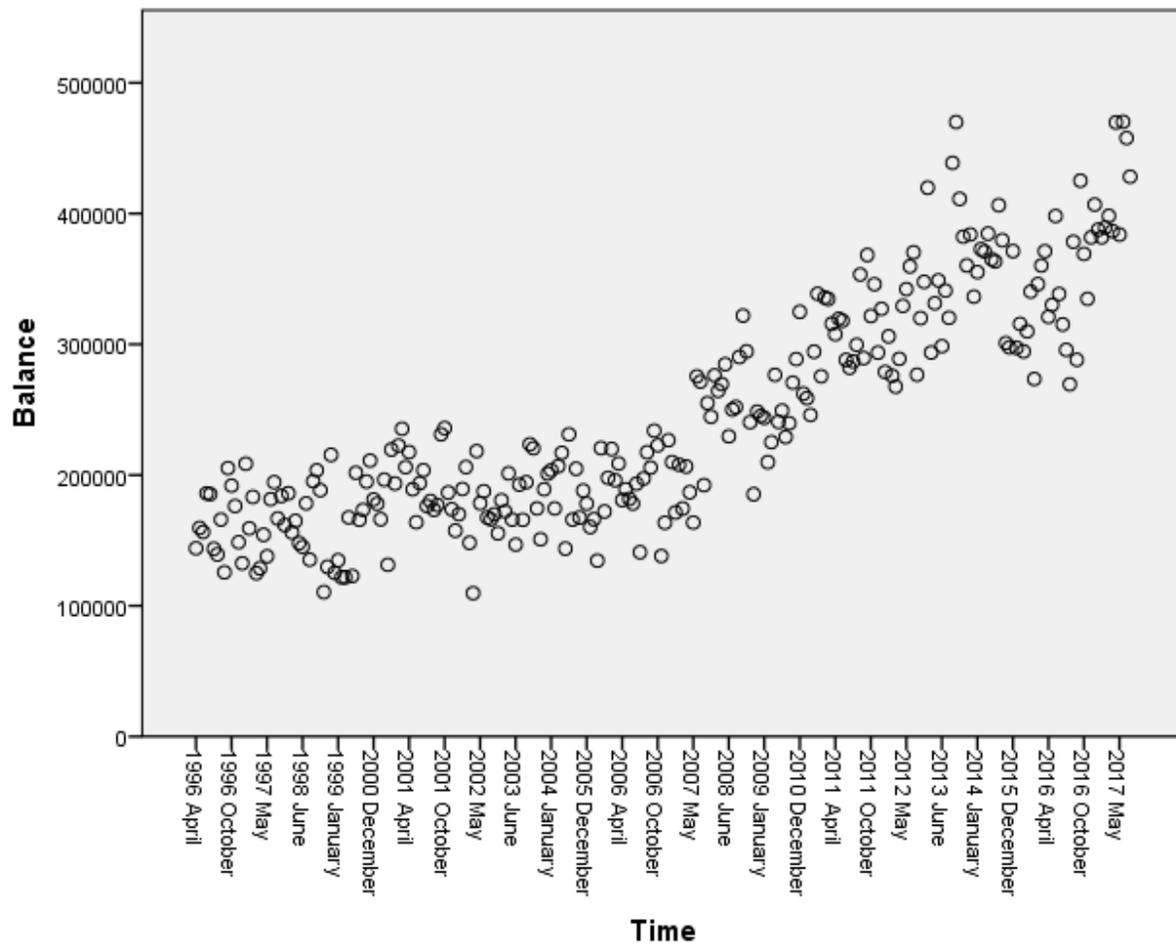
The trade balance consists of the balance of the export value of dairy products and eggs minus the import value of dairy products and eggs. Figure 13 shows an increasing positive trade balance over the years. It seems like this effect slowed down in the period before the abolishment in 2015. After the abolishment in 2015, the export level of milk in the Netherlands increased. To find out if there is any difference between the two periods, a segmented trend analysis is used.

Table 10. Time vs. trade balance

	Trade balance SITC
	Coeff.
T1	909,171***
	(39,072)
T2	2354,493***
	(434,299)

Notes. N=264. Time period 1 covers January 1996 till April 2015. Time period 2 cover April 2015 till December 2017. Asterisks denote: ***p < 0.01, **p < 0.05, *p < 0.1. Adjusted R2=0,767.

Table 10 shows a different relationship between the two time variables and the development of trade balance. The analyse shows statistical significant coefficients. The positive sign of time variable one, T1, indicates a positive development of the trada balance in the Netherlands. The coefficient of time periode two indicates also a positive share. The strength of the positive development of the trade balance in the Netherlands has increased. The total export of milk and eggs in the Netherlands increased more compared to the total import of milk and eggs in the Netherlands. Based on this table, we can conclude the abolishment of the milk quota system has positively influenced trade balance of the Netherlands. This observation supports hypothesis 5: abolishment of milk quota will stimulate the milk export in the Netherlands. This table contains data on the Dutch import/export value and trade balance of dairy products and eggs. The segmented trend analysis does not account for the specific effects of eggs on the Dutch import and export value. Therefore, the results might be over-ambitious in its claims. Note that in the R-squared is high with .767. This means that 76,7 per cent of the variance is explained by these statistical analyses.

5.6 The uptake of new technologies

Based on the theoretical framework, there might be a positive relationship between the abolishment of the milk quota and the investment effect. Referring towards economic effects, the investment effect plays an important role in this field. There is a relation between quota systems and their impact on structural change or new technologies (Oskam and Speijers;

Hennessy, 1995). Early examples of research into the investment effect of quota systems show that structural changes in the EU have been slow down (Bailey, 2004). On the other hand, restructuring of the dairy sector has continues all the same (OECD, 2006). The effects of the abolishment of milk quota on the uptake of new technologies are displayed in the following tables and figures. As mentioned before, the effects on the uptake of new technologies are displayed by focusing on the average gross investments by dairy farms and the level of labor intensity on dairy farms.

Average gross investments

Figure 16. Average gross investments for dairy farms
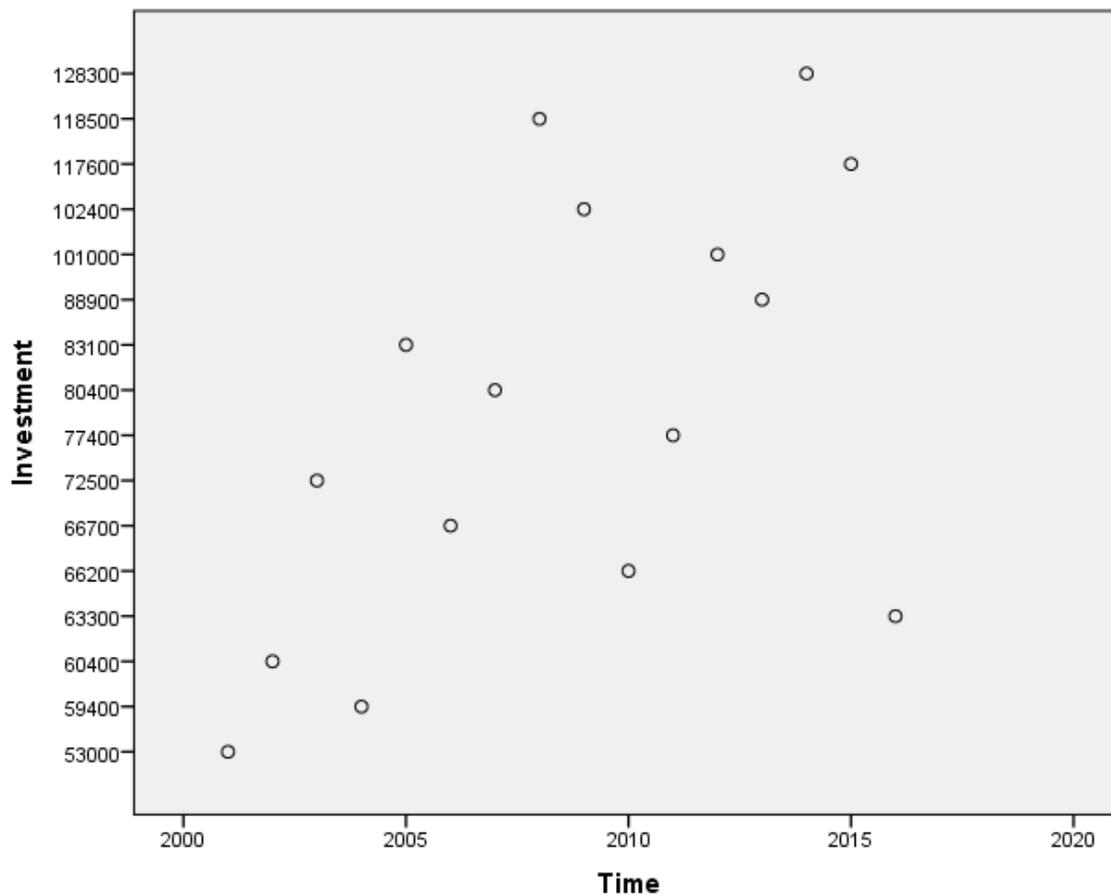
Figure 16 does not give striking insights in the development of average gross investments for dairy farms. In contrast to previous research, this study has been unable to demonstrate the abolishment of milk quota system will stimulate investments in product innovations.

Workforce

Figure 14. Simple scatter of workforce by time
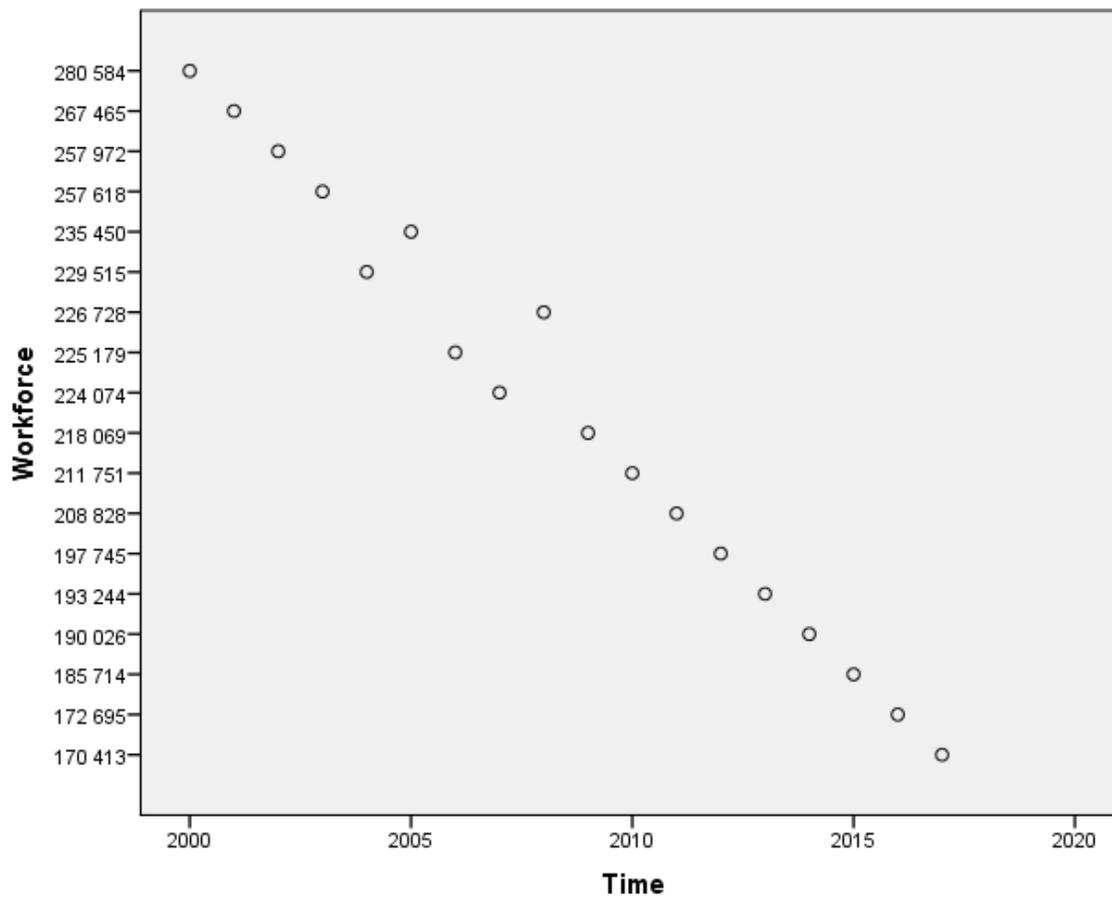
The level of labor intensity on dairy farms is a reverse variable. When the labor intensity decreases, this may indicate an increasing intensity of technology. Figure 14 shows a negative development of the size of workforce on dairy farms. This might indicate an increasing intensity of technology on dairy farms. To zoom in on this effect, the relation between the number of dairy cows versus annual work units is analyzed.

Number of dairy cows vs. annual work unit

Figure 14. Simple Scatter of dairy cows per AWU by time
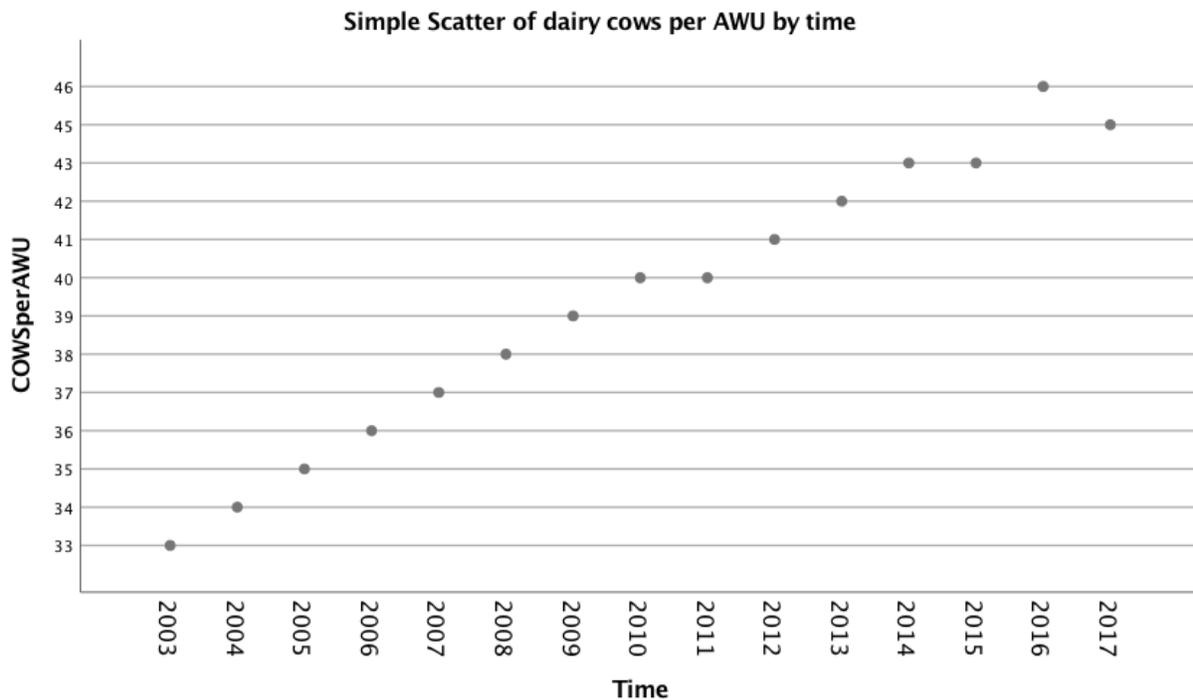
The annual work unit (AWU) represent the national average annual working time of adult full-time farm workers employed throughout a calendar year. The number of dairy cows per AWU has increased over the presented years. This result indicates intensification of technology on farms.

Comparing those result, hypothesis 6 cannot be accepted. This study has been unable to demonstrate that the abolishment of milk quota will stimulate investments in product innovations. However, the results may indicate a positive effect of the abolition of the EU quota system on investments in product innovations. One interesting finding is the increasing number of dairy cows per AWU after 2015. Several questions remain unanswered at present. Further research should be undertaken to investigate the relation between the abolition and the uptake of new technologies.

5.7 Summary

The analysis on the relation between the abolition of the EU quota system and different dependent variables shows some remarkable results. Only some results were in line with the expectation from the theory and the hypotheses. This method of analysis has a number of limitations. An important limitation is that there is a source of uncertainty in the method used. The small number of measurements might give statistical problems, especially for the variables 'structural changes in agriculture' and 'uptake of new technologies'. Besides this, there might be some other effects that have influenced the outcome.

Contrary to previous studies, this study found no significant relation between the abolition of the milk quota system and the number of cows in the time period afther the abolishment. After the introduction the milk quota system in 1984, the number of cows has decreased considerably. Remarkably, this change is not visibly in the periode after the abolition of the EU milk quota system. Tables 3 and 4 indicate a small, but possible effect of the abolition of the quota system on the increase in intensity for the largest farm type. This result in combination with the results of a declining number of farms in this period, indicates a shift towards larger and more intensive farms in the Netherlands. However, this is just an indication. Hypotheses 1 cannot be accepted.

Significant results support hypothesis 2: the abolishment of milk quota positively affects the total quantity of milk production in the Netherlands. The enormous milk supply can be traced back to the abolition of the system. Before the introducing of the milk quota system, there was also a surplus of milk products. Besides this, the milk prices became more unstable in the recent years. This research makes it not possible to indicates how the abolishment affected the producer's welfare surplus. Hypotheses 3 cannot be accepted. Nevertheless, the income of farmers might be effected. Combining this result with the indication of a shift towards larger and more intensive farms, small dairy farms could get into financial problems and small dairy farms might disappear. Contrary to the affected producers surplus, this results shows no indication for a positive relationship between the abolition of the milk quota and consumers' welfare. Hypotheses 4 is rejected.

The total export of milk and eggs in the Netherlands increased more compared to the total import of milk and eggs in the Netherlands. Based on significant results, we can conclude the abolishment of the milk quota system has positively influenced trade balance of the Netherlands. This observation supports hypothesis 5: abolishment of milk quota will stimulate the milk export in the Netherlands. This result might indicate that the abolition of the EU milk quota system and the increasing demand for milk products, not directly results in overproduction.

In contrast to previous research, this study has been unable to demonstrate the abolishment of milk quota system will stimulate the uptake of new technologies. However, there are some indications for a positive relationship. One interesting finding is the increasing number of dairy cows per AWU after 2015. These results are likely to be related to a general trend of less workforce and larger and more intensive farms. It does not seem the abolition of the milk quota directly stimulated the investments of innovations, but the milk quota abolition might fit in this contemporary trend.

Except results about the changes between the period before the abolishment and the period afther the abolishment, some suprising result has been observed. The result concerns the trendbreak after 2007. This trendbreak is visible in the number of cows and the start of unstable producer milk prices. A possible explanation for this might be that the CAP have announced the abolishment of milk quota in 2008 and started to increase the milk quota. Futher research might figure out if there has anything relevant happened in 2007.

Conclusion

In 2015, the agricultural sector in the Netherlands had to deal with a drastic policy change: the abolition of the EU quota system. Until 2015, the European government was regulating the agricultural sector by milk quotas. The reason for the introduction of this regime in 1984 was to overcome structural surpluses in the agricultural sector. Nowadays, the European Commission argued that the abolishment of the dairy quotas will create the possibility for EU farmers to expand production and therefore meet the growing demand (European Commission, 2017). To what extend creates the abolition of the EU quota system economic effects in the Netherlands? This research aimed to find a causal relationship between the abolition of the EU quota system and economic effects. This research created insights in the structural changes and analysed the influence of this policy change in the agricultural sector. The main question of this thesis is:

To what extent does the abolishment of milk quota of 2015 explain different economic effects in the Dutch agricultural sector?

This research provided some background information about Dutch dairy sector and its history. The theoretical framework provided a summary of general government intervention, production quota and especially milk quota systems. Based upon this, different hypotheses have been formulated. The theoretical framework about economic effects has aligned the relation between the abolition of the EU milk quota system and structural change in agriculture, welfare of producers, welfare of consumers, trade and the uptake of new technologies. Segmented trend analyses are executed to test the hypotheses. The next paragraph discusses whether or not the findings were in line with the hypotheses. The last paragraph will briefly discuss policy recommendations.

6.1 Answer to research question

Based on the theory of general government intervention, production quota and milk quota systems, an answer can be formulated to the research question.

This study has indentified structural change in agriculture. Contrary to previous studies, this study found no significant relation between the abolition of the milk quota system and the number of cows in the time period affter the abolishment. After the introduction the milk quota system in 1984, the number of cows has decreased considerably. Remarkably, an inverse effect is not visibly in the periode after the abolition of the EU milk quota system. The number of farms declined, but this proces remains unchanged in the periode after 2015. There is a shift towards larger and more instive farms visible. Results might indicate this process increased in intensity after the abolition of the milk quota system. However, this is just a little indication.

Furthermore, this study showed significant findings on the impact of the abolition on welfare of producers. The enormous milk supply can be traced back to the abolition of the system of milk quotas. At the same time, the milk prices became more unstable. Based on those results, it is hard to define to what extend the producers surplus has been affected. Nevertheless, the income of farmers might be affected. Contrary to the affected producers surplus, the results shows no indication for a positive relationship between the abolition of the milk quota and consumers' welfare.

The relevance of a relation between the abolition and trade effects is supported by this research. Based on the results, the abolishment of the milk quota system has a positive correlation with trade in the Netherlands. Beside this, this study has been unable to demonstrate that the abolishment of milk quota directly affects the uptake of new technologies. However, there are some indications for a positive relationship.

The more suprising result is the trendbreak after 2007 in the number of cows and the start of unstable producer milk prices. A possible explanation for this might be that the CAP have announced the abolishment of milk quota in 2008 and started to increase the milk quota in the following years. This would be a fruitful area for further work.

Overall, those results confirmed that government intervention can have an impact on economies. As mentioned in chapter 3, reasons of government intervention in the agrarian sector are: increasing efficiency in production, protection of income and national food safety and security. It is probably too early to say something about the general impact of the abolition on efficiency in the agrarian sector. On the other hand, on farm level efficiency in production is stimulated. National food safety and security does not seem as a structural problem, because of the growing supply of milk. Nevertheless, the income of farmers is becoming more vulnerable after the abolition of the EU milk quota system and the government loses part of control in this agricultural sector.

6.2 Policy recommendations

As expected, the abolition of the milk quota of 2015 had led to an increase in the Dutch milk production. At the same time, the producer prices of milk became unstable. Therefore, the abolition of the milk quota may stimulate further structural changes in the agricultural sector.

The European Commission argued that the abolishment of the dairy quotas will create the possibility for EU farmers to expand production and therefore meet the growing demand (European Commission, 2017). This research confirms this expectation. The abolishment of the milk quota system has positively influenced trade balance of the Netherlands. In contrast to the policy goal of 1984, make an end of a structural surplus, the abolishment of milk quota is indeed linked to further enhancing of the European agriculture market orientation and market transparency. A further growing demand of EU milk production might be necessary to meet the increasing production level of milk in the Netherlands. Otherwise, the abolition of the milk quota will result in structural surpluses.

By the abolition of the EU milk quota system, the milk quota is no longer a constraint for farmers. At the same time, the uncertainty in the agricultural sector increased. Examples are the unstable prices and the increasing level of dairy products in the Netherlands. Dependency of trade takes an important position in the Dutch economy. Besides the demand is affected by the economic

situation in the world, the demand of milk is related to the demand of milk from countries inside and outside of Europe.

On a small scale, Dutch dairy farmers face a challenge. They have to revise their production strategy to optimally and sustainably produce. The abolishment of the milk quota makes it possible for farms to shift towards larger and more intensive production levels. Competition in the free market will play an important role in this.

7
Reflection

7.1 Reflection

As mentioned throughout this thesis, the methodology that is used test the expected causal relationships is not perfect. The small number of measurements might give statistical problems, especially for the variables 'structural changes in agriculture' and 'uptake of new technologies'. This study should be repeated using monthly data or at least more yearly data. A further study could assess the long-term effects of the abolition of the EU milk quota system. For example, in 20 years. Furthermore, this study was limited by the absence of control variables. More research using control variables is needed. The agricultural sector contributes to the overall performance of the Dutch economy. General trends as economic situation and globalization might have affected the results of this research. A way to improve this research is to control for those variables. Additionally, a more general way to improve this research is to use the same method with different datasets or to use other methods with the same data. The second option could produce interesting findings. Especially in the way the different concepts are operationalized. For example, by including the revenues of 'big' manufactures as FrieslandCampina.

7.2 Future research

A greater focus on the effect of the phosphate right system could produce interesting findings in relation to economic effects in the Dutch agricultural sector. This, because the Dutch phosphate right system is also based on a limited character (Helming and Peerlings, 2002). This may interact with the abolition of the EU milk quota system.

A natural progression of this work is to analyze on European level. The European Commission has abolished the milk quota system for all European countries (European Commission, 2017). After the United States, the Netherlands has been the largest agricultural exporter in the world (CBS, 2016). Results of this single study may give some indications for developments in agriculture of other European countries. It might be interesting to do the same research for a different

European country. A comparison of countries could produce interesting insights. Especially as the quota systems have been governed and implemented differently in the European member states. Those differences can affect the economy in different ways. More generally, it might be relevant to discuss economic effects for the European Union in general. The Common Agricultural Policy is the agricultural policy of the European Union.

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