A comparison of state-owned enterprises and private companies

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Abstract

Worldwide we see trends of privatization and nationalization. It is questionable which type of ownership results in better financial performance of a firm. In this study, I examine the differences in performance between state-owned enterprises and private companies in the Netherlands. Financial performance is measured using profits and volatility of profits. I use a propensity score method to match public firms with private firms, using multiple matching algorithms, and to measure the average treatment effect on the treated. The results suggest that state-owned companies do not perform worse than private companies in terms of profitability, however, state-owned companies do perform worse in terms of the volatility of profits.

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I. Introduction

After the privatization wave in the eighties, that was initiated by the poor economic performance of the public sector, governments in western countries take more and more ownership back of public services (Kishimoto, Petitjean, and Steinfort, 2017). An example is the 'deprivatization' of ProRail, a rail infrastructure company, in the Netherlands. According to the Dutch Ministry of Infrastructure, the unexpected high costs are an important reason to take back ownership of the firm. Former communist states such as Russia and China follow, compared to the western countries, an opposite trend. While in the past all firms in these countries were state-owned, nowadays most firms are in private hands. The question is which type of ownership result in the best financial performance.

In the literature, there is no consensus whether public firms perform better or worse compared to private firms. Megginson, Nash, and Randenborgh (1994) show in their study about companies of developing and western countries that firms after being privatized, are more profitable and more efficient compared to public firms. They find this improvement of performance for fully privatized as well as for partly privatized firms. This confirms the findings of Dewenter and Malatesta (2001) that state-owned enterprises are less efficient and less profitable, although they do not find that privatization itself increases profits. Other studies, on the contrary, do not find less efficient public firms compared to private firms (Caves and Christensen, 1980) or even argue that public ownership result in more efficiency (Meyer, 1975; Pescatrice and Trapani, 1980). Boardman and Vining (1989) and Shirley and Walsh (2000) give an overview of empirical results of studies that research profitability or efficiency differences between private and public firms. The overview shows that a majority of the studies, in several sectors and competitive environments, find that privately owned companies outperform state-owned enterprises.

In this thesis, I will give insight into the effect of public ownership on firm performance. In contrast to most of the aforementioned studies about this subject that studied fully public owned firms, I will compare firms where the government has a significant part of ownership in a firm compared to firms where this is not the case. The number of firms where governments only have a minority part of ownership has grown over the past decades (Forbes, 2013), which emphasize the importance of this subject. Because of the limited literature about the effect of state-ownership on the volatility of profits, this study will examine this effect. To overcome problems that are related to measuring the effect of a treatment in observational studies, I use propensity score matching (Rosenbaum and Rubin, 1983). In this method, firms will be matched using a nearest neighbor matching, radius matching , and a Kernel matching algorithm. I will examine the differences in financial performance between state-owned enterprises and privately-owned firms in the Netherlands using the following research question:

Does public ownership of a firm result in worse financial performance compared to private ownership in the Netherlands?

This thesis is organized as follows: First, I link several theories and studies to the subject. This will give insight in how public ownership differs from private ownership and how these differences are linked to my expectations about the effect of public ownership. Second, I discuss the data and which methods will be used. Third, the result section shows the effect of public ownership, compared to private ownership, on financial performance. Finally, I draw conclusions and give implications and limitations of the findings in the discussion.

II. Literature review and hypothesis development

i. Differences in profitability

Public and private enterprises differ with respect to their transferability of property rights (Alchian, 1965). Public owners are less able to sell their share of the public firm. A consequence is that the incentive of owners to monitor and prevent inefficient behavior is mitigated (Crain and Zardkoohi, 1978). The theory of property rights of the firm predicts that public ownership leads to less efficiency compared to private ownership (Caves and Christensen, 1980) and possibly to less profits. Megginson, Nash, and Randenborgh (1994) find more profits for firms after privatization and suspect that this increase can be assigned to the fact that private firms are able to internalize the benefits of performance improvements. Nonetheless, incentives of politicians to monitor the public firm may be higher when decisions related to this firm are high on the political agenda (Vickers and Yarrow, 1991). This can be the case when a firm is in public and show poor performance. However, agency problems do also exist in private firms. Managers of private firms often own only a small part of the stock, which mitigate the incentive to act in the interest of the firm (Dewenter and Malatesta, 2001).

Publicly and privately owned firms also differ in the goals they want to achieve. Private firms often aim at optimizing profits. The government may have other reasons besides maximizing profits to take control of ownership in a firm. Governments should act differently compared to private owners since they are expected to correct market failures (Thomsen and Pedersen, 2000). One argument is to take care of the supply of public and merit goods (Kowalski, Büge, Sztajerowska, and Egeland, 2013). These goods are typically not supplied at an optimal level. The government is with state-owned enterprises able to take control over the supply and to internalize externalities. Another reason for governments to take ownership control of a firm is to provide employment (World Bank, 2006). These objectives do probably not match with profit-maximizing behavior.

Meyer (1975) finds more efficient public firms compared to private firms in the electric utilities sector. He states that this possibly can be attributed to the lower cost of capital of public firms, although he is not able to empirically prove this. Governments are often able to subsidize state-owned enterprises with low cost resources, which can be an advantage public firms compared to private companies (Thomsen and Pedersen, 2000). Other studies find more evidence for differences in cost structure between public and private firms that explain efficiency differences (Pescatrice and Trapani, 1980). However, only studies that investigated the effect of ownership in non-competitive markets find better performance of public firms (Shirley and Walsh, 2000). I expect private firms to be more profitable, given the property rights theory and the majority of studies that support this expectation. Hence, the first hypothesis is:

Hypothesis 1: State-owned enterprises are less profitable than private owned companies.

ii. Differences in volatility of firm performance

I assume firms to be risk averse, which mean they prefer the expected outcome of the investment with the lowest risk. This implies that firms prefer less volatile profits over more volatile profits with equal expected values. Therefore, more volatile profits will be labelled as worse financial performance.

Besides the possible profit decreasing effects can the goals of a firm result in less volatile profits. Governments that take ownership control of a firm often aim to serve the national interest. High risk behavior could harm this interest. When the government is responsible for certain essential functions in society, this may have an effect on the attitude towards risk of the state-owned enterprises.

However, public firms that perform badly and would go bankrupt may as a private firm still survive due to financial support of the government. Governments are often relatively wealthy which gives public firms excess to more credit and liquidity (Thomsen and Pedersen, 2000). A reason for the government to provide financial support could be to achieve one of the goals previously mentioned, despite the losses of the firm. Moreover, public firms may be able to maintain a high number of employees in economic downturn, to stimulate employment, whereas private firms are forced to reduce the number of employees. Boycko, Schleifer, and Vishny (1996) argue that because state-owned enterprises are controlled by politicians that these firms possibly pursue the political goals of politicians, which for example can lead to excess employment. Dewenter and Malatesta (2001) find some evidence for this. Their results indicate that labor intensity decreases after privatization. Nevertheless, I expect that the less risky behavior of state-owned enterprises will be more important because the most important objective of a government should be to act in national public interest. Therefore, the second hypothesis is:

Hypothesis 2: State-owned enterprises have less volatile profits than privately owned companies.

III. Data and methodology

i. Sample selection

To test the hypotheses I use data from the Orbis database. Orbis provides financial data of companies worldwide. In this thesis, the state-owned enterprises are labeled as the treatment group and the private companies are labeled as the control group. The treatment group contains all firms in the Netherlands that are at least 10% owned by the Dutch government in 2016. To increase the number of observations in the treatment group, I added missing values in the data manually. The Dutch government participated in 2016 in 28 firms. 21 State-owned enterprises are at least 10% governmental owned and are presented in the sample. The control group contains all firms in the Netherlands that are not in the treatment group and have available data of all used variables in the database.

The Dutch Ministry of Finance differentiate participations in firms in state-participations and policy participations (Ministerie van Financiën, 2016). State-participations are the permanent participations of the government where we can distinguish between the role of the government as stakeholder and the role as policymaker. The Ministry of Finance considers a participation in these firms as important to serve the national interest, since they play a vital role in the economy. In case of policy participations, it is not able to differentiate between these roles. These firms have become state-owned, for example due to a financial crisis. Both types of state-owned enterprises are presented in the data. The data contains thirteen state-participations and eight policy participations (see table A1 in the appendix).

Table A1 presents the 21 state-owned enterprises that are studied and compared to private companies. The firms act in nine different sectors and the most common sector is the *Finance and Insurance* sector that contains eight firms. These firms are mostly banks, investment and development companies. The latter exist to invest in Dutch regions to stimulate business activities and employment (Ministerie van Financiën, 2016). The government also acts in other sectors to ensure the provision of essential goods and services, for example to provide gas, electricity and public transport. Most firms in the treatment group are for the majority state-owned or even entirely state-owned. Only four firms are less than 50% owned by the government. The studied state-owned enterprises had in 2016 together more than thirty billion dollars total revenue and provided employment for circa 50.000 people.

ii. Propensity score matching

The assignment of firms into the treatment group and the control group is not random so we need to control for this. Comparing the observed treatment group and the control group could be biased due to self-selection (Dehejia and Wahba, 2002). In order to compare the state-owned enterprises with the private companies and obtain an artificially created control group, a propensity score matching method will be used. Rosenbaum and Rubin (1983) state that this method can be used to reduce bias when estimating the treatment effect in observational studies. In propensity score matching will each firm in the treatment group be matched to a firm that has similar observable characteristics, except the treatment. The propensity score can be interpreted as the predicted probability that a firm is state-owned, given the pre-treatment characteristics. This propensity score will be measured with a probit model.

Firms will be matched, based on the propensity score, by the use of a matching estimator. Caliendo and Kopeinig (2008) argue in their study that choosing a matching algorithm is a trade-off between bias and variance of the estimation. At first, the state-owned enterprises and the private companies are matched using the nearest neighbor matching method. With this estimator each firm in the treatment group will be matched to a firm with the closest propensity score. A limitation of this method is that every firm is matched, even if the propensity scores of the neighbor is not relatively similair (Becker and Ichino, 2002). Therefore, also the radius matching method is used. This method is a solution to bad matches. In this method each treated firm will be matched to a firm in the control group that fall within a certain radius of the propensity score. A risk of this method is the loss of treatment observations that cannot be match within the radius, which can result in an analyzed treatment group that is not representative for the treated population. However, Caliendo and Kopeinig (2008) argue that fewer matches increase the variance of the estimation. Therefore, also a Kernel matching method will be used. In Kernel matching will the treated observations be matched to all control observations with weights that are based on the distance between the propensity scores (Becker and Ichino, 2002). This lowers variance because more observations are used (Caliendo and Kopeinig, 2008).

To make sure that a certain combination of characteristics of a state-owned enterprise in the data is presented in the data of the private companies and there is enough overlap in characteristics to find sufficient matches, the common support condition will be used (Caliendo and Kopeinig, 2008). This means that for every value of a covariate, there is a positive probability of being treated or untreated (Heckman, LaLonde, and Smith, 1999). Firms that do not fall within the common support region will not be used for the analysis. A risk of this condition is that it can result in a relatively large loss of treated observations in the analysis (Bryson, Dorsett & Purdon, 2002).

iii. The model

In order to estimate a reliable effect of public ownership on performance it is necessary to control the influence of other variables. To not violate the conditional independence assumption of the propensity score model, it is necessary to include covariates that simultaneously influence the participation decision in the treatment group and the outcome variable (Caliendo and Kopeinig, 2008). These are independent variables that have an effect on both the probability that a firm is state-owned as well as the firm performance. When a covariate only affects firm profits and not the participation decision, then this variable will not increase selection bias (Li and Zhao, 2006). When a covariate only affects participation, then this variable will not have an effect on the estimated treatment effect (Li and Zhao, 2006).

Economic shocks that only affect certain sectors, competition differences between sectors and other specific market conditions may have an impact on the firm performance. On the other hand, governments possibly only participate in firms that are presented in a particular sector that fulfills important functions in society. Therefore, an important variable to control for is the industry a company operates in. Because the aim of the matching procedure is to find firms with the same characteristics, the industry is a necessary condition before firms will be matched based on other variables. The industry of each company is specified by the NAICS 2017 code with 2 digits. In order to perform the matching method, it is necessary to have at least two observations per industry. Therefore, I am forced to merge industries in the data. Industries are merged based on similarity and the first digit of the NAICS 2017 code. The following industries are combined: *Mining, Quarrying, Oil and Gas Extraction* with *Utilities and Administrative, Support, Waste Management* and *Remediation Services* with *Professional, Scientific and Technical Services*.

Larger companies, on average, have more market power and are expected to have higher profits. Moreover, Baumol (1959) argues that large firms, with higher capital, may increase their earnings per dollar of investment more compared to smaller firms with a lower capital. Governments possibly aim to participate in larger firms, because these have a larger impact on society. Therefore, the first included control variable is the size of a company.

The second included covariate is the market power of a company. A reason for governments to participate in firms is to prevent market failures. One cause of market failure is imperfect competition. Governments take for example control over ownership of firms that operate in a monopolistic market to make sure that products are sold for an affordable price. Market power also has an effect on profits so I need to include a control variable for this. Concluding, the probit regression to estimate the propensity score is:

$$Y_i = \mu + \beta_1 Size_i + \beta_2 Market\ Power_i + \in$$

Where Y_i is a binary variable that is 1 for firm *i* that is at least 10% owned by the government and is 0 when the firm is less than 10% state-owned. $Size_i$ is the effect of the size of company *i* on the probability that a firm is state-owned. The size of a firm is measured with total assets. I include the logarithm of total assets because diminishing marginal productivity may occur. $Market\ Power_i$ is the effect of the market power of company *i* on the probability that a firm is state-owned. To measure market power, the market share in an industry in terms of revenue of each firm in the dataset is calculated. All variables are measured in U.S. dollars. $\in$ represents the error term.

To achieve good matching quality, it is necessary to satisfy the balancing property (see Appendix *ii*). This means that observations with the same propensity score must have the same distribution of characteristics independently of the treatment (Becker and Ichino, 2002). In the propensity score model, the covariates must be balanced. Misspecification of the model can be a reason that the balancing property is not satisfied. Therefore, it might be required to include interaction effects and higher order terms (Caliendo and Kopeinig, 2008). When the balancing property is still not satisfied this can be an indication of a violation of the conditional independence assumption (Smith and Todd, 2005).

iv. The treatment effect

After the matching procedure, I compare the financial performance in terms of profitability between the state-owned enterprises and the matched private firms. Using a T-test it can be determined whether state-owned enterprises perform significantly different compared to private companies. I cannot estimate the average treatment effect, because I do not observe an individual that is treated and non-treated at the same time. Therefore, the effect of public ownership on financial performance is measured with an average treatment effect on the treated method (ATET). The average treatment effect on the treated can be estimated as follows:

$$ATET = E(Y_{1i}|T = 1) - E(Y_{0i}|T = 1)$$

Where E is the expected value of the difference between the outcome variable Y for treated observations ($T = 1$) and the treated observations if they were not been treated. This estimator takes the averages differences of the financial performance of the firms. The second term is unknown, because we do not observe the outcome of treatment firms if they were not treated. Therefore, firms with similar characteristics will be matched. Because we use matching algorithms, the average treatment effect on the treated can be written as follows:

$$ATET = \frac{1}{n_t} \sum_{i \in \{T=1\}} \left[y_{1i} - \sum_{j \in \{T_j=0\}} w_{ij} \cdot y_{0j} \right]$$

Where n_t is the number of treated observations, $j \in \{T_j = 0\}$ is the number of untreated firms matched with treated firms, y_{1i} represents the observed outcomes of the treatment units, y_{0j} represents the observed outcomes of the controlled units and w_{ij} is the weight of the control observations that are matched to a treated observation. For nearest neighbor matching, this weight is equal to 1 for the closest observation and equal to 0 for all other observations. For radius matching, the weight equals 1 for all control units that fall within the radius and equals 0 if they do not fall in this radius. For Kernel matching, the weight is a reflection of the closeness of the propensity score of each control unit. This ATET method estimates the average of the difference between the financial performance of state-owned enterprises and the financial performance of state-owned enterprises if they were private firms.

For the first hypothesis, the dependent variable is profits measured with net income. For the second hypothesis, the dependent variable is the volatility of the profits measured with the standard deviation of net income of the period 2014-2016. In addition, I use for both hypotheses a relative measure of the dependent variable. Matched large companies possibly have larger differences in profits or in the volatility of profits which may not be a significance difference for these companies, but might be a significant difference for smaller companies. The relative measure of profits and volatility of profits is measured relative to the size of a companies, which is measured with total assets.

IV. Results

i. Descriptive statistics

Before I examine whether state-owned enterprises perform significantly different from private companies, I compare how these two groups are presented in the data. Table 1 and 2 consist the descriptive statistics of the profits, the total assets and the total revenues of the two groups. State-owned enterprises have, on average, more assets and more market share. This is in line with the expectation that governments aim to participate in large companies and aim to take control over ownership of firms that operate in markets with imperfect competition. Relating the numbers to the first hypothesis, we see that private companies in the data on average have less profits. This is not in line with the expectation. State-owned enterprises in the data have more volatile profits, which is inconsistent with the second hypothesis. The number of observations for the volatility variable in the control group is lower due to missing values in the data.

Table 1: Descriptive statistics of private companies in 2016 in the Netherlands (in thousands, except market share)

Variable	N	Mean	Std. Dev.	Min	Max
Profit	7309	18353.3	182821.4	-4253094	4981675
Volatility	6644	20499.85	133028.1	.036405	5407120
Assets	7309	1073494	1.88e+07	56.921376	8.91e+08
Market Share	7309	.0025888	.0220244	0	0.8163214

Table 2: Descriptive statistics of state-owned enterprises in 2016 in the Netherlands (in thousands, except market share)

Variable	N	Mean	Std. Dev.	Min	Max
Profit	21	106826.3	146513.5	-160741.8	388962.7
Volatility	21	248822.5	676152	0	3102273
Assets	21	3.11e+07	7.44e+07	36866.08	3.06e+08
Market Share	21	.0211031	.0358445	0	0.12

ii. Effect of state-ownership

In order to determine the treatment effect, it is necessary to calculate the propensity score to match on. Table 3 presents the model to estimate the propensity scores. To satisfy the balancing property, the squared term of size, the squared term of market power and an interaction term of size and market power are included. The coefficients can be interpreted as how a variable is related to the probability that a firm is state-owned. Larger firms and firms with more market power have a higher probability to be state-owned. The results show a negative effect of the non-linear effects of size and market power on the probability that firms are state-owned. However, these effects are not significant which implies that there is no indication of non-linear effects of these variables. The interaction term shows that the effect of size on the probability that a firm is state-owned depends on the level of market power. The negative term indicates that, for example, the effect of market power on the probability that a firm is state-owned becomes more negative when the size of a firm grows.

Table 3: Estimation model of the propensity score

State-owned	Coefficient	Std. Dev.	Z	Sig.
Size	0.220384	0.041794	5.27	0.000
$Size^2$	-2.91E-11	1.23E-09	-0.02	0.981
Market Power	53.73062	21.0748	2.55	0.000
$Market\ Power^2$	-93.5832	67.21194	-1.39	0.164
Size * Market Power	-2.47859	1.17416	-2.11	0.035
(Constant)	-5.47334	0.641847	-8.53	0.000

Table 4 presents the average treatment effect on the treated of the profits from the matched state-owned enterprises and the private companies after nearest neighbor matching. In this method, each firm is matched to one firm with similar characteristics. The result for the absolute measure shows that the treatment, governmental participation in a firm with at least 10%, has a positive effect on firm performance. More detailed, state-owned enterprises have $6,162,378 higher annual profits compared to the matched private companies. The effect is not significant. The result for the relative measure indicates that state-owned enterprises perform worse compared to private companies. However, this effect is not significant.

Table 5 presents the effect of state-ownership on profits when using a radius matching method. With this method is a state-owned enterprise matched to all private companies that are similar enough to compare. In Table 5 are 15 treatment observations matched to 319 control units. The 6 dropped treatment observations cannot be matched and are not included in the analyses. The result for the absolute measure show that state-owned firms have $78,066,184 higher annual profits compared to the private companies. This effect is significant at a 5% significance level. The result for the relative measure indicates again that state-owned enterprises perform worse compared to private companies. This effect is significant at a 10% significance level.

Table 6 presents the effect of state-ownership on profits by using a Kernel matching method. With this method is each state-owned firm matched to 4838 private companies but each with different weights, which depends on their similarity in characteristics. The estimate for the absolute measure shows that state-owned enterprises have $75,919,461 higher annual profits compared to private companies. This effect is significant at a 5% significance level. The estimate for the relative measure indicates again worse performing state-owned enterprises. However, this effect is not significant.

Table 4: Average treatment effect on the treated for profits after nearest neighbor matching (in thousand USD)

Profit	Coefficient	Std. Dev.	t	Sig.
ATET				
Absolute Measure	6162.378	65438.034	0.094	0.463
Relative Measure	-0.031	0.044	-0.706	0.244

Table 5: Average treatment effect on the treated for profits after radius matching (in thousands USD)

Profit	Coefficient	Std. Dev.	t	Sig.
ATET				
Absolute Measure	78066.184	39472.120	1.978	0.033
Relative Measure	-0.088	0.058	-1.533	0.073

Table 6: Average treatment effect on the treated for profits after Kernel matching (in thousands USD)

Profit	Coefficient	Std. Dev.	t	Sig.
ATET				
Absolute Measure	75919.461	33072.382	2.296	0.016
Relative Measure	-0.063	0.053	-1.187	0.124

Table 7 presents the average treatment effect on the treated of the volatility of profits from the matched state-owned enterprises and the private companies after nearest neighbor matching. Again, in this method is each state-owned enterprise matched to a private company. The result for the absolute measure shows that governmental participation in a firm with at least 10% has a positive effect on the volatility of profits. The volatility of profits of state-owned enterprises is $35,500,774 higher compared to private companies. This result is not significant. The estimate for the relative measure also indicates a positive effect of state-ownership on the volatility of profits. However, this result is not significant.

Table 8 presents the effect of state-ownership on the volatility of profits when using a radius matching method. In this matching method are 19 state-owned enterprises matched to 236 private companies. Two treatment firms are dropped and not taken into account when estimating the effect. The result

for the absolute measure shows that the volatility of profits of state-owned enterprises is $218,000,000 ,higher compared to private companies. This effect is significant at a 10% significance level. The estimate for the relative measure also shows a positive treatment effect. However, this effect is not significant.

Table 9 presents the results concerning the volatility of profits after Kernel matching. Again, each state-owned enterprise is matched to 4838 private firms, each with a different weight. This result for the absolute measure shows that the volatility of profits of state-owned enterprises is $225,000,000 higher compared to private companies. This result is significant at a 10% significance level. Again, the result for the relative measure indicates a positive effect of state-ownership. However, this result is not significant.

Table 7: Average treatment effect on the treated for volatility after nearest neighbor matching (in thousands USD)

Profit	Coefficient	Std. Dev.	t	Sig.
ATET				
Absolute Measure	35500.774	2.12e+05	0.168	0.434
Relative Measure	0.308	0.280	0.280	0.391

Table 8: Average treatment effect on the treated for volatility after radius matching (in thousands USD)

Profit	Coefficient	Std. Dev.	t	Sig.
ATET				
Absolute Measure	2.18e+05	1.63e+05	1.344	0.097
Relative Measure	0.348	0.308	1.130	0.136

Table 9: Average treatment effect on the treated for volatility after Kernel matching (in thousands USD)

Profit	Coefficient	Std. Dev.	t	Sig.
ATET				
Absolute Measure	2.25e+05	1.49e+05	1.510	0.073
Relative Measure	0.293	0.244	1.203	0.121

V. Discussion

i. Conclusions

Many studies over the last decades researched the differences of firm performance between public firms and private firms with mixed findings. This thesis contributes to this research by investigating the impact of a government that has a significant part of ownership of a firm and also takes the volatility of profits into account. To investigate this, a propensity score matching method is used.

The results relating to the profitability of state-owned enterprises compared to private companies give mixed findings. Corresponding is the sign of the effect on the absolute measure by the use of each matching method. All methods for the absolute measure indicate that the effect of state-ownership on profits is positive. However, only the results after radius matching and Kernel matching show an effect that is significant on a 5% significance level. In addition, the magnitude of the effect differs significantly between the methods. For example, the estimated effect of the treatment after nearest neighbor matching is twelve times smaller than the estimated effect after radius and Kernel matching. However, the average treatment effect on the treated on the relative measure suggest an opposite effect. All three matching methods for this measure show a negative effect of state-ownership on the profitability of firms, although none of these estimates is significant at a 5% significance level. The differences between the absolute measure and the relative measure can be explained by the magnitude of the differences between the profitability of matched large firms or matched small firms. The magnitude of the differences is expected to be higher for large firms, which may affect the average treatment effect on the treated when using absolute values. The results implicates that although state-ownership on average increased profitability, the effect is not significant relative to the size of the firm and even give an indication for a negative effect. Altogether, these results indicate that the first hypothesis, that state-owned enterprises are less profitable than privately owned companies, can be rejected.

The results relating to the volatility of firm profits of state-owned enterprises compared to private companies give also mixed results for the absolute measure. All the matching methods give a positive treatment effect. This indicates that state-owned enterprises have more volatile profits compared to private companies. However, none of the measured effects is significant at a 5% significance level and only by using a Kernel matching or a radius matching I find an effect that is significant at a 10% level. Kernel and radius matching give also similar results in terms of the magnitude of the effect. The effect of nearest neighbor matching differs significantly from the effect of the other methods and the magnitude of the effect is about seven times smaller. The effect of state-ownership on the volatility of profits relative to the size of a company give similar results, compared to the absolute measure, for all the matching methods. All three methods give a positive effect on the volatility of profits, but none of

these estimates is significant. Altogether, these results indicate that the second hypothesis, that state-owned enterprises have less volatile profits than privately owned companies, can be rejected.

The main question of this thesis is if public ownership of a firm result in worse financial performance compared to private ownership of a firm in the Netherlands. More profits and less volatile profits are in this study characterized as better financial performance. The results indicate that the effect of state-ownership on profits is ambiguous and the effect on volatility of profits is positive in the Netherlands, although the majority of the results were not significant. This outcome shows that it is ambiguous whether governments are doing well, in terms of financial performance, by taking back ownership of firms. This study provides some support for the studies that did not find more profitable private firms or no differences between state-owned enterprises compared to privately owned firms (Meyer, 1975; Caves and Christensen, 1980; Pescatrice and Trapani, 1980). The results are in contrast with the majority of studies that find less efficient or less profitable state-owned firms.

One explanation for the finding that public firms have higher or equal profits compared to private firms is that public firms have lower cost of capital (Meyer, 1975). The higher profits of public firms might also be influenced by the markets they act in. A criterion for the Dutch government to participate in a firm is to serve the national public interest (Ministerie van Financiën, 2016). A reason to take ownership of a firm, for example, might be to prevent excessive profits of private firms in a monopoly. This possibly causes, because state-owned enterprises more often act in markets with more market power, that these firms have more profits compared to their matched private firms that possibly faces more competition. The model for the propensity score contains a proxy variable to control for this effect, however, this is only a rough measure of market competition. Boardman and Vining (1989) suggest to test the effect of ownership on firm performance in a competitive environment.

The higher volatility of profits of public firms can also be influenced by the Dutch government that participates in firms to serve the national interest. The Dutch government, for example, participates in firms that are of national importance and that are in a financial crisis and possibly go bankrupt. The profits of firms that were in a financial crisis before and now profitable again might be more volatile. This could influence the measured effect if such a firm is matched to a private firm that is more stable.

Another possible influencer of the variability of firm profits is the type of control of a firm. Different studies investigated the effect of management-controlled firms and owner-controlled firms on the variance of profits. Management firms can be compared with the state-participations in the dataset, these are firms where it is possible to distinguish between the owner of the firm and the policymaker. Owner controlled firms can be compared with policy participations of the government, these are firms where it is not possible to distinguish between the owner and control of the firm. Palmer (1973) finds

more variance of profits among management-controlled firms compared to owner controlled firms. However, Boudreaux (1973) finds larger variance of profits among owner-controlled firms.

ii. Limitations

The results I obtain in this thesis are subject to multiple limitations. First of all, since the research is limited to the effect of public ownership in the Netherlands, the number of observations in the treatment group is low. A small number of observations can lead to biases. It is questionable whether this small number of observations does not lead to overstating the results. Second, when estimating the effects with a radius matching method some treatment observations were dropped. Again, it is questionable whether the treatment group, after dropping some observations, is still representative for all state-owned enterprises in the Netherlands. Third, also including more years to estimate the volatility of profits would increase the reliability of the results. Profits of fewer years might be more influenced by random shocks or coincidences. However, including more years could also decrease the number of observations in the treatment and control group.

The data I used from the Orbis database was not complete. In the data were missing values for different variables of the state-owned enterprises as well as for the private companies. To save observations in the treatment group I added missing values manually. However, due to the large number of observations of the treatment group, this is not an feasible option. The observations that miss a value for a used variable are dropped from the data. This might lead to biased results, especially when missing values for firms in the data is not random.

More limitations are related to the propensity score matching method. To estimate the propensity score, it is necessary to include variables that simultaneously influence the treatment decision and the outcome variable. However, the conditional independence assumption cannot be tested. Since not all data of all covariates are available, it is possible that some important estimators of the treatment assignment are excluded from the model. This can potentially lead to matches of firms that are not similar enough to estimate a reliable ATET.

iii. Future research

The effect of participations of governments in firms may differ across countries. Firm performance differences between state-owned enterprises and private companies may be initiated by the goals that these firms want to achieve. The goals of the state-owned enterprises depend on the objectives of the government. Some governments for example only participate in firms to pursue non-economic goals like sustainability and security, while other governments participate in firms to stimulate the economy or increase earnings. Future research can focus on this country comparison.

The effect of state-ownership possibly also differs over time. The Dutch government took control over the ABN-AMRO bank in 2008 to save the bank from bankruptcy. This indicates that the reason for a government to participate in firms may dependent on the economic status of a country and on time. It is arguable that governments are more likely to participate in firms for non-economic reasons in times of economic welfare rather than in times of economic crisis. This may result in a different effect of state-ownership on firm performance over time.

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Appendix

i. Treatment group

Table A1: The state-owned enterprises in the Netherlands in 2016 that are at least 10% owned by the government

Company Name	Industry	Participation Type	Governmental Equity Interest
Bank Nederlandse Gemeenten	Finance and Insurance	State-participation	50%
Centrale Organisatie Voor Radioactief Afval	Administrative and Support and Waste Management and Remediation Services	State-participation	100%
De Nederlandse Investeringsbank Voor Ontwikkelingslanden	Finance and Insurance	State-participation	100%
Havenbedrijf Rotterdam	Transportation and Warehousing	State-participation	29.20%
Nationale Stichting Tot Exploitatie Van Casinospelen In Nederland	Arts, Entertainment, and Recreation	State-participation	100%
Nederlandse Financierings-Maatschappij Voor Ontwikkelingslanden	Finance and Insurance	State-participation	51%
Nederlandse Gasunie	Utilities	State-participation	100%
Nederlandse Loterij Organisatie	Professional, Scientific, and Technical Services	State-participation	100%
Nederlandse Spoorwegen	Transportation and Warehousing	State-participation	100%
Nederlandse Waterschapsbank	Finance and Insurance	State-participation	17.20%
Royal Schiphol Group	Transportation and Warehousing	State-participation	69.80%
Tennet Holding	Management of Companies and Enterprises	State-participation	100%

Ultra-Centrifuge Nederland	Management of Companies and Enterprises	State-participation	100%
Brabantse Ontwikkelings Maatschappij Holding	Finance and Insurance	Policy-participation	49.90%
De Nederlandsche Bank	Finance and Insurance	Policy-participation	100%
Energie Beheer Nederland	Manufacturing	Policy-participation	100%
Gasterra	Mining, Quarrying, and Oil and Gas Extraction	Policy-participation	10%
Investerings- en Ontwikkelingsmaatschappij voor Noord-Nederland	Finance and Insurance	Policy-participation	99.97%
Limburgs Instituut Voor Ontwikkeling En Financiering	Finance and Insurance	Policy-participation	94.30%
Prorail	Professional, Scientific, and Technical Services	Policy-participation	100%
Ontwikkelingsmaatschappij Oost Nederland	Professional, Scientific, and Technical Services	Policy-participation	55.90%

ii. Balancing property procedure

The balancing hypothesis algorithm and tests are described by Becker and Ichino (2002). The balancing property in this thesis will be tested with the same algorithm as Becker and Ichino (2002) used:

1. Fit the probit model.
2. Split the sample into *k* equal spaced intervals of the propensity score.
3. Test within each interval that the average propensity score of treated and controlled observations does not differ.
4. If the groups differ, split the interval in half and test again.
5. Repeat step 4 until the average propensity score is equal between treated and controlled observations in all intervals.
6. Test in each interval the mean of each characteristic between the treated and the controlled observations.
7. If the mean differs of one of the characteristics, the balancing property will not be satisfied.